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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’19’ to be held on 3th December 2019 at 9.00AM at ICBT Auditorium. This is the second International research symposium organized by the International College of Business and Technology. This will continue to move forward in the research arena under the ISSN-2659-2061.

The theme for this year is “Confronting Global Challenges: Outlook of Research” 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 set to experience challenges, if not overcome, mankind will face severe hardship or even extinction. Some of the global challenges we face include, depletion of resources, global warming and climate change has resulting in melting ice caps and extreme weather conditions in most parts of the world affecting agriculture and displacing millions of people, scarcity of clean water, the gap in living standards between the rich and poor becoming more extreme and divisive, threat of new and re-emerging diseases and increase in terrorism.

These global challenges must be overcome through a transnational concentrated effort. These challenges also provide opportunities for all to contribute and provide solutions. The research community is in the forefront of the continuous effort of mankind to overcome these challenges and to thrive as a civilization.

This conference will be a platform for academic and industrial researchers to publish their work in above-mentioned areas that would contribute to overcoming these global challenges.

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 2nd ICBT Annual International Research Symposium (AIRS) in ICBT Campus, Colombo, Sri Lanka. First I would like to express my gratitude to authors, reviewers and participants of 1st AIRS. Secondly 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 2nd ICBT Annual International Research Symposium.

AIRS endeavours 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/ co-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 AIRS further. I sincerely extend my thanks to contributors, editorial board members and looking forward for continuous support in future.

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

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BUSINESS MANAGEMENT

E-SERVICE TRUSTWORTHINESS AND ONLINE BANKING ADOPTION IN THE PRESENCE OF A MODERATOR: A RELATIONAL STUDY

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Abstract

Online banking adoption is a contextual phenomenon. Therefore, research attempted to identify the association of adoption constructs and e-service trustworthiness on consumer online banking adoption in Sri Lankan context. Sample consisted of leading private banks' customers. Deductive methodology and quantitative method has been followed. E-service trustworthiness factors were identified by conducting PCA. TAM, extended using the e-services trustworthiness. The empirical evidence supported positive relationship of adoption variable and TES variable towards online banking adoption by correlation analysis and hierarchical regression analysis. Presence of differences in adoption of online banking between low income category customers and higher income categories was also supported by contrast test of ANOVA. ANCOVA revealed that the covariate; age was not significantly related to the participant's online banking adoption while the Hayes's process for moderation analysis has confirmed relationship between e-service trustworthiness and online banking adoption is being moderated by the age of the respondent.

Key words: *Adoption, Covariate, Demographic variables, Moderation, Online banking*

Introduction

Banking sector of Sri Lanka continued to drive the growth of financial sector accounting for considerable 72.5 percent of the total assets despite the fact that marginal increase of services related economic activities whilst the country's economy is being vulnerable to internal and external disturbances as indicated by the macroeconomic indicators (CBSL, 2018). Banking sector recorded satisfactory capital and liquidity levels well over the stipulated regulatory thresholds. Nevertheless, the overall profitability has deteriorated due to escalating operating expenses and other factors. Therefore, this could be addressed by minimizing operational expenditure while improving other income avenues simultaneously by facilitating e-onboarding along with promotion of online banking services (OB) in unison. Various research studies highlighted that in the Sri Lankan context, OB acceptance is at an insignificant level excluding ATM usage and identified that usage of e-banking is comparatively minimal in considering increasing internet usage (Weerasekara & Abeygunawardhana, 2011). Whereas, leading private banks have recorded OB growth in higher numbers and continue to invest heavily on same. Significance of the research is that the contribution to both the theory and practice perspectives on adoption of OB, particularly in the developing country's perspective by incorporating interrelated models on technology adoption.

Objectives

Primary objective of the research was to identify the effect of e-service trustworthiness (TES) on customer adoption of OB in the context of leading private commercial banks operating in

Sri Lanka. Secondly, identify the effect of TAM predictors namely perceived usefulness; PU and perceived ease of use; PEOU, on OB adoption is also investigated. Thirdly, research attempted to identify whether there are any differences in adoption, based on different income categories. Demographic variable age has been used to inquire whether there is a moderation effect of age in between the relationship of TES and OB adoption. Simultaneously impact of the covariate; age on OB adoption also been investigated during the study.

Conceptual framework and hypotheses of the study

TAM is an extended explanation of Ajzen and Fishbein's theory of reasoned action (TRA). Davis's TAM (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) is applied extensively to understand user adoption and usage of technology (Venkatesh, 2000). TAM was developed by Fred Davis and Richard Bagozzi (Davis 1989; Bagozzi, Davis & Warshaw 1992). TAM is an adaptation of TRA for information systems field. TAM was originally used to examine OB adoption by Bhattacharjee (2001). Numerous attempts to extend TAM (e.g., TAM2) have generally guided largely by one of the following 3 approaches: by incorporating factors from interconnected models on customer adoption, by means of integrating additional or alternative belief factors, and lastly by examining antecedents and moderators of PU and PEOU. Based on this discussion and review of literature following conceptual model was formulated for the study.

Conceptual model

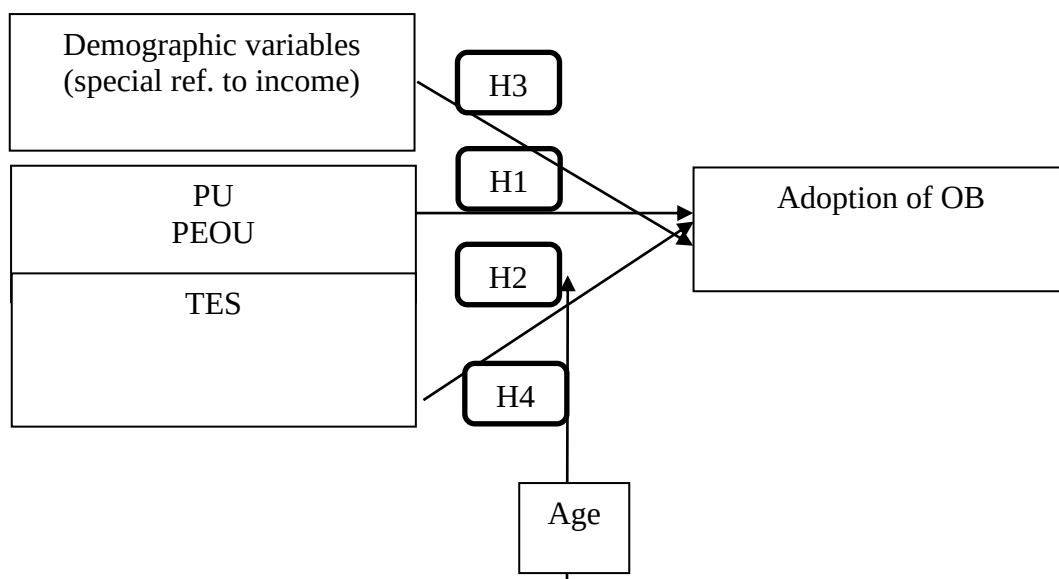


Figure 1: Conceptual model

PU is the one's perception of degree of enhancement of a particular task by a system and PEOU is the effort freeness of a system (Davis, 1989). Jayasiri et al. (2015) found that among other factors, PEOU and PU are among two of the most influential factors that describe the OB adoption in Sri Lanka. Another research effected by Deb and David (2013) found empirical evidence for positive relationship between PU, PEOU and societal influence on positive attitude towards mobile banking in Indian context. Considering the aforesaid facts following hypothesis is proposed,

H₁₁-There is a positive relationship with PU and PEOU on adoption of OB

Rotter (1967) defined trustworthiness as the belief that counterparty's word or promise is reliable and that particular party will fulfill the obligations in an exchange relationship. Certain researchers claimed that the variables of perceived security and trustworthiness in OB had a significantly positive impact on the adoption of OB. (Damghanian et al., 2016). The relationship between trustworthiness and behavioral intention are positively significant (Wang et al., 2015). Considering the aforementioned facts following hypothesis is proposed,

H₁₂-There is a positive relationship with TES and adoption of OB

The attributes related to demographic factors such as: gender, age, educational level, and monthly income were significantly influential variables on internet banking (Sivapragasam & Pieris, 2014 as cited by Rajapakse, 2017). Considering the aforementioned facts following hypothesis is proposed,

H₁₃-There is a difference in adoption of OB between lower income category customers and higher income category customers

There are moderating effects by demographic variables such as respondents' age, income levels and working hours on adoption of online banking as identified from the review on electronic banking (Yu, 2012 as cited by Rajapakse, 2017). Yoon and Occeña (2015) found that trust in C2C e-commerce can be moderated by age factor. Considering the aforementioned facts following hypothesis is proposed,

H₁₄-There is a moderation effect of age on the relationship of TES and adoption of OB

Methodology

Deductive methodology and quantitative method has been used in the study. Saunders (2011) specified that questionnaires can be utilized to examine and explicate relationships between variables. Due to the large sample and considering the expenditure, questionnaire survey deemed suitable. Respondents were the customers of three leading private commercial banks operating in Sri Lanka. Respondents were selected on multi-level cluster sampling method as per provinces/districts and major cities in which these banks are in operation. Accounts opening officers attached to the banks were selected as enumerators for data collection process of this research. Enumerators have collected data through self-administered questionnaires from the individual respondents. Altogether 450 questionnaires were distributed and 271 duly completed questionnaires (60.22%) were considered for the final data analysis. TES is a latent variable and there are several constructs that determine the TES such as bank attributes, e-service quality attributes, privacy and security etc. Hence, principal component analysis has been deployed for same enabling identification of factors related to TES. Subsequently, reliability analysis was performed using cronbach's alpha coefficients on TES, adoption and on the dependent variable; adoption of OB. To determine the relationship Pearson's correlation coefficient used. Regression analysis performed to investigate the coefficients and explainability of the model. Anova with planned contrasts used to determine the differences in OB adoption in different income categories. Trend variables was determined by the Anova trend analysis. Covariate effect on adoption

investigated by Ancova. Similarly, Hayes' process was used to analyze the moderating effect of age in between TES and adoption of OB.

Results

The IBM SPSS 20 with Hayes's process version 3.4 was used for analysis. Initial analysis demonstrated that most of the demographic characteristics of the population are being replicated vastly by the elected sample.

Since Trustworthiness of e-services (TES) is a latent variable that could not be directly observed, principle component analysis (PCA) was conducted on the 24 items of TES (Table 1) with orthogonal rotation (varimax). The Kaiser–Meyer–Olkin (KMO) measure verified the sampling adequacy for the analysis, KMO = .89 which is quite sufficient and all KMO values for individual items were > .7, which is well above the acceptable limit of .5 (Field, 2009). Bartlett's test of sphericity χ^2 , $p < .001$, indicated that correlations between items were sufficiently large for PCA.

Table 1-Summary of PCA results of TES items (N=271)

	Rotated factor loading			
	Bank attributes	E-SQ attributes	Privacy	OB website security
No. of items	8	8	4	4
Eigen values	7.32	1.91	1.32	1.24
Percentage of variance	31.40	7.91	5.82	5.77

Note: Only the factor loadings over 0.5 given in the table

Source: Survey data 2019

Cronbach's alpha values (Table 2) are higher than 0.7. Moreover, K-S test and Levene's test performed to ensure normal distribution of respondents' data and homoscedasticity where results were not significant for both the tests.

Table 2-Reliability analysis

	No. of items	Cronbach's alpha	Mean	Standard deviation
Adoption	10	.962	4.38	.55
TES	24	.988	3.78	.63
Adoption of OB	6	.884	4.45	.44

Source: Survey data 2019

Pearson correlation analysis revealed that the adoption of OB possesses a positive relationship with both TES and adoption variables whilst both the relationships were significant at .01 level (1-tailed).

Table 3-Correlation matrix

	Adoption of OB	TES	Adoption
Adoption of OB	1		
TES	.875**	1	
Adoption	.916**	.847**	1

** Correlation is significant at the 0.01 level (1-tailed)

Source: Survey data 2019

A multiple regression analysis was conducted using hierarchical method to predict the degree to which independent variables; adoption and TES impact the adoption of OB (Table 4 and Table 5). In accordance with model 1 (Table 4), the overall variance of OB adoption explained by TES is 76.2% as per the adjusted R square figure. According to the significance value, model 1 is statistically significant.

Table 4-Regression output

	<i>t</i>	<i>Sig.</i>	$\square$	<i>F</i> Change	<i>df</i>	<i>Sig. F</i> Change	Adj. <i>R</i> ²
Model 1				881.14	1	.000	.765
(Constant)	26.29	.000	2.108				
TES	29.68	.000	0.621				

Dependent variable: Adoption of OB

Predictors: (Constant), TES

Source: Survey data 2019

In accordance with model 2 (Table 5), the overall variance of OB adoption explained by TES and adoption is 87.4% as per the adjusted R square figure. According to the significance value, model 2 is also statistically significant.

Table 5-Regression output

	<i>t</i>	<i>Sig.</i>	$\square$	<i>F</i> Change	<i>df</i>	<i>Sig. F</i> Change	Adj. <i>R</i> ²

Model 2				232.27	1	.000	.874
(Constant)	17.29	.000	1.339				
TES	08.62	.000	0.249				
Adoption	15.24	.000	0.496				

Dependent variable: Adoption of ON

Predictors: (Constant), TES, Adoption

Source: Survey data 2019

For the current model the VIF and Tolerance values recorded as 3.535 and .283 which are well below 10 and above 0.2 subsequently; therefore, no collinearity within the data. Even the average VIF which is also 3.535 is not substantially greater than 1 which also shows that there is no cause for concern.

To determine the cases which are influencing the regression model, case-wise diagnostics, Cook's distance, Mahalanobis distance, DFBeta statistics and covariance ratio (CVR) were checked and all were in order. In order to generalize the model beyond the sample, it is necessary to check some of the assumptions of regression residuals. Graph of standardized residuals (ZRESID) and dependent variable (ZPRED) checked, histograms looked like normally distributed and P-P plot looked like curving around a diagonal line which is supportive for generalizing the model beyond the sample. Therefore, it could be summarized that the model appears in most senses to be both accurate for the sample and generalizable to the population of interest as the assumptions have been met and could be safely assumed that this model would generalize to adoption of OB in Sri Lankan context.

In order to examine the specific hypothesis stated as, there are differences between lower income group and higher income groups, one-way ANOVA with planned contrasts was performed (Table 6a & Table 6b). There was a significant effect of income on adoption of OB, $F(2, 268) = 244.01, p < .05, \omega = .80$. Secondly, there was a significant linear trend, $F(1, 268) = 459.97, p < .01, \omega = .78$, indicating that as the income increases adoption of OB also increases proportionately.

Table 6a- One-way ANOVA-Trend analysis results

			Sum of Square	df	Mean Square	F	Sig.
Between Groups (Combined)			34.479	2	17.239	244.007	.000
Linear Term	Unweighted		32.497	1	32.497	459.972	.000
	Weighted		33.796	1	33.796	478.353	.000
	Deviation		.683	1	.683	9.661	.002
Quadratic Term	Unweighted		.683	1	.683	9.661	.002
	Weighted		.683	1	.683	9.661	.002
Within Groups			18.934	268	.071		
Total			53.413	270			

Source: Survey data 2019

Table 6b- One-way ANOVA-Contrast test results

	Contrast	Value of Contrast	Std. Error	<i>t</i>	df	Sig.
Assume equal variances	1	1.8647	.08555	21.796	268	.000
	2	.4810	.04567	10.531	268	.000
Does not assume equal variances	1	1.8647	.08314	22.429	60.925	.000
	2	.4810	.02169	22.174	174.000	.000

Source: Survey data 2019

Main findings of ANCOVA as depicted in table 7, revealed that the covariate, participant's age was not significantly related to the participant's OB adoption, $F(1, 267) = 1.776$, $p > .05$, partial eta squared = .007. However, there was a significant effect of income levels on adoption of OB after controlling for the effect of participant's age, $F(2, 267) = 147.947$, $p < .05$, partial eta squared = .526.

Table 7- ANCOVA- Tests of between-subject effects

Dependent Variable: Adoption of OB						
Source	Type III Sum of Squares	df	Mean Square	<i>F</i>	Sig.	Partial Eta Squared
Corrected Model	34.604 ^a	3	11.535	163.734	.000	.648
Intercept	277.211	1	277.211	3935.025	.000	.936
Age	.125	1	.125	1.776	.184	.007
Income	20.845	2	10.422	147.947	.000	.526
Error	18.809	267	.070			
Total	5433.694	271				
Corrected Total	53.413	270				

a. R Squared = .648 (Adjusted R Squared = .644)

Source: Survey data 2019

Output of the moderation analysis (Table 8) has shown a moderation effect attributable to the significant interaction of TES and age and in this study the interaction is highly significant, $b = -.23$, 95% confidence interval (CI) $(-.32, -.14)$, $t = -5.09$, $p < .01$, indicating that the relationship between TES and adoption of OB is moderated by age.

Table 8- Moderation analysis output- as per Hayes’s process version 3.4 for SPSS

	<i>b</i>	<i>SE B</i>	<i>t</i>	<i>p</i>
Constant	.53	.32	1.66	.0991
TES	1.05	.09	11.58	.0000
Age	.88	.17	5.21	.0000
TES x Age	-.23	.05	-5.09	.0000

Source: Survey data 2019

Discussion

Consistent with the empirical results given in preceding section, adoption of consumer online banking has been supported by adoption dimensions and TES factors in the context of largest private commercial banks in Sri Lanka. Further, results of correlation analysis outcome noted that two aforementioned independent variables were positively correlated with adoption of OB. Additionally, there are empirical evidences supporting the positive relationship between adoption and TES variables on OB adoption (Baraghani, 2007 as cited by Rajapakse, 2017; Damghanian et al., 2016). Therefore, the findings of present research study conform to the previous findings. Furthermore, main constructs of adoption are the perceived ease of use (PEOU) and the perceived usefulness (PU). Thus, this research is consistent with the findings related to TAM. According to the regression analysis using hierarchical method, although adoption and TES constructs are governing variables as per the study, there are other factors which were not discussed in this study that impacts the adoption of OB. In addition, planned contrasts revealed that having a higher income significantly increased adoption of OB compared to having a lower income and that having a high income significantly improved adoption of OB compared to having a middle income. Moreover study revealed that the covariate, age was not significantly related to the participant’s OB adoption in the research context while the moderation analysis has confirmed relationship between TES and OB adoption is being moderated by the age of the respondent which is in line with empirical evidences (Yu, 2012; Yoon & Occeña, 2015).

Conclusion and Recommendations

Data analysis supported all the hypotheses (positive relationship of TES and adoption construct on OB adoption, existence of differences between lower income group and higher income groups and moderation effect of age between TES and OB adoption). In practical scenario, all the leading private commercial banks perform relatively well in the presence of sporadic technology changes. Yet, the banks cannot undermine the threat of fintech companies and innovative start-up businesses which are invading the consumer banking sphere to a greater extent with latest payment and settlement options, QR code-based payments, payment cards and e-money services, blockchain/distributed ledger related services, investment and instant online lending facilities amidst challenging supervisory and regulatory developments. Therefore, it was recommended marketers of consumer OB service providers, to capitalize awareness on PEOU and PU dimensions in conjunction with e-service quality, customer innovativeness, online security, privacy, risk management, developing trustworthiness and etc. (Gayan Nayanajith & Dissanayake, 2019; Gayan Nayanajith, 2019b).

Research findings are beneficial for the financial service providers particularly the bankers, developers and analysts, enabling them to execute segmenting, targeting and profiling their customers with the assistance of previously discussed factors alongside differentiation on demographic characteristics.

Current study is also subjected to several limitations; Nevertheless, future researches could be performed with greater representation of the entire population to validate the research findings in search of diverse findings in different country, cultural and societal contexts. Similarly, different research approaches and perspectives alongside the usage of novel and different models on technology adoption together with different mediators and moderators will indubitably create value.

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ASSESSMENT OF THE IMPACT OF MICROFINANCE ON FINANCIAL STABILITY AMONG BORROWERS IN MEDAWACHCHIYA

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Abstract

This study seeks to assess the impact of microfinance that deeply rooted in financial systems in developing countries as well as some regions of developed countries. As microfinance has the power to touch sensitive segments in financial and social systems, yet this paper focuses on its influence on financial stability of microfinance borrowers. This manuscript is a quantitative research and reviewed financial stability and microfinance systems in Sri Lanka. A questionnaire was utilized to collect primary data from 150 microfinance borrowers under simple random method at Medawachchiya. Further, economic and financial stability index (EFSI) was introduced to determine the importance of microfinance among other factors influential on financial stability. Eventually, hypotheses testing revealed a negative impact from microfinance on financial stability of microfinance borrowers. Even if borrowers were aware of negative impact from higher interest rates and cost, people still trusted microfinance as other financial options weren't available for them.

Key Words: Financial Stability, High Cost of Funds, Interest Rates, Microfinance, Recovery Methods

Introduction

Microfinance had been a debatable subject over last several decades since when many competitors ventured into the microfinance industry with variety of objectives. Even if microfinance is meant to alleviate poverty, to improve living conditions of the poor and to serve as a macro economic empowerment, recent developments in the industry exhibited as a business model solely structured and aimed for profitability. In the wake of new trends, it was questionable whether microfinance borrowers were benefitted from micro products and still drive towards personal financial stability. The term, microfinance is recognized as a range of financial services such as credit, savings and insurance offered to low income earners and micro-enterprises (Perera, 2016).

The history of microfinance goes back to 1720s in Ireland where donated funds were directed for business activities which were intended to pay back weekly (Blank, 2017). Thereafter many developments were taken place around the world until 1970s where Nobel Prize winner, Mohommad Yunus, introduced a financial model for poverty eradication namely Grameen Model in which small loan facilities are separately provided to individuals of a group. In the event of a default every member is responsible for repayments (Counts, 2008).

Methodology

Method

The research was structured as a quantitative research and was focused mainly on primary data since it was subjected to hypotheses testing. Accordingly, microfinance was identified as the main independent variable. In which there were many factors which were having direct impact towards financial stability, but the researcher focused only on three of these factors. They were considered as sub independent variables which were interest rates, recovery methods and high cost of funds. On the contrary, financial stability of microfinance borrowers was selected for the dependent variable. Accordingly, all sub independent variables were hypothetically measured on the dependent variable utilized with correlation and regression analyses. Furthermore, primary data was collected from a questionnaire obtained from microfinance borrowers in Medawachchiya. Moreover, as this was involved with primary data, the researcher used hypotheses testing followed by correlation.

Population

The population of the study was 9,400 microfinance borrowers that was based on internal data gathered through microfinance institutions in Medawachchiya. Accordingly, a sample size of 150 was selected with confidence level of 95% and respondents were 126.

Conceptual Framework

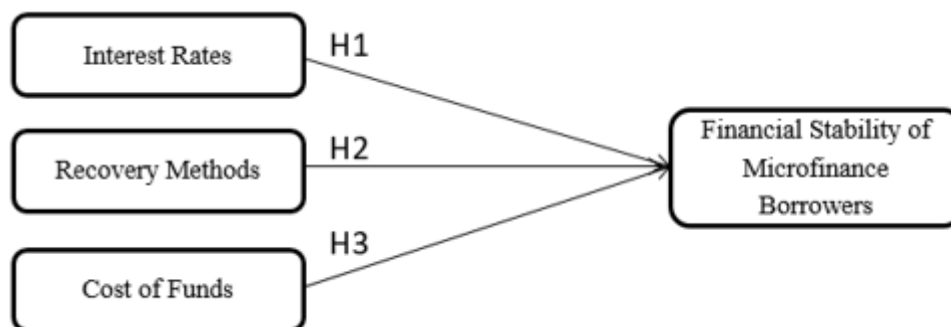


Figure 1: Conceptual Framework

Hypotheses

- H1 - There is a positive relationship between Interest Rates of microfinance and Financial Stability of microfinance borrowers.
- H2 - There is a positive relationship between recovery methods of microfinance and Financial Stability of microfinance borrowers.
- H3 - There is a positive relationship between High Cost Funds and Financial Stability of microfinance borrowers.

Results

Results: Economic and Financial Stability Index

Many factors were influential on financial stability, and microfinance was only one of them. To determine, the position of microfinance among these factors, an Economic and Financial Stability Index alias EFSI was introduced.

Table 1: Economic and Financial Stability Index

	Ranking by Experts on Importance								Total Rank	Rank Weight	
	A	B	C	D	E	F	G	H		%	Rank
Monthly Income	2	5	5	5	5	5	5	5	37	93%	1
Monthly Expenses	3	4	1	4	4	4	4	4	28	70%	2
Income Type (Fixed/Variable)	-	-	-	2	-	-	3	-	5	13%	7
Number of Income Earners of a family	-	-	3	-	1	2	-	-	6	15%	6
Monthly Loan Repayments	4	2	2	3	3	3	2	3	22	55%	3
Consumption Pattern (Eg:- Alcoholic)	-	-	-	-	-	1	1	1	3	8%	8
Type of Investments	1	3	4	1	-	-	-	-	9	23%	5
Availability of other sources of income	5	1	-	-	2	-	-	2	10	25%	4

Rankings were named from 1 to 5 scale, 1 depicting the lowest importance and 5 representing the highest importance, and ranks were given by 08 industrial experts.

This table exhibits factors affecting for financial stability of microfinance borrowers. Accordingly, it reflected that microfinance is the third most significant factor for financial stability.

Univariate Analysis

The majority of respondents were females (114 females, 90.5% from total respondents) who had obtained education up to ordinary level exam (73 respondents, 57.9% from total respondents). Table No.2 and 3 carry further details.

Table 2: Gender Analysis of Microfinance Borrowers

Sample characteristics	Mean	Male	Female
Gender (Number of People)	1.90	12	114
Percentage	-	9.5%	90.5%

Many microfinance schemes were focused on female borrowers due to the factors of higher successful repayment percentage in the industry.

Table 3: Education Level of Microfinance Borrowers

Sample characteristics	Mean	Until Grade 5 Exam	Until Ordinary Level Exam	Until Advanced Level Exam	Until Diploma
Education Level (Number of People)	1.98	30	73	19	4
Percentage	-	23.8%	57.9%	15.1%	3.2%

The majority was uneducated and failed to realize the predicaments of microfinance and its final impact on their financial stability.

Bivariate Analysis

Table 4: Regression Analysis

Model	R Square Value	b Value	(constant)	P Value
Interest Rates of Microfinance	0.009	-0.793	120.999	0.319
Recovery Methods	0.316	-3.996	144.091	0.000
High cost of funds exclusive of Interest Rate Factor	0.005	-0.401	118.750	0.446

H1 tested the positive impact from interest rates of microfinance on financial stability of microfinance borrowers. Accordingly, primary data was statistically analyzed and showed R Square=.009 and b=-1.904. Since b value reported a negative figure (b=-1-904), interest rates had a negative impact on dependent variable of financial stability. However, R Square demonstrated that this impact was not strong as it was 0.9%. Based on these facts, H1 was rejected and accepted the null hypothesis emphasizing the negative impact. Regression equation is $Y = a + bx$, ($Y = 120.99 + -0.793x$)

H2 of the research highlighted the positive impact from recovery methods on financial stability of microfinance borrowers. As per the results derived from statistics, it was realized that recovery methods governed a negative impact on financial stability (b=-3.996). R Square reported that 31% of the financial stability was explained by recovery methods (R Square=.316). For that reason, H2 had to be rejected and accepted the null hypothesis which stated that there was a negative impact from repayment methods on financial stability of microfinance borrowers. ($Y = 144.091 + -3.996x$)

H3 was designed to prove the positive impact from high cost funds on financial stability. Statistics reported a b value of -.401 indicating a negative impact from cost of funds on financial stability. Further, its level of impact was measured using R Square and it was indicated as 0.005 defining that 0.5% of the financial stability is explained by high cost of

funds of microfinance. Accordingly, the researcher rejected H3 and accepted the null hypothesis. ($Y = 118.750 + -0.401x$)

Table 5: Correlation Analysis

	Interest Rates of Microfinance	Repayment Methods of Microfinance Loans	High Cost of Funds exclusive of interest rate factor
Pearson Correlation	-.095	-.562	-.072
Sig. (2-tailed)	.319	.000	.446

Correlation analysis indicated that negative relationship between sub independent variables of interest rates, repayment methods and high cost of funds exclusive of interest rate factor and dependent variable. Interest rates = ($p=.319$, $r=-.095$), repayment methods = ($p=.000$, $r=-.562$) and high cost of funds exclusive of interest rate factor = ($p=.446$, $r=-.072$)

Discussions

Discussions of findings

Statistics reflected negative impact and relationship on/between sub independent variables and dependent variable of financial stability. Therefore, it denoted the fact that when the poor commenced borrowing microfinance, their financial stability ultimately decreased. In other words, the poor had better financial stability before obtaining microfinance.

Comparison and contrasting the findings with previous research findings

Even if results derived through this article indicated that microfinance resulted in reduction of financial stability of borrowers, on the contrary, (Mecha, 2017) stated that instead for waiting for other sectors in the economy to reduce poverty, microfinance reached them and contributed to eradicate the poverty. Further, (Khavul, 2010) mentioned that microfinance contributed to economic development via entrepreneurial initiatives.

Conclusion and Recommendation

Conclusion

The poor are the biggest financially constrained segment of society and their requirements are most often left unattended even neglecting their basic need. In that sense, microfinance was embraced by the poor as a way of moving out of the poverty, but it eventually pushed them further into the abyss of poverty. For that reason, this article reflected that the more they obtain microfinance, the more their level of poverty increased. This was caused basically due to higher cost of funds, higher interest rates and strict recovery methods of microfinance.

Recommendation

To utilize microfinance as an economic and social development tool in Medawachchiya, first, negative elements should be eliminated. Therefore, poor segments should have appropriate knowledge over microfinance. In that case, a law should be implemented to reveal the true cost of funds of microfinance. Further, the government Act on microfinance which was implemented by Sri Lankan government in 2016 is not operative as at date. Therefore, steps

are required from the government to fully operate the Act also with a regulatory body for the objective of controlling, supervision and monitoring microfinance institutions.

Apart from that, the financial industry in the country is needed to be further developed to create opportunities for microfinance institutions to borrow from financial resources at a low cost and to refinance them to the poor at a lower cost. By all means, microfinance is perceived as a part of Sri Lankan economy which cannot be avoided at any cost.

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IDENTIFICATION OF RELATIONSHIP BETWEEN GREEN ACCOUNTING AND PROFITABILITY: CASE STUDY OF DIALOG.

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Abstract

Environmental accounting will provide a framework of present, past and future of the firm in terms of environmental cost. Now a day's people more aware about the ecological performances of the firms because the green accounting will be providing a gap filling in between environment and profitability of the firm. The data for the study is collected from annual reports from year 2012- 2017 of Brandix, before and after implementing green accounting for the firm. After collecting data that will be analyzed by using return on capital-employed earnings per share, net profit margin and environmental cost incurred by the firm. The available data for green accounting in Sri Lanka is very limited so the sample size used for the study is very small. The data is analyzed by using the figures obtained from the annual reports of the company and performing a descriptive analysis to discover whether the green accounting system has an effect on profitability. At the end of this study, it will provide an understanding on environmental reporting practices followed by Dialog Axiata and the green accounting has effect on the profitability of Dialog Axiata.

Keywords

Earnings per share, Environmental cost, Firm profitability, Green accounting, Net profit Margin, Return on capital employment

Introduction

Earth is an award for human being, once the human being getting developed they did not think of the environment. However, before the human being were not developed universe was a peaceful place with fresh air, pure water and unpolluted land. Nevertheless, with high and developed innovations the environment was polluted. With the industrial revolution fast technology, the society changes and service upgraded can be seen. However, with that pollution also came to the world, but after few decades the companies concern to preserve the nature that can be clearly seen through their annual reports.

The developed countries are publishing their goals for protecting environment for the future years as well. Likewise, there are few developed organizations such as Dialog, Commercial Bank, Brandix and HNB have record their expenses for environment separately. However, the environmental problems are common around the world. When it comes to Sri-Lanka, the following environmental protection acts for manufacturing companies can be identified.

1. All the companies have to provide an initial environment examination report.
2. Waste or discharge of any industrial process, agricultural waste and sewage sludge and source separated recyclable.
3. The central environmental authority, which consists of three members, will be authorized for environmental protection of Sri-Lanka. (Authority, 1980)

Since Sri-Lanka is a developing country that is an extreme, need to examine the relationship between green accounting and the profitability. As in common general, the author has used

manufacturing organization of Dialog, in order to determine the relationship between green accounting and profitability.

Background of the Study

In the 21st century, the people are more concerning about the environment and the surrounding. First of all, the green accounting concept came to the use year 1980 by Professor Peter wood. (Pereira, 2017) Environmental accounting is discovered as a new concept of an accounting that refer to the accounting for the environment and its wellbeing.

The term “Environmental Accounting” is open to interpretation. In this guideline, environmental accounting is the identification, measurement and allocation of environmental costs, the integration of these environmental costs into business decisions, and the subsequent communication of the information to a company’s stakeholders. Identification includes a broad examination of the impact of corporate products, services and activities on all corporate stakeholders. (Shastry, 2000).

The research question of this research is whether there is a difference in the profitability before implementing and after implementing the green accounting system in the company.

Research Objectives of this research is to find out whether there is a difference in the profitability before implementing and after implementing the green accounting system in the company.

Significance of the Study

This research will provide an understanding and knowledge about the green accounting practices and the profitability, because that will lead the organization to think more on the environment. When it comes to obtaining raw materials to cloth manufacturing most of them are gaining from the environment. E.g.; water, thread. This research will provide a brief explanation on relationship between green accounting and profitability regarding to Return on Capital Employment, Net profit margin and Earnings per share

Methodology

Conceptual Framework:

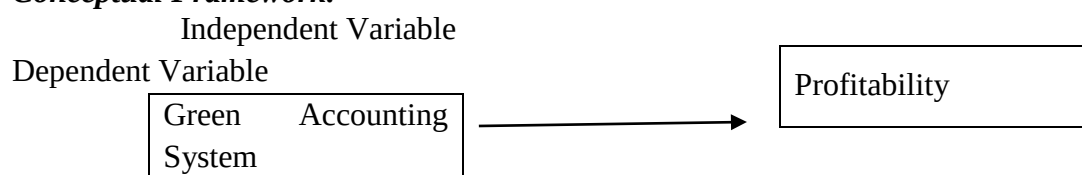


Figure 01: Conceptual framework

Data Collection:

For the research, the author will use previously collected data, secondary data of the Dialog. Secondary data is public information that has been collected by others. It is typically free or inexpensive to obtain and can act as a strong foundation to any research project — provided you know where to find it and how to judge its worth and relevance. (Wolf, 2016). Annual reports of Dialog Axiata will collect for a time 2012- 2017 will be used to carry out the further study of this study.

Data Analysis

The collected data will be analyzed through following data analysis method. The SPSS software will be used in the purpose of data analysis. “Descriptive analyses are central to almost every research project. Whether the goal is to identify and describe trends and variation in populations, create new measures of key phenomena, or simply describe samples in studies aimed at identifying causal effects, descriptive analyses are part of almost every empirical paper and report.” (Loeb et al., 2017)

Results of Analysis

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	EPS_Before	.0307	12	.02362	.00682
	EPS_After	.1089	12	.22018	.06356
Pair 2	ROCE_Before	.0519	12	.03659	.01056
	ROCE_After	.0635	12	.04253	.01228
Pair 3	NPM_Before	8.0167	12	3.03749	.87685
	NPM_After	9.5208	12	2.93882	.84836

Table 01: Paired sample statistics before and after implementing Green accounting

According to the Paired sample statistics it can be seen there is a clear difference of mean values before and after implementing Green accounting in Dialog from 2012- 2017 each quarter. They have implemented green accounting after 2014.

When it comes to EPS before implementing green accounting the value is 0.0307 but after implementing, it shows a mean value of 0.1089, which is a higher value than before there for it, can be concluded that there is an impact of green accounting for EPS in Dialog. Next in ROCE, before green accounting implementing the mean value that is showing is 0.0519 while after implementing mean value of ROCE is 0.0635. That is also higher than the before green accounting was implementing. Therefore, it can be concluded that there is an impact of green accounting for ROCE. Finally, for NPM before implementing green accounting to the organization it gives a mean value of 8.0167 while after green accounting is implemented it shows a value of 9.5208. It can be concluded that there is an impact of green accounting for NPM of the organization.

Paired Samples Test

			Paired Differences					t	df	Sig. (2-tailed)
			Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
						Lower	Upper			
Pair 1	EPS_Before - EPS_After	-.07825	.22599	.06524	-.22184	.06534	-1.199	11	.256	
Pair 2	ROCE_Before - ROCE_After	-.01158	.02069	.00597	-.02473	.00156	-1.939	11	.079	
Pair 3	NPM_Before - NPM_After	-1.50417	4.05671	1.17107	-4.08168	1.07334	-1.284	11	.225	

Table 02: Sig values of before and after implementing Green accounting

According to the above table sig value of EPS is 0.256 which is greater than 0.05. It implies that there is not a significant different in EPS before and after implementing green practices. The sig value of ROCE is 0.079, which is less than 0.1. Therefore, it can be concluded that there is a significant different in ROCE before and after implementing green practices at 10% level of significance. According to the sig value of NPM which is greater than 0.05 it can be identified that there is not a significant different in NPM before and after implementing green practices.

Descriptive analysis

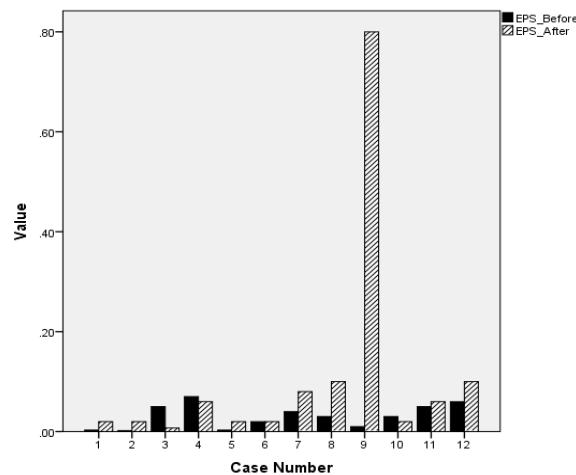


Figure 02: EPS before and after implementing Green accounting from 2012- 2017

In the above graph, it shows the EPS before and after implementing Green accounting from 2012- 2017 in each four quarter. It is clear that after implementing green accounting to the Dialog EPS amount has been increased in each quarter.

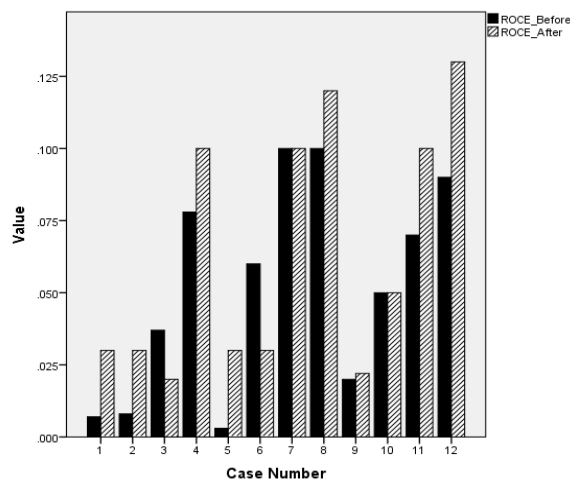


Figure 03: ROCE before and after implementing Green accounting from 2012 -2017

In this graph, it shows the relationship of ROCE from 2012 -2017 in each quarter of the year before and after implementing the Green accounting. According to the graph, it shows that after implementing green accounting the ROCE is considerably higher than before implementing green accounting. Therefor it can be concluded that there is a relationship between green accounting and ROCE.

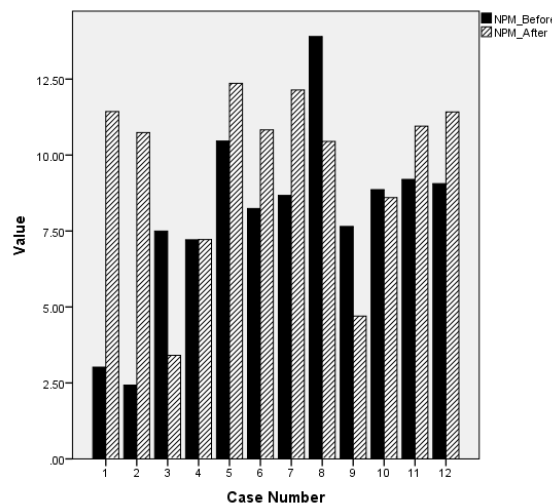


Figure 04: *NPM before and after implementing Green accounting from year 2012- 2017*

In above bar graph it shows the NPM from year 2012- 2017 for each quarter of Dialog. As an overall, it can be clearly depicting that the NPM is higher after implementing green accounting than before implementing green accounting to the organization. There for it can finalized that there is a relationship between NPM and Green accounting to the firm.

Conclusion and Recommendation

In the introduction and the background of the study, it gives a brief idea about green accounting globally and the Sri Lanka. The reasons for selecting the environmental accounting for the research is briefly explain the gap between the future and the present is well explained in the significance of the study. In addition, that describe about the dialog background and their current practices of environmental accounting.

Moreover, the literature review gives a brief idea about past studies carried out by the different author's worldwide. There are common factors and analyzing methods have been used for the proofing the relationship of green accounting and the profitability. Conceptual framework has been provided an idea about the dependent and the independent variables that will be used by the author for the future research. In addition, the variables that are required for the research is collected from the literature review. Secondary data has been collected through the annual reports, websites and quarterly financial reports of the dialog. In addition, they will be analyzed by using different analyzing methods in SPSS 22 software. Moreover, the analysis methods are descriptive analysis yearly from 2012- 2017 in Dialog. From the analysis, it could be concluded that the green accounting system has an effect on the profitability.

Recommendations

- Government should make regulations in financial, each organization has to include about their environmental reporting since most of organization skip that.
- Dialog can make campaigns such as environment protecting, less paper use and stop e – waste.
- Dialog can introduce e-waste management to Sri Lanka in partner with the Government in order to reduce the e waste from Sri Lanka.

- Corporate organizations on their part should ensure that they comply with the environmental laws of the nation, as it will go a long way in enhancing their performances.

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**THE FACTORS AFFECTING ON PURCHASING INTENTION OF ORGANIC
FOOD IN URBAN CONSUMERS – A CASE STUDY CONDUCTED IN MORATUWA
CITY**

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Abstract

This research will determine the foremost cogent factors driving consumers to shop for expensive food merchandise, so as for them to be organic. The question that rises is what is motivating consumers' judgments to buy organic food, what values are influential for Sri Lankan consumer choices? The prevailing studies on consumer reasons to purchase organic products demonstrate that organic food is generally bought due to non-noble motives such as care for one's own health or taste. In order to recognize why customers are concerned in purchasing a product, it is essential to understand the nature of the finalized buying decisional process and, therefore, of what they want or try to attain through the purchase. The research seeks to contribute to the understanding of what makes the patron decide between organic and non-organic food merchandise.

Key Words - Organic Food; Health Awareness; Perceived Value; Food Safety

Introduction

Over the last fifty years, the organic food movement has advanced into the most visible whole for a healthier and a lot of environmentally property food system. Baker et al., (2004) pronounced organic food market is as a hopeful and forecasting to grow powerfully. Therefore, considering drivers or motives for organic food consumption has become an important marketing research issue in recent years (Squires et al., 2001) There has been conducted a massive quantity of studies on organic food, seeking to work out the underlying factors explaining the shoppers call to buy ecologically friendly merchandise.

The developed countries as well as many Asian countries show a significant interest in organic food products and the organic food sector on those counties are continuously growing. Thus, even though Sri Lanka occupies a niche within domestic market today, it has a much larger potential to expand its market for organic food products. While exporting organic food products to international market, Sri Lanka has the necessary capabilities and competencies to cater into the domestic market as well. Regardless of being one of the major organic food producers in Asia, no significant statistic shows the demand of the Sri Lankan consumers for organic food products. However, there is an issue arise in which since organic products is so advantageous to the human body, why there are still less consumers of organic products in the market in some countries.

Objective and Significance of the Study

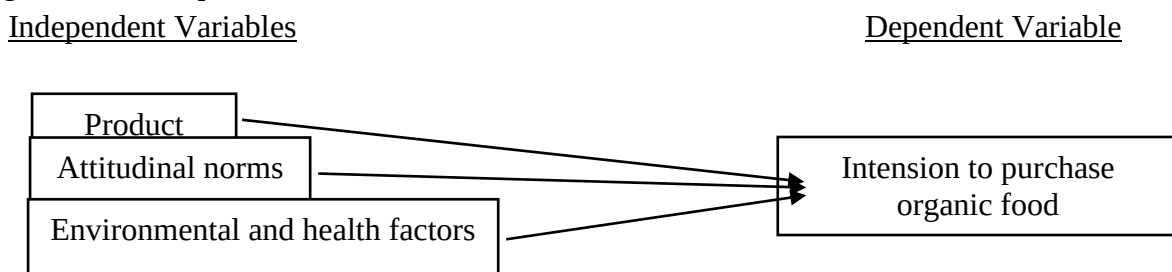
The main objective of the research is to decide what motivates the consumers to purchase and consume organic food products. To find out factors affecting the purchase of organic food and the relationships among them. The study is important in academic purposes as well as intension purposes. The approaches that can be applied by the organic producers in order to

attract more customers to consume organic food are also discussed together with the strategies that can be instigated by government to increase the consumption of organic products in the country. A study is conducted recognize the factors that motivating the consumption of organic food and to find out the approaches to attract more customers to consume organic food. It further recommends strategies can be instigated by government to increase the consumption of organic products. In addition, it is important to identify the health factors of organic food and encourage consumers to purchase it for health purpose. Finding of study provide a guide on the economic factors affecting the purchase intension of organic products.

Methodology

This study is going to be done by using both primary and secondary data. Primary data is collected through a questionnaire which is distributed among a 50 respondents who walks into supermarkets organic food section and secondary data is collected by journal articles, books, newspapers, magazines, textbook and internet. This research is going to be a combination of both primary and secondary data where it helps so much to find literature about this topic. Convenience sampling method is used to collect data, which comes under non-probability sampling method, where the investigator selects the sample according to the consumer's wish. The research model exhibits the buyer perspective towards getting organic food product are powerfully influenced by three variables specifically environmental and health concern, and product quality and attitude norms. The conceptual framework for consume purposes of organic food products is shown below.

Figure 01: Conceptual Model



Method of data analysis

The main data collection is done for this study is through questionnaires. The questionnaires are distributed among the sample and the results are taken into consideration descriptively. Many tools and figures will be used to present the data, which is collected. Pie charts, graphs and tables will be used systematically. Statistical techniques will be used to find our mean and frequency by the use of SPSS software.

The level of correlation between the variables is calculated using Pearson's correlation coefficient and the value of the correlation coefficient and the level of significance. (Basha, 2015) Correlation measures the strength and harness of linear relationships between two continuous variables. Using the correlation method, it is identifiable whether the environmental and health concern, product quality and attitude norms has a relationship between the intension to purchase organic food.

Results of Analysis

Relationship between quality and the purchase intention

Table 01: Correlation between quality and the purchase intention

		Intension	Quality
Intension	Pearson Correlation	1	.253*
	Sig. (2-tailed)		.076
	N	50	50
Quality	Pearson Correlation	.253	1
	Sig. (2-tailed)	.076	
	N	50	50

*. Correlation is significant at the 0.10 level (2-tailed).

According to the above table, it can be seen that there is a positive relationship between purchasing intension and quality as the correlation coefficient is 0.253. Moreover, the sig value of this relationship is 0.076, which is not less than 0.05. Therefore, there is no enough evidence to reject the null hypothesis. It implies that there is no significant relationship between purchasing intension and quality at 5% level.

Relationship between attitudinal norm, knowledge, and the purchase intention

Table 02: Correlation between attitudinal norm, knowledge, and the purchase intention

		Intension	Attitudinal norm and knowledge
Intension	Pearson Correlation	1	.315**
	Sig. (2-tailed)		.026
	N	50	50
Attitudinal norm and knowledge	Pearson Correlation	.315*	1
	Sig. (2-tailed)	.026	
	N	50	50

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

Results reveal that there is a positive relationship between purchasing intension and attitudinal norm and knowledge because the correlation coefficient is 0.315. Further, the sig value is 0.026, which is less than 0.05. Therefore, there is enough evidence to reject null hypothesis at 5% level of significance. It means that there is a significant relationship between purchasing intension and attitudinal norm and knowledge.

Relationship between health, safety, and the purchase intention

Table 03: Correlation between health, safety, and the purchase intention

		Intension	Health and safety
Intension	Pearson Correlation	1	.724**
	Sig. (2-tailed)		.000
	N	50	50
Health and safety	Pearson Correlation	.724**	1
	Sig. (2-tailed)	.000	
	N	50	50

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

According to results, it can be clearly observed that there is a strong positive relationship between purchasing intension and Health and safety since the correlation coefficient is 0.724. The sig value of 0.000 indicates that there is a significant relationship between purchasing intension and Health and safety at 5% level of significance because the sig value is less than 0.05.

Conclusions and Recommendations

The analyze reveal that the consumers generally hold positive attitudes towards organic foods with regard to health (lack of pesticide residues, vitamins and minerals). There were no significant discrepancies between the sociodemographic factors and the price of organic products. The results of the study additional show that the explanations advocated by the customers for getting organic food merchandise measure varied and primarily the motivations behind their call to get embrace issues for surroundings, health concern, food quality and their subjective norms. It does not seem to affect the attitudes towards the purchase intention of organic food products, as consumers do not perceive it to be expensive. The lack of availability and the lack of confidence about the quality of the organics are the key barriers, which affect the attitudes towards the purchase intention of organic foods.

Nowadays shopper behavior is ever changing towards purchase of the many environmental-friendly and organic merchandise, due to awareness of environmental degradation and therefore the connected problems. The overall awareness on organic food merchandise among the public is increasing and their angle towards purchase intention is positive. Shopper behavior involves the psychological processes that buyers bear in recognizing desires, finding ways that to unravel these needs; collect and interpret information; build plans and implement these plans, creating purchase choices and post-purchase behavior. Thus, the present study involves exploring the attitudes towards purchase intentions of organic foods.

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THE IMPACT OF WORKING CAPITAL MANAGEMENT ON PROFITABILITY - A STUDY RELATED TO A MANUFACTURING COMPANY IN SRI LANKA

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Abstract

This research attempts to identify the impact of working capital management and profitability by analyzing a manufacturing company in Sri Lanka (Hemas Holdings PLC.). The data was collected from annual reports of the selected manufacturing company from Colombo stock exchange for the past ten years from 2009 to 2018. Working capital to a company is like blood to human body, if it is carried out effectively and efficiently that will assure the health of the organization. The objective of this study is to identify the relationship between working capital management and profitability and its impact on profitability. The relationship between working capital and profitability is examined through Pearson correlation analysis. The working capital management represents the variables of Current ratio (CR), Quick ratio/acid-test ratio and debt ratio. The profitability represents the variables of Return on Assets. The conclusion of the study is working capital management has a great impact on profitability of the selected two manufacturing firms.

Key words: Working capital management, profitability, manufacturing companies, current ratio, quick ratio debt ratio and ROA.

Introduction

In the fast-moving world, firms are highly competing among them. A well designed and implemented Working capital management is expected to positively contribute to the creation of firm's value. Working capital management is one of the crucial components in financial management. The term working capital management simply refers to the efforts of the company's management towards effective management of current assets and current liabilities. Working capital management is the difference between the current assets and current liabilities. In other terms, an efficient working capital management refers to ensuring sufficient in the business to be able to satisfy short-term expenses and debts (eFinance, 2019). A firm should maintain a balance between liquidity and profitability while doing its business transactions. Liquidity refers to a company's ability to pay its near-term obligations a company needs liquid assets to effectively operate (Wild, Larson, & Chiappetta, 2005). The working capital management is dealing with current assets and current liabilities and directly affects the profitability and liquidity of firms.

Working capital management is a very sensitive area in financial management, which involves making decisions on the amount of assets and the financing (G.R.M. Gamlath and Y. Rathirane, 2014). In financial management, the main objective of a business would be to maximize profit but the other important aim would be to preserve liquidity. Firms that do not concern of liquidity may be insolvent or bankrupt. Therefore, businesses must concern working capital management, which may have an impact on the profitability. This study

focusses on working capital management and its impact on profitability, a study done on Hemas Holdings PLC for the past ten years.

Background of the Study

In order to explain the relationship between working capital management and profitability different researches had been carried out in different parts of the world. The research work is mainly focused on the impact of working capital management on profitability of the selected company. The working capital management is essential for a business to survive because of its effects on profitability, risk and the firm's value (Smith, 1984). Working capital management is measured by using the cash conversion cycle, the cash conversion cycle is one of the most important metrics used by business to calculate when conducting a cash flow analysis to a business (Peavler R,2019). A longer cash conversion cycle might increase profitability because it leads to higher sales, but the profitability may decrease if the cost of higher investment in working capital rise faster than holding more inventories. In this study, the research problem will arise as, does the working capital management have an impact of the selected companies' profitability.

Significance of the Study

Many researchers had attempted to address and make experiment to do a research to fill up a knowledge in manufacturing industry of Sri Lanka. There is a growing trend in Sri Lanka in field of manufacturing sector, therefore this would help to understand and evaluate the importance of working capital management for analyzing the financial performance of the firm. This research will attempt to identify the impact of working capital management on the financial performance of a selected manufacturing company for the past ten years.

Methodology

Based on the above research question and previous research reviews the following conceptual model could be formed.



Figure 01: Conceptual Framework.

H₀- There is no significant relationship between working capital management and profitability.

H₁- There is a significant relationship between working capital management and profitability. In this research, a manufacturing company in Colombo stock exchange has been selected (Hemas Holdings PLC.) The organization was selected on the availability of data range from 2009-2018. Secondary data has been used in this research and the data was collected by the financial reports of the company from Colombo Stock Exchange for the period 2009- 2018.

This research examines the relationship between working capital management and profitability by using statistical package for social science (SPSS). Some independent variables used are Working capital management, current ratio (CA), Quick ratio (acid test ratio) and debt ratio. The depended variables used are return on assets (ROA) and the profit. The following methods were followed.

Scatter diagram: The scatter diagram graphs pairs of numerical data, with one variable on each axis, to look for a relationship between them (The quality Toolbox, 2019).

Correlation analysis: correlation analysis is concerned in describing the strength of relationship between two variables. In this research, the correlation coefficient analysis is undertaken to find out the relationship between Working capital management and profitability. According to the correlation analysis and the regression model, the overall results are shown below.

Results of Analysis

Current Ratio

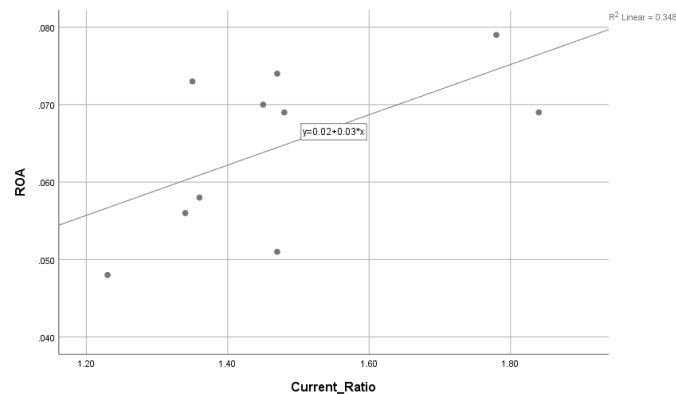


Figure 2: the relationship between Current ratio and Return on Asset for Hemas Holdings.

Figure 02 indicates the relationship between current ratio and Return on asset for Hemas holdings. According to the scatter diagram in figure 06 there is a positive relationship between Current ratio and ROA.

		ROA	Current Ratio
ROA	Pearson Correlation	1	.590
	Sig. (2-tailed)		.073
	N	10	10
Current Ratio	Pearson Correlation	.590	1
	Sig. (2-tailed)	.073	
	N	10	10

Table 1: correlation analysis for ROA and Current ratio for Hemas Holdings.

Table 01, shows the correlation analysis for Return on Asset and Current ratio. According to the pearson correlation (0.590) there is a moderate positive relationship between ROA and current ratio for Hemas Holdings. The sig. value is less than 0.1; therefore, there is a significant relationship between Current Ratio and ROA at 10% level.

Quick Ratio

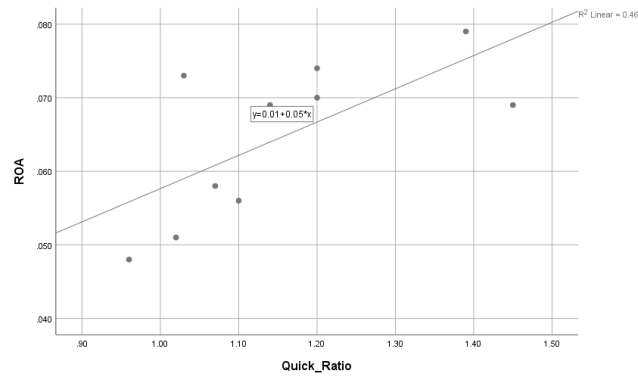


Figure 3: The relationship between Return on Asset and Quick Ratio for Hemas Holdings.

Figure 03, shows the relationship between ROA and quick ratio for Hemas Holdings. According to the above scatter diagram there is a positive relationship between Quick ratio and ROA for Hemas Holdings.

		ROA	Quick Ratio
ROA	Pearson Correlation	1	.680*
	Sig. (2-tailed)		.031
	N	10	10
Quick Ratio	Pearson Correlation	.680*	1
	Sig. (2-tailed)	.031	
	N	10	10

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

Table 2: Correlation analysis for ROA and Quick ratio for Hemas Holdings.

Table 02, shows the correlation analysis for Return on Asset and Quick ratio. According to the pearson correlation (0.680) there is a moderate positive relationship between ROA and quick ratio for Hemas Holdings. The sig. value is less than 0.05 therefore the null hypothesis can be rejected this indicates that there is a significant relationship between Current ratio and ROA.

Debt Ratio

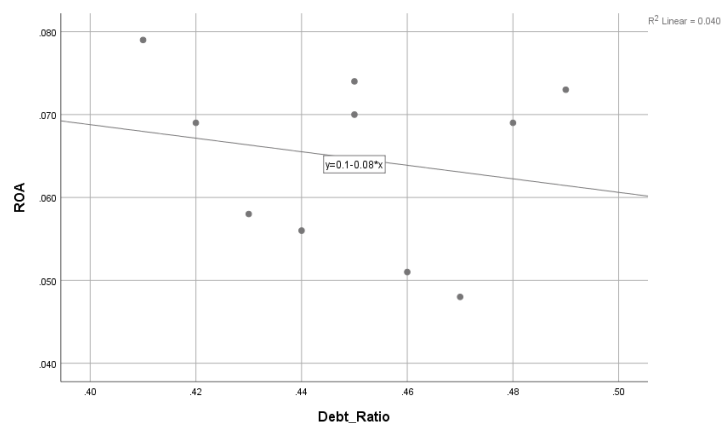


Figure 4: Relationship between Debt ratio and ROA for Hemas Holdings.

Figure 04, shows the relationship between ROA and debt ratio for Hemas Holdings. According to the above scatter diagram there is a negative relationship between Quick ratio and ROA for Hemas Holdings.

		ROA	Debt Ratio
ROA	Pearson Correlation	1	-.199
	Sig. (2-tailed)		.582
	N	10	10
Debt Ratio	Pearson Correlation	-.199	1
	Sig. (2-tailed)	.582	
	N	10	10

Table 6 : Correlation analysis for Debt ratio and profitability for Hemas Holdings.

Table 03, shows the correlation analysis for Return on Asset and Debt ratio. According to the Pearson correlation (-0.199) there is a weak negative relationship between ROA and debt ratio for Hemas Holdings. The sig. value is greater than 0.05 therefore the null hypothesis cannot be rejected this indicates that there is no significant relationship between Current ratio and ROA.

Working Capital Management

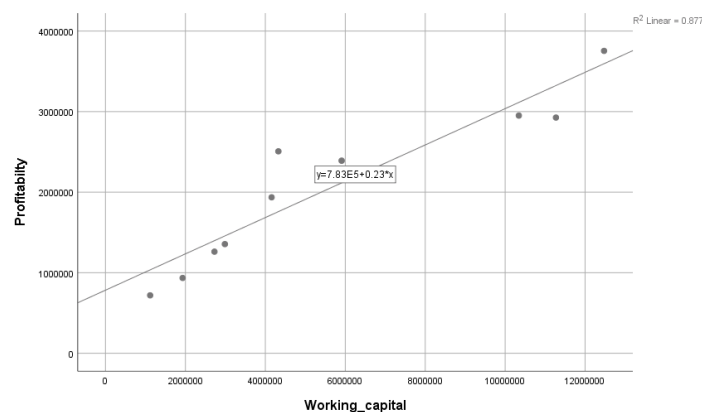


Figure 5: Relationship between working capital and profitability for Hemas holdings.

Figure 05, indicates the relationship between working capital management and profitability for Hemas holdings. According to the scatter diagram in figure 08 there is a relationship between Working capital management and profitability.

		Profitability	Working capital
Profitability	Pearson Correlation	1	.936**
	Sig. (2-tailed)		.000
	N	10	10
Working capital	Pearson Correlation	.936**	1
	Sig. (2-tailed)	.000	
	N	10	10

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

Table 47: correlation analysis for working capital and profitability for Hemas holdings.

Table 04, shows the correlation analysis for profitability and working capital. According to the Pearson correlation (0.936) there is a strong positive relationship between profitability and working capital for Hemas holdings. The sig. value is less than 0.05 therefore the null hypothesis can be rejected this indicates that there is a significant relationship between working capital and profitability.

The regression model conducted to find the impact is as follows:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.936 ^a	.877	.861	371162.97234

a. Predictors: (Constant), Working_Capital

Table 05: Model summary

Adjusted R squared value of 0.861 implies that 86.1% of variabilities are explained by the regression model.

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7832371475166.661	1	7832371475166.661	56.854	.000 ^b
	Residual	1102095616315.339	8	137761952039.417		
	Total	8934467091482.000	9			

a. Dependent Variable: Profit

b. Predictors: (Constant), Working Capital

Table 06: ANOVA Table

According to the result, it can be seen that the regression model is significant at 5% level since it shows sig value of 0.05, which is less than 0.05

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	783403.366	207477.936		3.776	.005
	Working Capital	.225	.030	.936	7.540	.000

a. Dependent Variable: Profit

Table 07: Coefficient Table

According to the coefficient table, it can be observed that there is a positive impact of working capital on profit as the regression coefficient is 0.225. Further, it shows a significant impact on profit at 5% level since the sig value is less than 0.05.

Therefore, the model can be written as follows.

Profit = 783,403.36 + 0.225 Working capital

Conclusion

From the above discussions, it can be concluded that the working capital management has a great impact on profitability. The current ratio and quick ratio have a positive relationship to return on assets but the debt ratio has a negative relationship to Return on Assets. The working capital management has a strong positive relationship to the profitability of the selected manufacturing company. Therefore, it can be concluded that financial managers will be able to create value for their shareholders through the efficient management of working capital management by exploiting the relationships between profitability and working capital management variables. To do this, companies need to dedicate considerable amount of resources in developing effective working capital management policy.

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WHY DO EMPLOYEES VARY IN PRODUCTIVITY? A STUDY ON WORK ENVIRONMENT & MANAGEMENT DRIVEN FACTORS.

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Abstract

The study sought to investigate the effects of work environment on employee's productivity in a selected organization, a multinational garment corporation located in Sri Lanka. Four research objectives were raised to assist the research, in order to identify the extent to which these factors can affect a workers' productivity, since it has been found that several past workers of this company have complaints with regard to their working environment.

In an attempt to realize the objectives of the study, 100 questionnaires were administered to the sample size of the employees and the information was analyzed using correlation, regression, descriptive statistics and such by using SPSS. It was found that physical work environment and management driven factors significantly affect their productivity directly.

Keywords: Employee Productivity, Garments Industry, Work Environment.

Introduction

The selected company is a Strategic Business Unit of Sri Lanka's largest apparel manufacturers, employing blue color and white color employees. The company produces for brands like Victoria's Secret, Marks & Spencer, and Calvin Klein. A good work environment has the power to motivate the employees and increase their performance largely, therefore, it is important to carefully bring together a satisfactory workspace for each worker based on their respective department (P, 2016).

Whereas, an unsafe and unhealthy work environment would consist of poorly designed workstations, no safety equipment, and insufficient safety measures in fire emergencies, unsuitable work layouts, lack of ventilation, inappropriate lighting and excessive noise. Therefore, the company must be able to create a workplace environment where employees are motivated to work; both in the physical and non-physical aspects.

According to an article (Sudarshan & Rasenthiran, 2018), several past workers of the company had a lot to say about their working environment, in terms of its physical and management-driven conditions.

An employee's workplace environment is a key determinant of the quality of their work and their level of productivity (Johannsdottir & Hansen, 2017). This work environment could consist of the office buildings; it is spacing and layout as the physical conditions under which workers operate.

Other factors could include the allocation of responsibilities at all levels of organization, definition of job descriptions, the degree of access management and administrative support, working patterns, shift-working, break times, health and safety policies, including the provision of training, development working practices and the adequate supply of protective clothing and equipment (Mendis, 2016). According to above literature, physical factors such as work layout, lighting, work equipment, thermal comfort and ventilation and Managerial

factors such as Supervisory support, Health & Safety practices, working patterns were considered.

The objectives of the study are:

- i. To assess physical environment factors, affect the productivity of workers of the company.
- ii. To assess management driven factors affect the productivity of workers of the company.
- iii. To determine the effect of work environment on productivity of employees of the company.

The outcome of the research would be used to alert the management of the company of the employees' perspective to specific work environment features. Ultimately, the company will be able to better itself by adding improvements and to increase the level of productivity of its employees.

The framework shows two (2) independent variables such as the physical work environment and management driven factors of the company, the productivity of the employees is the dependent variable. The author tested the work layout, lighting, work equipment, noise, thermal comfort and ventilation under the physical work environment. Supervisor support, health & safety practices, and work patterns were tested under the management-driven factors.

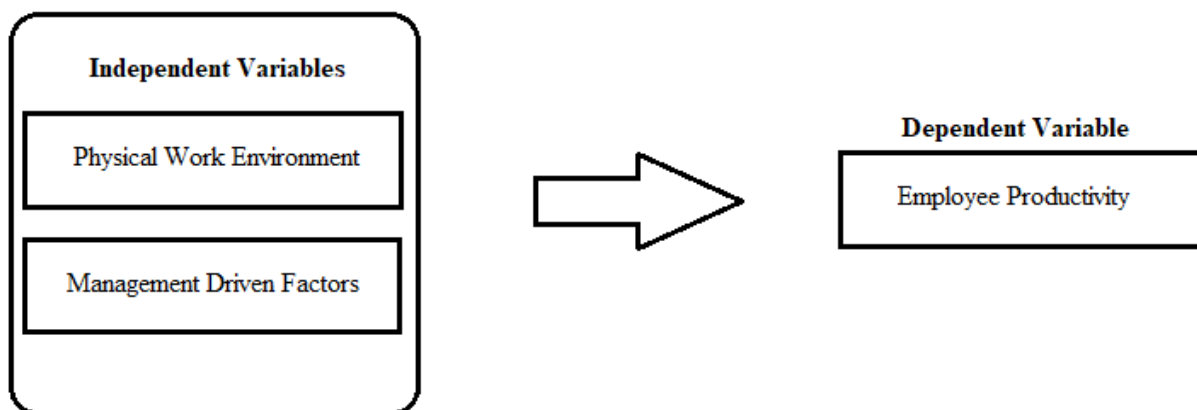


Figure 2: Conceptual framework, source: researcher's own work.

Hypothesis:

H₀: There is no relationship between physical work environment and employee productivity.

H₁: There is a relationship between physical work environment and employee productivity.

H₀: There is no relationship between management driven factors and employee productivity.

H₂: There is a relationship between management driven factors and employee productivity.

Methodology

The data for this research is under the quantitative data collection method. The target population of this study is all workers of the company, from the population, 140 employees production level employees were selected as the sample size.

Convenience sampling method was used. A Structured questionnaire was distributed for 140 employees in the organization. The questionnaire was consisting with three sections and Section A for demographic factors, Section B considered the working conditions in both the

physical work environment and the management driven factors, and Section C considered about the direct relationship between these variables. Correlation & Regression were used as the analytical tools.

Results & Discussion

The author received only 100 responds out of the selected sample. After receiving the respondents' data of 100 fully filled out questionnaires, and analyzing the information into statistical methods, it is now foreseeable to interpret the relevant hypothesis on terms of productivity, the physical work environment and the management driven factors of the company.

Correlation Analysis:

- Job productivity and Physical work environment:

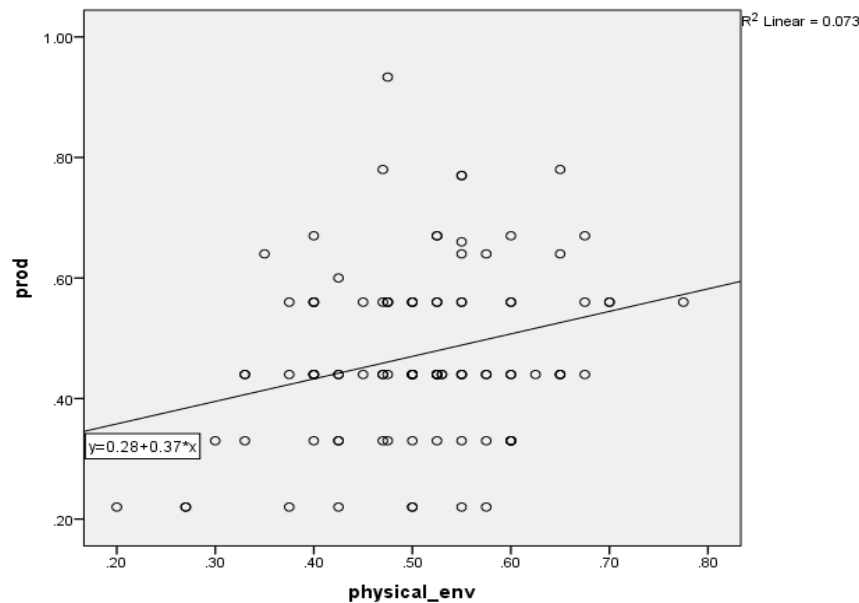


Figure 2: Relationship between physical work environment and job productivity

According to the above scatter diagram, there is a positive relationship between physical work environment and job productivity as it shows an upward slope on the graph.

Table 8: Correlation analysis between job productivity and physical work environment

		prod	physical_env
prod	Pearson Correlation	0.83	.270**
	Sig. (2-tailed)		.007
	N	100	100
physical_env	Pearson Correlation	.270**	0.83
	Sig. (2-tailed)	.007	
	N	100	100

According to the correlation analysis, the Pearson correlation value is 0.83, it implies that there is a strong positive relationship between physical work environment and employee productivity. Furthermore, sig value is 0.007; this value is less than 0.05 therefore there is enough evidence to reject null hypothesis at 5% level of significance, it reveals there is a significant relationship between physical work environment which includes work layout, lighting, work equipment, thermal comfort and ventilation and employee productivity.

- Job productivity and management driven factors:

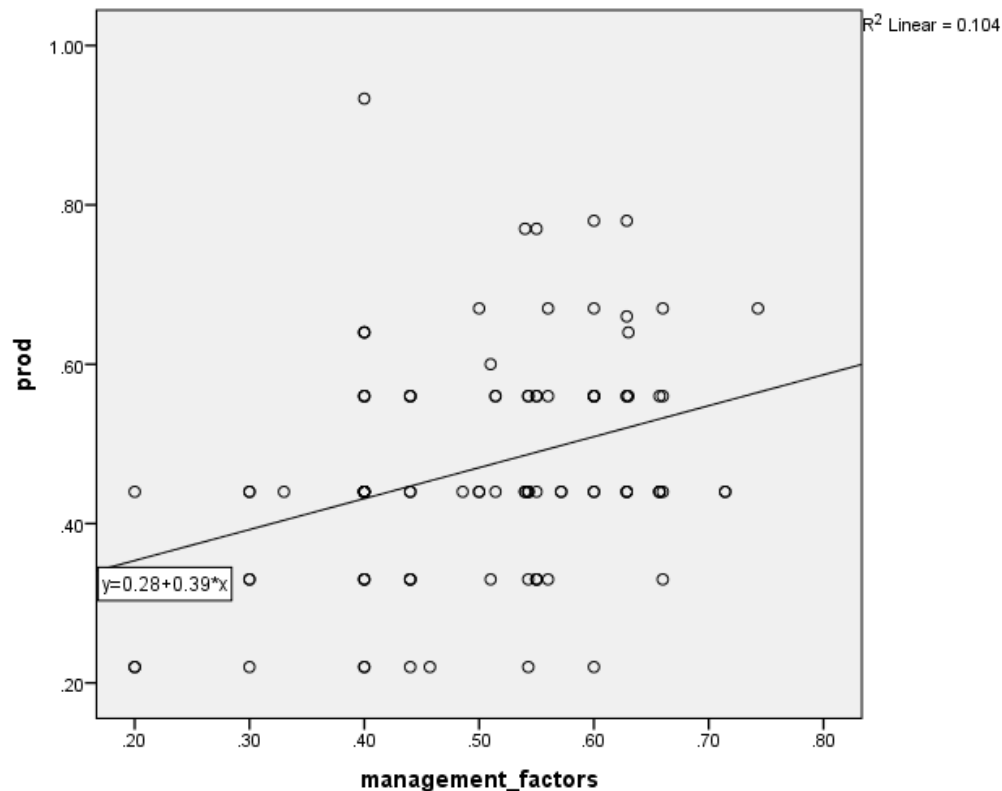


Figure 3: Relationship between physical work environment and management driven factors
According to the scatter diagram above, there is a positive relationship between job productivity and management driven factors as it shows an upward slope on the graph.

Table 9: correlation analysis on job productivity and management driven factors

Correlations

		prod	management factors
prod	Pearson Correlation	0.78	.322**
	Sig. (2-tailed)		.001
	N	100	100
management factors	Pearson Correlation	.322**	0.78
	Sig. (2-tailed)	.001	
	N	100	100

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

According to the correlation analysis, Pearson correlation value is 0.78, it implies that there is a strong positive relationship between job productivity and management driven factors. Additionally, the sig value is 0.001, which is less than 0.05. Therefore, there is enough evidence to reject null hypothesis at 5% level of significance, it reveals that there is a significant relationship between job productivity and management driven factors.

Regression Analysis

This analysis is implemented to examine the impact between two variables. This will be carried out through the model summary table, the ANOVA table and the coefficients table for both independent variables.

Table 10: Model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.358 ^a	.128	.110	.13489

a. Predictors: (Constant), management_factors, physical_env

According to the model summary table, the adjusted R square value is 0.110; it implies that out of all total variabilities, the regression model explains 11% of variabilities.

Table 11: ANOVA

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.259	2	.130	7.120	.001 ^b
	Residual	1.765	97	.018		
	Total	2.024	99			

a. Dependent Variable: prod

b. Predictors: (Constant), management_factors, physical_env

H₀: the model is not adequate.

H₁: the model is adequate.

According to the ANOVA table, sig value of regression is 0.001, this value is less than 0.05 therefore H₀ can be rejected at 5% level of significance, and it implies that the model is adequate.

Table 12: Coefficients

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.198	.076		2.611	.010
	physical_env	.234	.143	.169	1.642	.104
	management factors	.308	.124	.256	2.480	.015

a. Dependent Variable: prod

Job productivity= (0.198 constant) + (0.234 physical_env) + (0.308 management factors)
= 0.74

The value 0.074 derived from the beta values of each variable, shows that it has a positive value; this implies that there is a positive impact.

In order to interpret the sig values, each variable must be analyzed individually:

Physical work environment:

H₀: there is no significant impact between job productivity and the physical work environment.

H₁: there is a significant impact between job productivity and the physical work environment. According to the coefficients table, the sig value is 0.104, this is greater than 0.05, therefore there is enough evidence to accept null hypothesis at 5% level of significance, this implies that there is no significant impact between job productivity and the physical work environment.

Management driven factors:

H₀: there is no significant impact between job productivity and the management driven factors.

H₁: there is a significant impact between job productivity and the management driven factors. According to the coefficients table, the sig value is 0.015, this is less than 0.05, therefore there is enough evidence to reject null hypothesis at 5% level of significance, this implies that there is a significant impact between job productivity and the management driven factors.

Conclusions and Recommendations

It was observed that there is a significant relationship between job productivity and both the physical work environment and management driven factors. The organization could implement fluorescent lighting to avoid eye problems for the workers, and make the thermal surrounds more comfortable. As for the work layout, place materials, tools and controls within easy reach and provide more space between each worker to let workers carry out tasks freely.

Personnel to ensure that the machines that workers use are of good condition so that these individuals can work with no errors made by machines must implement regular machine quality checkups. For noise control, workers in noisy areas can wear earmuffs or earplugs.

Incorporate regular supervisory skills training programs to make the workers to feel comfortable around their supervisors and increase their productivity. With regard to health and safety practices, provide more head gear; facemasks, gloves, and other safety equipment to workers specific to their job title. Acquiring fire extinguishing appliances and having a fire fighting practice facility will be beneficial to the factory. Finally, for the work patterns, it is recommended to allow more breaks during work so that workers have more time to rest and work aids will help workers know how to carry out tasks.

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**ASSOCIATION BETWEEN LOYALTY PROGRAMS AND CUSTOMER
SATISFACTION OF ARPICO SUPER MARKET MAHARAGAMA**

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Abstract

Most businesses implement loyalty programs to increase customer satisfaction especially in retail industry. As customer satisfaction plays a vital role in success of any business, loyalty programmes should be effective in order to have a proper customer retention. All leading modern retail chains in Sri Lanka has introduced loyalty cards by integrating all benefits to their customers. But it is difficult to identify whether the customers are loyal only because of the loyalty programmes, the purpose of this research is to analyze the impact and the relationship of customer loyalty program and customer satisfaction. Data were collected through a questionnaire among a convenient sample of 100 customers from Arpico Super market Maharagama. The independent variables such as discounts, point systems, and tier reward systems affect customer satisfaction positively but intensity of each variable differs.

Keywords: Customer Loyalty, Customer Loyalty programs, Customer Loyalty Point Programs, Customer satisfaction, Tier reward system.

Introduction

Arpico super market chain is the only hypermarket chain in Sri Lanka, whom offers over 15000 products under one roof and provide unique and delightful shopping experience to their customers. Furthermore, as to retain their customers, Arpico super market offers two types of loyalty cards based on the usage of the cards, as platinum and gold.

Loyalty programs play a vital role in businesses in any industry and it is a powerful instrument to boost the customer loyalty. Loyal customers even become business builders if they tend to be loyal to the firm over time; they are buying more and through the positive word of mouth (O'Brien and Jones, 1995).

With the development in technology companies have come up with various types of initiative and creative tactics in order to enhance the customer relationship with the organization. Mostly in retail industry organizations use discounts, special offers and etc. to attract the customer attention towards the products and to build up the loyalty in both general and modern trade. With the development of digital technology most of modern trade retailers introduced loyalty card programs to build up the customer loyalty.

Loyalty programs signify an option to mass-market promotion since firms are better in a position to exactly target a gradually increasing segment of customer base (Karim 2011). According to previous researches, supermarket industry has a good customer base due to loyalty programs and can be an effective marketing tool compared to other promotional programs which enhance the level of customer satisfaction. However, sometimes the level of satisfaction of customers may not enhanced further after joining the loyalty program schemes (Kamu, 2017). Some customers who are not entitled to loyalty programs can be more loyal than who entitled to the loyalty programs. As an example a customer who are not a

loyalty card holder can purchase more from the store than a card holder. This creates a problem whether such customers are really satisfied with the tier reward system of Arpico. Since customers have access to wide range of alternatives in the market including the loyalty card service, it is not clear whether the loyalty card scheme has contributed to enough to enhance customer satisfaction towards the organization through loyalty cards. (Kamu, 2017).

Research objective & Significance

This study has helped to identify the customer purchasing behavior and preferences towards the loyalty program and it will help supermarkets to run loyalty programs effectively by doing alternation to the loyalty program according to the customer preferences. This research will be effective for marketing managers at Arpico super market chian to gain additional information about the issues which shall be further discussed in the research. The following objectives used as research objectives;

- To identify the relationship between customer loyalty programs and customer satisfaction
- To identify drawbacks which should be improved regarding customer loyalty programs

Methodology

A convenient sample of 100 customers whom purchase goods from Arpico super market in Maharagama were selected. Convenient sampling method was used because of the convenience and accessibility to conduct the survey. Through a questionnaire which consist of both open ended and close ended question were used to do the survey. Also, structured questions were used with five points likert scale questions and data was collected via an online questioner and manual interviews were carried out using the questionnaire. Furthermore, a limited amount of secondary data was collected from Arpico super market. Descriptive statistical methods were used to identify the distribution patterns of variables. Further, correlation analysis was used to identify the liner relationship between loyalty programs and customer satisfaction. Chi squared test was used to measure the association between the points earned by customer and the type of loyalty card

Results

The relationship between determinants of loyalty program and customer satisfaction can be tested as follows.

H0: There is no positive relationship between tier system rewards and customer satisfaction.

H2: There is a positive relationship of tier system rewards and customer satisfaction.

H0: There is no positive relationship of discounts on customer satisfaction.

H3: There is a positive relationship of discounts on customer satisfaction

Table 013: Type of Loyalty Card and Points Earned

Count		amount_of_earned_points				Total
		<500	500-1499	1500-2499	2500 and above	
card type	Silver	53	21	4	2	80
	gold	0	0	0	23	23
Total		53	21	4	25	103

Table 014 Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	92.391 ^a	3	.000
Likelihood Ratio	95.459	3	.000
Linear-by-Linear Association	76.214	1	.000
N of Valid Cases	103		

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is .89.

According to above chi square analysis the pearson chi square value is less than 0.05. Therefore the null hypothesis(H₀) can be rejected.(The null hypothesis :there is no relationship with between point system and tier reward system). it implies that there is a positive relationship between point system and tier reward system.

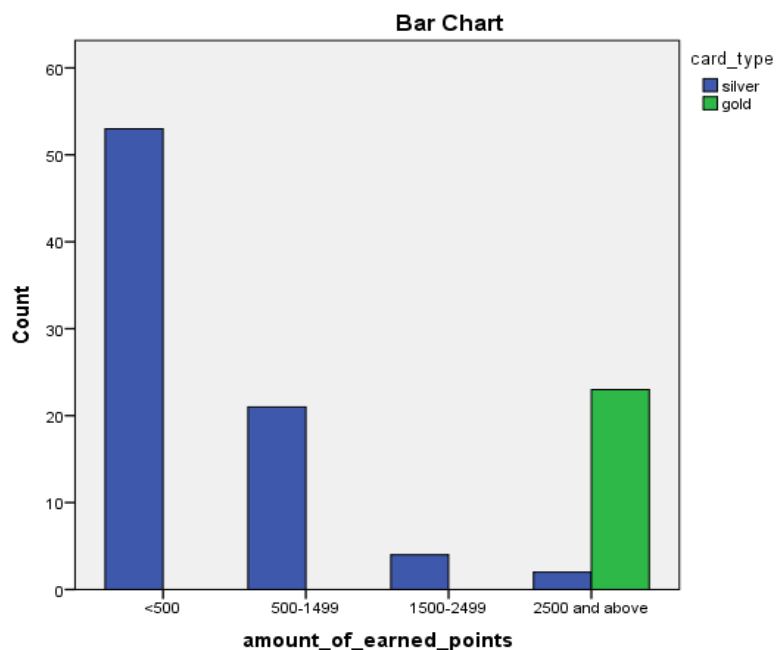


Figure 01:Points earned by customers

According to above graph it highlights that most of customers who earned more than 2500 points entitled to gold card. Based on the amount of point they earned the position of the tier reward system is decided. In the graph it shows that there is no gold card member whom have points less than 2500. Customers who earned 2500 points eligible to go for a gold card and based on customer preferences customers can still remain in the silver card category. That is why comparatively very limited silver card holders are there with range of 2500 and above
H0: There is no positive relationship between tier reward system and customer satisfaction.
H2: There is a positive relationship between tier reward system and customer satisfaction.

Table 03: Correlation Analysis

		overall_satisfaction_for_tier_reward_system	overall_satisfaction_with_loyalty_program
overall_satisfaction_for_tier_reward_system	Pearson Correlation	1	.475**
	Sig. (2-tailed)		.000
	N	103	103
overall_satisfaction_with_loyalty_program	Pearson Correlation	.475**	1
	Sig. (2-tailed)	.000	
	N	103	103

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

According to above table sig value is .000 which is less than 0.05. Therefore, there is enough evidence to reject HO at 5% level of significance. Furthermore, Pearson correlation value is .475. It implies that there is a weak relationship between tier system and loyalty program.

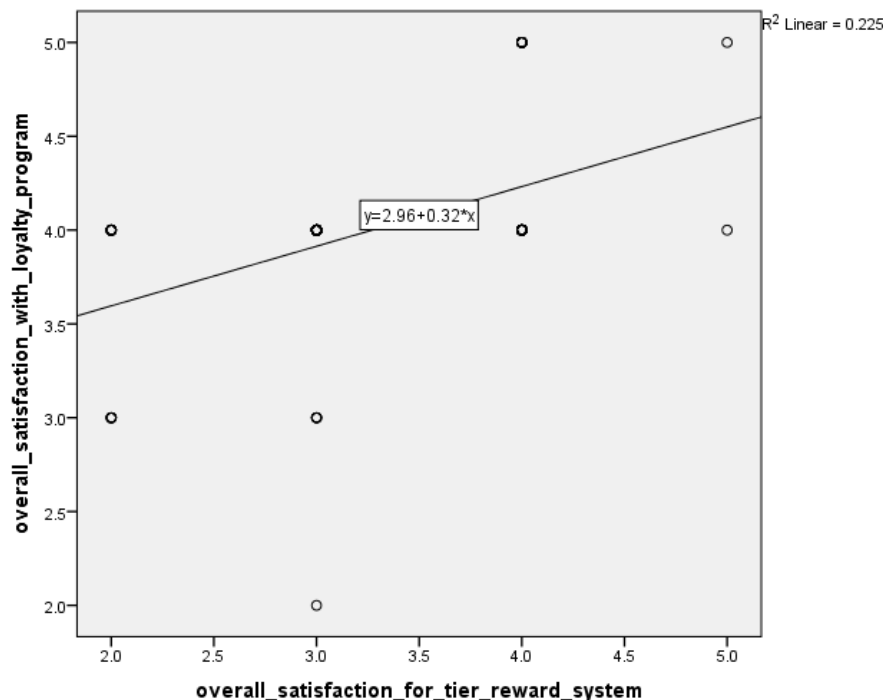


Figure 02: Scatter Diagram

According to above scatter diagram it embraces that there is a positive relationship between point system and satisfaction with loyalty program. However, above discussed correlation analysis with scatter diagram, implies that there is a weak positive relationship between tier system and satisfaction with loyalty program.

Table 04: Correlation table of discounts and overall satisfaction with loyalty program

		overall_satisfaction_with_loyalty_program	overall_satisfaction_for_discounts
overall_satisfaction_with_loyalty_program	Pearson Correlation	1	.530**
	Sig. (2-tailed)		.000
	N	103	103
overall_satisfaction_for_discounts	Pearson Correlation	.530**	1
	Sig. (2-tailed)	.000	
	N	103	103

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

H0: There is no positive relationship between discounts and customer satisfaction.

H3: There is a positive relationship between discounts and customer satisfaction.

According to Table_5, the sig value is less than 0.05 which means that there is enough evidence to reject null hypothesis at 5% level of significance. Which implies that, there is a significance relationship between discounts and satisfaction with loyalty program. The Pearson co- relation value is 0.53 and it means it has a moderate relationship between discounts and satisfaction for loyalty program.

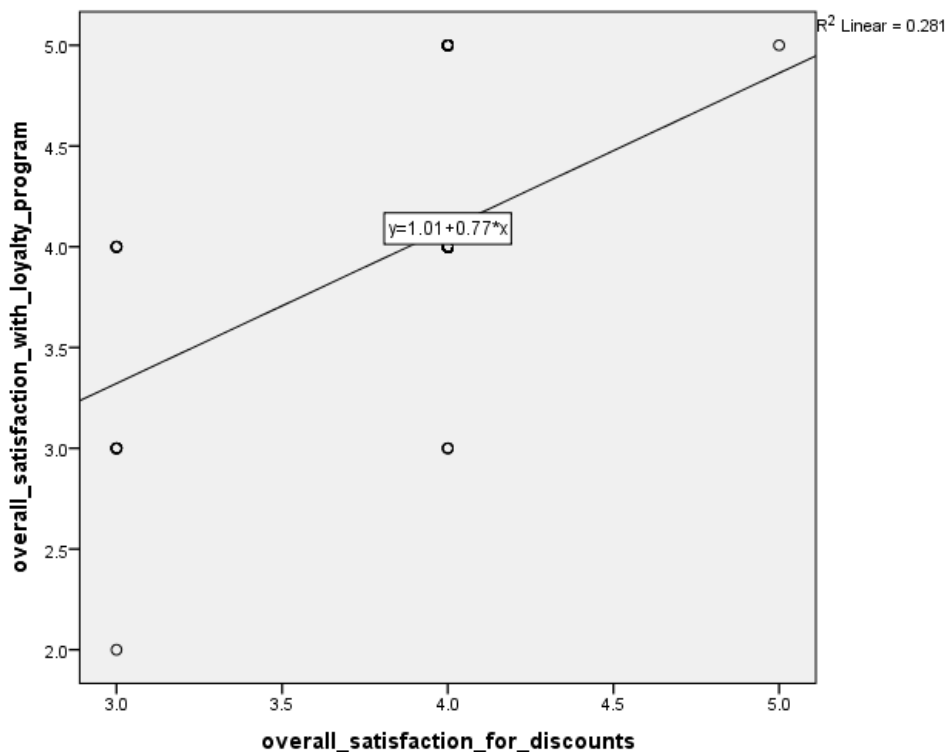


Figure 03: Scatter diagram

According to above scatter diagram it implies that there is a positive relationship between discounts and satisfaction for loyalty program. Furthermore, from above analysis it implies that there is a moderate positive relationship between discounts and satisfaction for loyalty program.

Conclusion

As a conclusion, the research implies that there is positive relationship between point system and tier reward system. When customers gain more points, the position in the tier reward system goes up. From the analysis found that most of customers who exceeded the boundary for the gold card in tier reward system they go for a gold card, but very few customers prefer to retain in the silver category though they exceeded the boundary based on their personal preference. When it comes to discounts it has a moderate positive relationship with customer satisfaction. Most of customers prefer loyalty program because of discounts and offers.

According to the analysis customers' behavior has been changed after entitling to the loyalty program. Furthermore, most of the respondent's grievance on converting the change money in to points and revoking charges. Finally, according to above all evaluations, there is a positive impact of loyalty programs on customer satisfaction. Mostly, satisfaction of customers who are in the top level of tier reward system are very important because they could be loyal for the firm with a longer period of time and the return from premium customers are also very high. Finally, according to above all evaluations, there is a positive impact of loyalty programs on customer satisfaction

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**IMPACT OF HUMAN RESOURCES PRACTICES ON JOB SATISFACTION OF
CUSTOMER CARE EMPLOYEES IN TELECOMMUNICATION INDUSTRY: A
STUDY BASED ON PRIVATE SECTOR ORGANIZATION IN SRI LANKA**

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Abstract

The study is carried out to explore the impact of human resource practices on employee job satisfaction in the telecommunication Sector of Sri Lanka. The purpose of this study is to observe the relationship between three HR Practices i.e. (Training and Development, Reward Management, Performance Management) and the customer care employee job satisfaction in the private sector organization of Sri Lanka. The data was collected through a questionnaire and a semi-structured interview. 40 Questionnaires were filled from the customer care department employees who worked at the selected organization. For interpretation and analysis of data pie charts, histograms, descriptive statistics, Correlation, Regression were conducted. The results showed that different human resource practices have a significant impact on the employee job satisfaction. Further the results revealed that Reward Management and Promotions are a key source of customer care employee job satisfaction in the organization.

Key Words – Customer Care employees, Job satisfaction, Performance Management, Reward Management, Training and development

Introduction

Human resource is deemed to give competitive advantage to companies because in addition to production related capacities it also takes human capital into account. It will be easy for competitors to copy other resources like technology and capital but the human resource is distinctive and not easy to imitate. Also after some years, the competition will be fierce and having the best talent in the company will be a challenge. Many of the scholars and practitioners said that sound human resource practices will lead to a higher level of job satisfaction (As cited in Torre,2012). The impact of human resource practices on job satisfaction is likely to have a positively relationship with some of the aspect of job satisfaction (As cited in Torre,2012). According to Cartwright and Holmes (2006), they have pointed to the critical role of human resource management policies like work practices, on employees' ability to derive a sense of meaning from work and to achieve satisfaction with work itself. It may also bring the impact on extrinsic aspect of job satisfaction which included satisfaction with pay (Marchington & Wilkinson, 2005).

According to Jehanzeb et al., 2012 study, it indicates that the degree of rewards, motivation and job satisfaction of employees has a strong relationship in the banking sector of Saudi Arabia. Iqbal, Imran and Zahid (2011) in a study on employee's job satisfaction in telecommunication companies located in Pakistan found that employees' motivation and satisfaction have significant impact to promotion. Further, Ali and Ahmed (2009) in a survey at UNILEVER companies, stated that reward has positive relationship to employee's motivation and satisfaction. As founded by Paposa and Kumar (2015) Employees with high-

quality performance appraisal experiences were said to be more likely to be satisfied with their job. Shelton (2001) studied the effects of employee development programs on job satisfaction and employee's retention aiming on business success. He found that training and development increase employee satisfaction. Where it also helps the employees to take right decision to stay with a company.

One of the seminal article by Huselid (1995) also studied eleven practices that are personnel selection, performance appraisal, incentive compensation, job design, empower of decision, information sharing, attitude assessment, labor management participation, recruitment efforts, employee training and promotion criteria. They found that four HR practices that are Compensation Practices, Promotion Practices, Performance Evaluation Practices and Empowerment Practices were predictors of job satisfaction in telecommunication industry.

Therefore, research question addressed in the study is as follows:

- What Human Resources practices effect on employees' job satisfaction in telecommunication industry in Sri Lanka?

The attempt was made to achieve the following research objectives:

- To examine the impact of HR practices on employees' job satisfaction
- To identify the most important HR practice on job satisfaction
- To provide appropriate recommendations to the impact of HR practices on employee job satisfaction

Significance of the Study

Currently this research would be significant in diagnosing the success of HRM practices. The Study has its importance in explaining the implementation of HRM practices and their Contribution towards the success keeping the employee within the organization and make them satisfied. Result of the Study would help in developing a better understanding on how to manage the HRM practices by the management. This research can be used as a guiding tool for the telecommunication firms as it provides the company with the information that fair HRM practices has greater impact on the Employee satisfaction.

Methodology

A Deductive approach was used for the study with quantitative data. The theoretical population of the study was selected as the "customer care employees "of all the telecommunication companies in Sri Lanka. However, a study population was selected as one private sector telecommunication company in Colombo. Here the population is 1000. Sample size of 40 was selected using simple random sampling method. Data was collected through a structured questionnaire and semi- structured interviews. Numerical data collected through a 1-5 Likert scale questionnaire. Data was examined using SPSS 21 version software.

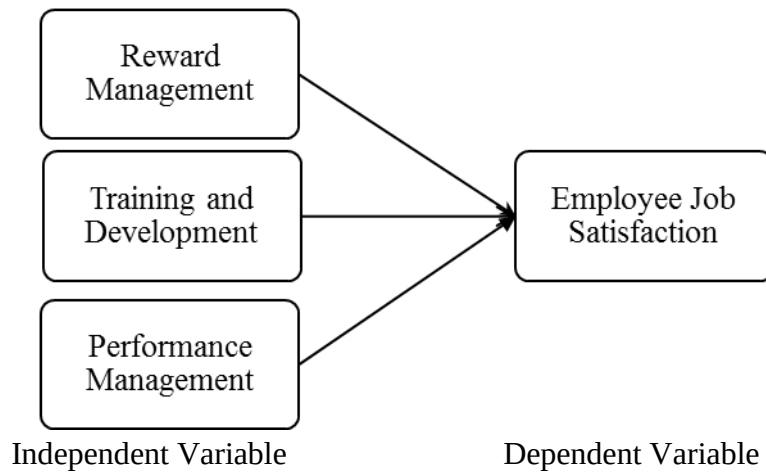


Figure 1 – Conceptual Framework

H1-: There is a significant relationship between reward management and employee job satisfaction.

H2-: There is a significant relationship between training and development and employee job satisfaction.

H3-: There is a significant relationship between performance management and employee job satisfaction.

Results

Descriptive Statistics

Demographic Variables

Out of the total number of respondents, majority of them were males and as the age wise majority of respondents were in the age category of 18-29 years (76.32%) with the experience of less than 5 years.

Table 1 – Descriptive Statistics of Demographic Variables

Variables	Category	Percentage
Gender	Male	60.53%
	Female	39.47%
Age	18-29 age	76.32%
	30-39	21.05%
	40-55	2.63 %
Working Experience	0-5 years	68.42%
	5-10 years	15.79%
	10-15 years	10.53%
	more than 15	5.26 %

Table 2 – Descriptive Statistics of Variables

Variables	N Valid	N Missing	Mean	Median	Mode	Std.Deviation	Variance	Sum
Transform reward	38	0	2.9737	3.0000	3.25	.69698	.486	113.00
Transform T & D	38	0	3.4781	3.6667	3.67	.55908	.313	132.17
Transform performance management	38	0	2.8388	3.0000	3.00	.48010	.230	107.88

According to the above table, the average level of satisfaction related to reward management is 2.973. That means the employees are positively satisfied on this variable. Median value for reward management is 3.00. That implies the half of the portion of the sample has taken more than the average value. Mode is 3.25. Majority of the employees are moderately satisfied on this variable.

The average level of satisfaction related to Training and Development 3.4781. That means the employees are moderately satisfied on this variable. Median value for Training and Development is 3.667. It indicates that the half of the portion of the sample has taken more than the average value. Mode is 3.67. Majority of the employees are somewhat satisfied on this variable.

The average level of satisfaction related to performance management is 2.838. That means the employees are moderately satisfied on this variable. Median value for performance management is 3.00. It indicates that the half of the portion of the sample has taken more than the average value. Mode is 3.00. Majority of the employees are somewhat satisfied on this variable.

Correlation of Variables and Job Satisfaction

Table 3 - Reward Management

Correlations			
		Transform satisfaction	Transform reward
Transform satisfaction	Pearson Correlation	1	.632**
	Sig. (2-tailed)		.000
	N	38	38
Transform reward	Pearson Correlation	.632**	1
	Sig. (2-tailed)	.000	
	N	38	38
**. Correlation is significant at the 0.01 level (2-tailed).			

According to the correlation between reward management and Job satisfaction it has shown 0.632. It Indicates a positive relationship between reward management and Job satisfaction. Therefore, the null hypothesis will be rejected and alternative hypothesis will be accepted. It

can conclude that there is a significance between reward management and employee job satisfaction.

Out of the overall independent variables reward management is having a more positive relationship than performance management and training and development.

Table 4 –Training and Satisfaction

Correlations			
		Transform training	Transform satisfaction
Transform training	Pearson Correlation	1	.483**
	Sig. (2-tailed)		.002
	N	38	38
Transform satisfaction	Pearson Correlation	.483**	1
	Sig. (2-tailed)	.002	
	N	38	38
**. Correlation is significant at the 0.01 level (2-tailed).			

According to the correlation between training & development and Job satisfaction it has shown 0.483. It Indicates a moderate positive relationship between Training and Job satisfaction. Therefore, the null hypothesis will be rejected and alternative hypothesis will be accepted. Lastly, it can conclude that there is a significance between training and development and employee job satisfaction.

Table 5 –Performance Management

Correlations			
		Transform satisfaction	Transform performance
Transform satisfaction	Pearson Correlation	1	.494**
	Sig. (2-tailed)		.002
	N	38	38
Transform performance	Pearson Correlation	.494**	1
	Sig. (2-tailed)	.002	
	N	38	38
**. Correlation is significant at the 0.01 level (2-tailed).			

According to the correlation between performance management and Job satisfaction it has shown 0.494. It Indicates a moderate positive relationship between performance management and Job satisfaction. Therefore, the null hypothesis will be rejected and alternative hypothesis will be accepted. Finally, it can conclude that there is a significance between training and development and employee job satisfaction.

Conclusion and Recommendation

The selected company for the study is one of the telecommunication giant in Sri Lanka. Sample is 40 employees. Due to incomplete responses 2 has been rejected. Main topic is impact of HR practices on employees' job satisfaction. Prior research studies have claimed that, training and development, performance management and reward management are highly effecting to the job satisfaction in the telecommunication industry. Histogram, pie charts, descriptive tables and correlation tables were used to analyze the data from SPSS. As per the semi-structured interview had with the participants, they have expressed that they require more promotional opportunities and more rewards. According to the descriptive and correlation analysis it also proved that reward management has a significant impact on job satisfaction.

- Should give high salary and pay raise on good performance – Company should develop proper/understandable performance evaluation scheme and should appoint qualified or specialized panel, people to overlook and do the needful as required.
- Should improve the communication and motivation by the higher positions and help them to go for the targets.
- Should give promotions for the eligible employees on time without delaying them.
- Training and development programs should be valid and reliable and need more employee engagement.
- Supervisor or manager should support more on training.
- Should give personal freedom for the employees by allocating a separate resting place since they are exposed to the customers throughout the day.

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THE STUDY ON EMPLOYMENT TYPES AND BENEFITS; A CASE STUDY IN COLOMBO DISTRICT

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Abstract

Employee commitment plays an important role in Human Resource Management and it is connected with the feelings of individuals about their organization. In Sri Lankan context, employee benefits are fixed with the employment types that they work. Therefore, the aims of this study were to identify the association between employee benefits and employment types, to identify the difference in employee commitment among employee benefits and to identify the validity of given job titles. Data were collected through a structured questionnaire from selected 80 employees in Colombo district. Descriptive analysis and t-test were used to achieve the objectives. The study found that there is an association between employee benefits and employment types so that the employees who have been recruited as casual employees are getting the benefits and similar work load of permanent employees while they feel that their job security level is poor and there is a significant difference in employee commitment between employees who feel that there is a job security and employees who do not feel job security. Therefore, it discloses that there is a problem in validity of given job titles.

Key Words: Benefits, Employee commitment, Employment types, Job titles.

Introduction

The concept of commitment plays an important part in HRM philosophy. Commitment refers to attachment and loyalty. It is associated with the feelings of individuals about their organization. According to Porter *et al* (1974), commitment is the relative strength of the individual's identification with, and involvement in, a particular organization.

Employee commitment does not have a direct link with what they get from the organization. According to previous researches the concept of commitment was discussed only on few common problem areas. The common factors that affect commitment of employees of organization namely the pay they receive, to satisfy career opportunities, the good leadership of managers, the work they do being challenging and the organization helping the employees to achieve work life balance, etc (Purcell, 2009). When considering in the Sri Lankan context, employee benefits are fixed with the employment types that they work. Therefore, it is important to identify benefits given among employment types and factors associated with their commitment.

Therefore, the objectives of this study were,

- To identify the association between employee benefits and employment types.
- To identify the difference in employee commitment among employee benefits.
- To identify the validity of given job titles.

This study helps to identify the reasons for less commitment from workers in their workplaces and what must be done in order for employee to show more commitment. Further, the significance of this study is this can be useful for employers and organizations to

rectify the mistakes and unethical practices and give employees a valid job title and importance.

Limitation of this research was that there wasn't any past researches done on the relevant topic involving contracts and commitment for which it was difficult to find information.

Methodology

Data were collected from selected 80 employees through convenience sampling in Colombo district. Selected employees employed under any of the employment types/contracts. A structured questionnaire was developed to collect data for this study. The questions in the questionnaire come up with to distinguish under which employment contract the employees are employed and what drives them forward and keeps them committed. Descriptive analysis was used to identify associations between employee benefits and employment categories. Moreover, t-test was used to analyzed the significant difference in employee commitment.

Results

According to Table 1, it can be clearly identified that majority of employees belong to permanent category while second largest category was fixed term employees. Least number of employees can be seen in probationer category.

Table 1. Distribution of employment types

Employment type	Frequency	Percentage	Cumulative Percentage
Permanent	55	68.8	68.8
Probationer	3	3.8	72.5
Casual	7	8.8	81.3
Fixed term	11	13.8	95.0
Apprenticeship	4	5.0	100.0
Total	80	100.0	

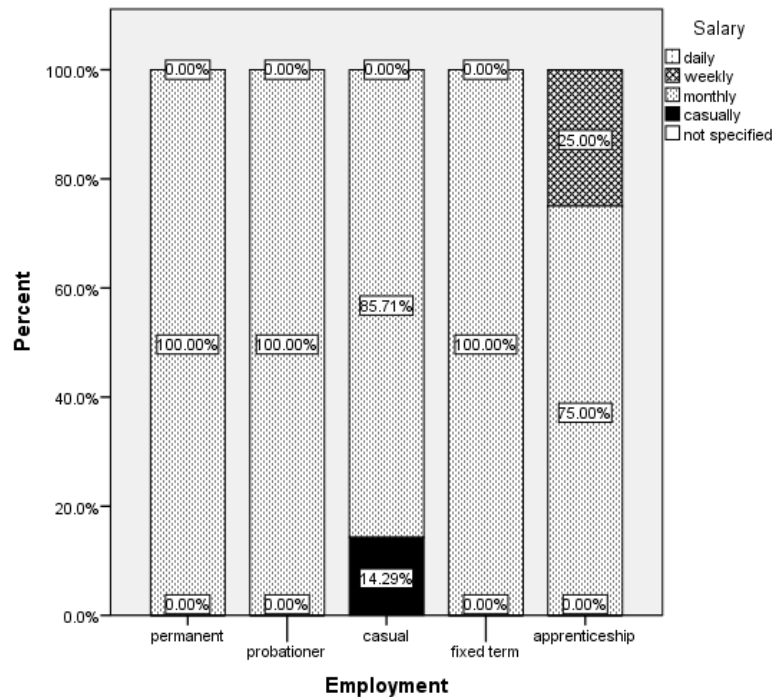


Figure 1 Salary of employees

Figure 1 shows whether the employees are given their due payments at the right time as prescribed by the employment contract. Results show that 85.71% of casual employees receive their salary monthly while the rest receive casually. Further, 25.00% of apprenticeship workers are receiving their salary weekly while the rest receives monthly.

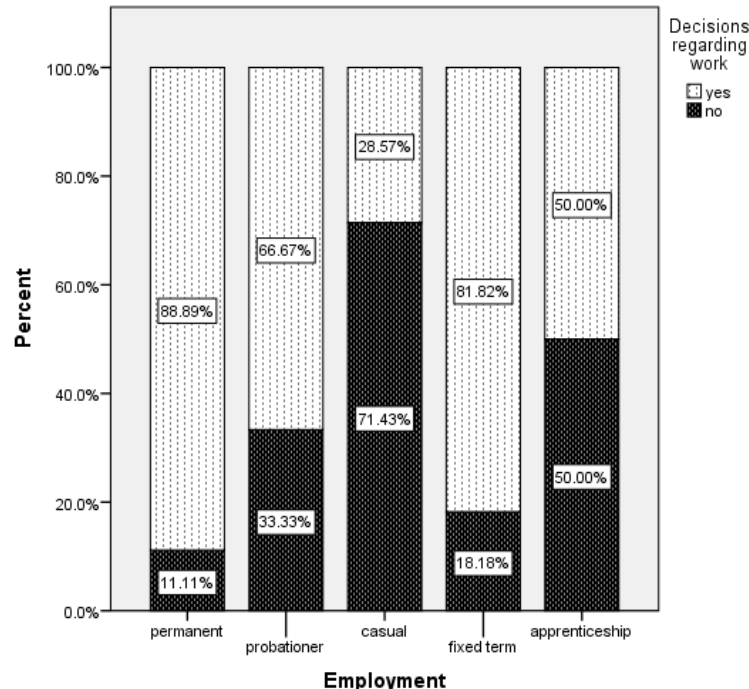


Figure 2 Taking decisions regarding work

According to Figure 2, it can be clearly observed that the majority of casual employees can not take decisions regarding work. However, there are 28.57% of casual employees who can make decisions regarding their work.

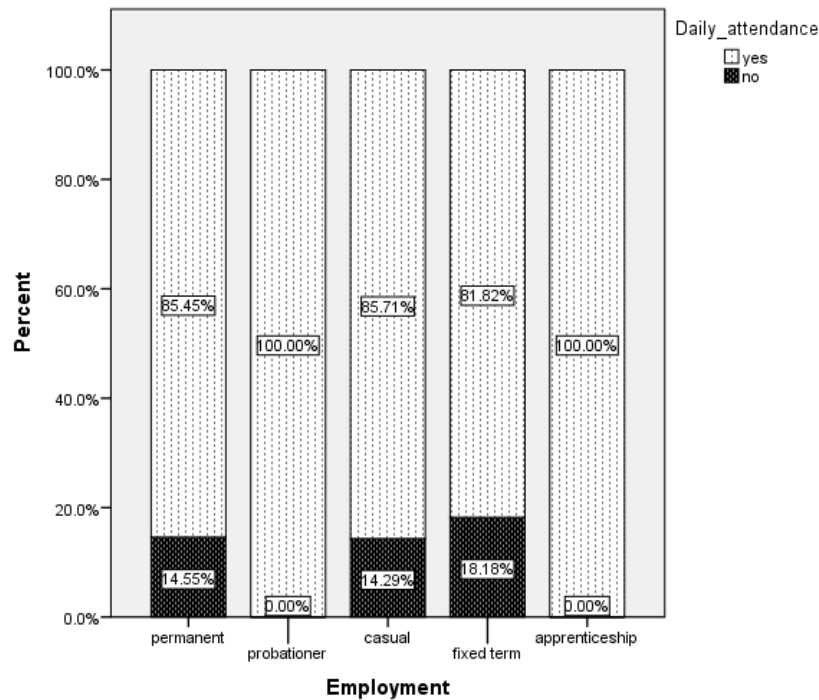


Figure 3 Daily attendance of employment types

Figure 2 finds out if the company marks the attendance of the employee daily depending on what type of contract they work for .As shown in the bar chart above, there are 85.71% of casual employees who have their daily attendance marked while the rest of 14.29% have not marked their attendance daily.

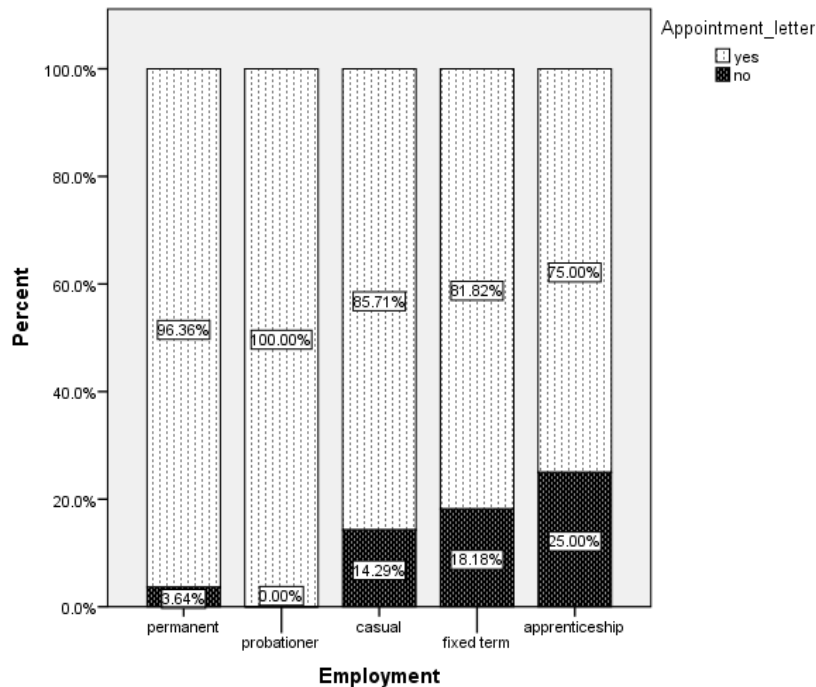


Figure 4 Appointment letter to employees

The results reveal that the majority of casual employees receive appointment letters while only 14.29% of casual employees are working without appointment letters (Figure 4).

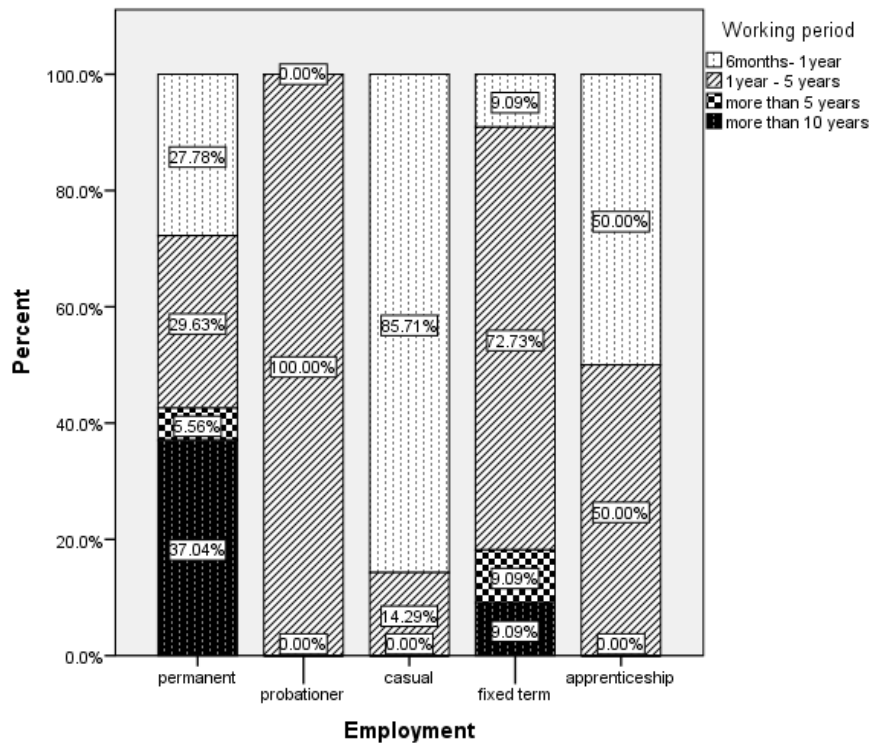


Figure 5 Working period of employees

The bar chart above compares employment by working period and it shows that the majority of casual workers have been working for 6 months to one year period and it was 85.71%.

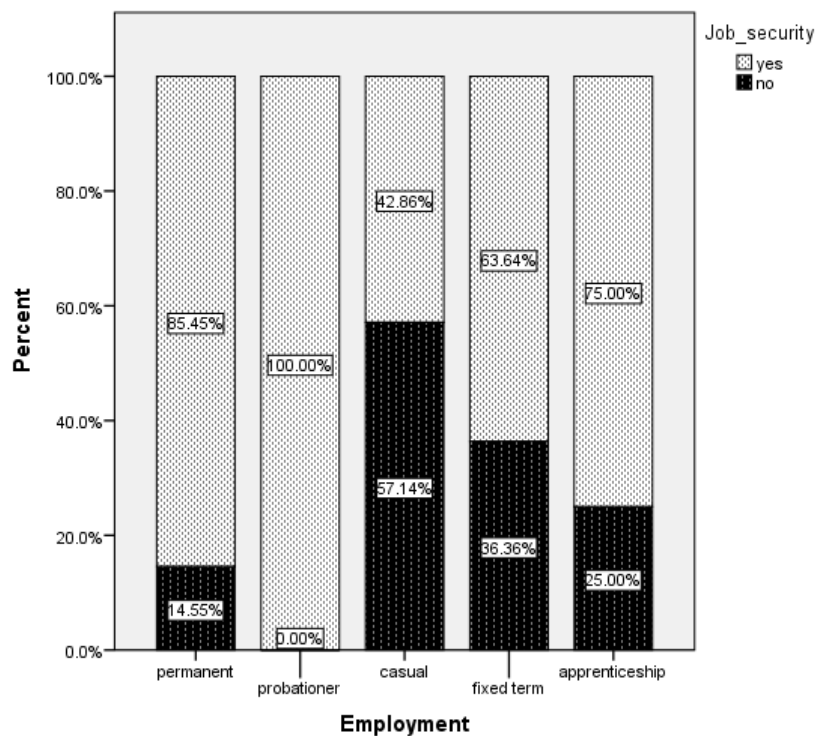


Figure 6 Job security of employees

According to Figure 6, it can be identified that the majority of casual employees stated that they do not have job security while 42.86% of casual employees are believing that there is a job security.

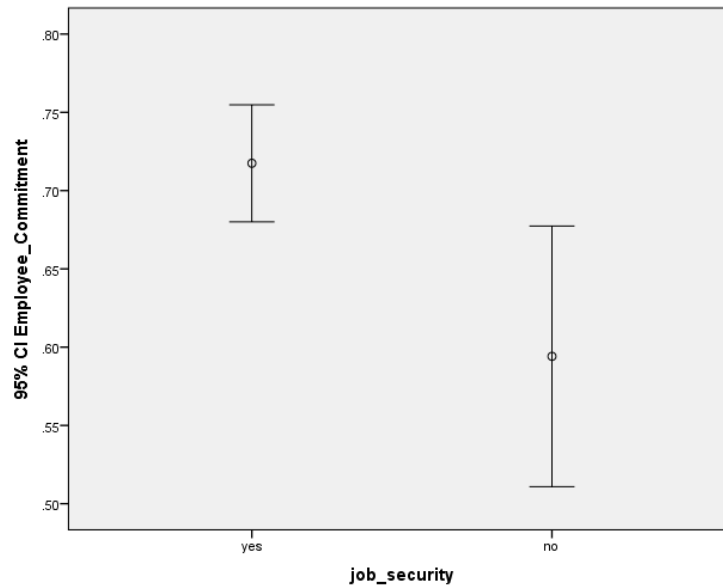


Figure 7 Job security that affects commitment level

The results of the 95% confidence interval graph reveal that the average commitment of employees who believe that there is job security is higher compared to the commitment of employees who believe that there is no job security in their job.

Table 2. Difference in employee commitment among job security

	Job security	N	Mean	t-test for Equality of Means		
				t	df	Sig. (2-tailed)
Employee commitment	Yes	63	0.7185	2.755	78	0.007**
	No	17	0.6000			

****Significance at 5% level**

According to the results of pooled samples t-test it can be observed that there is a significance difference in employee commitment between employees who believe that there is job security and employees who do not believe that they have job security.

Discussion

The study reveals that the employees who have been employed as casual workers have reported to work daily and one which attendance is not specified as a matter of fact. Casual employment does not have a contract between the employer and employee. The worker cannot expect work from the employer and the employer cannot expect the worker to be present to work daily. Further, Attention must be first given to find out whether the employee is a permanent or a casual employee for which the regularity of the payment of the salary is considered (Figure 1).

The right for taking decisions regarding work is given to positions of executives and above but in this case, the problem that we have come across is that there are few casual employees who can take decisions while having few permanent employees who cannot take decisions. Even though the casual workers do not usually get appointment letters and neither does

apprenticeships, the study shows that appointment letters are given to casual workers which means that they don't belong to the given contract and is invalid.

Also employees have been working for a long period of time in the organization with more than 5 or 10 years have marked neutral or agree when questioned if they won't leave the company which means they have developed a sense of loyalty and behavioral commitment towards the company (Kappagoda, 2013). As explained in the analysis job security and commitment level have a significant relationship, Job security is one of many factors that have an impact on commitment.

Conclusions and Recommendation

According to this study, it can be concluded that there is an association between employee benefits and employment types. Mainly, it can be seen that the employees who are getting the benefits and same work load of permanent employees while being working as casual employees. Thus, it reveals that there is a problem in validity of employment types given to the employees. Moreover, it can be concluded that majority of casual employees believe that their job security level is poor and the commitment level of them is low. Therefore, it should be considered about the positions of the employee holds at work and whether it is a valid title or not. In order to find out whether it is valid it must be yet again compared with the employment type.

As recommendations, firstly we need to look into the employment contracts, as seen above there are workers who are employed as casual workers but are just the same as the permanent workers for which an employer must not violate the rules and give the correct employment contract to workers. The company should also follow the laws and acts such as the shop and office act, wages board ord. etc. The company should pay a close attention to what the employee wants to achieve in their career and by helping them do so the employee will feel a sense of closeness with the company for which a higher commitment level can be expected.

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**RELATIONSHIP OF REWARDS AND EMPLOYEE'S MOTIVATION: A CASE
STUDY OF A SRI LANKAN NON-GOVERNMENT ORGANIZATION**

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Abstract

Non-Government Organizations (NGO) play a major role in uplifting living standards of people in many ways. Motivation of NGO servants plays a significant role in delivering that quality service to stakeholders. This specific study has been conducted at a selected NGO in Kandy, which serves vulnerable children in marginalized communities in Sri Lanka. The objective of the research was to evaluate motivational factors of employees. The study approach is a deductive and quantitative in nature. The population was 346. A sample size of 125 was selected using stratified sampling method. Data was collected using structured questionnaire and analyzed using SPSS with descriptive statistics, correlation, and independent sample T test. Results of the study showed that employees are moderately motivated. The study concludes that employees of the NGO are motivated by intrinsic rewards than extrinsic rewards.

Keywords: Employee motivation, Extrinsic rewards, Intrinsic rewards, Non-Government Organization

Introduction

NGOs have been identified as the next best alternative employment sector in Sri Lanka, apart from the government and private sector. After the Tsunami effect in 2004, more than 200 NGOs have implemented many Tsunami relief projects within the country. Graduates, professionals, consultants and casual labour were hired as the project staff by these local and international NGOs to serve people in need (Pulasinghage and Chatura, 2010). The selected organization specifically serves vulnerable children in Sri Lanka. Many local NGOs work with a project oriented focus. Most of these projects are short term. (Rehema, 2014). The employees are recruited short term basis and the employment contract will be ended under automatic cessation after the given period of the employment contract. If there are opportunities for future projects, employees will be transferred to new project. There is a serious concern about the job security after a completion of a project cycle which doesn't guarantee existing employees a continuation of their employment contract. Rehema (2014) said that NGOs staff turnover is often high and many staff feels that there are inconsistencies in the reward process within NGOs. Further, there are concerns on the benefits received by the NGO staff. Jegers (2008) found that there are less benefits received by the NGO staff compared to the staff in profit oriented organizations. But NGO staff has more self-satisfaction gained through the services provided to the needy. In this context, it is worth finding what motivate an employee of a NGO. Motivation is a psychological processes which arouses and sustain a goal-directed behavior (Luthans, 2005). Motivation level of an employee is directly affecting an organization's performance (Manzoor, 2012). Even though

NGO founders are not entitled to organization's profits (Jegers, 2008), performance level of a NGO is crucial in maintaining the relationship with donors, to comply with donors' project audits, attracting new donors by facing the competition from other NGOs. Project expenses are entirely managed by the donor funds received. There are few studies conducted on NGO employee motivation in other countries as well as in Sri Lanka (Hafiza et al., 2011, Pulasinghage and Chatura, 2010).

Rewards play a major role in motivating employee (Mumtaz, 2019). Benefits that workers receive from their jobs called rewards (Kalleberg, 1977). Rewards can be categorized into two called extrinsic and intrinsic. Extrinsic rewards mean tangible rewards. The external rewards like salary, fringe benefits, bonuses and promotions while psychological rewards such as appreciation, challenging job roles, caring and understanding approach from the supervisor are considered as intrinsic rewards (Frey, 1997; Mumtaz, 2019; Khan et al., 2014). There is a significant and positive relationship of intrinsic and extrinsic with employee motivation (Hafiza et al., 2011; Rashim & Daud, 2013). However, there is a gap in the empirical knowledge in respect of 'impact of rewards on NGO employee motivation' in Sri Lanka. The research question and objectives addressed in this study are as follows:

What is the impact of intrinsic rewards and extrinsic rewards on motivation level of staff at NGOs in Sri Lanka?

General Objective

To examine how intrinsic and extrinsic rewards affect employee motivation of the selected NGO in Sri Lanka.

Specific objectives

- To identify the relationship between Intrinsic rewards with employee motivation
- To identify the relationship between Extrinsic rewards with employee motivation
- To determine the degree of combined effect of intrinsic and extrinsic rewards on employee motivation of the selected NGO in Sri Lanka

Methodology

A deductive approach was used for the study with quantitative data. The theoretical population of the study was selected as the employees of all the branches of the selected NGO. The population size was 346 employees in eleven branches in Kandy, Nuwara Eliya and Mullative. A sample size of 125 was selected with a confidence level of 95% and confidence interval of seven. A stratified sampling method was used where employees from eleven branches were chosen randomly and proportionately to the branch size. A validated questionnaire was adapted. Intrinsic rewards was measured in terms of empowerment, recognition and appreciation, achievement, trust and team work. Extrinsic reward was measured in terms of salary, bonuses, fringe benefits and promotions. All the dimensions were measured with a 5-point Likert scale (1= strongly disagree to 5= strongly agree). Reliability was tested by a pilot study. And Cronbach alpha for all the variables were above 0.7 (see Table 2). Descriptive statistics, bivariate correlation and linear regression techniques were used to analyze the data set using SPSS software.

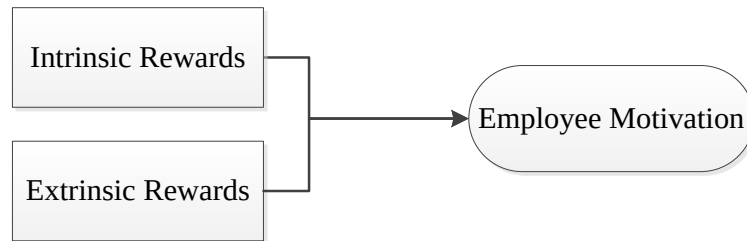


Figure 3: Conceptual Framework

H₁: Intrinsic rewards are positively related to employee motivation

H₂: Extrinsic rewards are positively related to employee motivation

H₃: Intrinsic and Extrinsic rewards have a positive significant joint impact on employee motivation

Results

Table 15: Demographic profile

Characteristic	Groups	%
Gender	Male	35.2
	Female	64.8
Age	18-25	4.0
	26-35	36.0
	36-45	34.4
	46-55	19.2
	Above 56	6.4
Marital Status	Married	72.8
	Unmarried	21.6
	Widow / Widower	5.6
Branch	Kandy	24.8
	Mullaitivu	9.6
	Nuwara Eliya	65.6
Work Experience	Less than 1 year	17.6
	1-3 years	28.0
	3-5 years	13.6
	5-10 years	24.8
	10-15 years	8.0
	above 15 years	8.0
Highest Level of Education	Primary School (Grade 1-5)	5.6
	Secondary School (Grade 6-11)	24.0
	A/L (Grade 12 - 13)	64.8
	Degree	5.6
Current Working Status	Permanent	22.4
	Project Base	46.4
	Daily Wage	1.6
	Temporary	18.4
	Renewable Contract	10.4

Table 16: Reliability Statistics

Variable	Cronbach's Alpha	N of Items
Motivation	0.738	6
Intrinsic Rewards	0.919	15
Extrinsic Rewards	0.936	9

Table 17: Univariate Analysis
Descriptive Statistics

	N	Mean	Std. Deviation
Motivation	125	4.1655	.42118
Intrinsic Rewards	125	4.0991	.43099
Extrinsic Rewards	125	3.3985	.58604
Valid N (listwise)	125		

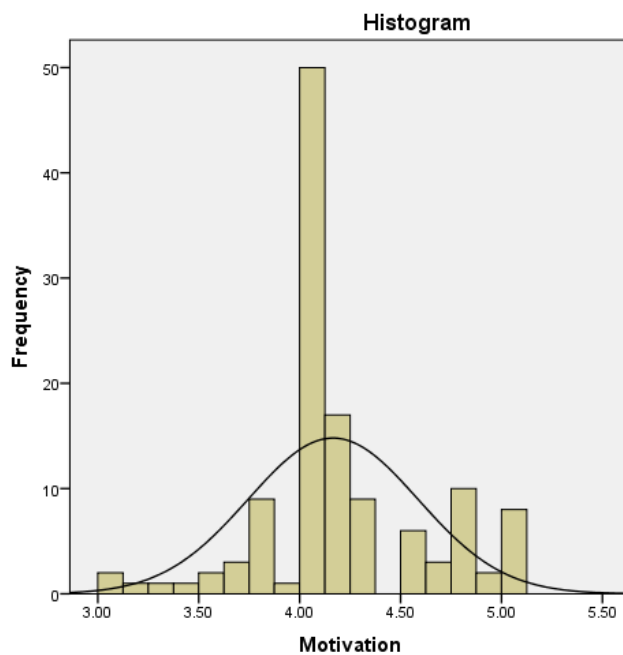


Figure 4: Distribution of Motivation

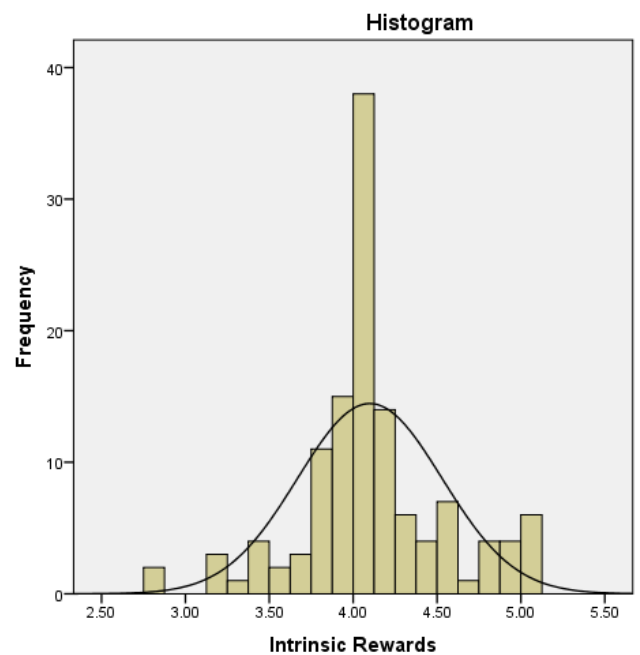


Figure 5: Distribution of Intrinsic Rewards

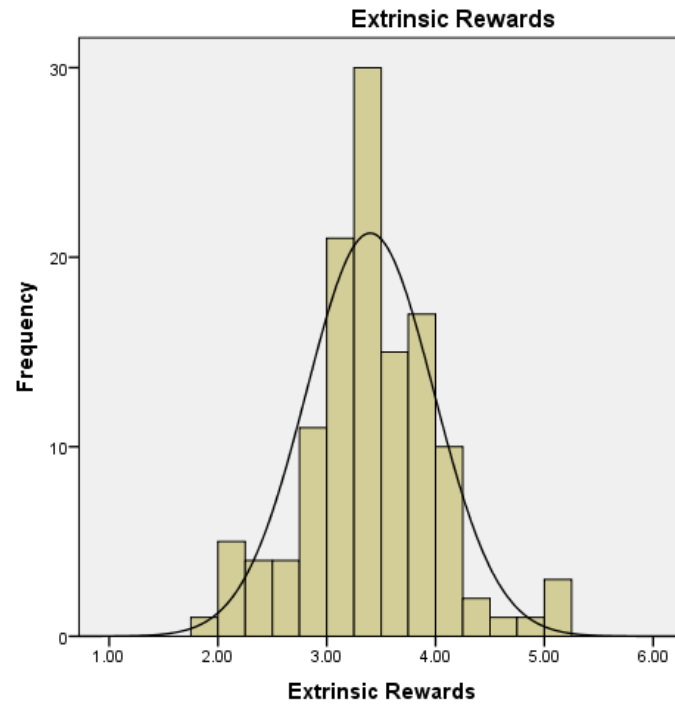


Figure 6: Distribution of Extrinsic Rewards

Table 18: Bivariate Analysis - Correlation
Correlations

		Motivatio n	Intrinsic Rewards	Extrinsic Rewards
Motivation	Pearson	1	.623**	.293**
	Correlation			
	Sig. (2-tailed)		.000	.001
Intrinsic Rewards	N	125	125	125
	Pearson	.623**	1	.431**
	Correlation			
Extrinsic Rewards	Sig. (2-tailed)	.000	.000	.000
	N	125	125	125
	Pearson	.293**	.431**	1
	Correlation			
	Sig. (2-tailed)	.001	.000	.000
	N	125	125	125

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

Table 19: Linear Regression – Model Summary
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.623 ^a	.388	.378	.33205

a. Predictors: (Constant), Extrinsic Rewards , Intrinsic Rewards

Table 20: Linear Regression – ANOVA
ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	8.545	2	4.273	38.751	.000 ^b
Residual	13.451	122	.110		
Total	21.997	124			

a. Dependent Variable: Motivation

b. Predictors: (Constant), Extrinsic Rewards , Intrinsic Rewards

Table 21: Linear Regression – Coefficients
Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.649	.291		5.673	.000
	Intrinsic Rewards	.595	.077	.609	7.768	.000
	Extrinsic Rewards	.022	.056	.031	.394	.694

a. Dependent Variable: Motivation

Discussion

According to Table 1, majority of the sample were female (64.8%), within age group of 26-35 (36%), 72.8% are married, 65% is working in the district of Nuwara Eliya, majority is between 3-5 years working experiences (28%) and 64.8% is qualified with Advanced Level. Majority of the staff members are project based (46.4%). In the above Table 3, motivation (M= 4.17, SD = 0.42) shows a value of above average, which means that the employees are generally motivated. In addition, they are satisfied about intrinsic rewards (M=4.1, SD=0.43) and extrinsic rewards (M=3.4, SD=0.59) rewards. However, the satisfaction level towards extrinsic rewards is slightly low than intrinsic rewards. The three variables are normally distributed (refer Figure 2, 3, 4). The impact of the independent variables collectively and individually on the dependent variable was examined at 5% significance level. According to Table 4, there is a significant moderate positive relationship in between motivation and intrinsic rewards ($r=0.62$, $n=125$, $p=0.00$). There is a significant weak positive relationship in between motivation and extrinsic rewards ($r=0.29$, $n=125$, $p=0.00$). According to Table 5,

39% of the variability of motivation is explained by intrinsic and extrinsic rewards. Table 6 indicates that the F value ($F=38.75$) is significant at 95% confidence level ($p= 0.00$). Thus the alternative hypothesis is accepted and null hypothesis is rejected. As per table 7, the Intrinsic rewards ($B= 0.6$, $p=0.00$) have been identified as the significant predictor of the dependent variable and the extrinsic rewards are not considered as the significant predictor of employee motivation ($B= 0.02$, $p= 0.69$).

Conclusion and Recommendations

NGOs play a major role in the Sri Lankan economy. It upgrades the living status of society as well as it creates a job market. The study was conducted to identify how rewards effect on motivation level of NGO employees since the NGO setup is different from a profit oriented organization. The results of the study showed that employees of the selected NGO are moderately motivated. Both intrinsic and extrinsic rewards are positively significantly related with motivation. However, intrinsic reward is the most predictive variable of motivation. Most of the studies have found that extrinsic rewards play a major role in changing employee motivation (Khan et al., 2014; Munir et al., 2016). But there are few studies which found that intrinsic rewards also make a significant difference in motivation level of employees (Dave et al., 2011; Frey, 1997). Even in this study intrinsic reward is the significant factor which impacts on motivation level. In the present working environment employees are more satisfied about the intrinsic rewards than extrinsic rewards. These findings are very useful for the HR personal of NGO institutions to design their rewards systems. The motivation level of NGO employees can be increased with less cost as intrinsic reward is the most predictive variable of motivation. A qualitative study can be conducted to identify the reasons for this behavior of NGO employees.

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**IMPACT OF COMPENSATION PRACTICES ON RETENTION OF ACADEMIC
STAFF IN PRIVATE SECTOR HIGHER EDUCATION INSTITUTIONS IN SRI
LANKA**

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Abstract

This study attempted to examine the impact of compensation practices on retention of academic staff in private sector higher education institutions in Sri Lanka. Basic salary, bonus, performance-related pay, benefits, promotions, work-life balance, and career advancement were taken as the independent variables for this study whilst employee retention was deliberated as the dependent variable. The study was carried out on survey method and the sample consisted of 85 respondents selected from 5 leading private higher education institutions. Data were collected through a structured questionnaire and measures of central tendency and multiple regression were applied for the analysis. This study evidently concluded that non-financial rewards are the best predictors of the retention of the academic staff of Sri Lankan private higher education institutions than financial rewards. Among the non-financial rewards, promotions and career enhancement path are the most influential factors on the retention of academic employees.

Key Words: Compensation practices, Retention

Introduction

The retention of employees has been shown to be significant to the development and the accomplishment of the organization's goals and objectives. According to Dessler and Varkkey (2017); Das and Baruah (2013), employee retention refers to firm's ability to allow the employees to stick to the organization in the long run. If an organization has right policies, strategies and approaches, the employee will voluntarily retain in the business for a longer period of time (Yazinski, 2009). One of the major elements of an environment which is able to motivate and retain employees is to make the best use of their skills to the benefit of an organization and its ability to satisfy their needs. Mabaso and Dlamini (2017) noted that employees' needs are technically described by the word "compensation" in organizational aspect. Compensation has become a key concern in almost all the industries as employers and employees come up with contradictory expectations on the same (Opatha, 2012).

This study focuses on Sri Lankan private education industry; one of the booming industries which come up with severe competition (Chandrasekara, 2016; Souza and Moore, 2017). A high number of leading service providers are competing with each other using various approaches to expand their market share in the growing market. One of the approaches which supports the firms to gain competitive advantages over competitors is acquiring and retaining an academically and professionally qualified academic staff who can deliver an inimitable quality service. Academic institutions compete with each other to acquire and retain a most qualified academic staff (Manogharan, Thivaharan and Rahman, 2018). One of the tools the institutions use in this competition is compensation practices (Al-Hinai and Bajracharya, 2014). However, Manogharan, Thivaharan and Rahman (2018) noted that many institutions

experienced that though the academic employees are given better compensation, their retention is comparatively low as they move institution to institution in the context of severe demand. In this circumstance academic institutions should thoroughly understand about how really the compensation practices affect retention of academic staff. Since the lack of empirical studies which involved in exploring the impact of compensation practices on academic staff retention in Sri Lankan context, the institutions are lacking with empirical evidences to get this understanding. Hence, this study attempts to fill this lacuna by resolving the research question; “How do compensation practices affect retention of academic staff in private sector higher education institutions, Sri Lanka?”

Objectives and significance of the study

Main objective of this study is to explore the impact of compensation practices on retention of academic staff in private higher education institutions, Sri Lanka. In addition to the main objective, a secondary objective is stated as to understand the most important compensation practices that contributes to the retention of academic staff.

Findings of this study support the managers to understand how compensation practices affect retention of the academic staff. Findings also support the managers to examine pros and cons of existing compensation practices in terms of retention. These enables the managers to configure its compensation practices as a way of maximizing employee retention.

Methodology

Conceptual framework

The study explores the impact of monetary and non-monetary compensation practices on employee retention. For this study, The Basic Salary (BS), Performance-Related-Pay (PRP), bonuses and benefits are taken as monetary compensation whereas promotions, Work-Life Balance (WLB), and Career Advancement Opportunities (CAO) as non-monetary compensation. The relationship between independent and dependent variables for the study is conceptualized in figure 1.

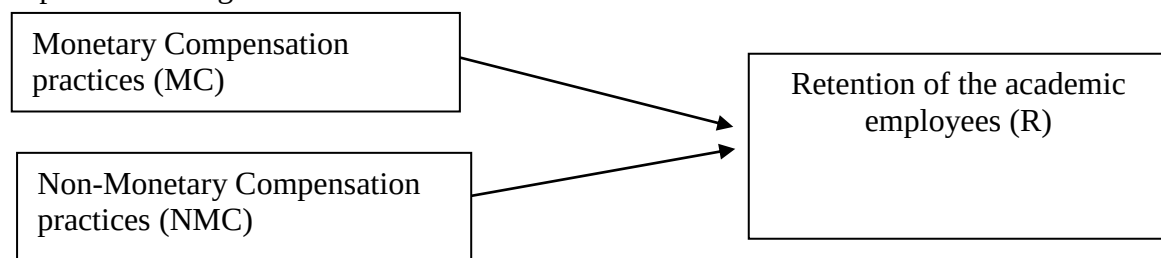


Figure 01: Conceptual Framework, 2019

Hypotheses

Hypothesis 01

Chiu, Luk and Tang (2002); Khan, Farooq and Ullah (2010); Kwasira (2016); Cao, Chen and Song (2013) found that there is an impact of monetary compensation on employee retention. Further, Opatha (2012); Armstrong (2015); Dessler and Varkkey (2017) have theoretically emphasized the relationship between monetary compensation and employee retention. Accordingly, the first hypothesis is given below.

H1: There is a significant relationship between monetary compensation and retention of academic staff

Hypothesis 02

Empirical research studies by Carraher, Gibson and Buckely (2006); Markova and Ford (2011); Bibi, Pangil, Johari and Ahmad (2017) stressed that there is a significant relationship between non-monetary compensation on employee retention. Rose (2018); Armstrong (2015); Dessler and Varkkey (2017) theoretically explained that relationship between non-monetary compensation and employee retention. Accordingly, the second hypothesis is given below.

H2: There is a significant relationship between non-monetary compensation and retention of academic staff

Study area and Data

The deductive approach was used in this research and this involves quantitative data. For this study population is the employees who are working as academic employees in Sri Lankan private higher education institutions. However, the study is carried out on sample basis and the sample consists of 85 respondents who have been selected through convenient sampling technique. 85 structured questionnaires were distributed among the respondents and 83 of them were collected. The response rate of the respondents is 93% and it was at a satisfactory level. The responses obtained were analyzed using the SPSS 20.0 version. Statistical techniques such as measures of central tendency and multiple regression analysis were used in the research. The transformed total scale scores of each compensation component were used as the independent variables and the transformed total scale scores of retention of academic staff as the dependent variable.

Results

According to the results of descriptive analysis, there are 39 male respondents (43.3%) and 51 female respondents (56.7%) in the sample. Majority of lecturers that is, 43.6% are in the age category of 30 to 34 years. Further, the most of the respondents in the sample are married employees (59.2%) and most of the respondents 58.5% have less than 2 years of experience in the present job. Average basic salary of the sample is the range of Rs. 40,000 – Rs. 44,999. Majority of respondents have Masters' level qualification.

Table 01: Regression analysis for retention of academic staff – Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Transformed BS	.040	.119	.038	1.835	.540
Transformed PRP	.107	.090	.110	1.190	.243
Transformed Bonus	.155	.091	.151	1.708	.046
Transformed Benefits	.158	.214	.124	1.739	.435
Transformed Promotion	.506	.126	.520	4.032	.000

Transformed WLB	.142	.126	.118	1.133	.266
Transformed CAO	.258	.130	.346	1.982	.038

Table 02: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig.
1	.938 ^a	.880	.853	.31433	96.274	.000

Above results illustrate that, promotion ($t = 4.032$, $p=0.000$) emerged as the most significant variable in explaining the variance in retention of academic staff. This practice is significant at 5% significance level. In addition, career advancement ($p=0.038$) and bonuses ($p=0.026$) are significant at 5% level of significance. Basic salary, performance-related pay, benefits and work—life balance practices are insignificant variables in explaining the variance in employee retention. Promotions have the strongest effect on retention of academic staff with a standardized beta of 0.520. Further, the results of regression analysis indicate that the adjusted R^2 of 0.853 with seven independent variables and this reveals that 85.3 % of total variance of retention of academic staff is explained by the compensation practices. Further, F-value by the table as 96.274 that is significant at $p=0.000$. These statistical evidences denote that seven independent variables are reliable predictors of retention of academic staff.

Table 03: Regression analysis for retention of academic staff – Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.288	.204		-1.413	.166
Transformed MC	.568	.192	.440	2.952	.006
Transformed NMC	.580	.172	.502	3.370	.002

a. Dependent Variable: Transformed ER

According to the table 03, monetary compensation ($p=0.006 < \alpha = 0.05$) is significant in the retention of academic staff. Therefore, the statistical evidences given above to reject the null hypothesis and its alternative hypothesis that *H1: there is a significant relationship between monetary compensation and retention of academic staff* is supported by statistical data.

Non-monetary compensation ($p=0.002 < \alpha = 0.05$) emerged as the most significant variable in explaining the variance in retention of academic staff and non-monetary compensation and has the strongest effect on employee retention with a standardized beta of 0.502. Therefore, the null hypothesis is rejected and its alternative hypothesis that *H2: there is a significant relationship between non-monetary compensation and retention of academic staff* is supported by statistical data.

Discussion

The results of this study revealed that monetary compensation practices i.e. basic salary, performance-related pay and benefits do not significantly affect employee retention. This is contrast to the findings of with Chiu, Luk and Tang (2002); Khan, Farooq and Ullah (2010). The most significant monetary compensation is the bonuses which is supported by Cao, Chen and Song (2013). Among non-financial compensation practices, promotion and career advancement opportunities are significantly impact on retention of academic staff and this is supported by the findings of Bibi, Pangil, Johari and Ahmad (2017). Empirical research studies by Carraher, Gibson and Buckley (2006); Markova and Ford (2011) have found that the most important factor of employee retention is non-monetary compensation than monetary compensation. This is proved by the results of current study.

Conclusion and recommendation

As per the discussion of the current study, it can evidently be concluded that promotions and career advancement are the most influential factors on retention of the academic employees in Sri Lankan private sector higher education institutions. Academic employees highly concern towards the promotions and career advancement opportunities provided by the company in taking retention decision. This study further supports to conclude that non-financial compensation mostly affect retention of academic employees than financial compensation.

Based on the above conclusions, this study recommends the top management of private higher education institutions to re-configure their compensation system aiming to ensure the retention of academic employees. Accordingly, higher education institutions should strengthen non-financial rewards for the academics. Here, they should prioritize promotions and career advancement opportunities as they are the most influential factors on retention. This study also recommends to do future research regarding a comparison on impact of compensation practices on the retention of academic staff of private sector higher education institutions and state owned higher education institutions.

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**INTENTION TOWARDS ONLINE SHOPPING; WITH SPECIAL REFERENCE TO
RETAIL SUPERMARKETS IN SRI LANKA.**

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Abstract

The e-commerce market is a rapidly growing industry, a small part of that industry belong to online shopping and it is also of the new ways where new generations shop. In Sri Lanka this is one of the fastest growing industries where customer pays a high intension towards their purchasing decision. The objective of this research is to identify how cultural, social, personal and environmental factors impact on consumer buying behavior in online shopping with reference to the retail supermarkets in Sri Lanka. To postulates the findings, the researcher has selected a sample consist with age between 15-45 within the respective domain. The results show that for most of individuals' purchase decision is highly influenced by cultural, social, personal and environmental factors. It further reveals that out of the total sample most of the youth respondents are highly engaged with online transactions and there are less number of people falls under least engaged category because of the perceived risk and their privacy.

Key Words: Consumer buying behavior, E-commerce, Impact factors, Online shopping, Purchasing intension

Introduction

The emergence of internet technology has brought up a vast opportunity for customers in their day today activities and it creates big impact on their purchasing behavior. Not only that most of the offline activities are now transformed to the online environment. With this point, online shopping has become one of a major part in consumer's daily routine and further has become very popular among the society. According to the last year records, during 2016 internet penetration of Sri Lanka had increased by 30% and Internet users grew up to 6.1 million especially due to the availability of several connection options such as mobile option, broadband option and dial-up option. Because of this many offline institutions have not unleashed themselves and to embrace online environment in to their operations (Colombo Digital Marketers, 2017)

According to Khan (2017) e-commerce transactions in Sri Lanka are expected to grow by more than 72% in the near future. And it has been further said that the most of Sri Lankan consumers are very popular at searching retail product for their everyday needs. Apart from the rising of e-commerce and internet penetration it is very important to identify the factors influencing online purchase intention in online retail shopping as lot of e-commerce trends have moved towards retail shopping. (Khan, 2017)

Hence the objective of this study is to identify the main factors that impact on online shoppers' buying decision and their significance impact on their online buying intension with reference to retail super market chain.

Research Objectives

The objective of this research is to find out the main factors that effect on online buying decision of customers with following objectives;

- To identify the relationship between cultural factors and online shopping behavior
- To identify the relationship between social factors and online shopping behavior
- To identify the relationship between personal factors and online shopping behavior.
- To identify the relationship between environmental factors and online shopping behavior.

Methodology

According to Department of census and statistics (2019), computer literacy rate defines as “A person who is age 5-69 is considered as digital literate person if he/she could use computer, laptop, tablet or smartphone on his/her own”. In order to become more specific and realistic on results the researcher has considered only on those people who fall under age 15- 39 as their computer literacy rate is more than 20% and it is a true fact that to shop online it is necessary to have the literacy of computer. Researcher has drawn 150 respondents of sample under convenient sampling and the sample includes the online shoppers in Colombo city. A structured questionnaire was used to collect data. Frequency analysis, correlations are used to analyze the data. Following hypothesis have been developed for analysis;

H0: There is no relationship between cultural factors and online shopping

H1: There is a relationship between cultural factors and online shopping

H0: There is no relationship between social factors and online shopping

H1: There is a relationship between social factors online shopping.

H0: There is no relationship between personal factors and online shopping

H1: There is a relationship between personal factors and online shopping

H0: There is no relationship between environmental factors and online shopping

H1: There is a relationship between environmental factors and online shopping

Results

Table 01: Correlation between Social factors and Online Shopping Experience

		Have online shopping experience	Social
Have online shopping experience	Pearson Correlation	1	.033
	Sig. (2-tailed)		.836
	N	60	42
Social	Pearson Correlation	.033	1
	Sig. (2-tailed)	.836	
	N	42	42

According to the above table, it can be seen that there is a positive relationship between social factors and online shopping experience as the correlation coefficient is 0.333. Moreover, the sig value of this relationship is 0.836, which is not less than 0.05. However, the sig value is less than 0.10. Therefore, there is enough evidence to reject null hypothesis at

10% level of significance. It implies that there is a relationship between purchasing intension and quality at 10% level of significance.

Table 02: Correlation between Cultural factors and Online Shopping Experience

		Have online shopping experience	Cultural
Have online shopping experience	Pearson Correlation	1	.109
	Sig. (2-tailed)		.492
	N	60	42
Cultural	Pearson Correlation	.109	1
	Sig. (2-tailed)	.492	
	N	42	42

According to the above table, it can be seen that there is a positive relationship between cultural factors and online shopping experience as the correlation coefficient is 0.109. Moreover, the sig value of this relationship is 0.492, which is not less than 0.05. However, the sig value is not less than 0.10. Therefore, there is enough evidence to accept null hypothesis at 10% level of significance. It implies that there is no relationship between online shopping experience and cultural factors 10% level of significance.

Table 03: Correlation between Environmental factors and Online Shopping Experience

		Have online shopping experience	Environmental
Have online shopping experience	Pearson Correlation	1	.199
	Sig. (2-tailed)		.207
	N	60	42
Environmental	Pearson Correlation	.199	1
	Sig. (2-tailed)	.207	
	N	42	42

According to the above table, it can be seen that there is a positive relationship between environmental factors and online shopping experience as the correlation coefficient is 0.199. Moreover, the sig value of this relationship is 0.207, which is not less than 0.05. However, the sig value is not less than 0.10. Therefore, there is enough evidence to accept null hypothesis at 10% level of significance. It implies that there is no relationship between online shopping experience and environmental factors at 10% level of significance.

Discussion & Recommendations

This study examines the demographic factors, frequency of online shopping the most preferred product items of online shoppers in Colombo District & it was revealed that age, income and their educational level are significantly influence on online shoppers purchasing decision. And most of the teen and youth segment believe that purchasing product through online would be much convenient and less price where the elderly segment state that lack of

trust on online sellers and difficulty of seen the product physically as the main factors that they don't shop online. The above said independent variables such as; cultural, social, personal and environmental factors show a positive relationship with buying intension but those are not significantly influence for buyer's online purchasing decision except social factors. The researcher has taken this point as an important area when finding the limitations of this research. The sample size, responses may have not given by the respondents properly would be the main factors considered under the limitations

The findings of this study align with Swinyard et al (2003), T.S.H.Teo (2006), L.L.Sim (2002) where they found that income of online shoppers significantly matters when making an online purchasing decision. Further the findings of this study also aligned with L.L.Sim (2002) that elderly segment so not shop online because they want to see the product physically before buying and also the lack of privacy .

In Sri Lanka, still there are limited number of people who have access to internet and buy products online, nevertheless there are people who use internet but do not know the steps to follow for online shopping. And also people are fear to buy products online as they do not get any chance to see the products physically and that make people restricting to buy products online and that is why Sri Lanka states on a low position when comes to internet usage and online shopping.

However, the government of Sri Lanka has been taken steps to increase the awareness and usage of internet facility among the general public by establishing "nanasala" outlets around the country and the education department has taken an initiative to enhance the computer literacy skills of school students by executing e-book concept, distributing tablets among teachers and students to engage to an e-learning platform. Apart from that there are several private sector internet providers who serve good quality internet facility covering most parts of the island. As suggestions the researcher can suggest to increase the sample size and to consider online shoppers' perceived risk factors, what initiatives the government can take to enhance online shopping experience in Sri Lanka in future researchers.

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**ASSOCIATION BETWEEN PERFORMANCE APPRAISAL METHODS AND
EMPLOYEE PRODUCTIVITY. CASE STUDY ON TYRE MANUFACTURING
COMPANY IN SRI LANKA**

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Abstract

Performance appraisal is a key HR function done by every organization. It is the most criticized but most vital responsibility of the human resource and line managers. Having a good performance appraisal enables employees to get a better understanding of what they are currently doing. By having a good understanding of where they are at and where they are assigned to the job, can bring many benefits to the both employee and the organization. Out of these, both parties can achieve the main benefit is increasing the productivity. The study used structured questionnaires as its data collection instrument. Chi square analysis were used to analyze the association between the variables. The study revealed that there is a significance association between employee productivity and clearly defined objectives, fairly done performance appraisal and appropriateness of the technique used by the company.

Key words: - Employee performance level, Performance appraisal, Performance appraisal systems.

Introduction

Performance appraisal is a regular review of an employee's job performance and overall contribution to a company. (Armstrong, 2014) A performance appraisal evaluates an employee's skills, achievements and growth or lack thereof. There are two basic systems in an effective performance appraisal. They are; evaluation system and feedback system. Management, information and motivation are the three major functional aspects of performance evaluation system (Kane and Lawler, 2009). Performance appraisal method support to understand the individual and it gives a picture on how to utilize the employee for the success of the organization. Effective performance appraisal works for the betterment of the individual and for the organization. Different organizations use different performance appraisal techniques. When deciding on what is the best method for them, most of the time they consider about the easiness for the administration. When it comes to the manufacturing industry, performance appraisal techniques are directly linked to their performance target rather than considering the soft skills of the employee. This is much more common in applying for the blue color workers. When preparing the evaluations the main elements to consider are appropriateness of the technique, quality of the content of the evaluating form and quality of the Employee Performance Evaluation procedure. (Opatha, 2003). Therefore, the researcher intends to identify the effectiveness of the current appraisal system used in a tyre manufacturing company.

The objectives of the study are:

1. To identify whether the current performance appraisal method clearly reflect the job role of the employee.
2. To identify whether a fair performance appraisal will help to increase employee's productivity.

3. To provide recommendation to improve the current appraisal system.
The researcher used the below mentioned conceptual framework for the study.

Independent Variables

Dependent Variables

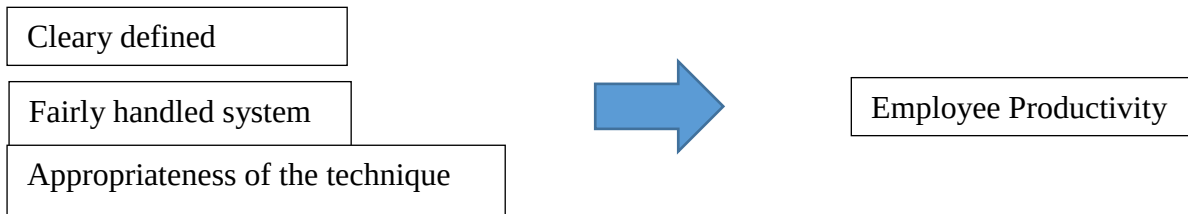


Figure 7: Conceptual framework, source: researcher's own work.

- a) H0:- There is no significance association between clearly defined objectives and employee productivity
H1: -There is a significance association between clearly defined objectives and employee productivity
- b) H0:- There is no significance association between a fairly handled performance appraisal and employee productivity.
H1: - There is a significance association between a fairly handled performance appraisal system and employee productivity.
- c) H0:- There is no significance association between appropriateness of the technique used and employee productivity.
H1; - There is a significance association between appropriateness of the technique used and employee productivity.

Methodology

The data for this research is under the quantitative data collection method. There are three production divisions in the selected tyre manufacturing organization; they are division A, B and C. The study was limited to division A, out of the 1000 employees among them the author choose 10% of employees as the sample size using the convenience sampling method but was able to get respond from 96 production technicians and 3 immediate supervisors.

Primary data collection method was used and structured questionnaire validity and reliability was given to the sample.

The collected data was analyzed using the SPSS. A chi-squared analysis was used to analyze the association between the variables.

Results and the discussion

Profile of the Respondents: Among the 96 production employees 90% of them have worked more than 4 years.

Table 1: - Association between clearly defined objectives in performance appraisal and employee productivity

	Value	df	Significance(2-sided)
Pearson Chi-Square	19.292 ^a	1	.000
N of Valid Cases	96		

When considering the association between clearly defined objectives in performance appraisal and employee productivity, the author found there is a significance association.

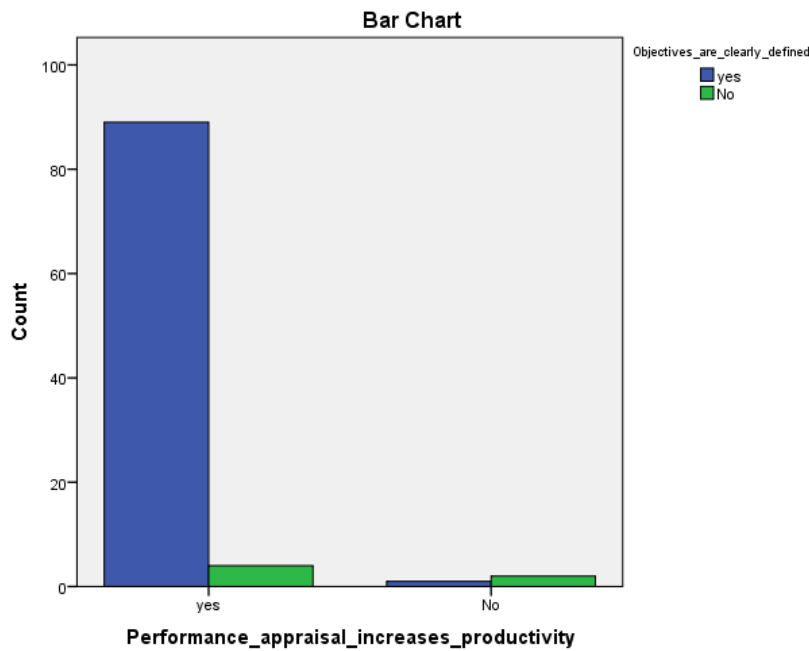


Figure 1: Association between defined objectives in performance appraisal and employee productivity

According to the study, 91 respondents said that clearly defined objectives in their appraisal would help them in their work; it is 94.7% in percentage terms. This finding supports the previous findings of clearly defined objectives enhance the performance of the tea estate largely with an indication of 67.5% the respondents (Kamencu, 2011). The null hypothesis can be rejected, as the sig value is less than 0.05. Therefore, this finding proves that there is a significance association between clearly defined objectives in the performance appraisal and their productivity.

Table 2: - Association between fairly done performance appraisal and employee productivity

	Value	Df	Significance (2-sided)
Pearson Chi-Square	34.065 ^a	1	.000
N of Valid Cases	96		

a. 5 cells (83.3%) have expected count less than 5. The minimum expected count is .03.

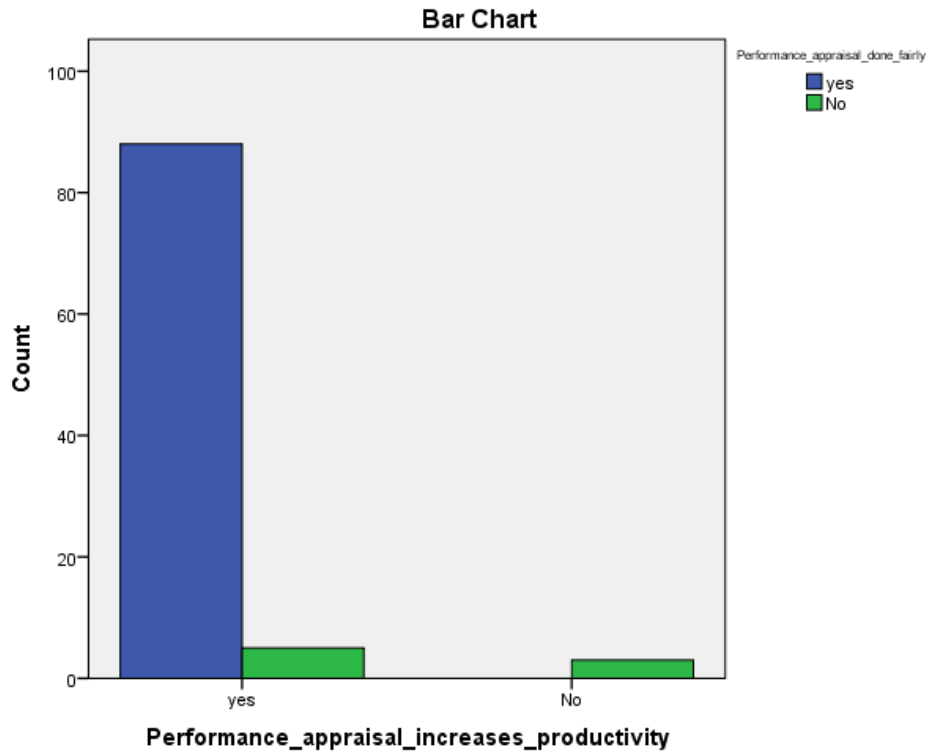


Figure: 2: - Association between fairly done performance appraisal and productivity.

In testing the hypothesis of “There is no significance association between appropriateness of the technique used and employee productivity”, it was found the sig value is less than 0.05, which supports to reject the null hypothesis. The results of this study show that there is a significant association between suitability of the performance appraisal technique selected and employee productivity. This finding supports the previous findings of doing a reasonable and fair performance appraisal is very important both employer and employee to increase the productivity of the entire organization. (Prather, 2010).

Table 3: - Association between suitability of the performance appraisal technique selected and employee productivity.

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	63.323 ^a	2	.000
N of Valid Cases	96		

a. 5 cells (83.3%) have expected count less than 5. The minimum expected count is .03.

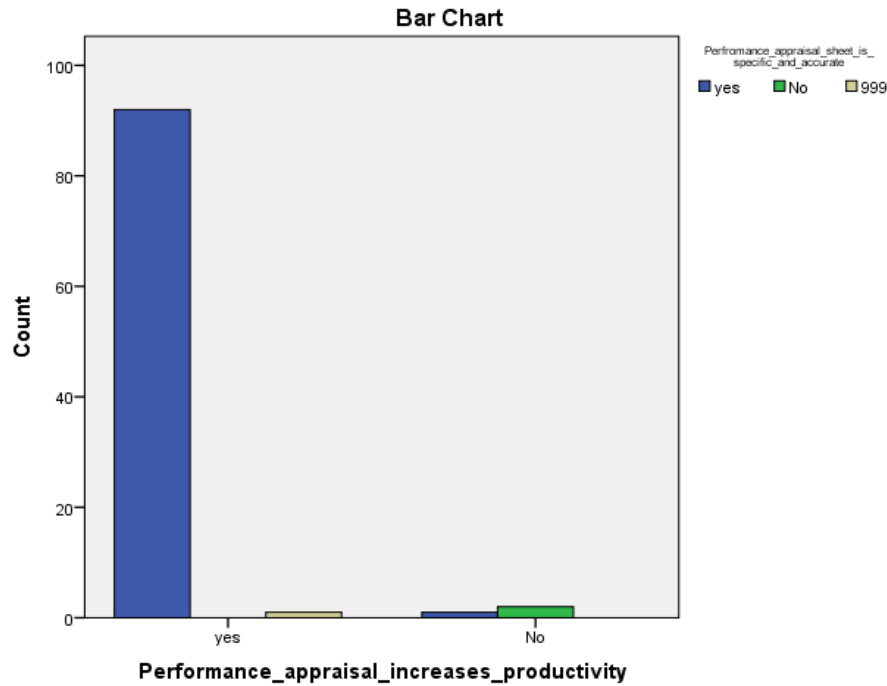


Figure 3: Association between performance appraisal sheet and Productivity.

According to Estino (1999), committed employees feel a certain bond with the organization, which, in the positive form, makes them more willing to perform and according to her article performance appraisal gives the employees a good idea about the work that they are doing right now. This will help the employee to identify his/her strengths and weaknesses and to prevent them and to increase the productivity of the organization (Daoanis, 2012).

Table 4: Relevancy of the appraisal system

Dimensions and Elements	Yes (N)	No (N)	Yes (%)	No (%)
Individual importance of Performance Appraisals used in the company (employees idea)				
(a) Performance Appraisals increases my personality	16	80	16.7	83.3
(b) It gives a clear idea on what I am doing	87	9	90.6	9.4
(c) It gives a clear idea on what my boss expect from me	94	2	97.9	2.1
(d) Promotions are based on performance appraisals	14	82	14.6	85.4
Purpose of the appraisal system (Supervisor's idea)				
(e) Adequacy for administrative purposes	0	3	0	100
(f) Adequacy for development purposes	1	2	33.33	66.66

According to the above table 4, 80% of the employees were saying that their appraisal method does not support them to develop their personality also the majority said they do not get a clear idea on their job role and what is the bosses' expectation. Furthermore, they do not believe there is a link between the promotion system and the appraisal.

More importantly, the supervisors also believe the current system does not support for the administrative purpose especially on deciding the rewards and developing the employees. Though the current system done in a fair way very limitedly support for the administrative purpose. The specialty of this is, that all the supervisors who responded to this survey are who have been working in this organization for more than twenty years that means for the past 20 years there were no improvement happen to the current system.

Although there are drawbacks in the current system, still the given sheet supports to provide a constructive feedback to the employee, which can be easily understood by the employee. Since they use 180-degree feedback system, employees' voice can be clearly identified.

Conclusion and Recommendation

According to this study, there is a significance association between clearly defined objectives and employee productivity, fairly done performance appraisal and employee productivity, appropriateness of the technique used and employee productivity. This confirms that the performance appraisal has a direct impact on all of the above criteria mentioned (Table 01, 02, 03) Furthermore, Employees who have worked more than four years responded positively about the current system but the respond gave by the newly joined employees were not favorable compare to the experienced employees. Therefore, the researcher suggest conducting a forum on performance appraisal for new employees and it is advisable to provide them with specific feedback more frequently as they are new with the practices.

In addition, the researcher suggests managers need to use the performance appraisal document as a discussion starter. Considering about the personal goals will support to develop the employee and the organization both. One to one interview need to be handled without considering the time. 360-degree performance appraisal model need to be implemented at least for the team leaders. Furthermore, the researcher suggests using a uniform evaluation cycle and providing regular feedback and coaching them. Same time it is needed to train the supervisors on new techniques to handle appraisals and on how to support the individuals on giving smart objectives. Since this process valued with the judgmental technique it is necessary to develop supervisory skills on it.

The study suggests that future research can conduct a research on the effect of different performance appraisal methods on employee productivity.

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**LIQUIDITY AND CAPITAL STRUCTURE ON PROFITABILITY OF FIRMS:
SPECIAL REFERENCE TO TELECOMMUNICATION SECTOR IN SRI LANKA.**

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Abstract

Capital Structure is most significant discipline of company's operations, and the decision on capital structure and its components is viewed as one of the most extensively research area. On the other hand, Liquidity is the most prominent issue in corporate finance, and it directly affect the profitability of the firms. This study has investigated the relationship between liquidity and capital structure, and it allow special reference to the telecommunication sector in Sri Lanka. The main objective was to identify liquidity and capital structure, influence on profitability of the firms. Therefore, the selected firms analyzed public sector and private sector telecommunication performances in Sri Lanka. The data analysis was based on annual reports of the company's from 2014 to 2018. The correlation and regression analysis respectively examined the nature of the relationship between the variables, and it suggest; that there is a significant impact of liquidity and capital structure on profit of the firms.

Key words: Liquidity, Capital Structure, Profitability.

Introduction

Background of the study:

There is so much happening in telecommunication ecosystem today, it is absolutely spectacular and it seem to have rapid changes in technological developments. The main purpose of this study was to identify, liquidity and capital structure were influence on profitability in telecommunication sector in Sri Lanka. Therefore, Liquidity management is very important, and it directly affect to the profitability of the firms. However, Liquidity is defined as short term survival in the firm, and also, it measure a business` ability to meet its short- term obligations by using the cash and near cash assets. "A study of liquidity is major importance to both the internal and the external analysts because of its close relationship with day-to-day operations of a business" (Bhunias, 2010).

In corporate finance, capital structure is most significant discipline of company's operations, and the decision on the capital structure and its components is viewed as one of the most extensively research area. In this context, capital structure refers to examine the financial performance through a combination of equity and debt. Base on that, profitability is a measure of the amount by which sector revenues exceeds, relevant to their expenses. A profit ratios indicates how effectively management can make profits on their sales. Finally, the relationship between the liquidity and capital structure most prominent issues in the corporate finance, and it depend on the profitability of the firms as well.

Research Objectives

The present study is envisaged with the following objectives.

- To understand the relationship between liquidity and capital structure and profitability of the firms.

- To determine the determinants of profitability influencing liquidity and capital structure.

Research Questions:

In order to gain proper result of this study, there are some significant area is to be concern.

- Is there any relationship between liquidity and capital structure influence on profitability?
- Does the liquidity and capital structure behavior equal to both sectors?

Independent Variable:

Dependent Variable:

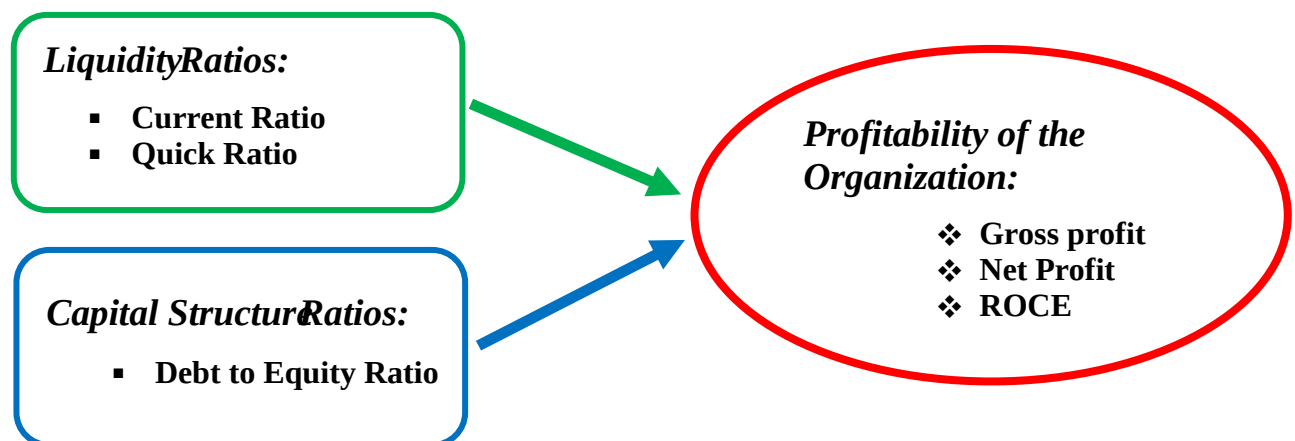


Figure 1: Conceptual frame work:

Hypotheses of the study:

The following hypotheses were formulated for the study.

H0: There is no impact of liquidity on profitability.

H1: There is an impact of liquidity on profitability.

H0: There is no impact of capital structure on profitability.

H2: There is an impact of capital structure on profitability.

Methodology:

Data source:

The present study used secondary data for the analysis. The data utilized in this study is extracted from the comprehensive income statements and financial position of the sample companies of telecommunication sector in Sri Lanka. Therefore, the selected firms were analyzed public sector and private sector telecommunication performances in Sri Lanka.

Sampling design:

“Sampling design is a definite plan for obtaining a sample from a given population. It refers to the technique or the procedure the researcher would adopt on selecting items for the sample” (Kothari, 2004). The sample of this study conducted to gather the data from the annual report, from 2014 to 2018 period of time.

Mode of analysis:

In the present study, the data analyzed done by the descriptive statistics. Therefore result of the descriptive statistics defined regression analysis and correlation analysis by using SPSS.

Important aspect of the regression analysis is used to answer the research question as what extent the liquidity influence on capital structure. The following ratios are taken into accounts in this connection.

Table -1: Description of Liquidity, Capital Structure and Profitability Ratios

Variables	Measure	Symbols
Liquidity Ratios		
Current Ratio	Current Assets/ Current Liabilities	X1
Quick Ratio	(Current Assets – Inventory) /Current Liabilities	X2
NCI Ratio	(Quick Assets -Current Liabilities) /Daily operating expenses	
Capital Structure Ratios		
Debt-to-Equity Ratio	Total Liabilities / Total Equity	X3
Profitability Ratios		
Gross Profit Ratio	(Gross Profit / Turnover)*100	Y1
Net Profit Ratio	(Net Profit / Turnover)*100	Y2
ROCE Ratio	{(EBIT + Finance cost) / (Total Equity+ Total Debt)}*100	Y3

In this study, liquidity and capital structure ratios are considered as the independent variable, which was measured by the three key ratios as current ratios, quick ratios and debt to equity ratio. Meanwhile, profitability is viewed as the dependent variable. They include Gross profit ratio, Net profit ratio and ROCE ratio concern to measure the profit of the firms.

Profitability = f (Current Ratio; Quick Ratio; Debt to Equity Ratio)

It is important to note that the profitability depend upon Current Ratio (CR); Quick Ratio (QR) & Debt-to-Equity Ratio. The following three module are formulated to measure the impact between liquidity & capital structure and profitability.

$$Y1 \text{ Gross Profit Ratio} = \beta + X1 \text{ Current Ratio} + X2 \text{ Quick Ratio} + X3 \text{ Debt Equity Ratio} + \varepsilon \dots \dots (1)$$

$$Y2 \text{ Net Profit Ratio} = \beta + X1 \text{ Current Ratio} + X2 \text{ Quick Ratio} + X3 \text{ Debt Equity Ratio} + \varepsilon \dots \dots (2)$$

$Y2 \text{ ROCE Ratio} = \beta + X1 \text{ Current Ratio} + X2 \text{ Quick Ratio} + X3 \text{ Debt Equity Ratio} + \varepsilon \dots (3)$

(β = Beta) (ε = Error)

$Y = \beta_0 + \beta_1 X1 + \beta_2 X2 + \beta_3 X3 + \mu$

Correlation regression and reliability analysis:

Public Sector Performances:

Table 2: Correlation and Regression, measured with Gross Profit Ratio (Public Sector)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R Square	F-Value
		B	Std. Error	Beta				
1	(Constant)	-.033	.213		-.154	.903	.440	.465
	X1CurrentRatio	-6.567	6.560	-.19.973	-1.001	.500		
	X2QuickRatio	6.579	6.385	.21.213	1.030	.490		
	X3DebttoEquity Ratio	.489	.258	.2.102	1.899	.309		
Dependent Variable : Y1 Gross Profit Ratio								

Table 3: Correlation and Regression, measured with Net Profit Ratio (Public Sector)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R Square	F-Value
		B	Std. Error	Beta				
2	(Constant)	-.020	.044		-.447	.732	.795	.286
	X1CurrentRatio	.413	1.348	.3.690	.306	.811		
	X2QuickRatio	-.301	1.312	-.2.855	-.229	.856		
	X3DebttoEquity Ratio	-.017	.053	-.2.214	-.319	.803		
Dependent Variable: Y2 Net Profit Ratio								

Table 4: Correlation and Regression, measured with ROCE Ratio (Public Sector)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R Square	F-Value
		B	Std. Error	Beta				
3	(Constant)	.018	.009		1.969	.299	.938	.158
	X1CurrentRatio	.358	.278	8.538	1.286	.421		
	X2QuickRatio	-.322	.271	-8.157	-1.191	.445		
	X3DebttoEquity Ratio	-.025	.011	-.845	-2.295	.262		
Dependent Variable: Y3 ROCE Ratio								

Private Sector Performances:

Table 5: Correlation and Regression, measured with Gross Profit Ratio (Private Sector)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R Square	F-Value
		B	Std. Error	Beta				
1	(Constant)	.537	.310		1.733	.333	.242	.945
	X1CurrentRatio	2.295	4.174	19.410	.550	.680		
	X2QuickRatio	-2.153	3.962	-18.670	-.544	.683		
	X3DebttoEquity Ratio	-.159	.473	-.717	-.337	.793		
Dependent Variable: Y1 Gross Profit Ratio								

Table 6: Correlation and Regression, measured with Net Profit Ratio (Private Sector)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R Square	F-Value
		B	Std. Error	Beta				
2	(Constant)	.837	.323		2.592	.234	.373	.491
	X1CurrentRatio	3.996	4.349	14.750	.919	.527		
	X2QuickRatio	-3.515	4.127	-13.303	-.852	.551		
	X3DebttoEquity Ratio	-1.046	.493	-2.054	-2.121	.280		

Dependent Variable: Y2 Net Profit Ratio		

Table 7: Correlation and Regression, measured with ROCE Ratio (Private Sector)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R Square	F-Value
		B	Std. Error	Beta				
3	(Constant)	.305	.061		5.014	.125	.807	.277
	X1CurrentRatio	2.634	.820	28.588	3.212	.192		
	X2QuickRatio	-2.457	.778	-27.346	-3.158	.195		
	X3DebttoEquity Ratio	-.334	.093	-1.931	-3.596	.173		
Dependent Variable: Y3 ROCE Ratio								

The result of the variable impact remain as follow:

Public Sector Performances:

$$Y1 \text{ Gross Profit} = -0.033 + -6.567 X1 + 6.579 X2 + 0.489 X3 + \varepsilon \dots \dots \dots$$

(1)

$$Y2 \text{ Net Profit} = -0.020 + 0.413 X1 + -0.301 X2 + -0.017 X3 + \varepsilon \dots \dots \dots$$

(2)

$$Y2 \text{ ROCE Ratio} = 0.018 + 0.358 X1 + -0.322 X2 + -0.025 X3 + \varepsilon \dots \dots \dots$$

(3)

Private Sector Performances:

$$Y1 \text{ Gross Profit Ratio} = 0.537 + 2.295 X1 + -2.153 X2 + -0.159 X3 + \varepsilon \dots \dots \dots (4)$$

$$Y2 \text{ Net Profit Ratio} = 0.837 + 3.996 X1 + -3.515 X2 + -1.046 X3 + \varepsilon \dots \dots \dots (5)$$

$$Y2 \text{ ROCE Ratio} = 0.305 + 2.634 X1 + -2.457 X2 + -0.334 X3 + \varepsilon \dots \dots \dots (6)$$

Results and discussion:

The above equations indicate the relationship between the various independent and dependent variables used in the study. According to that, the correlation values were found to be mixed with positive and negative values, between the variables. However, if the independent variable has negative value, it indicate that overall effeteness' of dependent is decreasing. If an independent variable has a positive value, that means it increase the impact of the dependent.

The adjusted R-square is a modified version of R- square that has been adjusted for the number of predictors in the model. Therefore, above tables re-presented that public sector telecommunication performance has adjusted R square 0.44, 0.795, 0.938 respectively, and it imply that 44%, 79% and 94% of proportion has measured in the model. On the other hand, private sector telecommunication performance is point out 0.242, 0.373, and 0.807 respectively.

An examination of the model summary in conjunction with ANOVA (F- Value) indicates that model explains the most possible combination of predictor variable that could contribute the means between two variables are significantly different. (It is similar to T- Test).

******, Correlation is Significant at the 0.05 level ******

Table 8: Total significant values (sig value)

	Measure	Sig Value
Public Sector Performances	☐ Gross Profit	0.903
	☐ Net Profit	0.732
	☐ ROCE	0.299
Private Sector Performances	☐ Gross Profit	0.333
	☐ Net Profit	0.234
	☐ ROCE	0.125

Conclusions and recommendation:

In summary, correlation and regression analysis explains, there is no significant impact between the liquidity and capital structure, although it does not effect to the profitability of the firms as well. Major finding of this study has imply that, significant values are higher than 0.05 level of confident. Therefore, both of public and private companies re-presented same level of significant, and it remain more than 0.05. (If there is a significant impact the sig value should be < 0.05)

Base on that, this study determined overall effect of the liquidity influence on capital structure do not exist significant impact to the profit. Comparing overall ratios figures with public and private sectors, there are some disagreements, which can be consider as poor financial position are available in both sectors.

R.Kajananthan suggested “that Sri Lankan Telecom PLC have been in better liquidity, solvency, and profitability condition than Dialog Axiata PLC over the past five years (2009 to 2013). Major findings of his study can be derived from the aspects of liquidity, solvency, and profitability condition performance. As mentioned earlier, two traditional and one cash flow liquidity ratios did not show that there were statistically significant differences between Dialog Axiata PLC and Sri Lanka Telecom PLC. Second, both traditional and cash flow liquidity ratios indicated that the Dialog Axiata PLC was not in a healthy liquidity condition” (R. Kajananthan, 2014).

The overall conclusion indicate that, there is an impact between two variable, and there is no any significant impacts between liquidity and capital structure. Suggest that, if this study may use other variables such as Solvency, Efficiency and Financial Leverage Ratios, there might have an impact between the liquidity and capital structure. At the same time, the data analysis were analyzed more than 20 years, the result of this study will be more sufficient than this.

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**IMPACT OF WORK LIFE BALANCE ON JOB SATISFACTION OF FEMALE
EMPLOYEES: SPECIAL REFERENCE TO COMMERCIAL BANK PLC**

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Abstract

This study is aimed to explore the impact of work-life balance on job satisfaction of female employees in Commercial Bank PLC in Sri Lanka. Family support, personal life satisfaction, work place support and job stress were used as independent variables and job satisfaction was deliberated as the dependent variable. Data were collected through 50 female respondents who are working in the different departments of Commercial Bank PLC using multi-stage sampling. A structured questionnaire consisting of 38 questions was distributed to collect primary data. Measures of central tendency, Pearson correlation coefficient and regression analysis were applied in SPSS version 20 for the analysis of data. It was clearly evident that personal life satisfaction, work place support and job stress have significant relationship with job satisfaction and the most influential factor on job satisfaction was the work place support. Further, the study revealed that there was a significant relationship between work life balance and job satisfaction of female employees in Commercial Bank PLC.

Key Words: Work life balance, Job satisfaction, Public Limited Company

Introduction

The changing social structures are arising out of dual career couples, single parent families, globalization and changes in the demands and patterns of work. Opatha (2012) defined work-life balance as the life that is related to a person's employment and what happened in the work-life has significant impact on their family as well as on their career life. There has been increasing interest in the conflict between family and work domains in the recent years. Armstrong and Taylor (2014) noted that job satisfaction as the attitudes and feelings of people for their work and positive and favorable attitudes towards the job indicate job satisfaction. Job satisfaction plays a vital role to achieve firms' objectives and complete advantages.

Issue of managing workplace needs with personal life needs is gaining importance among workers all over the world (Stanton and Young, 2009). With the concept of dual career families, women employees' contribution in the organizations are gradually increased. Rifadha and Sangarandeniya (2015) stressed that since banker's job is considered to be highly stress full, the organization should take necessary steps to look after their employees in a manner they are satisfied. Further, the banking sector female employees face many difficulties in performing their duties and responsibilities in Sri Lankan environment (Weerasinghe, Dedunu, and Jayani, 2017). Hence, there are satisfaction issues among female employees who are working in private sector banks. Therefore, the research question addressed in this study is "*How does work-life balance affect job satisfaction of female employees in Commercial Bank PLC?*"

Objectives of the study

The main objective of this research is to explore the effect of work life balance of female employees on job satisfaction in private sector banks in Sri Lanka. Further this research attempts to recognize the most important work life balance practice on job satisfaction.

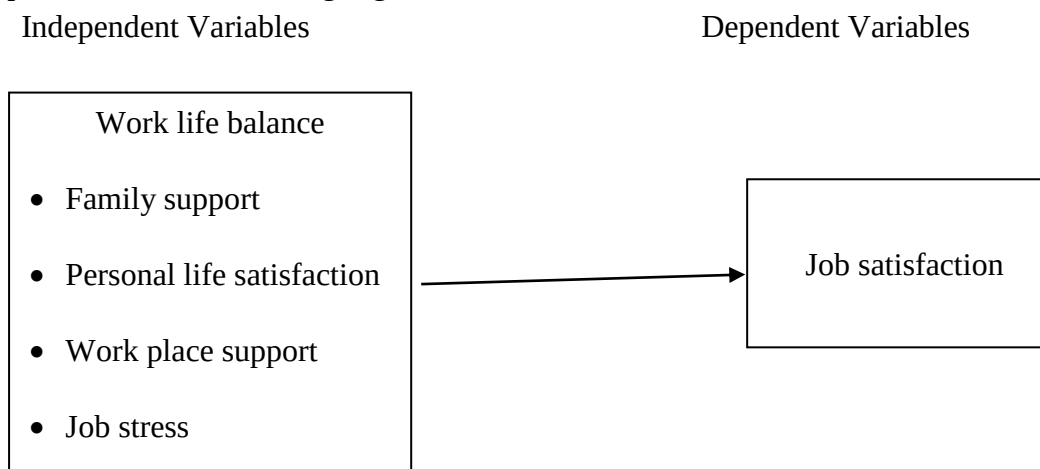
Significance of the study

Analyzing satisfaction levels across work life balance and job satisfaction can help management to identify factors that contribute to the satisfaction or dissatisfaction of the employee of the bank. Further, findings of this study will be helpful the top level management to develop strategies to enhance job satisfaction level to minimize job stress and maintain a healthy work-life balance among female employees of the bank. The findings of the study can be further used to identify the causes for work-family conflict of employees in the banking sector.

Methodology

Conceptual framework

The research was based on the deductive approach and the quantitative research method. Family support, personal life satisfaction, work place support and job stress were used as independent variables and job satisfaction was deliberated as the dependent variable. The relationship between the independent variables and dependent variable for the study is conceptualized in the following Figure 1.



Hypotheses

H1: There is a significant relationship between family support and job satisfaction

- H2: There is a significant relationship between personal life satisfaction and job satisfaction
- H3: There is a significant relationship between work place support and job satisfaction
- H4: There is a significant relationship between job stress and job satisfaction

Study area and Data

Population consisted of women employees who are working in Commercial Bank PLC. The sample of this study consisted of 50 female respondents who are working in the different departments of the head office and three branches; Nugegoda, Kolpity and Maharagama of

Commercial bank PLC. The probability sampling procedure of multi-stage sampling technique was used to select respondents to the sample. Both primary and secondary data were gathered for this study. Primary data were gathered from the respondents in the sample individually. Therefore, the unit of analysis for the current study is individual. A structured questionnaire consisting of 38 questions was made to collect primary data and Four questions were used to know demographic information of respondents. A five point Likert scale has been used to measure the impact of work life balance on job satisfaction. The SPSS 20 version was applied to present and analyze data. Statistical techniques such as measures of central tendency, correlation analysis and regression analysis have been used to analyze data.

Results and discussion

Descriptive statistics

Table 1: Demographic information

Demographic Factor	Component	Frequency	Percentage	Mean	Mode
Age	≤ 24 years	05	10	2.98	3.00
	25 years – 29 years	09	18		
	30 years – 34 years	18	36		
	35 years – 39 years	11	22		
	≥ 40 years	07	14		
Material status	Married	34	68	1.00	1.00
	Single	16	32		
No of children in family	No children	04	11.8	2.95	3.00
	1 child	09	26.5		
	2 children	18	52.9		
	3 children	03	8.8		
Years of working experience	≤ 1 year	03	6	3.00	3.00
	1-3 years	13	26		
	4-6 years	20	40		
	7-9 years	09	18		
	≥ 10 years	05	10		

According to the above table, the majority of respondents that is, 36% are in the age category of 30 to 34 years. Furthermore, the mean age is 2.98 and the modal age is 3.00 of respondents which indicates that most of the respondents in the sample are in the age category of 30-34. The most of the respondents (68%) in the population are married employees. 52.9% of respondents' have two children and only 8.8% respondents have three children. The modal years of experience 3.00 indicates that the majority of respondents (40%) are having working experience of 4-6 years.

Correlation analysis

Table 2: Correlations between independent variable and job satisfaction

No	Factors	Job satisfaction
1	Family support	.623 ^{**}
2	Personal life satisfaction	.845 ^{**}
3	Work place support	.879 ^{**}
4	Job stress	-.821 ^{**}
5	Transformed_WLB	.769 ^{**}

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

As shown by Table 2, there is a moderate positive correlation between family support and job satisfaction since $r = 0.623$. However, there is a strong positive relationship between personal life satisfaction and work place support with job satisfaction with $r = 0.845$ and $r = 0.879$ respectively. The correlation coefficient of job stress and job satisfaction ($r = -0.821$) illustrates that strong negative relationship. It further shows that there is a strong positive relationship work life balance and job satisfaction ($r = 0.769$) with 5% level of significance.

Table 3: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.769	.715	.708	.29458

Results of regression analysis show that the adjusted R^2 is 0.708 and this figure reveals that 70.8% of total variance in job satisfaction is explained by work life balance. This means that work life balance has 70.8% impact on job satisfaction.

The summary of the results of hypotheses which were tested in this study is presented in table 04.

Table 04: Summary of Hypotheses Testing

Code	Hypothesis	Evidence Correlation	p-values
H1	There is a significant relationship between family support and job satisfaction	.623 ^{**}	0.153
H2	There is a significant relationship between personal life satisfaction and job satisfaction	.845 ^{**}	0.006
H3	There is a significant relationship between work place support and job satisfaction	.879 ^{**}	0.003
H4	There is a significant relationship between job stress and job satisfaction	-.821 ^{**}	0.000

According to the table 04, family support ($p=0.153 > \alpha=0.05$) is not significant in job satisfaction. Hence, there is enough statistical evidence to accept the null hypothesis and its alternative hypothesis that *H1: There is a significant relationship between family support and job satisfaction* is rejected.

Since personal life satisfaction is taken ($p=0.006 < \alpha=0.05$), statistical evidences support to reject the null hypothesis. Therefore, the alternative hypothesis i.e. *H2: there is a significant relationship between personal life satisfaction and job satisfaction* is accepted.

As shown in the above table, work place support ($p=0.003 < \alpha= 0.05$) is significant in job satisfaction. Therefore, there is statistical evidence to reject the null hypothesis and the alternative hypothesis of *H3: there is a significant relationship between work place support and job satisfaction* is accepted.

Job stress ($p=0.000 < \alpha= 0.05$) emerged as the most significant variable which affects job satisfaction. Therefore, the null hypothesis is rejected and statistical data support to accept its alternative hypothesis that *H4: there is a significant relationship between job stress and job satisfaction*.

Conclusions and recommendations

The purpose of this study was to examine the impact of work life balance on job satisfaction and to identify which factor of work life balance has more influence on job satisfaction in Commercial Bank PLC. The results of this study revealed that personal life satisfaction has significant positive relationship with better job satisfaction and this result is consistent with Aydintan and Koc (2016). In contrast to the current study findings, Shujat, Cheema and Bhutto (2011), there is a significant relationship between family support and job satisfaction. Findings of this study show that there is a significant relationship between work place support and job satisfaction. This result supports the previous research findings of Adikaram (2016); Varatharaj and Vasantha (2012); Rifadha and Sangarandeniya (2015). Further, this reveals that job stress has negative significant relationship with job satisfaction. According to the correlation analysis, the most important work life balance practice which affect job satisfaction is work place support. Finally, it can be concluded, that there is a significant impact of work life balance on job satisfaction of female employees of Commercial bank PLC.

Based on the above conclusions, it is important to concentrate on the matter and take necessary solutions in order to get rid of this problem that female employees in the banking sector. Assigning employees for convenient branches in distance, organizing programs/workshops to reduce their stress, making flexible work arrangements and providing child care solutions for employees who have kids are suggested for balancing work and family life to enhance job satisfaction of female employees in Commercial Bank PLC.

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IMPACT OF ECOTOURISM ON TOURISTS' ATTRACTION: A STUDY ON TOUR OPERATORS IN COLOMBO

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Abstract

This study provides an insight into identification of the impact of ecotourism on tourist attraction to Sri Lanka, current ecotourism factors available in tourism, potential key ecotourism factors that affect tourist attraction and extent to which these factors affect tourists' attraction. A quantitative approach followed and data were collected through a questionnaire. The sample was 30 tourists conveniently selected from three tour operators in Colombo. Findings of the study reveals tourists are not satisfied with the degree of current ecotourism factors available in the tours except for nature-based activities. Furthermore, ecotourism factors like nature-based activities, interaction with local community and environmental education have high impact on attracting more tourists. But, eco-friendly lodging has a low impact on attracting tourists. The study has suggested that ecotourism factors highly influence attraction of more tourists and the tourism companies can adopt these factors in formulating their future ecotourism plans.

Keywords: Ecotourism, Tourist Attraction, Eco-friendly lodging, Nature-based activities

Introduction

Ecotourism is a subset of broad nature based on tourism that includes several components like community benefits, education, sustainability and ethics (Goodwin 2003; Brandon 1996; Honey 1999; Fennell 1999; Buckley 2000). According to Cristina (2004) ecotourism involves visiting natural areas with the objectives of learning, studying or participating in activities that do not bring negative effects to the environment; whilst protecting and empowering the local community socially and economically.

Tourism industry in Sri Lanka dates back to 1960's and has grown steadily over the years. At present it is one of the major foreign exchange generating industries in Sri Lanka and nearly 150,000 people directly or indirectly depend on the industry for their livelihood. Tourism in Sri Lanka initially focused on beach tourism (Sri Lanka Tourism Development Authority, 2015)

The country has seven UNESCO World Heritage sites, 13 National Parks, a Biodiversity Park and 93 other protected natural areas, adding value to an eco-tourism resource based on immense abundance. The coast-based eco asset tourism of the country includes the 24 protected areas bordering the coastal zone (CZMP, 2003), associated with coastal habitats such as lagoons/estuaries, mangroves, salt marshes, etc. In addition, its rich biodiversity hard coral reefs, nearly 1000 species of fish and many other invertebrate species offer unique opportunities for the undersea nature lovers.

Tourism was the third largest foreign exchange earner for the country in 2017, preceded by Worker's Remittance and Textiles & Garments, significantly contributing to the Sri Lankan economy. Foreign exchange earnings from the tourism sector increased to 14.8% of the total foreign exchange earnings, compared to 14.2% recorded in the previous year. The official

tourist receipts for 2017 were estimated at Rs. 598,356 million as compared to Rs. 512,593 million in 2016, growing by 16.7%. In terms of US Dollars, the total tourist receipts were estimated to be US\$ 3,924.9 million, compared to US\$ 3,518.5 million observed in the previous year, increasing by 11.5% (Sri Lanka Tourism Development Authority, 2017)

According to one study, a random sample of tourists in 2007 revealed that 85 percent are likely to patronize travel companies that preserve the environment; further, they are likely to pay more for this privilege (Jones, 2008). However, Arlen (2009) reports that in a recent review of Eco tour operators, 27 of 34 said that they do not give environmental concerns high priority.

One of the significant challenges that the tour operators face is to identify the real impact of ecotourism on tourist attraction in tourism industry. Thus, this study will be focused to identify the impact of ecotourism on tourist, current ecotourism factors available in tourism, potential key ecotourism factors that affect tourist attraction and extent to which these factors affect tourists' attraction. The findings of this study can assist the managers to develop appropriate strategies to improve eco-tourism factors and activities in their tour packages and to eliminate elements which result in adverse effects on tourist attraction. Thus, the study findings will be helpful in attracting more tourists and generating high profits for the organizations.

Methodology

Sampling and Data Collection

Study population is the tourists who visit Sri Lanka through selected three tour operators in Colombo. 30 tourists were selected as the sample of the study; 10 respondents were selected conveniently from each of the three tour operators. This sample is consisted of travelers from different countries coming to Sri Lanka. A quantitative approach was followed and data were collected through a well-structured, five point Likert scale questionnaire. Data was examined using SPSS 21 version software.

Conceptual Framework

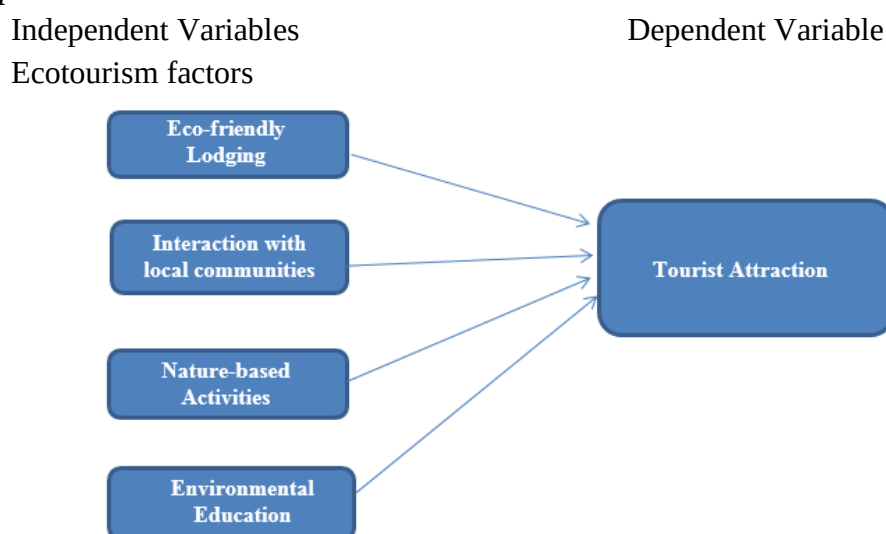


Figure 1: Conceptual Framework of the Research

Hypothesis

H1- There is a significant relationship between Eco-friendly lodging and tourist attraction.

H2- There is a significant relationship between Interaction with Local communities and tourist attraction.

H3- There is a significant relationship between Nature-based activities and tourist attraction.

H4- There is a significant relationship between Environmental Education and tourist attraction.

Results and Discussion

Table 1: Eco-friendly Lodging

	Question 1		Question 2		Question 3		Question 4		Question 5	
	Mean 3.533 S.D- .860		Mean 3.500 S.D -1.008		Mean 3.966 S.D- .927		Mean 4.100 S.D- .480		Mean 4.000 S.D- .946	
	F	%	F	%	F	%	F	%	F	%
Strongly Agree	0	0	0	0	0	0	0	0	0	0
Agree	5	16.7	7	23.3	2	6.7	0	0	3	10.0
Neutral	6	20.0	5	16.7	7	23.3	2	6.7	4	13.3
Disagree	17	56.7	14	46.7	11	36.7	23	76.7	13	43.3
Strongly Disagree	2	6.7	4	13.3	10	33.3	5	16.7	10	33.3

All the mean values are above 3 and close to 4 or more than 4. So, the value 4 in Likert scale represents ‘disagree’ and this indicates that the tourists disagree with the fact that they prefer eco-friendly lodging offered by the company.

Table 2: Interaction with local community

	Question 6		Question 7		Question 8		Question 9		Question 10	
	Mean 3.666 S.D. .884		Mean 3.400 S.D. 1.162		Mean 3.933 S.D. .520		Mean 3.900 S.D. .711		Mean 3.100 S.D. 1.213	
	F	%	F	%	F	%	F	%	F	%
Strongly Agree	0	0	2	6.7	0	0	0	0	4	13.3
Agree	4	13.3	5	16.7	0	0	1	3.3	5	16.7
Neutral	6	20.0	7	23.3	5	16.7	6	20.0	8	26.7
Disagree	16	53.3	11	36.7	22	73.3	18	60.0	10	33.3
Strongly Disagree	4	13.3	5	16.7	3	10.0	5	16.7	3	10.0

Mean values are closer to 4 which indicate disagreement of tourists with the fact that they are well exposed to local communities to share and learn about local customs and traditions. The

tourists are dissatisfied with the degree of exposure they get from the company to interact with the community.

Table 3: Nature-based Activities

Mean values denotes the fact that tourists are more attracted to wildlife activities. The mean

	Question 11		Question 12		Question 13		Question 14	
	Mean 2.533 S.D- 1.224		Mean 2.500 S.D.- .776		Mean 3.733 S.D.- .827		Mean 3.700 S.D.- .876	
	F	%	F	%	F	%	F	%
Strongly Agree	5	16.7	0	0	0	0	0	0
Agree	14	46.7	19	63.3	2	6.7	4	13.3
Neutral	4	13.3	8	26.7	9	30.0	5	16.7
Disagree	4	13.3	2	6.7	14	46.7	17	56.7
Strongly Disagree	3	10.0	1	3.3	5	16.7	4	13.3

values of responses related to remote, natural environments and kinetic activities are closer to 4. This indicates that the tourists are not attracted by these two activities.

Table 4: Environmental Education

	Question 15		Question 16		Question 17		Question 18		Question 19		Question 20	
	Mean 3.566 S.D. .935		Mean 4.033 S.D. .764		Mean 3.666 S.D. .884		Mean 3.533 S.D. .860		Mean 3.533 S.D. .899		Mean 3.900 S.D. .844	
	F	%	F	%	F	%	F	%	F	%	F	%
Strongly Agree	0	0	0	0	0	0	0	0	0	0	0	0
Agree	5	16.7	1	3.3	4	13.3	4	13.3	5	16.7	2	6.7
Neutral	7	23.3	5	16.7	6	20.0	9	30.0	7	23.3	6	20.0
Disagree	14	50.0	16	53.3	16	53.3	14	46.7	15	50.0	15	50.0
Strongly Disagree	4	16.7	8	26.7	4	13.3	3	10.0	3	10.0	7	23.3

The mean values calculated for the questions on environmental education were closer to 4 or above 4. Thus, indicating tourists' dissatisfaction with the way that environmental education is provided during the tours.

Table 5: Correlation between Eco-friendly lodging and Tourists' attraction

Correlations

		A	Q
A	Pearson Correlation	1	-.148
	Sig. (2-tailed)		.434
	N	30	30
Q	Pearson Correlation	-.148	1
	Sig. (2-tailed)	.434	
	N	30	30

The correlation between Eco-friendly Lodging and the tourists' attraction is -0.143 and thus it proves that there is a weak negative relationship between the two variables. P value is greater than 0.05 and insufficient evidence to prove hypothesis I.

Table 6: Correlation between Interaction with local community and Tourists' attraction

Correlations

		q	B
Q	Pearson Correlation	1	.655
	Sig. (2-tailed)		.034
	N	30	30
B	Pearson Correlation	.655	1
	Sig. (2-tailed)	.034	
	N	30	30

The correlation between Interaction with local community and Tourists' attraction is .655 and it shows that there is a moderate positive relationship between Interaction with local community and Tourists' attraction. P value is less than 0.05 proving hypothesis 2 that there is significant relationship between Interaction with local community and Tourists' attraction.

Table 7: Correlation between Nature-based activities and Tourists' attraction

Correlations

		q	D
Q	Pearson Correlation	1	.714
	Sig. (2-tailed)		.048
	N	30	30
D	Pearson Correlation	.714	1
	Sig. (2-tailed)	.048	
	N	30	30

The correlation between Nature-based activities and Tourists' attraction is .714 and it implies the fact that there is a strong positive relationship between the two variables. P value is .048

proving hypothesis 3 that there is a significant relationship between Nature-based activities and Tourists' attraction.

Table 8: Correlation between Environmental Education and Tourists' Attraction

Correlations		q	E
Q	Pearson Correlation	1	.137
	Sig. (2-tailed)		.469
	N	30	30
E	Pearson Correlation	.137	1
	Sig. (2-tailed)	.469	
	N	30	30

The correlation between Environmental education and Tourists' attraction is .137 which is a weak positive relationship. P value is .469 proving there is no significant relationship between the variables.

Conclusions and Recommendations

The study results indicate that tourists are not satisfied with the existing ecotourism factors corresponding to eco-friendly lodging, interaction with local community and environmental education except nature-based activities. The results of this study have original implications for the businesses as well as academic researchers that certain ecotourism aspects have positive relationship with tourists' attraction. The factors such as interaction with local community and nature-based activities have significant relationship with tourist attraction while Environmental education has a positive relationship with tourist attraction. As proven in previous literature they are highly related to personal amusements and interests whereas eco-friendly lodging only appeals to a certain group of tourists as harder Eco tourists who show very little preference for larger group travel or reliance on formal aspects of the tourism industry such as travel agents and tour operators. They also have the lowest interest on statements about interpretation and escorted tours (Weaver and Lawton, 2003).

Thus organizations should improve on the ecotourism factors to best serve and fulfill the expectations of the tourists. The ability to get environmental education is one of the most valuable attributes of ecotourism. This can range from highly formal outcomes (including student field trips that involve assessment) through to the informal absorption and processing of information through guidebooks, signage or simple observation (Weaver and Lawton, 2001). Evidence also demonstrates a positive relationship between interaction of local community and tourist attraction. As mentioned earlier Eco tourists are keen on acquiring knowledge based on their experiences so, they prefer human interactions to gather knowledge about the local customs, traditions, food patterns, industries and life styles.

This research shows that nature-based activities have a significant relationship with tourist attraction. Thus, the company can attract more tourists if it facilitates tourists with the

opportunities to engage in nature-based activities such as wildlife observations, local cuisine programs, and bird-watching. For instance, in a discussion concerning the classification of water recreational activities, Smarton (2000) lists four generalized types of recreation activities: kinetic; situation-based; harvest-based; and substitution-based. It was claimed, that because ecotourism would discourage a consumption use of natural resources, the harvest-based experience does not apply to activities as hunting, and the collecting of flora and fauna. The other three forms mentioned claimed to be included in ecotourism activities: kinetic experiences such as hiking, diving, swimming; situational based experiences entail the strong association with the destination as a unique characteristic; and a substitution or aesthetic experience includes observation of natural phenomena such as bird-watching.

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AN EMPIRICAL STUDY ON IMPACT OF SERVICE QUALITY ON CUSTOMER SATISFACTION OF MICRO FINANCE INSTITUTIONS: SPECIAL REFERENCE TO I.G. GROUP OF COMPANIES (PVT) LTD

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Abstract

Financial companies currently face tough competitions as customers have wide choice of financial companies to select when they seek money. Many finance companies in Sri Lanka provide easy and flexible loans to satisfy customers. Previous research indicates service quality as important determinant of customer satisfaction. This research surveyed 50 customers of I.G Micro Finance Company and found tangibility, reliability, responsiveness and assurance dimensions of service quality have played a pivotal role in Micro financing customer satisfaction. Empathy service quality factor should be practice more in Micro Financing. I.G Group of Companies (PVT) Ltd already well in practice of reliability service quality factor. The study helped I.G Group of Companies (PVT) Ltd to identify current issues in services provide by the company, impact of service quality dimensions on customer satisfaction and further improvements in micro finance services.

Keywords: Customer satisfaction, Service quality, Service quality dimensions -SERVQUAL

Introduction

According to Kotler (2001) satisfaction is a person's feeling of pleasure or disappointment resulting from comparing a products perceived performance in relation to his or her expectations. Customer satisfaction = Performance- Expectations. The importance of understanding customer requirements is so great that companies try innovative ways and means to get close to the customers and hear the voice of the customer (Shani and Sopna, 2001 cited in Kotler, 2011).

Quality in a service business has become a measure of the extent to which the service provided meets the customer's expectations. Companies have found that in order to increase profits and market share, they should pay much attention to service quality. Service quality has become a key strategic factor for companies to differentiate their products and services from other competitors by using service quality as a process that customers evaluate. Many researchers suggest that customers access service quality by comparing what they feel a seller should offer and compare it against the seller's actual service performance (Gronroos, 1982). The importance of quality to firms and customers is unequivocal because of its benefits contributing to market share and return on investment (Parasuraman et al., 1985).

Customer satisfaction is perceived as psychological state like feeling, appearing after buying and consuming a product or service (Morgan and Anderson, 2005). Thus, customer satisfaction reflects a pleasure resulting to product's consumption, including under or over fulfilment level (Oliver, 1996). According to Olivier's argument, customer satisfaction does not mean only positive feeling, it could also lead to a negative or neutral feeling withdrew from consuming a product or a service. Briefly, customer satisfaction is captured as positive

feeling or satisfaction, indifference (neutral), or negative feelings (dissatisfaction) (Bhattacharjee, 2001 cited in Swaid and Wigand 2007).

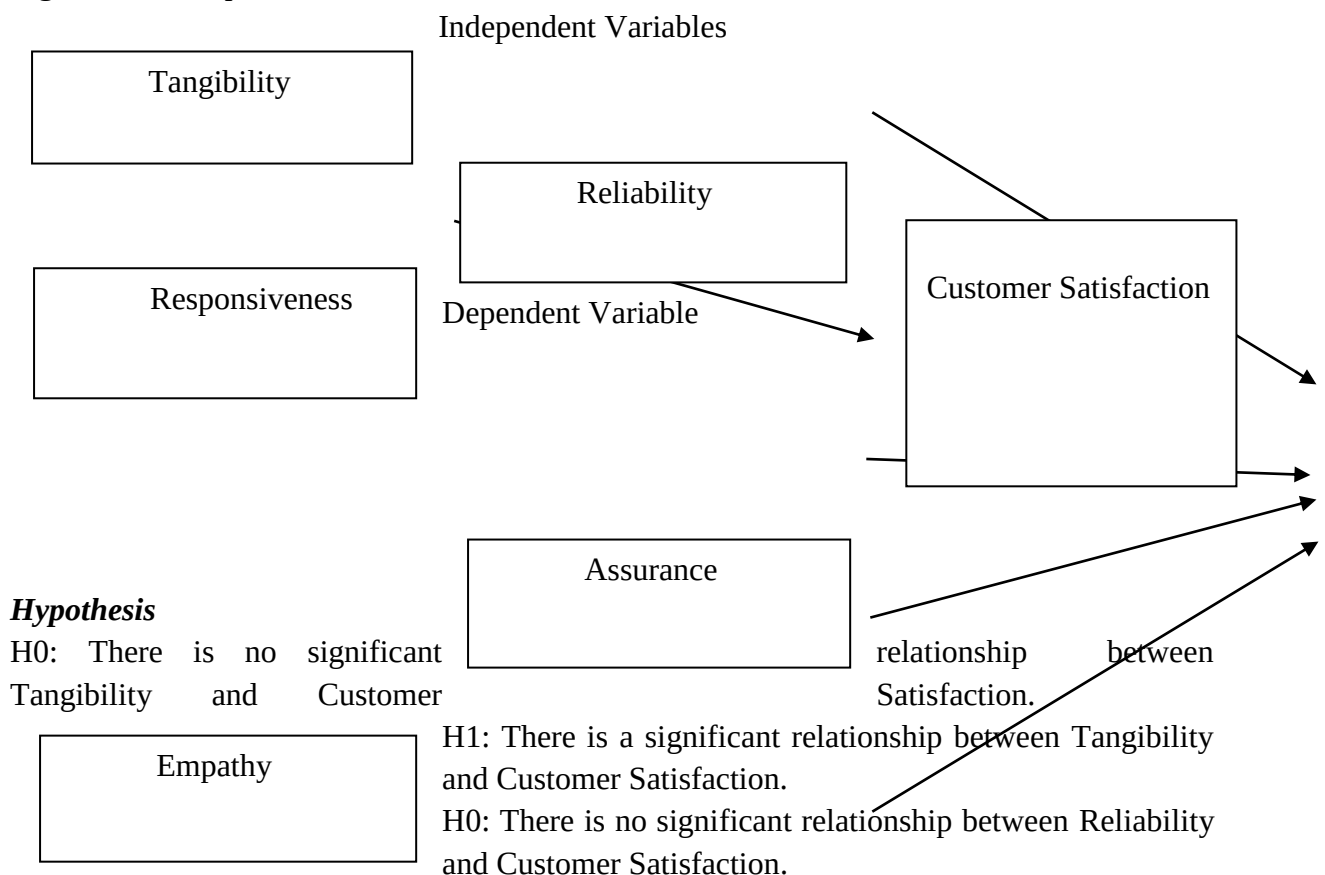
This study is based on I.G. Micro Finance Company. Company records reveal that, during past year there is a significant decrease in customers. Formal and informal feedbacks of customers indicate some level of customer dissatisfaction about services. Therefore, I.G. Micro Finance Company encounters many challenges due to the increasing competition of other micro finance companies. It is vital to investigate the impact of service quality on customer satisfaction and take measures to improve service quality.

Main objective of this study is to explore the impact of service quality on customer satisfaction of I.G. Micro Finance Company. Identify the current service quality practices used by the company, identify the most affecting service quality dimensions on customer satisfaction and suggest a method to improve service quality are some secondary objectives of this study. This research is a great help to top management and employees of I.G Group of companies who are responsible for taking business decisions and making policies. Other micro finance companies also can be benefited from the findings of this study since they can evaluate their service quality according to the study findings.

Methodology

This is a descriptive type of research. Conceptual frame work is as follow,

Figure 1: Conceptual frame work.



Hypothesis

H0: There is no significant relationship between Tangibility and Customer Satisfaction.

H1: There is a significant relationship between Tangibility and Customer Satisfaction.

H0: There is no significant relationship between Reliability and Customer Satisfaction.

H1: There is a significant relationship between Reliability and Customer Satisfaction.

H0: There is no significant relationship between Responsiveness and Customer Satisfaction.

H1: There is a significant relationship between Responsiveness and Customer Satisfaction.

H0: There is no significant relationship between Assurance and Customer Satisfaction.

H1: There is a significant relationship between Assurance and Customer Satisfaction.

H0: There is no significant relationship between Empathy and Customer Satisfaction.

H1: There is a significant relationship between Empathy and Customer Satisfaction.

Population of this research is the loan customers of I.G. Micro Finance Company. Sample size of this research is 50 customers. Researcher used cluster sampling method recognizing five clusters in the population as Daily Loan customers, Weekly Loans customers, Monthly Loan customers, Mortgages Loan customers and Vehicle Loan customers also known as leasing. Then, 10 customers from each cluster were selected conveniently. In 2017, I.G Micro Finance company had issued 828 loans among 234 customers. May be within a year total no of customers. According to population size 50 sample size is a realistic value.

As primary data collection method researcher used questionnaire method. Questionnaire is consisting of three major sections. First section is on demographic factors of customers. This helps to get an idea about personal factors of loan customers. Second section is on service quality. Third section is on customer satisfaction. Second and third sections are Likert scale questions. These parts help the researcher to give conclusion for the company for their incensement of customer satisfaction level towards the service quality factors. Over all questionnaire questions are consisted of two variables and demographic factors. This helps the researcher to come to a conclusion of the company's problem statement and also to interpret the data according gathered information which help to develop the research topic. Researcher had used SPSS software (version 24) to analysis data.

Results and Discussion

Table 1: Service Quality Dimensions

	Mean	Std. Deviation
Tangibility		
Modern Equipment of Company	3.28	.730
Employees are tidy in appearance	3.48	.677
Physical facilities are visually appealing	3.76	.771
Cleanness of physical environment	3.82	.691
Reliability		
Promises to do something on time	3.90	.614
Interest of solving troubles	3.74	.664
Services at the time assure to perform	3.50	.647
Keep records accurately	3.86	.606
Responsiveness		
Employees of the company enlighten customers	3.00	.639
Employees of the company give quick service to customers	3.18	.661
Employees of the company are always enthusiastic to help customers	3.32	.653
Employees of the company are active to act in response	3.54	.838

to customer requests		
Assurance		
The activities and behavior of employees of company will instill coolness in customers.	3.22	.764
Customers of company feel safe and secure in their transactions and dealing.	3.72	.834
Employees and staff of the company are constantly courteous and polite with customers.	3.56	.787
Employees of the company are having the knowledge to answer customer questions.	3.46	.734
Empathy		
Company gives customers individual attention.	3.16	.766
Company operating hours convenient to all their customers.	3.50	.931
Company have employees who give customers personal attention.	3.32	.844
Employees of the company understand the specific needs of their customers.	3.70	.789

According to table 1 tangibility, responsiveness, assurance and empathy are in neutral stage because most of the sub service quality factors are in neutral stage. Reliability service quality factor is more in to satisfied level when comparing with other service quality factors. 18% of highest dissatisfaction shows in activity and behavior of employees. 48% of highest satisfaction shows in feel safe and secure when transaction and dealing with company.

		Tangibility	Reliability	Responsiveness	Assurance	Empathy	Customer Satisfaction
Customer	Pearson Correlation	.103	-.008	.197	.159	.227	1
Satisfaction	Sig. (2-tailed)	.475	.958	.171	.269	.112	
	N	50	50	50	50	50	50

Table 2: Correlation Analysis

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

Pearson Correlation of tangibility is 0.103. There is a weak positive relationship between Tangibility and Customer Satisfaction. Sig value is 0.475 it is greater than 0.05. So, there is no enough evidence to reject null hypothesis at 5% level of significant. Pearson Correlation of reliability is -0.008. So, there is a weak negative relationship between Reliability and Customer satisfaction. Sig value is 0.958 it is greater than 0.05. So, there is no enough evidence to reject null hypothesis at 5% level of significant.

Pearson Correlation of responsiveness is 0.197. So, there is weak positive relationship between Responsiveness and Customer Satisfaction. Sig value is 0.171 it is greater than 0.05. So, there is no enough evidence to reject null hypothesis at 5% level of significant. Pearson Correlation of assurance is 0.159. So, there is weak positive relationship between Assurance

and Customer Satisfaction. Sig value is 0.269 it is greater than 0.05. So, there is no enough evidence to reject null hypothesis at 5% level of significant. Pearson Correlation of empathy is 0.227. There is a weak positive relationship between Empathy and Customer Satisfaction. Sig value is 0.112 it is greater than 0.05. So, there is no enough evidence to reject null hypothesis at 5% level of significant. No significant value is less than 0.05

Table 3: ANOVA ^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	19.669	5	3.934	1.304	.280 ^b
Residual	132.751	44	3.017		
Total	152.420	49			

a. Dependent Variable: Transformed Customer Satisfaction

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

Coefficients ^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.923	4.715		1.256	.216
	Transformed Tangibility	.163	.182	.147	.898	.374
	Transformed Reliability	-.078	.178	-.066	-.438	.663
	Transformed Responsiveness	.207	.143	.215	1.452	.154
	Transformed Assurance	.159	.225	.111	.707	.483
	Transformed Empathy	.252	.157	.235	1.607	.115

a. Dependent Variable: Transformed Customer Satisfaction

Regression analysis which was conducted on customer satisfaction as the dependent variable and five service quality factors as independent variable: Tangibility, Reliability, Responsiveness, Assurance and Empathy. Result of regression analysis indicate adjusted R² 0.030 and a F-value 1.304 (sig>0.001) compare with the p value with five independent variables. Adjusted R² of 0.030 reveals that 3% of total variances of customer satisfaction depends on service quality practices. That five service quality factors 3% of total variance in

dependent variable: customer satisfaction. Tangibility ($t = 0.898$; $\text{sig} = 0.374$), Reliability ($t = -0.438$; $\text{sig} = 0.663$), Responsiveness ($t = 1.452$; $\text{sig} = 0.374$), Assurance ($t = 0.707$; $\text{sig} = 0.483$) and Empathy ($t = 1.607$; $\text{sig} = 0.115$) values and beta values of these service quality factors shows weak relationships with the customer satisfaction. Also implies according to sig value null hypotheses cannot be rejected. According to analysis of t values and beta the company should increase their customer satisfaction by developing overall service quality.

Conclusion and Recommendations

All the service quality factors are greater than 0.05. That means there is no enough evidence to reject null hypothesis at 5% level of significant. Pearson correlations and scatter dot shows the relationships between service quality dimensions and customer satisfaction. Tangibility shows value of 0.103 (0 to +25) Pearson Correlation. So, it implies that there is a weak positive relationship between tangibility and customer satisfaction. Reliability shows value of -0.008 (0 to -25) Pearson Correlation. So, it implies that there is a weak negative relationship between reliability and customer satisfaction. Responsiveness shows value of 0.197 (0 to +25) Pearson Correlation. So, it implies that there is a weak positive relationship between responsiveness and customer satisfaction. Assurance shows value of 0.159 (0 to +25) Pearson Correlation. So, it implies that there is a weak positive relationship between assurance and customer satisfaction. Empathy shows value of 0.227 (0 to +25) Pearson Correlation. So, it implies that there is a weak positive relationship between empathy and customer satisfaction. According to Pearson correlation empathy has the highest value. Sig value of empathy is 0.112, it is closer to 0.05. That means empathy service quality factor should be practice more in I.G Micro Finance company. Company operating hours should convenient to all their customers, company should have employees who give customers personal attention, employees of the company should understand the specific needs of their customers, company should give customers individual attention from these things company can develop their customer satisfaction toward service quality factor of empathy. According to Pearson correlation reliability has a value of -0.008. That means reliability has a weak negative relationship with the customer satisfaction. This shows I.G Group of companies promise to do something on time, interest of solving troubles of customers, service at the time assure to perform and keep record accurately.

According to Pearson correlation Company should also practice responsiveness, assurance and tangibility. These three service quality factors show weak positive relationship between customer satisfactions. To develop the service quality of Responsiveness employees of the company should enlighten customers exactly when service is performed, should give a quick service, always should enthusiastic to help customers and should active to act in response to customer request. To develop the assurance service quality factor company should have knowledgeable employees, employees should constantly courteous and polite, company should secure of transactions and polite and employees should develop their behaviour. To develop tangibility company should develop sub factors of tangibility. Company should use modern equipment, employees should be tidy in appearance, physical facilities of the company should visually appealing and also company should have cleanness physical environment. From these sub-factors company can uplift their service quality of tangibility.

Especially company should practice service quality of Empathy. Company had already introduced online loan applying system but the system is not in operating due to most of the customers don't know about this system and also company is not giving priority for that system. If Company can develop this system service quality of Empathy can be developed. Company should give knowledge to the customers about this online loan application system. Company should also handle daily this system as well. From this system company will give individual attentions and online individual feed backs about their loan applications. Customers will also satisfy from this. Online application can do any time so it will be convenient to the customers. To increase the customer satisfaction level towards the Responsiveness and Assurance, Company should have knowledgeable, attractive, friendly and helpful employees. Company should conduct training and development programs to newly join employees. Also, company HR department should give special attention when recruiting, selecting and appointing suitable candidates. Daily cleaning process can develop the service quality of Tangibility to uplift the customer satisfaction level.

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ENGINEERING AND CONSTRUCTION

Invited Talk

Influence of electrodes spacing on the ability of aluminum-based electrocoagulation units to remediate *Escherichia Coli* from wastewater

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Abstract

The current paper investigates the effluence of electrodes spacing on the efficiency of aluminium-based electrocoagulation units in terms of *Escherichia coli* (*E. coli*) removal from wastewater. To achieve the planned goal, a new aluminium-based electrocoagulation unit, which utilises the concept of baffle-plates to achieve efficient water mixing process, has been used to treat *E. coli* containing synthetic wastewater samples. The electrolysis process was carried out for 20 min at three different distances between the electrodes (5, 10, and 15 mm), while the applied current density and the initial pH were kept constant at 1.5 mA/cm² and 7, respectively. The results obtained indicated that the removal of *E. coli* is inversely proportional to the distance between electrodes. *E. coli* removal decreased from 96% to about 70% as the distance between electrodes increased from 5 to 15 mm, respectively. Moreover, it has been noticed that increasing the distance between electrodes from 5 to 15 mm results in an increase of 3 kW.h/m³ in power consumption. Therefore, according to the results of the current study, the distance between electrodes must be kept as short as possible to achieve efficient *E. coli* removal.

Keywords: Electrocoagulation; *E. coli*; wastewater; distance between electrodes.

FULLY AUTOMATED DEVICE FOR BLOOD GROUP IDENTIFICATION

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Abstract

The typical method of identifying blood groups is to mix reagents with blood samples and identify the blood group based on the agglutination pattern. However, this method requires human interference up to a large degree and requires a certain degree of precision to reduce errors which results in the time taken to produce the result being solely dependent on the nurse (i.e. person performing the test).

This device aims to automate the above-mentioned process which reduces the possibility of errors and decreases the time taken to produce the result. This device is specially designed for ambulances, aero planes, accident and emergency wards and outpatient departments.

Keywords

ABO grouping system, Automatic device, Blood groups, Image processing, Plate test

Introduction

According to the International Society of Blood Transfusion, there are 38 blood group systems including the ABO, Rh, and Kell systems. The ABO system is considered as the most important blood group system since any person possess anti-A and/or anti-B antibodies in their blood [Mitra et al., 2014].

The ABO system has four blood groups. They are, A, B, AB and O. It is vital that the blood group of a patient is known to a doctor as the administration of blood of a non-matching blood group is fatal. Blood grouping is vital for blood transfusions and especially for pregnant women to avoid medical complications [LORNE LABORATORIES, 2019].

In the grouping process, specific reagents (Anti-A, Anti-B, Anti-D and in some cases, Anti-AB) are mixed with the samples of patient's blood. After that, the result (blood group) is given according to the presence and absence of agglutination of red blood cells with each reagent [Ferraz et al., 2010].

In 2010, Ferraz et al. have discussed the idea of developing an automatic system for blood group identification. In their system, the blood samples and the reagents were added and mixed manually. Then images of the samples were taken, analyzed and samples with and without agglutination were identified. Finally, the blood group was determined according to the results. An image processing application was used for the process. By 2016, they had developed the system into an automated device. In that device, the steps from mixing of blood samples with reagents were automated. However, the placement of blood and addition of reagents were needed to be done manually [Ferraz et al., 2016].

There are several other systems designed for the blood group identification using image processing. [Ravindran et al. (2017); Vinay (2017)]. However, these systems also need the manual placement of reagents and blood samples.

The aim of this project is to design, develop and implement a device capable of classifying blood groups automatically where the only human intervention required is to draw blood from the patient, remove the needle and place the syringe on the syringe pump mechanism on the device.

Methodology

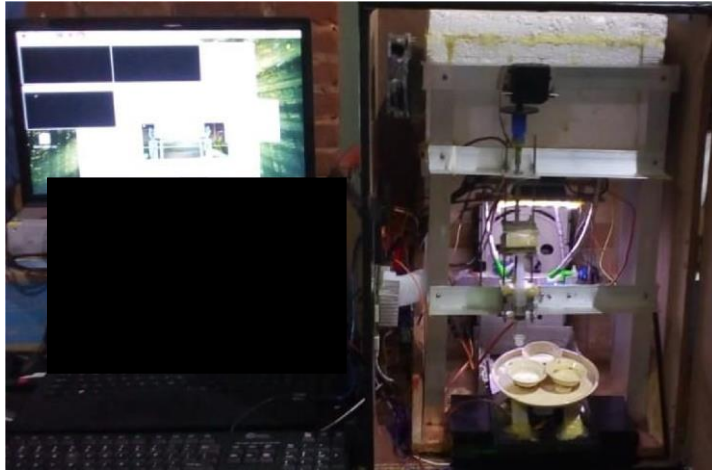


Figure 8: The prototype

Three milliliters of blood is taken from the patient using a 5ml syringe and placed on the syringe pump. After pressing the start button the syringe pump mechanism pumps the blood into the three plates in equal volumes. Reagents contained in the cooler (kept between 2 °C – 8 °C) are added to the plates via tubes and mixed using an oscillating tray mechanism. Then the camera obtains a video feed which is processed to identify the clotting pattern which is in turn used to identify the blood group. Finally, the blood group (Figure 3) is displayed on the screen. Since the reagents are contained inside of the machine it results in a further reduction in time and effort as typically the reagents are contained in a refrigerator which must be taken out of containment and then must be returned back after use (Figure 2 and figure 3). The entire mechanical process of the device is controlled by two Arduinos (Mega 2560) and the image processing algorithm is executed on a Raspberry pi (Raspberry Pi 3 model b). The programs running on the two Arduinos only utilise the GPIO ports and the PWM output ports to control the entire mechanical process of the device. The image processing algorithm was programmed using Python language and the OpenCV library which is an open source computer vision and machine learning software library containing a large number of algorithms that can be used to identify objects, track moving objects and find similar images from an image database [opencv.org, 2019]. The particular algorithm running on this device is a custom real time image processing algorithm created using OpenCV functions. The presence and absence of agglutination is identified using the total area of red coloured pixels (i.e. larger pixel area means no agglutination is present and lesser pixel area means agglutination is present). Only the blood covered area (i.e. red coloured area) of the tray is isolated by transforming the video feed to HSV colour space and by setting the required parameters to identify the desired colour. Then the video feed is transformed into binary and the pixel area (of the blood/ reagent mix) is obtained by getting the contours. Finally based on

the obtained areas the presence or absence of agglutination is identified and the result (Figure 5) is displayed based on what reagents caused the blood to agglutinate.

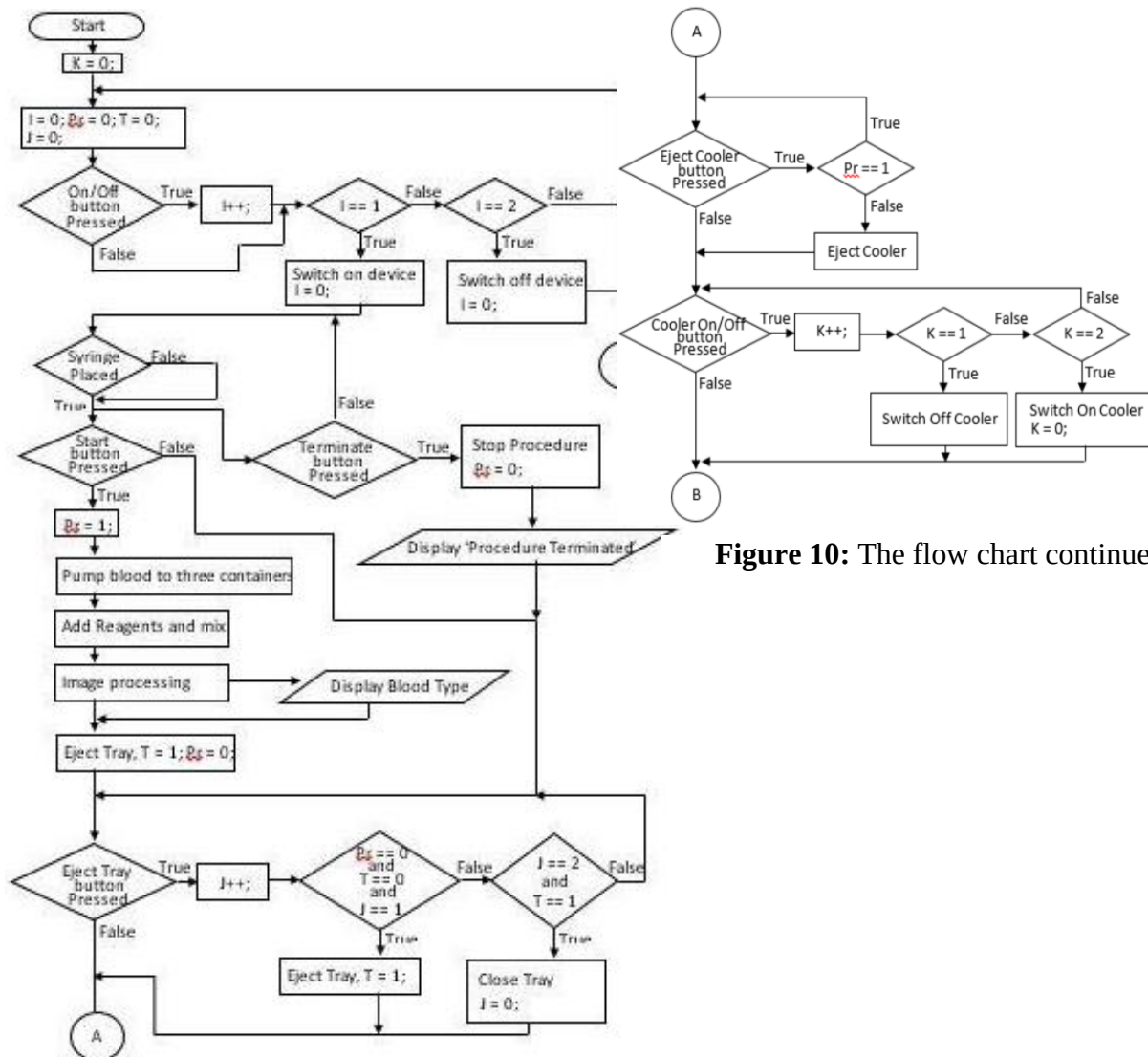


Figure 9: The flow chart

Figure 10: The flow chart continues

Results & Discussion

During the testing procedure, it was observed that the device (Figure 1) functions properly. The mechanism starts properly when the start button is pressed after placing the syringe on the syringe pump. Blood is separately/evenly pumped into the three plates and the reagents are added and mixed (Figure 4). Then the image processing algorithm identifies the blood group (Figure 5) accurately without any unwanted delays.

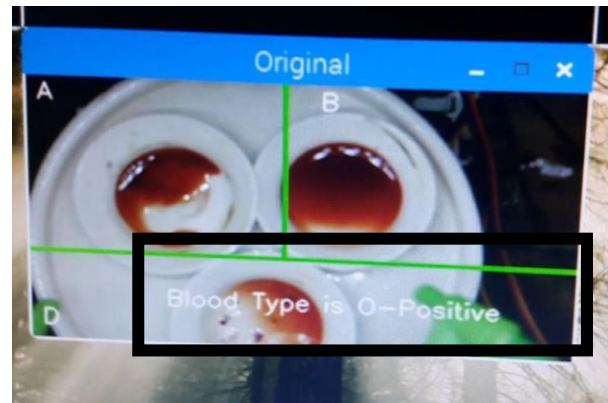


Figure 11: The blood samples with reagents

Figure 12: The result

However, it was observed that there are several issues in the process (No issues were encountered in the image processing algorithm or in any firmware). The cooler was not capable of continuously keeping the reagents between 2 °C – 8 °C due to poor insulation and large volume of the compartment. Leakage of reagents was observed in two of the three valves (Used to control the flow of reagents) due to the poor quality and the controllability of the valves used. Opening and closing of the tray mechanism worked smoothly however, the tray was not precisely horizontal (Was with a small but visible inclination towards one side) which resulted in the blood samples collecting to one side of the plate which led to lower visibility of the clotting pattern to the camera.

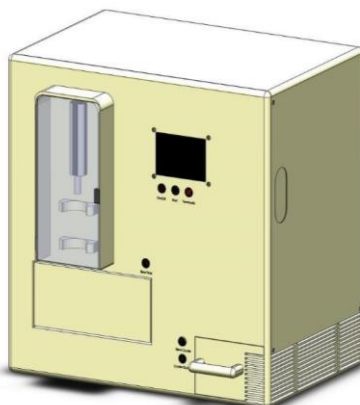


Figure 13: The proposed design.

Conclusion & Recommendations

The overall device works as expected apart from the issues mentioned above which are mainly caused due to the lack of funding as most parts need to be custom made which costs a considerable amount. An improved design for the device (Figure 6) was proposed and being implemented which consists of more solid, smooth, efficient mechanisms, more compact and efficient cooler and improved user interface/display.

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**AN INVESTIGATION ABOUT WHY PEOPLE CORRUPT IN BUILDING
CONSTRUCTION INDUSTRY IN SRI LANKA.**

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Abstract

Construction industry is one of the major contributors to the whole economic growth of a country. Even in Sri Lanka, construction plays a major role. However, construction industry is vulnerable to corrupt practices because it involves considerable capital investments. The objectives of this study was to determine why people are corrupt in building construction industry Sri Lanka and finally to determine and propose some measures to eliminate corruption. In achieving these research objectives, the study was done quantitatively and directed through literature review on the areas related to corruption in building construction industry followed by a questionnaire survey. Results show that the top form of corruption frequently encountered was fraud. Respondents stated that unproductive administration and political structure is the reason why people are corrupt in Sri Lanka. The top two Barriers to reporting corrupt practices were a belief that it will be a waste of time because no serious action will be taken and less confidence in the national anti-corruption agencies and the judicial system as per respondents. By considering those research findings, researcher has made recommendation to mitigate corruption.

Key words: Corruption; Construction industry in Sri Lanka

Introduction

Corruption can be defined in various ways depending on persons' perspectives. As a general definition for corruption could be definite as the abuse of public belongings, power and resources for personal gains (Sohail et al, 2007). Corruption could take place at any place of the world, any federations, by any level of a contractual grading, at any phase of a construction project and among any member to specific project/public activity (Stansbury et al, 2007). Corruption may vary from its scale in a manner of even grand where the large sum of money is used or else petty where the small sum of money is used as per Lipsky's perspective. (Lipsky, 1980). However, the citizens of a country have to experience these illegal behaviours of officials.

Following table 1 shows the most prevalence form of corruption in construction industry and its definition.

Table 1: Most Prevalence Form of Corruption in Construction Industry

Corrupt activity	Definition
Bribe	Payments made upon to get something in return. (e.g. Offer promises of awarding contracts without following the standard guideline of procurement).
Kickbacks	Payments made to someone illegally in exchange for secret help or work for favourable decision (Cambridge University

	Press, 2018).
Fraud	Deceiving people in order to get advantages. The crime of getting money by deceiving people. (Cambridge University Press, 2018)
Embezzlement	Getting money secretly that is in your care or that belongs to an organization or business you work for.
Tender rigging and collusion	Illegal conspiracy in increasing the prices of bids among competitors.
Fronting	Create front companies to get contracts.
Conflict of interest	A Clash between the interest of the client group and individual interest of an official in the client group (UN, 2006).

Those practises were common in developed countries and also in developing countries. The event and all forms of corruption in building construction industry to be identified in advance, prior searching causes.). Transparency International has named the construction industry as the most corrupt industry in the world (Transparency International, 2008).

No one either knows or could predict the actual cost of corruption. Here is a good example to get an idea of the money losses due to the construction corruption. Debating after more than nearly one year of period, the US government has passed the new transportation bill which covered US \$286 billion over six years, or US \$47.7 billion per year. In world, the construction sector losses due to corruption over eight times the amount which the USA government spends on their transportation per year (Manzetti et al, 2007). These figures are hard to be simply be ignored due to its value.

The non-governmental organization named Transparency International doing surveys by getting the details from various standardized reputed surveys such as the World Bank, central banks of the countries to find out the corruption perception index (CPI) annually. The CPI marks countries on a scale between 0 which means highly corrupt -100 which means very clean. Figure 1 shows the rank of Sri Lanka where it stands according to the CPI between 2008 and 2017, Year respect to the particular CPI value. Sri Lanka was ranked in 95 out of 175 countries, as per the year of 2017 CPI report (Transparency International, 2017).



Figure 2.1. Transparency International corruption scores and ranks for Sri Lanka (2008 - 2017).

Why people are corrupt in building construction industry.

Our perspectives were that the corruption exists when governance steadiness and procedures are weak. There can be a number of honest people in offices but mismanagement of them may gone towards corruption. There are lack of studies done in this subject matter in Sri Lanka. Therefore, reasons for why people tend to corruption should discuss with the help of general/social perspective.

As per Sarker, An appropriate example of the foulness of corruption is inequality, poverty, insecurity and slow development in several states. The huge matter is the chronic under-enforcement of anticorruption laws in various countries (Sarker, 2007).

In our culture, wealthy people are seen as the commanders than the rest. This makes the society separate as social and economic classes which ultimately results in Corruption. In Nigeria, research was done by Ayodel states that government of Nigeria has to regulate a pay which is sufficient to live for civil servants but most of the richest and the influential persons are engaged in corrupt practices Ayodel's view on this was differ from the Sarker but ultimate expectations are equal. (Ayodel et al, 2011).

An appropriate standardized and equivalent legal system for a nation will decreases the percentage of corruption. As per the study of Treisman, once the country is governed by a common law, the level of corruption was decreased (Treisman, 2007).

When inefficiency increases in particular a level, corruption increases at the same level which was noted in some research studies. When there is transparency, corruption level decreases spontaneously. With the increased level of transparency, the chances/opportunities in corrupt practices are less because public could caught those activities (Stansbury, 2005).

The transparency in construction industry is at the very low position. In construction each and every person who engage in corrupt events as per the name of concealed data which only could be bring up by the top level of the organization. Very recently the Sri Lankan

government has introduced an act named RTI which means “Right to Information” but it is not strong enough to address this matter. Limitations of the Act needed to be corrected.

There is no one particular answer for the question “why people corrupt in building construction industry. It differs with the peoples’ perspectives. Above determinants and finding are to be tested among Sri Lankan context as to identify the nature of corruption in Sri Lankan building construction industry.

Objectives:

1. To identify the different ways and the cause of corruption in building construction industry at the pre contract stage.
2. To analyse causes of corrupt practices within Colombo region in building construction industry at the pre contract stage.
3. To determine possible preventive measures and propose those to eliminate building construction corruption within Colombo region at the pre contract stage.

Methodology

Research Design

Sampling Techniques

The researcher has used the both simple random sampling and judgment sampling techniques for this research. Simple random sampling is a probabilistic sampling technique where the equal probability is giving for each and every element of the population. Simple random sampling technique is used to select architects from different organisations. Professionals in Building Construction industry in Colombo district were selected by using the judgemental sampling technique.

Quantitative approach is more reliable for these kind of researches. A questionnaire was used as the suitable approach to collect necessary data, because it could be done at a reasonable cost, also it gives opportunity to collect data among people easily. The method data collection ensures the anonymity of the respondents which is keen to consider while doing sensitive research topics. The questionnaire was consisted as closed ended and last two questions were kept as open ended questions to express respondent’s ideas on this regard.

The respondents were asked to respond as per the Likert Scale. (i.e. Never, Very Rarely, Rarely, Frequently and very Frequently).

This study had been conducted in Colombo and that is one of the business cities in Sri Lanka where a number of infrastructure facilities are available (DCP, 2012).

Architects, Engineers and Quantity Surveyors are named herein as professionals. The researcher selected 20 professionals from consultant organisations, 45 professionals from contractor organisations, 15 professionals who works for Employers and 15 professionals from Government organisations such as State Engineering cooperation etc. All these made a total of 100 personnel and all these professionals are actively engaged in the building construction industry. Table 2 shows the sample size of this research.

Table 2: Distributed of sample size

Affiliation	Sample size
Consultant	20
Contractor	45
Employer	15
Government officials	10
Total	100

Data were analysed by using descriptive statistics such as frequency, mean and standard deviation. Further, the ranks obtained according to the mean and that was considered to identify the most significant situations/reasons/causes/effects. If the same rank was obtained by two or many, the standard deviation would be used to decide the ranking.

The researcher was keen to ensure the respondents' assurance regarding the given information was kept confidential and will not be disclosed anywhere, unless otherwise for the academic purposes of the researcher.

Results & discussion

All respondents' characteristic data were analysed herein. According to Table 2: the respondents are having sufficient years of experience and education level to aware of corrupt activities in building construction industry.

The data were collected from diversity of respondents in building construction industry such as from their work field, affiliation and occupation level as well. It shows majority of the respondents were from quantity surveyors and that could added weight to the findings because the quantity surveyors are the cost consultants/advisors to projects who works for every stakeholder to a project as in from Employer to the suppliers & subcontractors. Consisting of respondents at each occupation level would help to gather ideas of corruption at each occupation level in building construction industry. This shows lower participation from the Top management and their tight work nature and lack of interest could be reasons for nonparticipation to the survey.

Surveys done by Vee and Skitmore in 2003 Handiwattege, De Silva and Pathirage in 2007, Brown and Loosemore in 2015 were based on responses of 31, 30 and 23 while the Tabish and Jha in 2011 were based on 6 respondents. Therefore, it shows the number of respondents for these type of researches are less. (Tabish et al, 2011) (Tabish et al, 2012) (Brown et al, 2015)(Vee, 2003).

As shown in the Table 3, many professionals have been experienced corrupt activities at the beginning and latter part of their careers where corruption do not depend on the academic level of the professionals. There is a high possibility in engage in corrupt activities from the professionals who works in Engineering and Quantity Surveying work field than Architectural. Contractors are in the top of the list as the most possible affiliation of the occupation who are engage in corruption in building construction industry. According to the above statistics government officials were less engaged in to corrupt activities. They might

fear to reveal corruption because of their profession and status that they have but according to literature government sector were prone to corruption than others.

Under the level of occupation of Table 3 shows that the percentage was increased gradually from junior level to Management level and it dropped from nearly 8% at the Top Management level. This illustrates the possibility in engaging in corrupt activities were dependent on the level of occupation. Finally it was proven that the corruption has wide spread and only the level of the corruption activity may depend with the professionals' demographic.

Table 3: Background and experience in the building construction industry.

Background	Description	Frequency	%
Years of experience	0-5 years	30	50.8
	5-10 years	15	25.4
	10-15 years	6	10.2
	More than 15 years	8	13.6
	Total	59	100.0
Academic qualification	Diploma	1	1.7
	Higher National Diploma	11	18.6
	Bachelor's Degree	35	59.3
	Master's Degree	12	20.3
	Total	59	100.0
Work Field	Architecture	2	3.4
	Engineering	15	25.4
	Quantity Surveying	42	71.2
	Total	59	100.0
Affiliation	Consultant	15	25.4
	Contractor	35	59.3
	Employer	6	10.2
	Government Officials	3	5.1
	Total	59	100.0
Occupation level	Junior Level	24	40.7
	Senior Level	19	32.2
	Management Level	12	20.3
	Top Management	4	6.8
	Total	59	100.0

About 70% of respondents claimed that they have personal experience in corrupt activities related to the building construction industry in Sri Lanka as shown in Figure 1. This was a proven that corruption is exists in building construction industry in Sri Lanka.

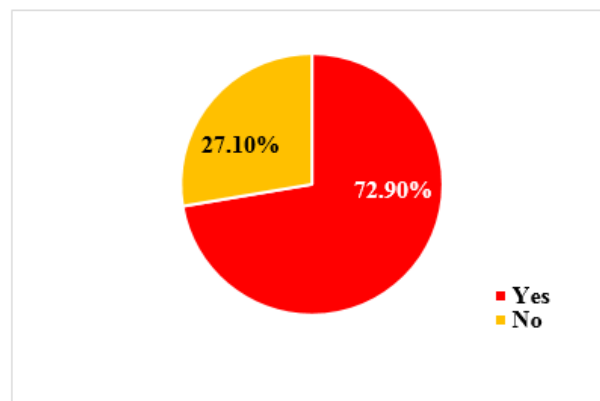


Figure 1: Personal Experience in Corrupt Activities Related to Building Construction Industry in Sri Lanka.

Table 4. Personal Experience in Corrupt Activities with the demographic details

	Response				Total
	Yes	%	No	%	
<u>Years of experience</u>					
0-5 years	19	63.33	11	36.67	30
5-10 years	14	93.33	1	6.67	15
10-15 years	5	83.33	1	16.67	6
More than 15 years	5	62.50	3	37.50	8
Total	43		16		59
<u>Academic Qualifications</u>					
Diploma	1	100	0	0	1
Higher National Diploma	8	72.73	3	27.27	11
Bachelor's Degree	24	68.57	11	31.43	35
Master's Degree	10	83.33	2	16.67	12
Total	43		16		59
<u>Work Field</u>					
Architecture	1	50.00	1	50.00	2
Engineering	12	80.00	3	20.00	15
Quantity Surveying	30	71.43	12	28.57	42
Total	43		16		59
<u>Affiliation of the Occupation</u>					
Consultant	10	66.67	5	33.33	15
Contractor	28	80.00	7	20.00	35
Employer	4	66.67	2	33.33	6
Government Officials	1	33.33	2	66.67	3
Total	43		16		59
<u>Level of the Occupation</u>					
Junior Level	15	62.50	9	37.50	24
Senior Level	15	78.90	4	21.1	19
Management Level	10	83.3	2	16.7	12
Top Management	3	75.00	1	25.00	4
Total	43		16		59

Table 4 shows, fraud(mean =3.19;SD=0.97) as the most prevalent, followed by kickbacks(mean=3.17 ;SD=0.985), bribe(mean=3.11;SD=1.202), embezzlement (mean=3.11;SD=1.238), conflict of interest (mean=3.06;SD=1.009), tender rigging and collusion(mean=2.87;SD=1.329) and fronting(mean=2.66;SD=1.356). Fraud involves commonly as represents of false misinterpretation of facts for commercial gain (UN, 2006). Kickbacks and bribery were often used to get contracts. The order of prevalence of these corrupt practices varies from a country to another while those are exists.

Table 5. Prevalence of Forms of Corruption as Reported by Survey Respondents.

Forms of corruption	N	Mean	Rank	Standard Deviation (SD)
Fraud	47	3.19	1	0.970
Kickbacks	47	3.17	2	0.985
Bribe	47	3.11	3	1.202
Embezzlement	47	3.11	4	1.238
Conflict of Interest	47	3.06	5	1.009
Tender rigging and collusion	47	2.87	6	1.329
Fronting	47	2.66	7	1.356

Further, the respondents were asked to rank causes of why people are corrupt in building construction industry Sri Lanka as shown in Table 5. The top ranked causes were “unproductive administrative and political structure”(mean=4.15;SD=1.021) and “Excessive greed for money”(mean= 4.13;SD=0.969). These causes should be addressed to eliminate the corruption from the Building construction industry Sri Lanka. Arowolo and Adebayo showed the similar cause as above (Arowolo, 2008).

Table 6: Causes of why people corrupt in building construction industry in Sri Lanka as reported by Survey respondents

Causes for why people corrupt in building construction industry	N	Mean	Rank	SD
Unproductive administrative and political Structure	47	4.15	1	1.021
Excessive greed for money	47	4.13	2	0.969
Less Transparency	47	4.11	3	0.938
Legal System	47	3.72	4	1.210
Culture itself	47	3.47	5	1.266

Six barriers that impede the reporting of corrupt practices were apparent among respondents as illustrates in Table 6. Result shows that the professionals have loss the faith on the legal system in the country by ranking the “a belief that it will be a waste of time because no serious action will be taken” and “Less confidence in the national anti-corruption agencies and the judicial system” as the first top two on the list. As Asians Sri Lankans and Indians compel to get revenge from the other party who revealed some corrupt practices which can see in day today new papers. Controlling corruption should start by an individual/organisation either witnessing/experiencing corruption, reporting those to the necessary persons or authorities as stated in literature review (Sohail et al, 2008). CCI Sri Lanka (Chamber of Construction Industry Sri Lanka) has taken serious actions to eliminate the corruption from its member while introducing and practising several rules and practices to the industry. This gives a good sign of future construction industry in Sri Lanka.

Table 7: Barrier to report corrupt practices in building construction industry as reported by Survey respondents

Causes of barrier to report corrupt practices	N	Mean	Rank	SD
A belief that it will be a waste of time because no serious action will be taken.	47	4.02	1	1.053
Less confidence in the national anti-corruption agencies and the judicial system.	47	3.87	2	1.096
Fear of dismissal imposed by the employer (Occupation penalty)	47	3.81	3	0.992
Unknown the reporting authorities or procedure to be followed.	47	3.77	4	0.983
Loyalty to organisation or friends prevents individual from reporting any illicit activity.	47	3.74	5	1.132
The fear of physical harm to one's self and/or one's family.	47	3.49	6	1.120

Recommendations

The most reliable responses and literature findings in countries to mitigate corruption were summarised, organised and presented in table 8.

Table 8: Recommendations & the way to implement it

Recommendation	Way to implement it
Proper political Leadership	Proper political leadership as well as top management commitment is crucial in anti-corruption practices. Leader should set a good example with integrity, hard work and honesty because that leader has to take some critical and difficult decisions when fighting against corruption.
Anti-corruption legislation via anti-corruption commission	A considerable action could be taken by mainstreaming anti-corruption procedures through policy sector. A common starting point is to establish an anti-corruption commission with an investigative and prosecutorial function to perform independently.
Blacklisting companies or organisations	Hard-hitting endorsements are must against companies caught engaging in corruption penalty and blacklisting for upcoming projects.
Transparency	Transparency is one of the key characteristic of good governance. Transparency means that information should be provided in an understandable way that should be freely available and directly accessible for the parties who need it.
E-Tendering/Procurement	E-procurement is the use of IT in public procurement. It can increase transparency, facilitate access to public

	tenders, reduce direct interaction between procurement officials and bidders, increase competition, and allow for easier detection of irregularities and corruption, such as bid rigging.
Institution of regular and random checks	The construction industry to review the conduct of the professionals involved at sites through either regular/random checks conducted by government officials who should not be specifically allocated to some regions.
Improving institutions.	Improving institution process consist renewal of rules to match with the present, less time consuming, smoother and less troublesome ways to conduct work in the functioning of legal courts and in the administration of justice, transparency in the judgements, promoting efficiency and active police force and make the system, apart from the political hands to investigate and prevent corruption.
Development of honest and ethical construction culture	Regardless of how tough the jurisdiction systems, people are the root cause for corruption. The government should put effort into promoting honest and healthy rights all the time, not only technically but also morally, ethically and culturally.
Responsible press	A responsible press is appropriate to collect, analyse, organise and present because disseminate information is considerably vital to aware the public and to provide momentum for undertaking reforms to mitigate corruption.

Conclusion

The survey results revealed that the four most endemic corrupt activities were fraud, kickbacks, bribe and embezzlement as per the research done based in Colombo district Sri Lanka. The results shows involvement of Government, scale of the project, project uniqueness, number of project phases, concealed work, unproductive administration and political structure, excessive greed for money, less transparency, legal system and culture itself respectively as the Causes for why people are corrupt in building construction industry. Additionally, the results shows industry practitioners' perspective as a belief that it will be waste of time because no serious action will be taken after reporting a corrupt activity. That shows the less faith of the citizens about the judicial system and anti-corruption agencies. Furthermore, if the war against corruption will succeed, government officials and respectable parties must have nerve to punish and expose corruption.

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A STUDY ON ENVIRONMENTAL POLLUTION MANAGEMENT IN THE CONSTRUCTION INDUSTRY IN KANDY CITY

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Abstract

This research paper focuses on Environmental Pollution Management in the construction industry of Kandy City and the steps taken to minimize environmental pollution in Kandy municipal area. These days construction industry holds a major place in environmental pollution of Kandy city and as a developing area it is vital to minimize this problem in order to face with the development. There are various ways in which the environmental pollution is caused by the construction industry. Air pollution, water pollution, soil pollution and noise pollution are some of them. Main object of this research is to identify reasons for these environmental pollution ways and find innovative solutions to minimize environmental pollution that occurs in construction industry of Kandy city by conducting a survey in different types of salutory bodies in Kandy municipal area.

Key words: Construction Industry, Environmental pollution, types of pollution, solutions to minimize, Kandy City

Introduction

Environmental pollution is a major problem throughout the world that has sprung out as a result of modernization and industrialization. The world is getting modernized, creating both advantages and disadvantages. Environmental pollution is one of the huge disadvantages of modernization and industrialization of the world. Using artificial elements such as chemicals and using developed new technology cause this environmental pollution directly.

As a third world country Sri Lanka also has this huge problem,” Environmental Pollution”. Among the various types of industries, causing environmental pollution construction industry is in a high level.

There are various ways in which the environment is polluted by the construction industry in Sri Lanka. Some of them are air pollution, water pollution, soil pollution and noise pollution. The below stated are some examples of how it happens.

- Air pollution – Harmful and poisonous fumes, dust emission.
- Water pollution – Adding chemicals and garbage in to the water.
- Land/ Soil pollution – Cutting trees and mismanagement of waste.
- Noise pollution - Machinery noise and vehicle noise.

In Sri Lanka, Kandy city faces this issue in major scale. Kandy city is a main city in Sri Lanka which is capital of the Central Province. It is an administrative city and also a sacred city.

Even though the Kandy city is blessed to be a world heritage, due to pollution charming beauty is threatened. And also, there are major problems in Kandy city due to the environmental pollution. As a result of environmental pollution, health issues have occurred, natural beauty and historical value are destroyed, tourism industry is threatened, natural disasters have occurred, and global warming is evident. This research is an attempt to identify

most of the causes and the effects caused by the construction industry for environmental pollution of Kandy city and to find more innovative solutions to minimize the environmental pollution in Kandy city.

Aims and objectives

The aim of this research is “To implement a mechanism to minimize environmental pollution caused by the construction industry in Kandy municipal area”.

And also, the objectives of this research are,

- To identify main environmental pollution factors in different types of construction projects in Kandy city.
- To analyse the reasons for environmental pollution in construction industry in Kandy city.
- To find innovative solutions to minimize the environmental pollution in construction industry in Kandy city.

Methodology

For this study, the researcher has chosen a methodology which includes six phases. The first step of this methodology was data sampling. The researcher collected most of the existing data and information of environmental pollution in the construction industry, such as photos, printed materials and internet resources. It was helpful to researcher to get an idea about existing situation of environmental pollution due to the construction industry of Kandy municipal area. After that the researcher collected raw data from selected thirty professionals (Middle level managers, technical staff and non-technical staff) from ten local salutary bodies. For that the researcher used qualitative approach of data collection and prepared semi- structured interview questions and open – ended questionnaires to assess their ideas which covered special nine areas of environmental pollution caused by the construction industry. They are listed below.

- Main ways of environmental pollution caused by construction industry in Kandy city.
- The identified reasons for each type of environmental pollution way.
- How the environmental pollution in construction industry effect to the labours at site.
- How the environmental pollution in construction industry effect to the construction process.
- How the environmental pollution in construction industry effect to the society and country.
- Previously done surveyors about this matter.
- Recent examples in Kandy city for environmental pollution caused by construction industry.
- Present actions which have taken for minimize the problem.
- Proposals to minimize the environmental pollution caused by the construction industry in Kandy city.

Next the researcher analysed all the collected data using qualitative data analysing method and categorized them. In addition to that the researcher found more innovative solutions

which can be applied for future construction projects with expert knowledge from overseas as alternatives to minimize the environmental pollution in Kandy city. Finally, the researcher considered all the analysed data and then determined the conclusion.

Results & Discussion

Collected data which based on the above methodology are summarized and analysed as below.

There are identified main ways of environmental pollution due to construction works in Kandy city. They are,

- Air pollution, water pollution, noise pollution, soil/land pollution, visual pollution and construction waste.

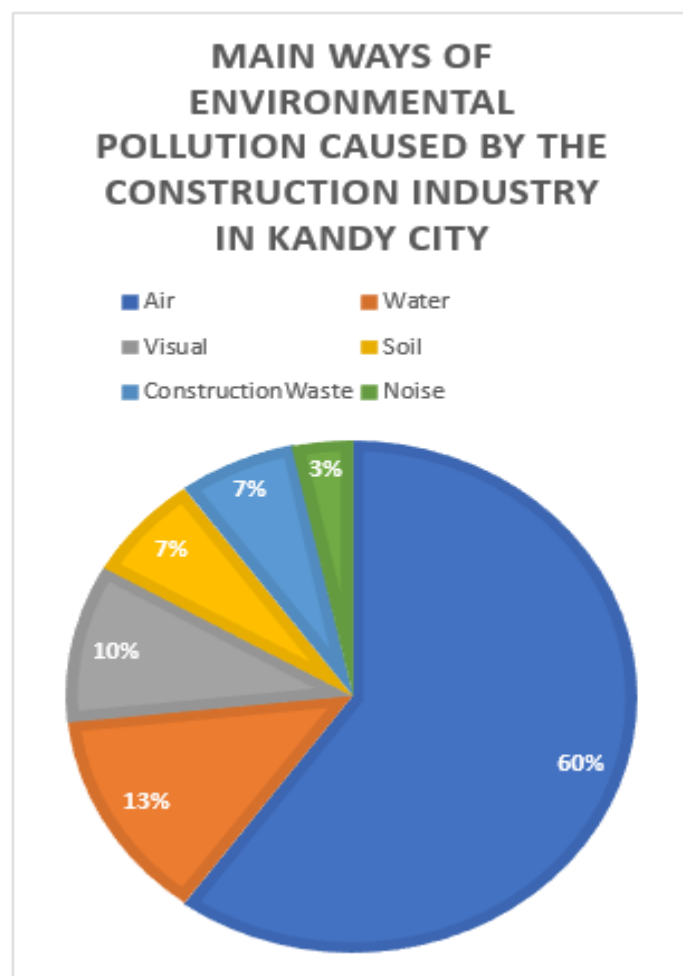


Figure 1 - Main ways of environmental pollution caused by the construction industry in Kandy city

Table 1- Identified reasons for each type of pollution way

Ways of pollution	Identified reasons
Air pollution	Burning chemicals and garbage, Different types of gases and fumes emitting from heavy machineries, Number of vehicles and traffic jams due to transport of construction materials, generating high level of dust due to constructions, Geographical characteristics of Kandy creating stagnation and emission of dust/smoke
Water pollution	Waste water generation at sites (labour camps, cleaning tool/machines), Mixing of waste chemicals, oil, cement, lime and other toxic chemicals to surface and ground water.
Visual pollution	Most project designed without considering green value and the natural beauty of the city, increasing concrete views, Irregular constructions disturb the natural view.
Land pollution	Improper road and soil excavation, Using polythene and plastics at sites
Construction waste	Improper disposal of industrial used waste, Lack of dumping yards.
Noise pollution	Produce high frequency noise from vehicles and machineries.

As per the analysed data below mentioned facts are the effects that are happening for the labours due to environmental pollution in construction in Kandy city.

- Health problems such as, breathing issues, respiratory troubles, lung cancers, coughing, high blood pressure, stress, heart problems, liver/kidney troubles, Dengue, Cholera, Malaria, asthma, allergy and irritation of eyes, nose and throat

There are identified main three causes for the construction process due to the environmental pollution. They are,

- Reducing efficiency of workman. [Due to absence and health problems.]
- Getting delay the construction project. [Progress speed falls.]
- Extra expenses due to delay of the project.

According to collected data there are six recognized manners which the environmental pollution affects to the society and the country.

- Destroy the world heritage value and the natural beauty of the city.
- Occurring health problems among people.
- Day to day work decreases due to disturbances.
- Occurring natural disasters due to environmental pollution.
- Traffic jams.
- Effect to country's economic condition.
- Effect to the tourism industry of the country.
- Complains and court cases will be raised.

According to the analysed data there are highlighted sites in Kandy city where the environmental pollution can be seen. They are,

- Sites around Bogambara lake(Hotels) - 40% of the responses.
- Ongoing projects at General Hospital, Kandy – 28% of the responses.
- Road construction projects in Kandy city - 20% of the responses
- Ongoing projects at Bogambara ground – 12% of the responses.

Summary of their responses for “present actions taken to minimize the problem” as follows.

- Following “three R “concept. [Reduce, Reuse, Recycle]
- All the machineries are maintaining periodically.
- CEA established building laws and rules to minimize the pollution. [building construction guidelines]
- Kandy lake rehabilitation project.
- Remedies which have taken in road construction such as, watering all the strip and wetting along the road.

According to the collected data they have presented their own proposals to minimize this problem.

- Recycle and reuse waste construction materials.
- Use environmental friendly raw materials to construction industry.
- Apply environmental management systems [EMS, EMP] for construction and get prior approval from central environmental authority.
- Introducing proper waste management systems.
- Use solar power for working construction machineries.
- Construction should be planned of minimum excavation and building should be designed according to the suitable architectural model.
- Government put simple laws for labours and all workers to clean the site after finish work each and every day.
- Authorities should be strict on the matter.

Above is the current status of the environmental pollution caused by the construction industry in Kandy city which describes the ways of pollution, reasons for pollution and the solutions for this problem.

Conclusion and Recommendation

Air pollution is the main environmental pollution way caused by the construction industry in Kandy city. Basically, basin type geographical characteristics of Kandy city creating stagnation and emission of dust/ smoke is causing for this situation. Burning chemicals and garbage, different types gases and fumes emitting from heavy machineries, number of vehicles and traffic jams, due to transport of construction materials, generating high level of dust due to constructions are the main reasons for air pollution occurs due to construction process in Kandy city. In addition to that water pollution, visual pollution, land pollution, construction waste and noise pollution are also the way of polluting the environment of Kandy city by the construction works.

In present society has already taken some of the mitigation methods to avoid environmental pollution caused by the construction industry. But still the problem did not solve to the fullest. There are some innovative proposals to the environmental pollution caused by the construction industry in Kandy municipal area. They are, Reuse and recycle construction

materials, Use environmental friendly raw materials to construction industry [Innovative solutions from overseas] such as, straw bales, grass Crete, rammed earth, hemp Crete, bamboo, recycled plastic, wood, ferrock, ash Crete, and Timber Crete, Apply EMS and EMP plans in construction projects, Use solar power for working construction machineries, Managing dust through fine water sprays and screen the entire site to stop dust spreading, Use non-toxic paints, solvents and other non -risky materials, Avoid erosion, Leave maximum vegetation corer, Introduce water treatment plants and sludge treatment systems, Cover up all drains on sites, Use low Sulphur diesel oil in all vehicles and equipment engines and joint with the modern specifications of particulate filters, Use modern, quiet power tools, equipment and generators, low effect technology and wall structure as sound proof.

These methods will be given higher contribution to expand the environmental status of the Kandy municipal area by reducing impact of the construction industry to the environmental pollution. This will guide to protect Kandy's heritage value and the people's living standards to a greatest level.

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**STUDY ON QUANTITY SURVEYOR'S CONTRIBUTION TOWARDS
SUSTAINABLE HIGH-RISE BUILDING CONSTRUCTION IN WESTERN
PROVINCE OF SRI LANKA**

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Abstract

Sustainability is one of the key concepts of the present world. Because of to the abuse of natural resources by its ancient human, today's natural resources have been confronted with massive natural disasters. Therefore, the world has paid special attention to this. Construction industry closely interconnected with natural environment and it differs from the human expertise. Hence the people involved in the construction industry must be well aware of the concept of sustainable development in order to avoid natural disasters. This study is focusing on the contribution of Quantity Surveyors in promoting sustainable high-rise building construction in Sri Lanka. As a developing country, Sri Lanka is keen on adhering to sustainability practices to protect the environment for future generations. This research is conducted among the 100 quantity surveyors currently residing in the western province of Sri Lanka. Quantity surveyor will need to perform the most effective responsibilities for sustainable construction, since quantity surveyor has been performing a major role in construction industry. Promoting sustainable high-rise building construction among quantity surveying professionals will help to unveil their real capabilities and role in the construction industry and prepare the required provisions to protect the environment.

Key Words: High-Rise Building, Quantity Surveyor, Sustainable Construction,

Introduction

Quantity Surveyor is a professional in the construction industry and also known as Building Economist (AIQS (Australian institute of Quantity Surveyors),2019). Currently Quantity Surveyor plays a key role in managing construction projects. By engaging in sustainable construction activities, a Quantity Surveyor can contribute to Sustainability (Randstad, 2019).promoting sustainability among the Quantity Surveyors will help to ensure environmental protection and identify the real potentials of these professionals. This research attempts to find out how quantity surveyors contribute towards sustainable high-rise building construction in Western Province of Sri Lanka.

Background

Sustainability is to save the resources for future generations to meet their needs and fulfill the needs of the present generation (Brundtland, 1987). According to Mary McMahon (2003) sustainable construction means focusing on the economic, social and environmental impact of creating an employable structure. In other words, designers and contractors are required to use buildings that do not have long-term environmental damage. It aims to reduce consumption of natural resources and minimize the impact on natural systems. Consequently,

the responsibility of the construction industry for sustainable development especially the significant impact on the environment is caused by the construction activities.

Research Aim

The purpose of the research study is to determine how Quantity Surveyors contribute towards promoting sustainable high-rise building construction in Sri Lanka.

Research Objectives

Following objectives have been identified as a key component in fully analyzing the key objectives of this research:

1. Identify world trends in sustainable construction.
2. Identify the current Sri Lankan construction industry approach towards sustainability.
3. Identify how Quantity Surveyor contributes to Sri Lankan sustainable construction
4. Identify methods for improving Quantity surveyor contribution for sustainable construction

Research limitations

This research will be concerned on Completed/ operational High rises (23m – 150m) located for the past 10 years in the Western Province.

Methodology

This research aim is trying to identify Quantity Surveyor's contribution towards sustainable high-rise building construction in Western Province of Sri Lanka. Therefore, this research seeks to identify possible facts and ways in which the process can be developed. To achieve these objectives requires both quantitative and qualitative.

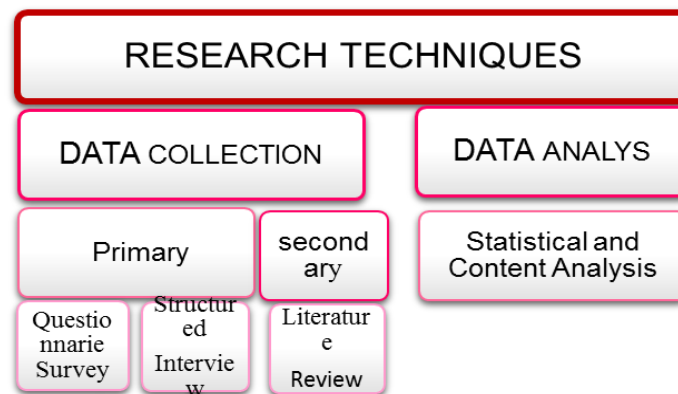


Figure 14: Research Techniques

Data Collection Method

Questionnaire survey

This is expected to be carried out of a total 100 Quantity Surveyors who work in the Western Province of Sri Lanka. Initially, the questionnaire will be asked to use the data they provided to carry out the research and the data collected during other activities is not being used. The participants should be informed that their applications will be secreted and the overall analysis will be used to retrieve the experimental output.

Interviews (Structured)

Interview with 10 managing level quantity surveyors and getting information on their vision for sustainable construction. Participants should be made aware of the research and its Origin. The approval of the interviewers is required for interviews.

Literary survey

All information collected through the literature review must be properly directed towards preparation of questionnaire.

Data Analysis Methods

Numerical analysis methods are used to analyse data that generates statistical information. Questionnaire survey and interview can provide statistical information. Therefore, due diligence should be formulated to obtain the details of the research with the purpose and research objectives.

Results and Discussion

The results obtained from the online questionnaire survey and semi-structured interviews. Questionnaire survey was conducted among hundred numbers of participants who are involved with high-rise building construction industry in the western province of Sri Lanka. Questionnaire included twenty-four questions, which are divided in to four main sections. Semi-structured telephone interview includes ten questions, which also covers the areas described in the above questionnaire. This combined method was adopted in order to reinforce the results obtained from the questionnaire survey with logical reasoning. Furthermore, statistical analysis method was used to analysis the results of the questionnaire survey while as all of the answers lead to quantitative answers. As the semi structured interview provided some qualitative information content analysis method was used to obtain the data output.

Section 01 – General Individual Information



Figure 2: Professional classified according to organisation type, sector and location

According to the answers received of the questionnaire, and in above figure 02 it can be stated that very high percentage of the quantity surveyors in the western province of Sri Lanka are knowledgeable about what is sustainability and related concepts such as sustainable construction and rating methods. Although majority have knowledge on the above, it is clear that the knowledge on sustainability is one-dimensional and has lot of room for improvement.

Section 02 – Sustainability Awareness

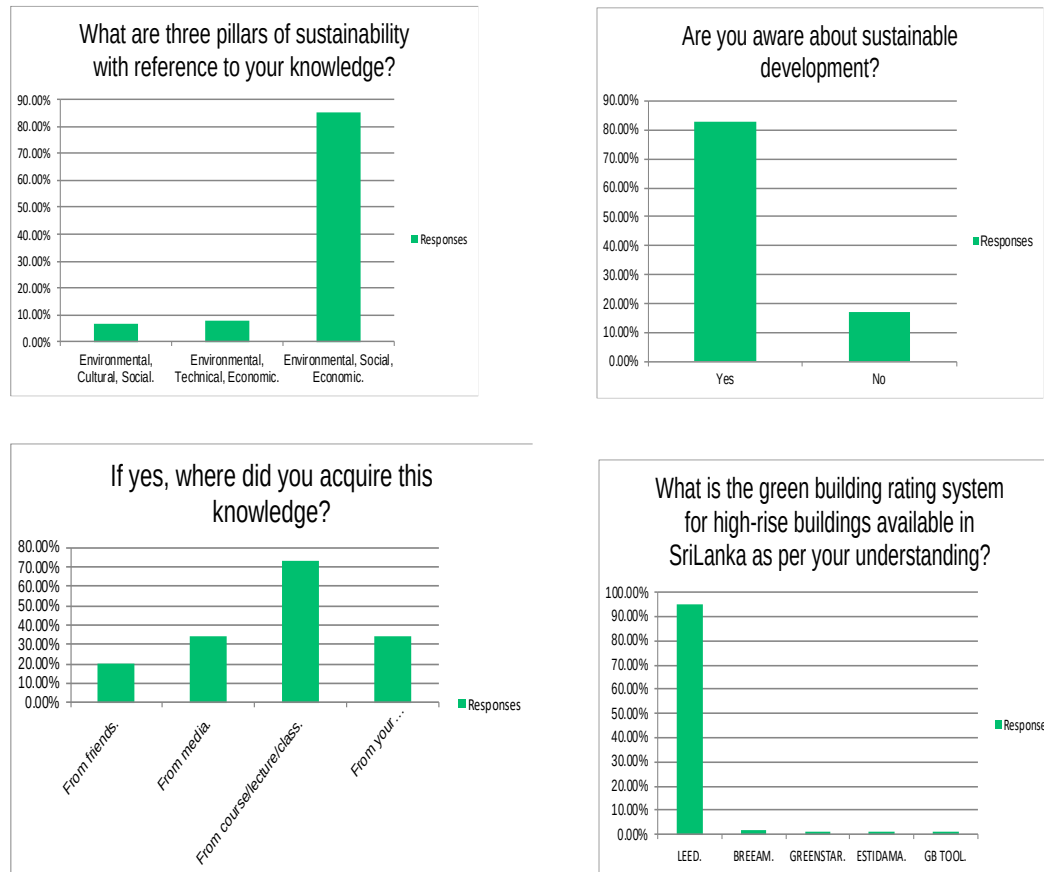


Figure 3: Knowledge on three pillars of sustainability and awareness percentage

When considering the knowledge on sustainable development as per figure 03, majority (83%) of the participants are having a good understanding. With reference to the source of obtaining knowledge, the most popular source of information is courses, lectures and classes. Moreover, certain participants are gathering knowledge through their organisations, media and friends respectively. In addition, all display the familiarity with green building systems and a quantification of the familiarity through a weighted average method respectively. Most of the participants have responded their answer as “yes”; while most familiar rating system was discovered as LEED rating system. Moreover, it can be seen that least familiar rating was GB Tool. According to the familiarity can categories second, third and fourth places as BREEM, GREENSTAR and ESTIDAMA.

Section 03 – Involvement with Sustainability

Figure provides the ranking for why various organisations are currently practicing sustainable construction.

As per the results gathered, importance of the ranking order can be shown as follows;

1. Appreciate the environment.
2. Obtain authority approval.
3. Reduction cost of construction lifecycle.
4. Customer attraction.
5. Gain publicity.
6. Achieve awards.

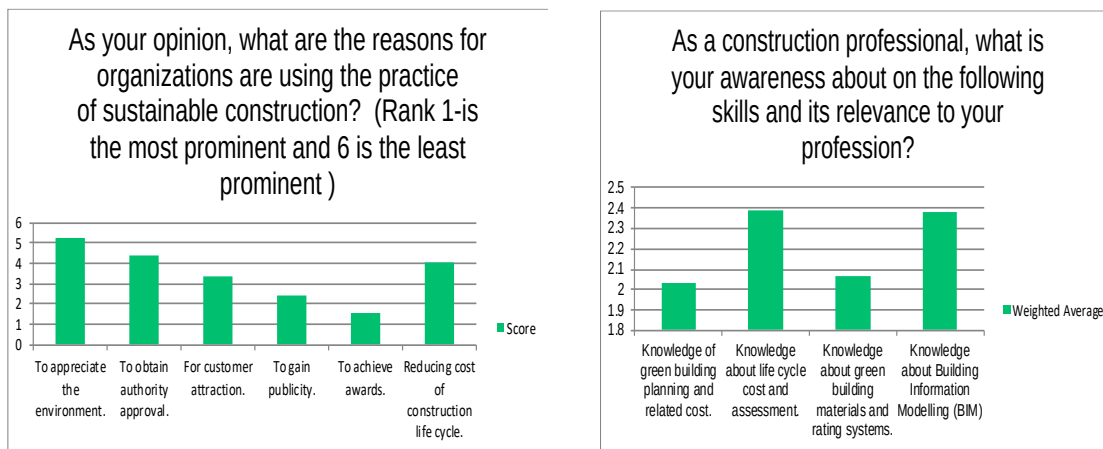


Figure 4: Reasons for organisations using sustainable practices.

Another question focused on the relevancy of sustainable practice towards the quantity surveying profession.

The identified sustainable practice related competencies are;

1. Waste management
2. Material Management
3. Building information modelling
4. Carbon emission monitoring
5. Value management

Table 01: QS skills in Sustainable practices

Sustainable practice related competence	Quantity Surveying skills
Waste management	design economics, cost planning and quantification and costing
Material Management	Conflict avoidance, dispute resolution and contract administration
Building information modelling	contract administration, dispute avoidance and dispute resolution
Carbon emission monitoring	construction technology, dispute avoidance and dispute resolution
Value management	quantification, costing, procurement and

Conclusions and Recommendation

This section provides a clear understanding about the outcome of this research. According to all telephone interviews, sustainability is an important concept to the construction and all the professionals link their work practices with the concept of sustainability. Moreover, according to the answers received of the questionnaire, it can be stated that very high percentage of the quantity surveyors in the western province of Sri Lanka are knowledgeable about what is sustainability and related concepts such as sustainable construction and rating methods. Although majority have knowledge on the above, it is clear that the knowledge on sustainability is one-dimensional and has lot of room for improvement.

According to findings of the questionnaire lack of training, knowledge, regulations and senior professionals who can advise on sustainability are found as most prominent barriers of promoting sustainability in Sri Lanka. Through the questions, it was understood that there are not enough methods to promote the knowledge on sustainability. With reference to, the interviews the methods proposed were training programs, CPD sessions, government intervention with related laws and involvement of various professional bodies to promote sustainability among Sri Lankan quantity surveyors

Recommendations

The main aim of this research is to determine how Quantity Surveyors contribute towards promoting sustainable high-rise building construction in Sri Lanka. The following recommendations can be made towards achieving that target.

- To assist in introducing new laws, rules and regulations concerning sustainability in to the Sri Lankan legal system.
- Promote sustainability through various quantity surveying bodies such as IQSSL, RICS, AIQS.
- Promote sustainability by introducing mandatory subjects to quantity surveying courses throughout the country.
- Provide more recognition towards professionals who specialize in the area of sustainability.

Limitations of the research

This research was conducted among all levels of quantity surveyors working in government and private sector high-rise building construction project. Therefore, it is not feasible to target a set of people with similarities to provide answers that are more precise.

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**A STUDY TO IDENTIFY CORRECT PRACTICES TO PREVENT/MINIMIZE
DISPUTES IN SRI LANKAN BUILDING PROJECTS**

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Abstract

Disputes are a major concern for any construction project. Causation of the disputes are already identified by many researchers and they proposed the solutions for disputes. However, disputes are still prevailing large in the industry. Therefore, identifying the origins of the disputes may prevent/minimize disputes in later stages. This study explored the incorrect practices perform by each party in the pre contract stage and suggest a check list of correct practices for each party to avoid disputes in post contract stage, including Client, Consultant and Designer. To achieve this goal, comprehensive literature review and extensive questionnaire survey was carried out. Data gathered from the questionnaire survey revealed that consultant is the most responsible party for incorrect practices and client was the least. Furthermore, proper contract administration plays a significant role in the disputes as per the research findings.

Key Words: Avoidance, Construction Disputes, Correct practices

Introduction

According to Yates (1998) Construction industry in many countries displayed unexpected increase in conflicts and disputes. He further observed that Construction industry is plagued by the conflicts and disputes and it is an enormous burden to the industry. Moreover, Yates (1998) states that resolution of disputes account for higher costs, longer time and waste of professional work hours. Similar to Yates, Cheung and Yiu (2007) also identified that, assets consume by the disputes can be used in elsewhere for more beneficial purposes of both parties. Yates (1998) identified the reasons for disputes from a different perspective than the majority of the scholars. As per the categorization presented by Yates (1998) three main reasons identified as the reasons for disputes, which are, sophisticated Construction contracts are lacking the comprehensiveness as a result of limited rationality and ambiguity. He further explains it as “real motives of the parties unravel when contract is on motion and some alterations and modifications are needed”. Second reason is the “opportunistic behaviour of the parties”. Third, reason as suggested by Yates (1998) was unavailability of appropriate safeguards, assurances and mechanisms for the involving parties. Many of the scholars from different perspectives identify main causes for the disputes. Nevertheless, disputes are still prevailing large in the industry as a major concern in post contract stage. Therefore, it is clear that identification of real causation is the first step to prevent/minimize the disputes. By identifying the real causations, correct practices can be developed as a second step to avoid the disputes from early concept stages of the project. With correct practices, paramount goal of time, cost and quality can be achieved in the construction projects.

Research Aim

Aim of the study is to prepare a checklist of correct practices to prevent/minimize disputes in Sri Lankan building projects.

Objectives

1. Identify the causation of the disputes in construction industry.
2. Identify the practicing dispute avoidance procedures in construction industry.
3. Formulate a checklist of correct practices to minimize disputes by identifying the incorrect practices performed by client, consultant and designer in the pre contract stage.

Methodology

Most suitable method to perform this research is quantitative method. Because this research was performed to identify the correct practices in the industry. Therefore, those practices are already performed in the industry, but needed to arrange as a checklist to identify the importance on basis of numerical values. After the identification, those checklists can be used as a guideline for the professionals in the industry to avoid disputes. Structured questionnaire survey and comprehensive literature survey used for this research. According to Naoum (1998) there are certain distinctive advantages of using questionnaire survey.

Questionnaire survey

Which are, it is economical and speedy rather than other methods. Using an email message of questionnaire survey can gather lot of responses within a short period of time for a cost of nothing. Moreover, it gives the respondent a chance to consult further resources to confirm his response, which increase the accuracy of the information. Collected information from literature review used to compile the detailed questionnaire. The questionnaire survey consists of close-ended questions with five-point Likert scale. This scale used to gather and measure the data on causation of disputes, effects of disputes and prevention of disputes. For the sampling process, respondents will be selected from client, contractor, and designer and consultant parties. To get a worthwhile response 40 -70 number of respondents will be selected.

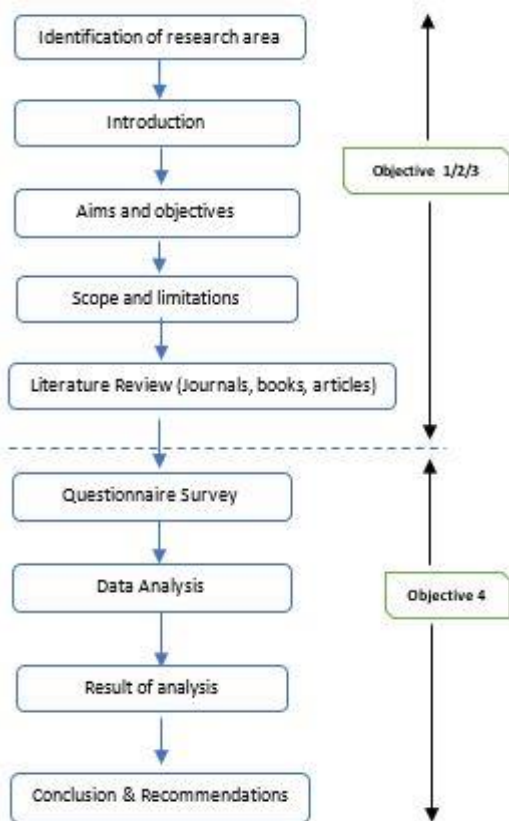


Figure 1: Research Process

Relative Importance Index (RII) formula used to analyses the data collected through questionnaire survey. Tables, diagrams and charts were used to present the research findings in more meaningful manner.

Results

The first ranked erroneous practice is inadequate contract administration or in other words failures to administer the contract. In RII analysis, this incorrect practice scored the highest value, which is 0.804 (*Refer table 1*). Obviously, the highest value obtained in the entire analysis. This means the poor contract administration practices of the consultants in pre contract stage influences later stage disputes. Less experience persons, involving in the preparation of the contract documents and negligence in the checking of the necessary details/provisions contribute to this in significant amount. This also mentioned in the Arcadis 2018 dispute report. It mentions that poor contract administration is a worldwide phenomenon for disputes (Cooper, 2018).

Table 1: Consultant's role in dispute origins

Incorrect practice	RII value
Inadequate contract administration	0.804
Errors in specifications	0.758

Errors in contract documents	0.740
Incomplete tender information	0.736
Lack of knowledge in site condition	0.698
Misinterpretation of client's requirement	0.694
Inappropriate procurement method	0.679
Re using past project specifications	0.657

Table 2: Designer's incorrect practices

Incorrect practice	RII value
Design errors	0.762
Negligence	0.736
Misinterpretation of client's requirement	0.709
Work on tentative information	0.702
Reusing past designs	0.623

Findings in this research also reflects above by scoring the highest rank in RII analysis. Design errors top ranked by scoring 0.762 value in RII analysis (*Refer Table 2*). If errors in designs discovered in the construction stage, it may cause significant impact on the cost and time of the project. Moreover, large number of variations is also a possibility and might cause disputes in the construction stage. Cooper (2018) and Alshahrani (2019) also stated that inadequate designs frequently cause the disputes.

Table 3: Client's incorrect practices

Incorrect practice	RII value
Unrealistic expectations – in time, cost and quality.	0.792
Inadequate time allocation for document preparation	0.747
Inadequate time allocation for design	0.736
Lack of funds	0.698
Ambiguity in client's requirements	0.694

Inaccurate site investigations	0.668
Change of scope before design & document finalization	0.611

Table 4: Common incorrect practices

Incorrect practice	RII value
Poor communication	0.796
Poor feedback from parties	0.766
Lack of team spirit	0.721
Opportunistic behaviour	0.634
Multi-cultural team	0.555

Unrealistic expectations of the client were rank highest in the analysis by scoring 0.792 (*Refer table 3*).Tolson (2009) explained this scenario as client expects maximum return on their money, with minimum risk, time and money. Moreover, this is not a possible outcome to produce. Often this pressure from client leads to disputes in the construction stage.

Poor communication top ranked among the common practices by scoring a 0.796 in RII analysis (*Refer Table 4*). Tolson (2013) also highlighted that communication is a key ingredient in the project. Armes (2016) also stated that inability to communicate is a key criterion in disputes. Feedback is also important part of the communication. In the analysis, feedback from parties scored a 0.766 in RII analysis. For effective communication, feedback is also important. If communicated idea not feedback properly, disputes might arise in the later stages.

Discussion

According to the research findings, it was identified that consultant is the most responsible party for incorrect practices in the pre contract stage. Designer is second most responsible party and the client was the least. In further analysis of consultant's incorrect practices, inadequate contract administration placed as the most effected cause and re using past details placed as the least effected cause. However, this least effected cause also has scored a significant value in the data analysis. Pursuant to the results of the data, analysis following checklist were developed for the use of consultant party as shown in figure 01.As per the data analysis, origin of disputes travels back to the errors in the design. Design errors are the highest scored dispute in regarding designer's incorrect practices. This is a major reason for disputes in construction stage. Further analysis revealed that negligence of the designer is also closely knitted as a dispute origin. In figure 02, it shows the developed checklist for the use of designer.

Pursuant to the results obtain from data analysis, client's unrealistic expectation on time, quality and cost is one of the major originators of the disputes. Further analysis concluded that client's pressure on consultants and designers for immediate finalization of documents

and drawings played major role in dispute causation. In figure 03, it shows the developed checklist for the use of client.

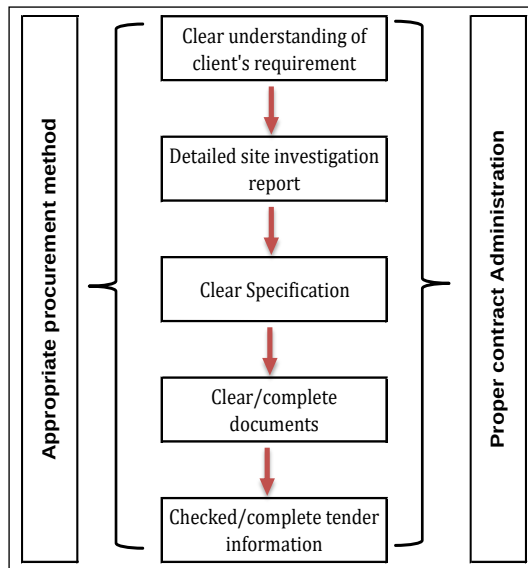


Figure 01: Consultant's correct practices checklist

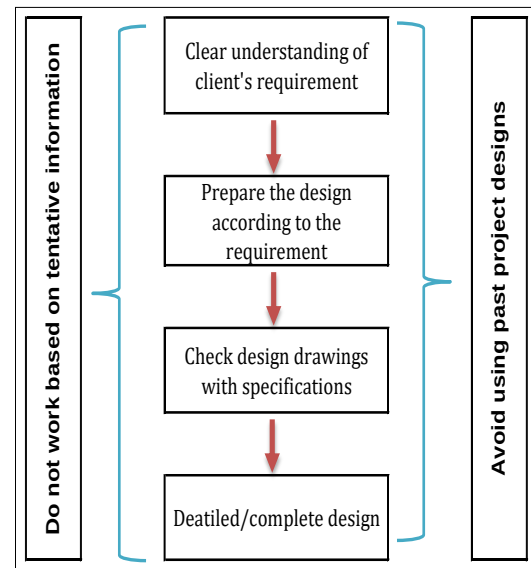


Figure 02: Designer's correct practices checklist

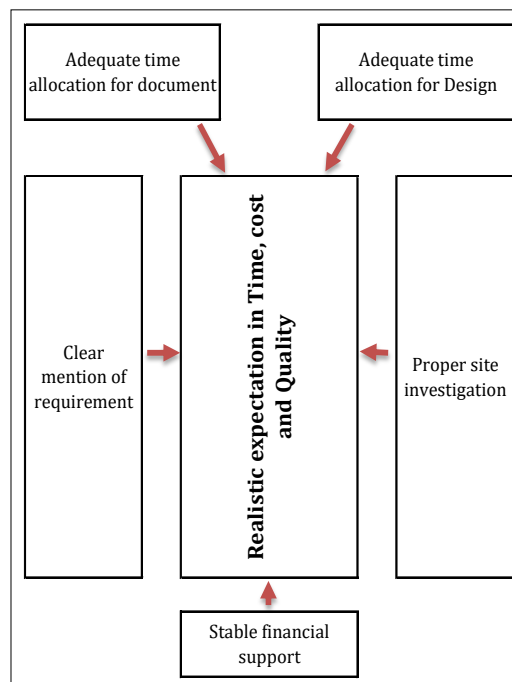


Figure 03: Client's correct practices

Conclusions and Recommendation

Consultant plays a major role as the leading dispute originator. As it reveals inadequate contract administration from the consultant, party has a significant impact to the dispute origination along with the errors in the contract document and specifications. Not only the

consultant but also the designer is responsible for a considerable portion of dispute origin. As per the survey-results, it revealed that design errors and designer's negligence provide substantial motivation for later stage disputes. In addition to above client's unrealistic expectation and pressure on designers and consultants for early finalization vital to the dispute origination. As survey exposed poor communication and poor, feedback from parties' also have a noteworthy contribution to the disputes. Pursuant to the survey results, it is identified that human behaviour plays a major role in the dispute origins. All the identified dispute causations mainly depend on the interaction of the parties. Good communication protocol and adherence to that protocol might avoid most of the identified dispute causations. Therefore, it is the responsibility of the parties to implement a series of correct practices (as suggested in the discussion chapter) along with comprehensive communication protocol to ensure the correct flow of the activities, not only in the pre contract stage but also in post contract stage.

According to the findings of the research, following recommendations can be suggested;

- Innovative programs should be introduced to develop communication skills of the participants. Through this program, chemistry between people should be improved. Moreover, influencing the people to follow the correct path also recommended.
- Checklist of correct practices should be developed and follow by each party in the Sri Lankan building projects. Through this practice, most of the disputes can be neutralized in the cradle.
- Competency, experience and attitudes of the professionals should be considered when appointing to the project. With those traits and suitable person for suitable job, most of the conflicts can be avoided.
- Building Information Modelling (BIM) should be used from the inception of the project to reduce the conflicts and clashes between parties and designs.

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INVESTIGATION ON THE STRENGTH OF SOIL BRICK WITH PARTIAL REPLACEMENT OF CEMENT AND FLY ASH

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Abstract

Sri Lanka is most popular building material of soil bricks (burnt clay bricks). The aim of this research is to provide the strength characteristic soil brick with partial replacement of cement and fly ash. Soil is a natural resource and clay bricks manufacturing to top soil removal. This can be reduced environmental pollution and environmental impact. Fly ash waste material is increased in Sri Lanka. This is can decreased fly ash waste material. This purpose bricks will be prepared using different ratios. There is fly ash (20%to 50% at 10% increments), soil (clay) (68% to 38% at 10% decrement) and 12% cement. This ingredient mixes and poured to mold of 9"x6"x4". This research has prepared 60 brick samples. The best mix proportions were 40% Fly ash, 48% soil (clay) and 12% cement. According to the results, 6.03 N/mm² was the best compressive strength from those values. Also, the minimum water absorption percentage was 15.84%.

Key words: Fly ash, Compressive Strength, Water absorption

Introduction

Asian countries are the largest production of the brick in the world. From this continental, China has a biggest production industry of the brick and India is the second largest producer of the brick in South Asian. India is total estimated CO₂ emission is 41.6 million tones and GHG emissions is 4.5% [2]. When the production of these bricks, there are several impacts to the environment [5]. Such as, CO₂ emission, air pollution and land pollution. Land pollution impact is due to the enough clay requirement for made this brick. Also, it is burned by wood stacked. When it is burn. CO₂ will be existing to the air and it will be affected to the green house emission [2].

Fly ash is one of the different type of additive material for use to the concrete mix proportion. Using these materials can be reduce the environmental and natural risks from engineering properties. Such as brick and block. According to the sources has been identified the Fly ash is the huge waste material in Sri Lanka. Sri Lanka have several types of power plant, but Lak Vijaya power plant is the good example for the fly ash wastage. A 2640 tons of coal are produced per day by a 300MW Lak Vijaya power plant. Therefore, 180 tons of fly ash and 40 ton of bottom ash will be release as a waste material [3].

Aim & Objectives

Aim

To determine the optimum strength with partial replacement of cement and fly-Ash.

Objectives

- To study on the behavior of cement and fly ash with soil (using Literature reviews).
- To construct propose brick samples with different ratios.

- To investigate the optimum strength using different ratios.
- To compare the soil brick and propose brick.

Methodology

Dedigama is a large town, located of the city of Galigamuwa. This research to selected Dedigama area. Because that are has selected 52 kiln plants. That area so many people doing in brick works. They are created bricks using traditional brick create method. After that collected three bricks each location. Then conduct the compressive strength test for check a compressive strength.

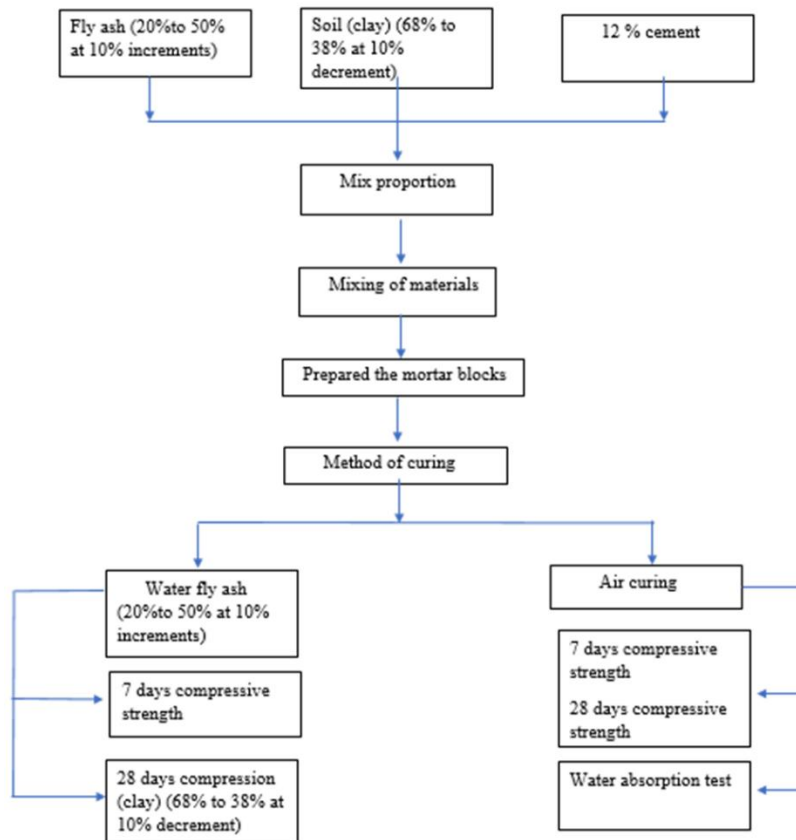


Figure 1-Research Process

Used materials

The present study fly ash used is got from thermal power plant located Puttalam “Lak Vijaya power plant”. That power plant fly ash unclassified. Because classified fly ash waste lot of money. And also, Sri Lanka haven’t technology for classification.

Mix proportion

In this study to use various mix proportions of fly ash, soil and cement were studied sufficient compressive strength. fly ash, soil and cement are used as a percentage. Material required percentage, each samples brick no. and different curing methods table

Table 1: Table Material required percentage, each samples brick number and different curing methods table.

Proportion no.			W	X	Y	Z
Brick no.	Compressive strength	Air curing	W1, W2, W3 W4, W5, W6	X1, X2, X3 X4, X5, X6	Y1, Y2, Y3 Y4, Y5, Y6	Z1, Z2, Z3 Z4, Z5, Z6
		Water curing	W7, W8, W9 W10, W11, W12	X7, X8, X9 X10, X11, X12	Y7, Y8, Y9 Y10, Y11, Y12	Z7, Z8, Z9 Z10, Z11, Z12
	Water absorption		W13, W14, W15	X13, X14, X15	Y13, Y14, Y15	Z13, Z14, Z15
Fly ash (%)			20%	30%	40%	50%
Soil (clay) (%)			68%	58%	48%	38%
Cement (%)			12%	12%	12%	12%

Mixing of materials

Take required quantities and mixed thoroughly in dry state. First need to mix soil and fly ash using shovel. After add required quantity of cement. Again, thoroughly mix raw materials and determine the colour of dry mixture. After addition the required quantity of water and mixture was thoroughly mixed. let the mixture to dry to given half an hour. Traditional brick creates methods used and find out this brick create method.



Figure 2- Mixing and casted brick

Testing methods

Under this topic there has been done two testing methods. Before done these two tests has been carried out the curing methods. It has been categorized two parts, they are used air curing and water curing. This method is found According to above mention literature (Md. Ashikuzzaman, 2018). After taken out brick samples were kept for air dry two days. Then water curing samples transferred to water tank and also air curing samples drying air.

The cubes subjected to water curing have been tested for 7- and 28-days compressive strength tests. But, under the air cured cubes have been tested for 7 days and 28 days compressive strength test. Also, cubes that have been curing or only 28 days have been subjected to water absorption test.

Brick will be crushed by compression testing machine in ICBT laboratory. Compressive strength of the brick was checked after 7 days and 28 days of water curing, air curing and water absorption test samples

Standard reference

Calculations for compressive strength

$$\text{Compressive strength } N/mm^2 = \frac{\text{Actual (Failure) load (kN)} \times 1000}{\text{cross sectional Area (mm}^2\text{)}}$$

This research has applied SLS 39:1978 stranded. This method used and found maximum water absorption percentage.

Weight of Dry Brick (kg) = M_1

Weight of Wet Brick (kg) = M_2

$$\text{Maximum Water Absorption percentage} = \frac{M_2 - M_1}{M_1} \times 100\%$$

Research Findings

Investigate the optimum strength using different ratios.

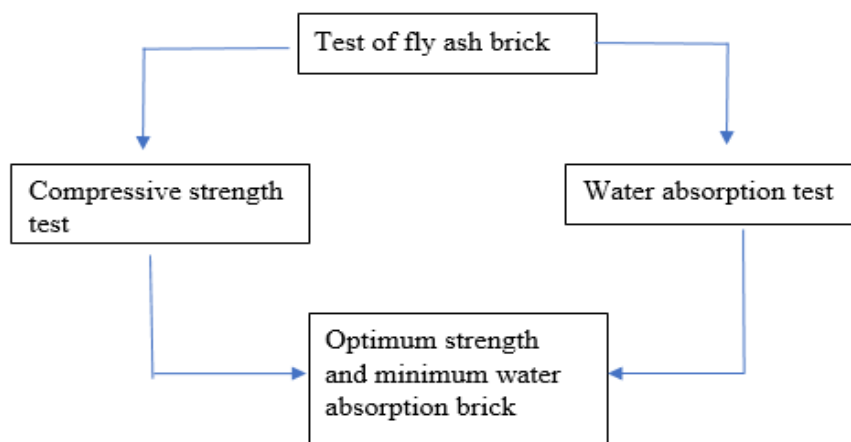


Figure 3: Testing methods

Method of compare the soil brick and new brick

- ❖ To compare the propose brick strength and available soil brick strength.
- ❖ To compare the SLS standard.
- ❖ To compare the propose brick water absorption with SLS standard.

SLS 39:1978 Standards introduced by 1978 amendment No: 1 of 1981. (Table 2 Brick specification)

Table 2: Brick specification

Description	Wire cut brick types	Handmade bricks	
		Grade 1	Grade 2
Use in places	High rise buildings	Two story buildings	One story building
Compressive strength	10N/mm ²	4.8 N/mm ²	2.8 N/mm ²
Maximum water absorption	18%	28%	28%
Efflorescence	few	Normal	Normal

Table 3: Selected area brick compressive strength

Location	<u>COMPRESSIVE STRENGTH</u> (N/mm^2)			Mean Compressive strength (N/mm^2)
Location A	3.66	3.72	3.75	3.71
Location B	4.25	4.36	4.34	4.32
Location C	3.84	4.25	3.96	4.02
Location D	3.54	3.48	3.33	3.45
Location E	3.15	3.22	3.25	3.21
				Mean Compressive strength=18.71/5=3.74

Results and Discussion

Table 4: Summary of brick compressive strength

Proportion No.	Compressive strength N/mm^2			
	7days-Water	28days-Water	7days-Air	28days-Air
w	1.29	1.95	2.81	3.27
x	1.85	3.203	2.53	3.4
y	1.6	5.105	3.42	6.03
z	1.43	2.25	1.26	2.83

Table 4 gives the details about the summary of brick's compressive strength. The highest value was shown in the Y brick. The highest compressive strengths were 5.105 N/mm^2 at 28days- water and 6.03 N/mm^2 at 28days -Air. Also, considering the data in the X bricks, it seems that those values were also somewhat good than other W and Z proportions.

These obtained values are shown in the below graph.

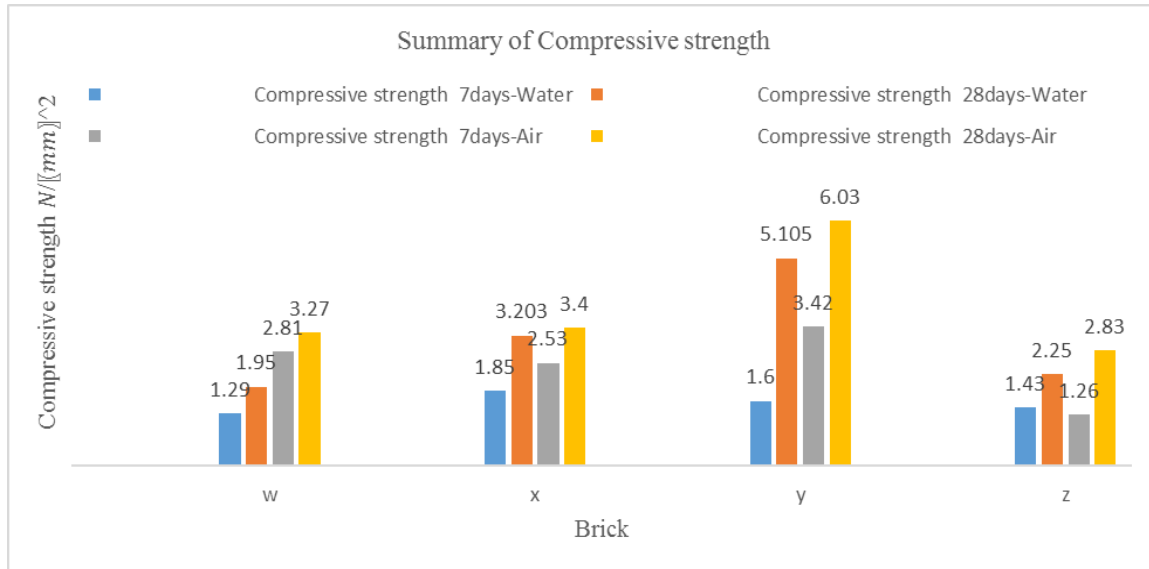


Figure 4: Variation of compressive strength

Table 2 shows the SLS standards of Brick specifications and its contents. As shown here, the highest strength shows the types of wire cut bricks. When comparing the table ii and table iii can be critically evaluated that obtained Y bricks results has been showed the very high value than handmade bricks.

In this table 4 gives the information of obtained data from five locations, which has been studied before start to this research. The values achieved from those areas were in the range of 3.0 – 4.5 (N/mm^2). The mean strength was that 3.74(N/mm^2). By comparing the mean value with obtained results together, can showed that Y types of bricks also better than these bricks.

Table 5: Summary of brick compressive strength, and Water absorption%

Brick no	Compressive strength (N/mm^2)	Water absorption%
W-28 day	3.09	22.58
X-28 day	3.2	12.69
Y-28 day	5.06	15.84
Z-28 day	2.38	21.58

It shows that obtained data of compressive strength and water absorption at 28 days. But when considered the water absorption column that can be evaluated that X-28 bricks had tried to point out the minimum value (12.69%) than table 4. Furthermore, the values of the water absorption test carried out in this research were much lower than those of the SLS standard values.

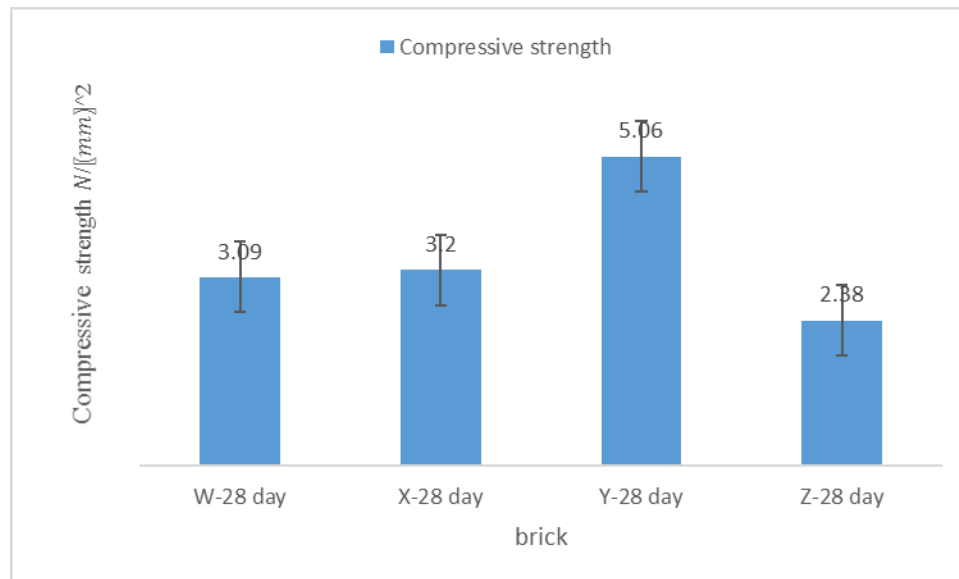


Figure 5 Variation of compressive strength

As shown in Figure 5 the compressive strength showed major change with adding fly ash and cement content. Significantly, the Y-28 brick has showed the maximum compressive strength.

Conclusion and Recommendation

The studied of the previous research papers that can be investigated, there had a combination when added the cement and Fly ash to soils. Based on these researches and this experiment can be concluded that it will be succeed. The best ratio was that has been obtained from this research is Y brick. The mix proportions were 40% Fly ash, 48% soil (clay) and 12% cement. According to the results, 6.03 N/mm² was the best compressive strength from those values. In addition, the minimum water absorption percentage 15.84% has been shown in the Y brick. Therefore, it can be purpose for two story buildings. The Y types of bricks was the good standard brick than SLS standard conditions. Because it has been gone beyond above SLS standard. Can be recommended that Y types of bricks use as a replacement of Grade 1 type bricks and Grade 2 type bricks. Y proportion brick can be recommended for two-story building, X.Z types of brick can be used for one story buildings. Because of above 2.8 N/mm² strength and minimum water absorption showed less than 28%. The Air curing method can be recommended to make of this type of bricks.

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DEVELOPMENT OF CONCRETE USING BACTERIA

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Abstract

This was developed to obtain the performance of the concrete by the bacterial induced special growth. This was developed to a bacterial concrete where bacteria are induced into motors and concrete to heal up the cracks. Here the attempt of mixing bacteria “bacillus subtilis strain jc3” with concrete showed a significant increase in the compressive strength and slump height. When 30 ml of bacillus subtilis is added to M20 grade concrete it attains maximum compressive strength. In concrete self-healing property is successfully achieved due to the addition of this bacteria. This invention relates to the civil engineering field. If a crack is created on a concrete structure, the only solution to recover it is plastering it with cement. But here using a bacterial gel (bacillus subtilis + agar gel + calcium lactate powder), the cracks can be healed internally by applying the gel on the cracks. When doing concrete work, along with the mixture of cement, fine aggregates and coarse aggregates the above mentioned bacterial solution can be used. Through this the compressive strength and the self-healing property are increased.

Key Words: Agar gel, Bacillus Subtilis, bio concrete, Calcium Lactate, Self-healing

Introduction

Concrete is the most widely using component in the construction field. Concrete can be introduced as one of the main materials used in the construction industry from the foundations of buildings to the structure of bridges and underground parking lots. Traditional concrete has a flaw; it tends to crack when subjected to tension. These cracking are formed with exposure to water and chemicals. Concrete has compressive strength. Therefore, steel has used to reinforced. When cracks happen, workers are trained to either plastering the damage or lay down it completely. So it is very important to develop a self – healing concrete, using a mixture of bacteria which can germinate when water and oxygen has a chance to corrode the steel reinforcement. Another method of healing the cracks is spraying or plastering a bacterial solution on the cracks in concrete. It is very important to select the right bacteria which can survive within the concrete. For that, the selected type was Genus Bacillus. The main reason of selecting Genus family bacteria can survive in high alkaline environments. For the above research, seven bacteria of the Genus Bacillus family were tested namely Bacillus Pasterizong, Bacillus Sphaericus, Bacillus Subtilis, Bacillus Cohnii, Bacillus Balodurans, Bacillus Pseudofirums and Escherichia Coli. By testing those bacterias, finally the most suitable bacteria were found and its name Bacillus Subtilis. Here the Bacillus Subtilis JC3 was taken for the further research work. Next finding a suitable food source for the bacteria that could survive in the concrete took a long time and many different nutrients were tried until it was discovered that Calcium Lactate does not interfere with the setting time of the concrete. Here as the first step culturing the bacteria was done and the maintenance of stock culture was done. Here slump test was done to measure the workability of fresh concrete. The process of selecting suitable ingredients of concrete (M20) such as cement,

aggregates, water and determining their relative proportions with the object of producing concrete of required minimum strength, workability and durability as economically as possible for M20 (1:1.5:3) 10 ml.

20 ml, 30 ml of *Bacillus Subtilis*. In specimen preparation standard grade concrete design mix is made and cubes of 150 mm*150 mm*150 mm are made. The cubes are casted with bacteria and without bacteria. After casting, the specimens are demolded after 24 hours. The cubes are tested after 7 days, 14 days and 28 days for compressive strength test and results have been obtained using compression testing machine. In curing process, adopted two types of curing first one is curing of bacteria specimen and normal specimen in ordinary potable water and another type is curing of normal specimen (without bacteria) in bacteria solution. And also for old cracks a gel/ plaster and a liquid was made using the bacteria and food source. A method of healing the old cracks occurred in concrete structures using a gel plaster made up of the bacteria *Bacillus subtilis* jc3 alone with the nutrient medium calcium lactate. Selecting the relevant concrete structure which has cracks on the surface and applying the gel plaster made up of the bacteria *Bacillus subtilis* jc3 alone with the nutrient medium calcium lactate on the crack. The bacteria cells in the gel plaster absorbs the oxygen in the air with the process of cellular respiration and releases CO₂ in the process of cellular respiration. This CO₂ reacts with Ca in calcium lactate nutrient medium and produces calcium carbonate which is commonly known as limestone. Then a layer of limestone is precipitated on the crack and healed the cracks internally. A method of healing the old cracks occurred in concrete structures using a liquid solution made up of the *Bacillus subtilis* jc3 and calcium lactate. The above explained process is happening here also. A method of increasing the compressive strength of concrete, curing it in a bacterial solution of *Bacillus subtilis* jc3 alone with calcium lactate. Curing in water is the normal way of concrete curing. But a concrete structure cured in a bacterium medium, the compressive strength increased gradually. This curing process should be done from 7 days to 28 days. The method of mixing bacteria *Bacillus subtilis* jc3 alone with calcium lactate solution with concrete to increase the compressive strength of the concrete. Mixing the 30 ml of the above mentioned solution to the concrete cubes of grades M20 (150mm*150mm*150mm) and after 7 days, 14 days and 28 days the compressive strength of M20 concrete cubes have achieved the compressive strength of normal concrete of M25 grade. The slump value of the bacteria mixed concrete is also high and it means the workability of concrete is high. Instead of M25 normal concrete, the bacteria mixed concrete of M20 can be used to have the high compressive strength.

Mixing bacteria *Bacillus subtilis* jc3 alone with the calcium lactate solution with concrete to selfheal the cracks occurred in the concrete structures. Mixing as in claim 4, the concrete cubes are made and the bacteria remain dormant until a crack occurred in the concrete cubes and when a crack occurred the bacteria become active by taking oxygen and water vapor through outside and then the process in claim 1 takes place and self - healing the cracks. After healing, the bacteria do not over grow because the nutrient medium need for the existence of the bacteria is kept constant and the crack heals and with experiments it was found that for 30ml of solution 10ml of calcium lactate should be used. There is no enough technology in Sri Lanka to see the healing of cracks in concrete unfortunately.

Methodology

Selecting the right bacteria.

A mineral producing bacteria have been found that could help mend in micro-cracking. Selfhealing concrete could solve the problem of concrete structures deteriorating well before the end of their services life. To refill the cracks, specially selected type of bacteria genus bacillus subtilis jc3 alone with calcium based nutrients can be used.

The starting point of the research was to find the bacteria's capable of surviving in an extreme alkaline environment. Cement and water have PH value of up to 13 when mixed together, usually a hostile environment for life, most organisms die in an environment with PH value of 10 or above. The search concentrated on microbes that thrive in alkaline environments which can be found in natural environments. Samples of endolithic bacteria (bacteria that can live inside stones) were collected along with bacteria found in sediments in the lakes. Strains of the bacteria genus bacillus were found to thrive in this high alkaline environment. Bacteria from the samples were grown in a flask of water that would then be used as a part of the water mix for the concrete. Different types of bacteria were incorporated into a small block of concrete. Each concrete block would be left for two months to set hard. Then the block would be pulverized and remains tested to see whether the bacteria had survived. It was found that the only group of bacteria that were able to survive were the ones that produced spores comparable to plant seeds. Such spores have extremely thick cell walls that enable them to remain intact for up to 20 years while waiting for a better environment to germinate. They would become activated when the concrete starts to crack, food available and water seeps into the structure. This process lowers the PH of the highly alkaline concrete values in the range (PH 10 to 11.5) where the bacterial spores become activated. Finding a suitable food source for the bacteria that could survive in the concrete took a long and many nutrients were tried until it was discovered that calcium lactate was a carbon source that provides biomass. If it starts to dissolve during the mixing process, calcium lactate does not interfere with the setting time of the concrete. Finally, it is clear that bacillus subtilis jc3 is the most suitable bacteria for self-healing.

Cement – ordinary Portland cement available in local market, specific gravity 3.16

Coarse aggregates – crushed granite angular aggregates of size 20 mm, specific gravity 2.686

Fine aggregates – natural river sand, specific gravity 2.668

Water – locally available portable water

Bacteria – bacillus subtilis jc3, laboratory cultured bacterium *Culture of bacteria.*

The pure culture is maintained constantly on nutrient agar slants. It forms irregular dry white colonies on nutrient agar whenever required a single colony of the culture is inoculated into nutrient broth of 200 ml in 500 ml conical flask and the growth conditions are maintained at 37degree temperature and placed in 125 rpm orbital shaker. The medium composition required for the growth of culture is peptone, NaCl, yeast extract.

Maintaining the stock culture.

Stock cultures of bacillus jc3 were maintained on nutrient agar slants. The culture was streak on agar slants with an inoculating loop and the slants were incubated at 37 degrees Celsius after 2-3 days of growth slant cultures were preserved under refrigeration until further use. Sub culturing was carried out for every 90 days. Contaminations from other bacteria was checked periodically by streaking on nutrient agar plates.

Mix design and batching.

Grade – M20

W/C ratio – 0.5

Method of placing – manual

Cement: fine aggregates: coarse aggregates – 1:1.5:3 *Specimen preparation.*

Standard grade concrete design mix is made and cubes of 150mm*150mm*150mm are made.

Mixing bacteria.

Mix design can be defined as process of selecting suitable ingredients of concrete (M20) such as cement, aggregates, water and determine their relative proportions with the object of producing concrete of required minimum strength, workability and durability as economically as possible for M20 (1:1.5:3) 10ml, 20ml, 30ml of bacillus subtilis jc3. The mixing involves, mixing of bacteria in concrete in three different portions like 10ml, 20ml, 30ml for cubes. These specimens without bacteria are also used for comparison purpose. To activate the growth of the bacteria, a concrete specimen, when it cracks, a chemical precursor called calcium lactate is used.

Depending its mortality 1.09g/l of water is used. Depending its mortality 1.09g/l of water is used for mixing in concrete.

Curing.

In curing process, we adopted two types of curing first one is curing of bacteria specimen and normal specimen in ordinary portable water and another type is curing of normal specimen (without bacteria) in bacteria solution (bacillus subtilis jc3) *Self-healing cracks.*

To recover the old cracks, the bacteria gel can be used as a plaster and injecting or spraying the liquid form of the bacterial solution along with nutrient medium can be used.

Summary of the invention.

Based on the experimental investigation,

Bacillus subtilis jc3 can be produced in the laboratory in order to be safe and cost effective.

The compressive strength is 33.32 MPa, which is maximum when the bacteria medium applied is 30ml.

The M20 bacterial concrete having higher compressive strength than the normal M25 grade concrete.

The self-healing property is successfully achieved in bacterial concrete.

Bacterial technology has been proved the basis for an alternative method for high quality structures that will be cost effective and environmentally friendly.

The application of microbial concrete to the construction may amplify some of the existing construction process and revolutionize the ways of new construction process.

Detailed description of the invention.

The procedure is already discussed above and here the invention is described. For the bacteria mixed concrete cubes, two important tests namely slump test and compressive strength test was done and through the final values of the two tests it is clear that the bacteria (bacillus subtilis jc3 alone with the nutrient medium calcium lactate) increase the compressive strength of concrete and slump value of the concrete.

Slump test.

The concrete slump test is an empirical test that measures the workability of fresh concrete, more specifically. It measures the consistency of the concrete in that specific batch. This test is performed to check the consistency of freshly made concrete. The slump test is a slump of the behavior of a compacted inverted cone of concrete under the action of gravity, it measures the consistency or the wetness of concrete.

Results

The slump values are as follows;

Volume of bacteria	Slump value
0ml	290.33mm
10ml	286.45mm
20ml	284.07mm
30ml	281.76mm

Table 01-The slump values of M20 concrete

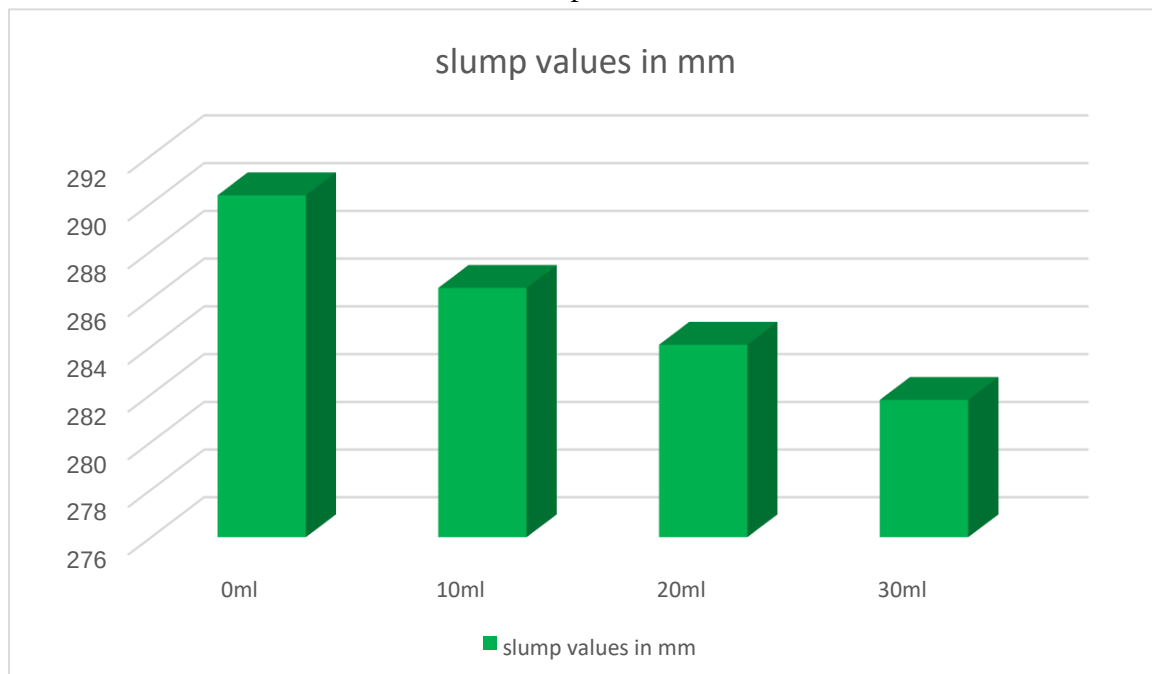


Figure 1: slump values of M20 concrete

Compressive strength test.

The cubes are tested after 7 days, 14 days and 28 days and the results have been obtained using compression test machine.

Table 02: Compressive strength analysis for M20 concrete

ml of bacteria	7 days curing	14 days curing	28 days curing
	Compressive strength (MPa)	Compressive strength (MPa)	Compressive strength (MPa)
0ml	12	13.11	21.78
10ml	12.4	15.16	26.43
20ml	12.24	18.32	29.32
30ml	15.75	24.42	33.32

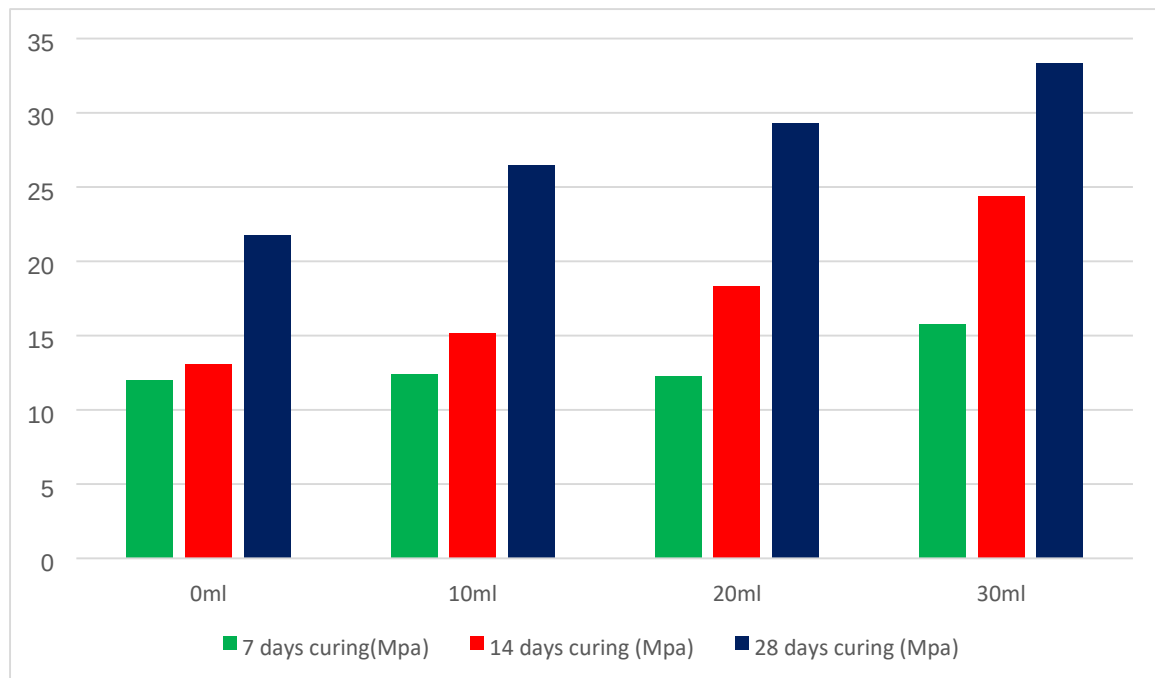


Figure 02: Compressive strength analysis for M20 concrete

Table 03: Comparison of M25 to M20 bacterial concrete

Days of curing	M25 (normal concrete 1:2:4)	M20 (bacterial concrete 1:1.5:3)
7 days	12	15.75
14 days	13.33	24.42
28 days	15.56	33.32

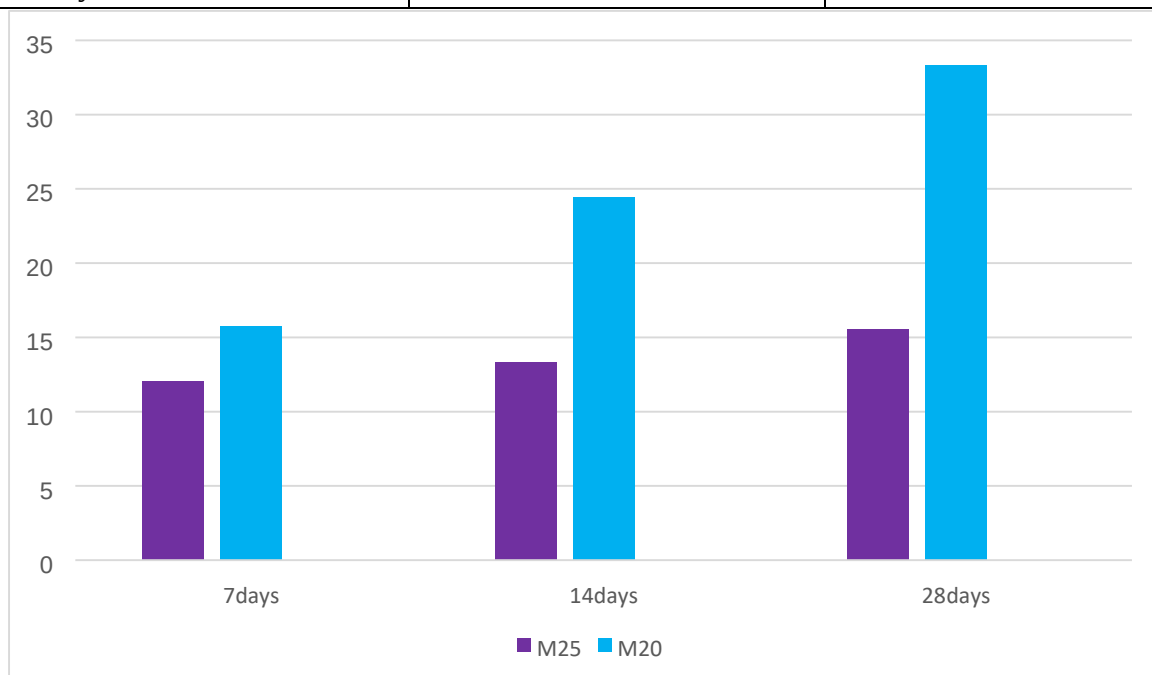


Figure 03: Comparison of M25 to M20 bacterial concrete

Here the compressive strength of concrete gradually increased from 10ml to 30ml of bacteria. From the above chart we can analyze, our M20 grade bacterial concrete having higher compressive strength than normal M25 grade concrete by our M20 bacterial concrete. Hence the cost of construction is reduced.

Through this the concrete with high compressive strength can be manufactured without using more aggregates, water and cement. In bacterial concrete, self-healing process starts when water enters into the cracks and reacts with the bacteria. This reaction produces CaCO_3 , due to hydrolysis of urea in concrete. From this compound one molecule of CO_2 releases due to leaching effect and left CaO which is a main component of cement and there by fill the crack. For old cracks that are in the concrete structures, it can suggest that applying a gel of bacillus subtilis jc3 along with calcium lactate can heal the cracks. Here the cells of bacteria absorb oxygen and water vapor in the air for existence through cellular respiration and emitted CO_2 . This CO_2 reacts with calcium (nutrient medium) and produce calcium carbonate which is called lime stone. Through the process of injecting bacteria solution for cracks this output can be obtained. So using bacillus subtilis jc3 bacteria, healing old cracks internally can be done. And also by using bacteria solution with calcium lactate in the preparation of concrete, the strength can be increased and self-healing process can be increased with low cost.

Discussion

In the construction field, the most upcoming problem is the strength of the concrete using. When a concrete structure was formed after sometime it starts to crack. With the lack of other ingredients for concrete formation, there is a problem in strength. No way to heal the cracks internally in the construction field. People only use cement plastering for this.

For this problem a bacterial solution alone with nutrient medium can use. There are two types: a liquid formation and a gel formation with calcium lactate nutrient medium. No harm as this bacterium is diluted half: half and used. From the beginning of concrete alone with the ingredients the liquid formation of this solution can be used to enhance the strength. For the cracks originated since a long time, a gel form of the solution is there to apply in the crack and within 50-100 days 2mm width crack can be healed completely using this. No harm in case of using this. Ordinary people can use this, as the solution is subjected to a series of diluting process. This is mostly suitable for construction field.

Conclusion and Recommendations

Can enhance the strength of concrete

Can healed internally long term cracks which subject to crack the concrete structures one day

No harm in handling the bacterial solution as it is diluted.

1. A method of healing the old cracks occurred in concrete structures using a gel plaster made up of the bacteria bacillus subtilis jc3 alone with the nutrient medium calcium lactate.

Selecting the relevant concrete structure which has cracks on the surface and applying the gel plaster made up of the bacteria bacillus subtilis jc3 alone with the nutrient medium calcium lactate on the crack. The bacteria cells in the gel plaster absorbs the oxygen in the air with the process of cellular respiration and releases CO_2 in the process of cellular respiration. This CO_2 reacts with Ca in calcium lactate nutrient medium and produces calcium carbonate

which is commonly known as limestone. Then a layer of limestone is precipitated on the crack and healed the cracks internally.

2. A method of healing the old cracks occurred in concrete structures using a liquid solution made up of the bacillus subtilis jc3 and calcium lactate.

The above explained process in claim 01 happens here also.

3. A method of increasing the compressive strength of concrete, curing it in a bacterial solution of bacillus subtilis jc3 alone with calcium lactate.

Curing in water is the normal way of concrete curing. But a concrete structure cured in a bacterium medium, the compressive strength increased gradually. This curing process should be done from 7 days to 28 days.

4. The method of mixing bacteria bacillus subtilis jc3 alone with calcium lactate solution with concrete to increase the compressive strength of the concrete.

Mixing the 30 ml of the above mentioned solution to the concrete cubes of grades M20 (150mm*150mm*150mm) and after 7 days, 14 days and 28 days the compressive strength of M20 concrete cubes have achieved the compressive strength of normal concrete of M25 grade. The slump value of the bacteria mixed concrete is also high and it means the workability of concrete is high. Instead of M25 normal concrete, the bacteria mixed concrete of M20 can be used to have the high compressive strength.

5. Mixing bacteria bacillus subtilis jc3 alone with the calcium lactate solution with concrete to self-heal the cracks occurred in the concrete structures.

Mixing as in claim 4, the concrete cubes are made and the bacteria remain dormant until a crack occurred in the concrete cubes and when a crack occurred the bacteria become active by taking oxygen and water vapor through outside and then the process in claim 1 takes place and selfhealing the cracks. After healing, the bacteria do not over grow because the nutrient medium need for the existence of the bacteria is kept constant and the crack heals and with experiments it was found that for 30ml of solution 10ml of calcium lactate should be used.

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HEALTH SCIENCES

PREVENTION OF TRANSMISSION OF MITOCHONDRIAL DNA DISEASE THROUGH PRONUCLEAR TRANSFER

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Abstract

Mitochondrial DNA disease is a maternally inherited disease caused due to the presence of mutant mtDNA (mitochondrial DNA). Research has been conducted to prevent the transmission of the mtDNA disease by preventing the transfer of mutant mtDNA. Pronuclear Transfer (PNT) is one such therapy to prevent the transmission of mtDNA. At first the technique was tested on abnormally fertilized human zygotes. Following its success the technique was tested on normally fertilized human zygotes. PNT showed a minimal mtDNA carryover of <2%. Two successful births have been reported following PNT. This review article provides an understanding about the mtDNA disease, unpredictable nature of its inheritance and the need to opt for prevention methods in transmitting the disease. An integrated knowledge on the prevention of mtDNA through PNT, its effectiveness and future research are provided.

Keywords

Mitochondrial DNA Diseases, Mitochondrial DNA Replacement Therapy, Pronuclear Transfer

Introduction

Mutations in the Mitochondrial DNA lead to a broad spectrum of disorders which are collectively called as ‘mitochondrial DNA disorders’. These disorders largely affects the organs and systems which are highly dependent on oxidative phosphorylation such as nervous system, heart and skeleton muscles (Hurbert and Turnbull., 2018)

Mitochondrial DNA diseases are maternally inherited. Mutations can occur in two ways, either as heteroplasmic, where both wild - type and mutant mtDNA co- exist or as homoplasmic, where all the mitochondria in the cell are mutated. Severity of the disease is determined by the level of heteroplasmy. Presence of higher levels of mutated mtDNA causes severe conditions whereas presence of low levels of mutated mtDNA (<30%) would not cause any clinical symptoms (Herbert and Turnbull, 2015)

The transmission of mutated mtDNA from a heteroplasmic mother to offspring follows a phenomenon called ‘Genetic Bottleneck’. As a result an unaffected female can give birth to either unaffected, mildly or severely affected offspring (Khan et al., 2015)

Mitochondrial disorders still have no curative treatment and often lead to severe disability and death (Hurbert and Turnbull., 2018). Presently available treatments are mainly aimed at preventing or slowing down the complications of the condition. Currently a women carrying mtDNA disease can consider options such as In vitro fertilization using donor eggs, pre implantation genetic diagnosis and prenatal diagnosis. However these options are not always ideal due to various limitations.

Therefore it is paramount to consider methods to prevent the transmission of the mtDNA disease, from mother to offspring from the birth itself. Currently the scientists have

approached this methodology through Mitochondrial Genome Replacement Technology (MGRT) which replaces abnormal mitochondria with normal mitochondria. MGRT includes three techniques namely Maternal Spindle Transfer (MST), Pronuclear Transfer (PNT) and Polar Body Transfer (PBT).

In this review article the use of Pronuclear Transfer Technique in prevention of mtDNA disease is discussed.

Methodology followed in pronuclear transfer (pnt) and results

After receiving the research license from Human Fertilization and Embryology Authority (HFEA), the research on pronuclear transfer technique was conducted.

Firstly the technique was tested on abnormally fertilized zygotes generated by human IVF. The maternal and paternal pronuclei from the abnormally fertilized zygote were removed. Next an enucleated healthy donor oocyte was taken and the above two pronuclei removed were transferred to the enucleated donor. The pronuclei will be removed along with a small amount of cytoplasm called as the karyoplast. The karyoplast can contain minute amounts of mtDNA.

The pronuclei thus removed were placed under the Zona Pellucida of the healthy donor oocyte. Later the two pronuclei were fused and reconstituted zygote was formed. It was cultured for 6-8 days in vitro.

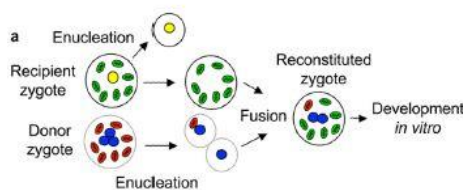


Figure 1: Schematic diagram showing the potential transfer of donor zygote mtDNA to the recipient

Afterwards the microsatellite markers of resultant embryos were analyzed. The analysis confirmed that the pronuclei did not result in any change in the nuclear genotype of the embryo and that the embryos contained only the nuclear genotype of the pronuclear donor.

Following PNT, 8 out of 36 (22.2%) of two pronuclear transfer zygotes developed to 8> cell stage. Furthermore no difference in embryo development at any stage was seen. Following two pronuclei transfer, 8.3 % of embryos developed to blastocyst stage. This amount is approximately 50% of the blastocyst formation rate for unmanipulated abnormally fertilized embryos. (Craven et al., 2010). According to Craven et al (2011) the inability of the remaining 50% to reach the blastocyst stage could be due to the reduced developmental capacity and the considerable variations in the chromosomal constitution in the abnormally fertilized zygotes.

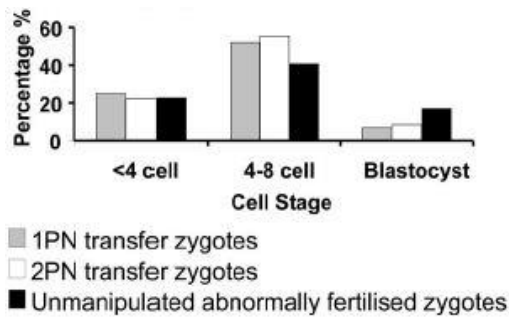


Figure 2: Percentages for the development of zygotes to blastocyst stage (Craven et al, 2010)

Ensuring that the onward development of pronuclear transferred zygotes is possible, next the carryover of the mtDNA of the pronuclei donor in the reconstituted embryo was tested (Craven et al, 2010). Since the karyoplast is also transferred along with the pronuclei, a small fraction of the mtDNA, termed carryover will get into the recipient oocyte. Therefore it is inevitable to transfer pronuclei without any mutant mitochondria (Wolf., 2017)

Next the non-coding mtDNA control region from both the pronuclei donor and recipient were sequenced and it showed polymorphic mtDNA variants unique to donor and recipient. (Craven et al, 2010)

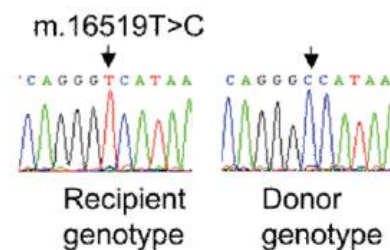


Figure 3: Result of the sequence of non-coding mtDNA in donor and recipient (Craven et al, 2010)

Afterwards, Hot Last Cycle PCR- RFLP assays were performed for the above variants. The results thus obtained showed that there is variation in the amount of mtDNA genotype from the donor zygote which is transferred to the two pro nuclei transfer embryos. This confirms the presence of mtDNA carryover during PNT. (Craven et al, 2010).

Researchers then tried to examine whether the proportion of mtDNA genotype of the pronuclei recipient varies between blastomeres formed from the reconstituted embryo. Accordingly they found that 1/8 embryos had no detectable mtDNA from pronuclei donor zygote. The remaining seven embryos contained various levels of donor mtDNA (Craven et al, 2010)

Table 1: Analysis of levels of donor mtDNA carry-over in individual blastomeres from 8 embryos (Craven et al, 2010)

Development stage	Blastomere number							
	1	2	3	4	5	6	7	8
8-cell	5.7	2.4	nd	nd	nd	nd	nd	nd
8-cell	30.2	11.1	10.8	10.7	10.1	5.1		
8-cell	15.6	5.8	nd	nd				
6-cell	nd	nd	nd	nd	nd	nd		
6-cell	1.1	0.3						
5-cell	10.5	nd	nd	nd				
4-cell	39	18.9	14	8				
4-cell	20	15.7	2.3					

The researchers next took measures to reduce the mtDNA carryover. This was done by carefully manipulating the pronuclear karyoplast and removing the pronuclei with minimum amount of cytoplasm. Afterwards Hot last cycle PCR – RFLP assay were conducted. The assay results showed that 4/9 embryos contained undetectable levels of mtDNA carryover. Also the average mtDNA carryover in all the remaining embryos were <2%. These embryos also showed lesser variations in mtDNA carryover between individual blastomeres. Furthermore these levels of mtDNA variations were equivalent to those seen in unaffected individuals in epidemiological studies (Craven et al, 2010)

Table 2: Analysis of levels of donor mtDNA carry-over in individual blastomeres from 9 embryos following improvements to pronuclear karyoplast removal (Craven et al, 2010)

Development stage	Blastomere number								
	1	2	3	4	5	6	7	8	9
9-cell	11.4	6.1	nd	nd	nd	nd	nd	nd	nd
8-cell	nd	nd	nd	nd	nd	nd	nd	nd	nd
7-cell	8	2.5	1.9	nd	nd	nd	nd	nd	nd
6-cell	4.4	4.5	3.9						
5-cell	11	3.3	3.3	2.4	1.4				
5-cell	nd	nd	nd	nd	nd				
3-cell	nd	nd	nd						
3-cell	nd								
2-cell	5.8	nd							

Having succeeded in PNT with minimum mtDNA carryover in abnormally fertilized zygotes, next steps were taken to test PNT in normally fertilized zygotes.

Surprisingly the normally fertilized zygote did not tolerate the PNT as in abnormally fertilized zygotes. In order to overcome this situation, the researchers followed an alternative strategy where the pronuclei were transferred shortly after they first appeared. Such PNT is termed as early PNT (ePNT)

Accordingly ePNT showed 92% of survival in normally fertilized egg, while the late PNT (LtPNT) showed only 59%. Moreover these zygotes showed normal division to 2 cell stage (Hyslop, 2016)

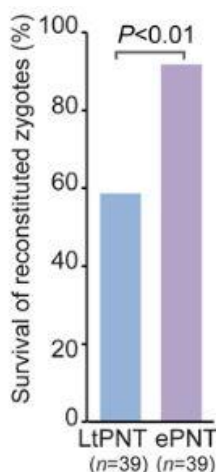


Figure 4: Survival percentages of the ePNT and LtPNT zygotes (Hyslop, 2016)

Following the success of PNT in normally fertilized zygotes, this technique was applied on women carrying mtDNA disease.

In 5th January 2017, a child conceived using PNT was successfully delivered. Another such successful delivery were reported in 19th February 2017 (Rai et al., 2018)

Discussion and conclusion

By following early pronuclei transfer (ePNT), the Pronuclear Transfer technique can be performed in normally fertilized human zygotes. Even though it is inevitable to prevent mtDNA carryover, PNT has the potential to minimize the mtDNA carryover to <2%, thus preventing the transmission of mtDNA disease. Further research has to be done to minimize the mtDNA carryover to less than the current 2% (Craven et al, 2017). To date two successful births upon the use of PNT have been reported.

Some technologies emerged to prevent the transmission of mutant mtDNA are the use of CRISPR/Cas9 system and the use of mitochondria targeted nucleases namely mtZFNs and mitoTALENs which removes mutant mtDNA and reduce the heteroplasmy levels (Craven et al., 2017) However these techniques should be further developed to be allowed in clinical trials (Rai et al, 2018)

If a method can be found to eliminate the mtDNA carryover, transfer of mutant mtDNA can be prevented completely thereby preventing the transfer of mtDNA disease entirely.

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PORK DNA DETECTION IN PROCESSED CHICKEN PRODUCTS AVAILABLE IN THE SRI LANKAN MARKET BY MULTIPLEX-PCR

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Abstract

Species identification in processed meat products has become paramount due to many industrial frauds reported around the world. Hence species identification is essential to ensure the safety of the product, customer's choice and fair-trade. This study aims to detect Pork DNA in processed Chicken products sold in the Sri Lankan market to reveal any frauds or/and contaminations that may take place in the Sri Lankan processed meat industry. Raw chicken, raw pork and processed samples were randomly purchased from the local market. DNA was extracted using TNES high salt method. Extracted sample DNA was subjected to amplify mitochondrial *Cytochrome-B* gene using species-specific primers by multiplex-PCR. One processed sample amplified both chicken and pork bands. Other samples only amplified the chicken band. In this study, amplification of the pork band in one product significantly indicate such frauds or/and contaminations do occur in processed chicken products in Sri Lanka.

Key words – Contamination, Detection, Industrial frauds, Multiplex-PCR, Processed meat, Species identification

Introduction

Species-identification in processed meat products has become a major necessity due to the abundance of frauds reported. Due to the rapid urbanization and industrialization, there is a high demand for processed meat. Lowering of prices, less availability, constant unhealthy competition in the meat industry leads to various frauds such as adulteration, contamination, meat falsification and false labelling. Processed meat is more prone to such frauds for economical purposes as the ingredients are unable to be distinguished by visual properties. Considering the frauds reported from all over the world, high demand for transparency, food authentication and to ensure the consumers' choice, inspections and surveillance on processed meat have become a must. Regrettably, Sri Lanka has less availability in reliable methods for regular routine inspections in species analysis for processed meat. Hence, determining the species in Sri Lankan processed meat products must be carried out immediately to reveal any frauds that might have been occurring without the public's knowledge. This study aims to detect pork DNA in processed chicken products sold in the local market using species-specific multiplex-PCR to reveal any substitution, mislabelling, frauds etc.

Methodology

Sample Collection

Authentic meat samples of chicken (*Gallus gallus*), pig (*Sus scrofa*) as positive controls and five different processed chicken products were randomly purchased from the local supermarket. All the processed samples were given codes as CHK1, CHK2.....CHK5. After collection, the samples were stored at -20°C till the experiment.

DNA Extraction

Both raw and processed meat DNA was extracted using TNES high salt extraction method. The samples were homogenized using individual autoclaved motor and pestles and 1mg of sample was transferred to a 1.5ml microcentrifuge tube. 600µl TNES lysis buffer and 40µl of 20%w/v SDS was added and vortexed for 30 seconds. 2µl and 5 µl of 20mg/ml proteinase K was added to raw and processed samples respectively. The whole mixture was then incubated at 65°C for one hour. Then 150µl of 6M NaCl was added and vortexed for 30 seconds. The tube was centrifuged for 10 minutes at 10,000 rpm. If the supernatant had high amounts of protein, the supernatant was carefully transferred to a new microcentrifuge tube and 100µl protein precipitation solution was added. The tube was vortexed for 2 minutes and centrifuged for another 5 minutes at 10,000 rpm. 500µl supernatant was then carefully transferred to a new microcentrifuge tube and an equal amount of isopropanol was added and mixed by slightly inverting the tube. Then the tube was incubated at -20°C for 20 minutes. The mixture was centrifuged at 13,000rpm for 5 minutes and the supernatant was discarded. 300µl of 70% ethanol was added and the mixture was centrifuged for 2 minutes at 13,000 rpm. The supernatant was removed and the pellet was air dried. The pellet was then dissolved in 100µl of distilled water and stored in -20°C till further processing.

Detection Of The Isolated Genomic DNA After The Extraction

The extracted DNA quality was determined by 1.5%w/v agarose gel electrophoresis in 0.5M TBE buffer and stained with 50µl of ethidium bromide. The gel was run at 100V for 1 hour and visualized under UV light. The digital image was obtained.

Oligonucleotide Primers

The oligonucleotides for this experiment were obtained from the study(Matsunaga *et al.*, 1999).

Table 1: Species-specific oligonucleotide primers and expected amplified segment length

Primer name	Primer sequence	Product size
Chicken(Forward)	5'-GGGACACCCTCCCCCTTAATGACA-3'	266bp
Chicken(Reverse)	5'-GGAGGGCTGGAAGAAGGAGTG-3'	
Pork(Forward)	5'-ATGAAACATTGGAGTAGTCCTACTATTACC-3'	149bp
Pork(Reverse)	5'-CTACGAGGTCTGTTCCGATATAAGG-3'	

Multiplex-PCR Assay

For the purpose of simultaneous detection of each species, a single step multiplex-PCR was developed. The amplification was carried out in a 25µl of total reaction volume containing 2.5µl of 10x DreamTaq Green Buffer (including MgCl₂), 0.5µl of 10mM DNTP, 1µl of 10µM chicken and 1µl of 10µM pork primer, 0.2µl of 5U/µl DNA Taq polymerase and 3µl of extracted DNA. The assay was performed in a 270 thermal cycler using the following conditions; initial denaturation at 94⁰C,3 minutes; 30 cycles at 94⁰C,40 seconds, 63⁰C,40 seconds, 72⁰C,40 seconds, final extension at 72⁰C,4 minutes. Positive and negative controls were included. The thermal cycle conditions are illustrated in Fig.1.

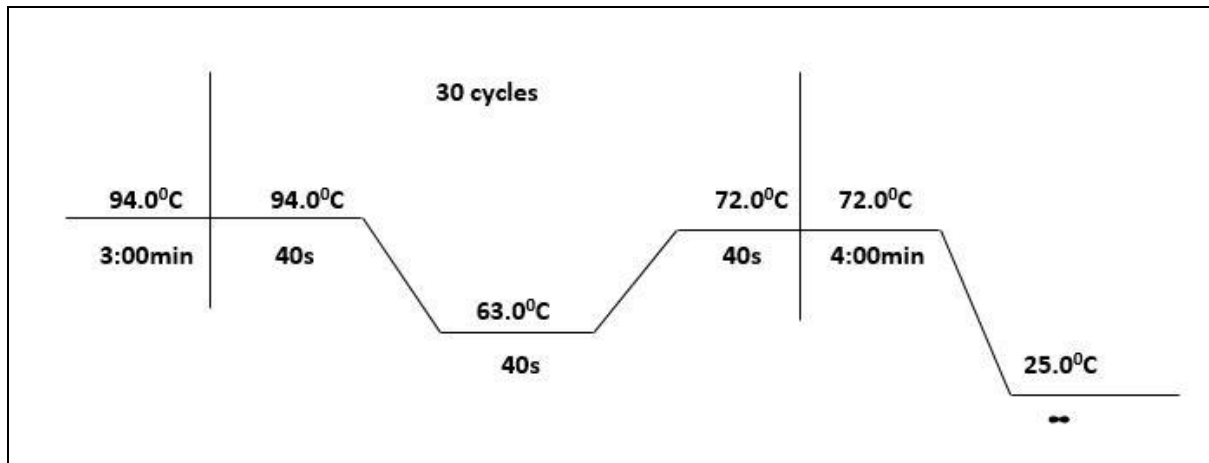


Figure 1: Graph of the PCR reaction

Detection of Amplified PCR Products

Amplified PCR products were analysed by 2.0%w/v agarose gel electrophoresis in 0.5X TBE buffer and stained by 100µl of ethidium bromide. 50bp DNA ladder was used as the molecular weight marker. The gel was run at 100V for 60 minutes.

Results

Detection of The Isolated Genomic DNA

The gel image showed good genomic bands indicating the protocol has yielded a good amount of genomic DNA in both raw and processed samples (Figure 2).

Multiplex-PCR Assay

Multiplex-PCR assay was successfully performed amplifying 266bp, chicken and 149bp, pork DNA fragments. All the PCR products resulted in clearly visible single bands of expected sizes. Raw chicken and pork samples were used as positive controls and were run separately in the gel. A combined sample of chicken and pork DNA was also run in the same gel to validate the multiplex PCR. Out of five processed chicken products, CHK2 amplified the pork 149bp band along with the chicken 266bp band indicating a contamination with pork. Positive and negative controls were run alongside and gave the expected results (Figure 3).

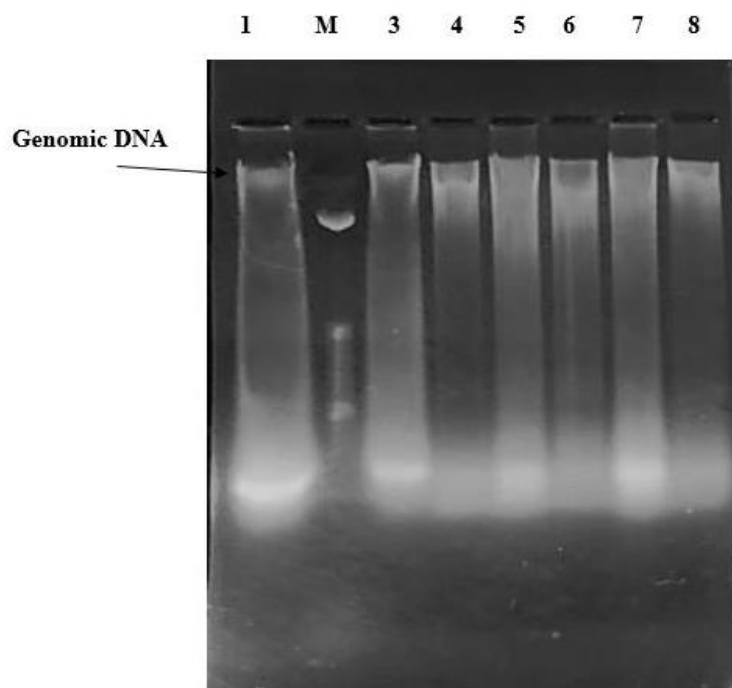


Figure 2: Gel diagram depicting extracted genomic DNA; Lane1 raw pork, Lane2 50bp DNA ladder, Lane3 raw chicken, Lane4 CHK1, Lane5 CHK2, Lane6 CHK3, Lane7 CHK4, Lane8 CHK5

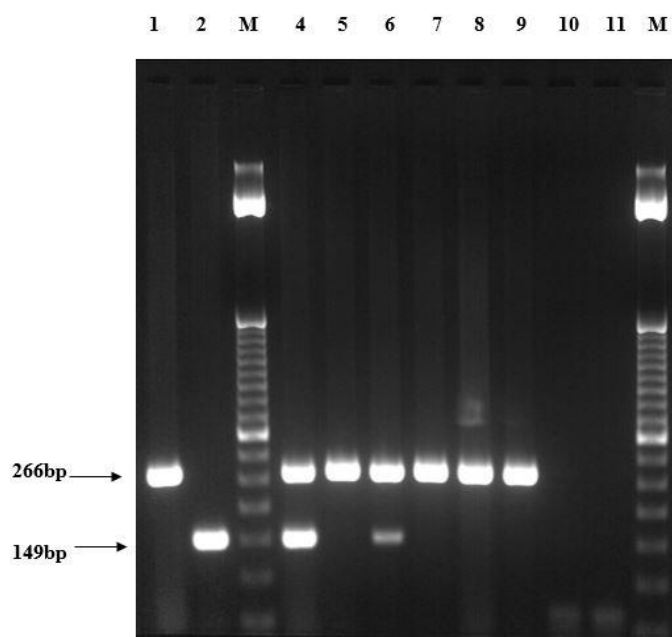


Figure 3: Gel image depicting Multiplex PCR analysis; Lane1 raw chicken, Lane2 raw pork, Lane3 50bp DNA ladder, Lane4 combined sample of raw chicken and raw pork, Lane5 CHK1, Lane6 CHK2, Lane7 CHK3, Lane8 CHK4, Lane 9 CHK5, Lane10 Negative extraction, Lane11 Negative PCR reagent, Lane 12 50bp DNA ladder

Discussion

In this study, out of five processed chicken products, one product amplified the pork band along with the chicken band indicating a pork DNA contamination. The result suggests these frauds or/and contaminations could be happening in Sri Lanka as well. But pork band amplified in the CHK2 product has a significantly lesser intensity compared to the amplified chicken bands suggesting it has a more chance of being an accidental contamination or/and unhygienic conditions rather than intentional commingling or other frauds. The indication of pork could be because meat products from various animals are prepared in similar meat plants and due to accidental and coincidental blending of trace amounts of one meat type or meat items with another during handling and processing. Regardless of whether intentional or accidental, the impacts of mislabelling incorporate customer deception, potential health dangers and the failure of consumers to purchase items based on their religious and moral convictions (Hubner, 2016). Labelling is one of the most essential methods for correspondence among producers and customers. Poor hygienic conditions can also lead to contamination of various types of meats (Keyvan, Kul and Tansel, 2017). Assessment of meat for meat borne pathogens which can cause illnesses of the general public is significant. Due to limitations in protein-based methods such as denaturation of proteins owing to high temperatures, pressure, vigorous conditions involved in processed meat, they result in less sensitivity and specificity. Hence they are considered be less reliable in assessing processed meat products. In contrast to protein, unique properties of DNA such as higher stability in grotesque environment and conditions used in meat processing, thermo-stability and even, ubiquity presence prove DNA to be more applicable in species identification. Compared to the existing methods, multiplex-PCR is highly significant as it allows the amplification of two or more targeted regions simultaneously in the same reaction allowing the detection of multiple species in a mixture. It is cost effective and time efficient making it ideal for industrial meat species identification. As the nucleotide sequencing technology is rapidly developing, multiplex-PCR is refining to be a more accurate, robust and affordable.

Conclusion

This study demonstrated multiplex-PCR method to be a powerful tool for species identification, to detect frauds and food traceability. The study further stipulated the possibility of such frauds or accidental commingling occurring in the Sri Lankan processed meat industry. More studies with increased number of samples are recommended to obtain a broader notion about possible frauds in Sri Lankan processed meat industry.

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EFFECTIVENESS OF IMMUNOTHERAPY IN CANCER TREATMENTS: USE OF NK CELLS

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Abstract

Malignancy diseases represent the leading cause of deaths worldwide mainly owing to the limited efficacy of current anticancer therapies. Although immunotherapy is rendering promising results in cancer treatments, many adverse events and factors hampering therapeutic efficacy, especially in solid tumors and metastases still need to be solved. Furthermore, immunotherapeutic strategies have mainly focused on modulating the activity of T cells, and Natural Killer (NK) cells have only recently been taken into consideration. NK cells represent an attractive target for cancer immunotherapy due to their innate capacity to eliminate tumor cells in a non-Major Histocompatibility Complex (MHC) and non-tumor antigen-restricted manner. In this review the efficacy of the NK cell based immunotherapy in human cancer treatments are analyzed together with their role in elimination of cancers and future prospects of use NK cells as a therapeutic agent to treat cancers.

Key Words: Cancer, Immunotherapy, NK Cells

Introduction

Cancer is a rising problem all over the world. According to the International Agency for Research on Cancer (WHO), the global cancer burden is estimated to have risen to 18.1 million new cases and 9.8 million deaths in 2018. Therefore, development of an effective treatment strategies to eliminate cancers are urgently needed. In past few decades, the recent major scientific advances demonstrated the importance of immunotherapy, targeted therapy and hormonal therapy in cancer treatments.

Cancer immunotherapy is an appealing alternative strategy to prevent tumor growth that includes therapies to induce either potent passive or active antitumor response against malignancies by upgrading the power of immune system (Cheng *et al.*, 2013). Adequate immune responses can eliminate tumor cells and when the immune responses are inadequate, tumor growth and immunosurveillance enter into a dynamic balance until tumor cells evade immunosurveillance, at which point neoplasm occur clinically as a consequence. Adoptive NK cell transfer has made a great promise in cancer immunotherapy over past three decades. NK cells have made as an important tool of cancer treatments through better understanding of their functions and progression in the NK cell biology field.

NK cells were first identified in 1975, as granular lymphocytes that are larger than T and B lymphocytes. These distinctive granulocytes of NK cells' contain both perforin (a membrane disrupting protein) and granzymes (a proteolytic protein family), which are responsible for NK cell mediated killing (Sanapala *et al.*, 2012). The precursors of NK cells are still not characterized yet in humans. Matured NK cells comprise more than 18% of all peripheral blood lymphocytes (Merkt *et al.*, 2015). NK cells are able to kill particular cells without prior sensitization. They are also potent to produce various cytokines, such as IFN- γ , TNF- α , GM-CSF, and IL-3 (Perussia, 1991).

All types of NK cells express surface receptors (NK cell receptors -NKR). NKR can be classified as inhibitory receptors and activating receptors and NK cell functions are tightly regulated by a balance between these activating and inhibitory receptors. NK cells are able to recognize and spontaneously kill stressed cells including cancer cells, through these immune receptors. Cancer cells potent to initiate effector functions of NK cells including cytotoxicity, cytokine production and proliferation, either through lack expression of self-identifying molecules like major histocompatibility complex (MHC) class 1 that binds to inhibitory receptors on NK cells or by up regulating the expression of ligands for activating receptors on NK cells that can overcome the inhibitory signals (Raulet *et al.*, 2014).

Methodology

In this review article, numerous research articles, review articles, websites, journals, and e-books that are related to cancer treatments and NK cell based immunotherapy were referred as the sources and their results, and research procedures were compared and contrasted while highlighting the advantageous, disadvantageous and risk factors are.

Results and Discussion

Adoptive transferring of ex vivo expanded and activated autologous NK cells has been clinically evaluated for cancer immunotherapy and was found to greatly improve clinical responses without any significant side effects in metastatic RCC, malignant glioma and breast cancer patients. However, these autologous NK cells were unable to exhibit their maximum cytotoxic capacity in vivo and were not consistently effective in cancer patients and that can be due to MHC-1 expression in cancer patients that suppress autologous NK cells in vivo. Moreover endogenous NK cells do not consist with sufficient capability to combat advanced tumor cells. When LAK cells were adoptively transferred into cancer patients in combination with high IL-2 doses poor clinical outcome was observed as patients experienced life-threatening toxic side effects such as vascular leak syndrome (Cheng *et al.*, 2013). More success was achieved when adoptively transferred IL-2 activated NK cells rather than administering IL-2 systematically.

Indeed, strategies using adoptively transferred human-mismatched (haploidentical) NK cells have been more successful for cancer immunotherapy, including against leukemia, and solid cancers. It has been shown to be safer with minimal toxicity. They are able to expand in patients with various malignancies including metastatic melanoma, renal cell carcinoma, Hodgkin's disease and poor-prognosis AML. A disadvantage of this approach is using KIR mismatched allogenic NK cells eventually led to immune-mediated rejection due to MHC mismatch (Cheng *et al.*, 2013).

According to the clinical data mentioned above, it is evident that overnight or short-term activation of NK cells is not sufficient for phenotypic and functional recovery of the malignancies (Sutlu and Alici, 2009). The data on infusion of autologous NK cells presented above reveal that it may be more efficient with long-term ex vivo activated NK cells. Corroborating this hypothesis, long-term expansion and activation of autologous NK cells from multiple myeloma patients provide significantly superior cytotoxic ability relatively to short-term activated autologous NK cells. Moreover, the high level of IL-2 expression in long-term expanded NK cells, as compared with endogenous NK cells and short-term

activated NK cells, may provide a higher benefit from subsequent IL-2 administration to the patients.

There are several challenges that must be overcome to optimize the use of NK cells in cancer therapy, including blocking the inhibitory receptors that prevent the activation of NK cells, eliminating T regulatory cells that suppress the activity of NK cells, enabling NK cells to traffic into tumors, neutralize the cytokines (TGF β) that are immunosuppressive and secreted by tumor cells, eliminate myeloid-derived suppressor cells, and supply cytokines and growth factors that are required for NK cell proliferation, activation and persistence. In addition, overcoming the tolerance mechanisms used by NK cells to do no harm to self, also remains as an important challenge (Morvan and Lanier, 2016).

Pre-clinical and clinical data clearly indicates that NK cell infusions in allogenic and autologous setups are safe with possible anti-tumor effect. However, further investigations are required to fine-tune and select an optimal NK cell therapy scheme. All reviewed approaches, including endogenous modulation of NK cells and adoptive transfer seem to be feasible and efficacious and provide evidence to that one scheme will not be suitable for all malignancies and therefore, all possible approaches need to be evaluated. In adoptive transfer settings of NK cells, there is a NK cell dose dependent response (Morvan and Lanier, 2016). Furthermore, monoclonal antibody based targeted therapies clearly indicate that NK cells are one of the main effector components exerting ADCC and thus clearing tumor cells.

Conclusion

NK cells based immunotherapy in cancer basically aim to improve the antitumor activity of the NK cells through activating endogenous NK cells and promoting their proliferation in patients. Obtaining a sufficient number of NK cells for cancer immunotherapy is critical in clinical protocols. Therefore the number, purity and state of NK cell proliferation and activation can be considered as the key factors. Thus large number of highly cytotoxic NK cells can be generated under conditions that meet regulatory and clinical requirements for cell therapy.

NK cells may be also used in combination with other treatment settings, potentially leading to synergistic antitumor activities. There are many questions and practical issues regarding the NK cell based immunotherapy in cancer. Standardization of protocols will be necessary to allow for future comparisons between different trials. The requirement for good quality clinical trials cannot be over-emphasized. NK cells may have a promising role in immunotherapy against certain human cancers, both alone and in combinations with other therapies. Thus studies within the field on NK-cell-based immunotherapy should be encouraged.

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EFFECT OF NICOTINE ON BRAIN'S FUNCTIONAL CAPACITY: MEMORY AND COGNITION

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Abstract

Tobacco smoke is a toxic, complicated, dynamic and carcinogenic mixture. This article suggests that exposure to nicotine can be neurotoxic & effects to the human brain functional capacities such as memory and cognition. The studies were undertaken to know the effect of cigarette smoke on cognitive functions in young healthy adults. Numerous tests were done to show evidence of acute and chronic effects of tobacco smoking on cognition and memory in smokers, ex-smokers and non-smokers. The discoveries show that nicotine may impact in cognitive domains, for example working memory, might be either long-term effects or etiological factors related to smoking. Therefore young adult smokers should quit cigarette smoking. Response time was quickest in never-smokers and slowest in smokers. The chronic exposure to nicotine has a deleterious effect on working memory.

Key Words: Tobacco Smoking, Memory, Cognition

Introduction

Tobacco smoke is a toxic, complicated, dynamic & carcinogenic mixture of over 5,000 chemical substances. This poisonous and carcinogenic combination might be the most common source of poisonous chemical exposure and chemically-mediated illnesses in people. The WHO estimates that 5.4 million untimely deaths are because of smoking around the sector (Talhout *et al.*, 2011). The World Health Organization has estimated that 1.5–1.9 billion people worldwide will be smokers in 2025. Cigarette additives apart from tobacco are commonly called "components", even as the time period "additive" is used for substances. Ingredients may be labeled as carcinogenic and non-carcinogenic ingredients

Nicotine (C₁₀H₁₄N₂) is not carcinogenic. Smokers experience severe distress when attempting to trouble quit because they are addicted on nicotine (called withdrawal symptoms). Nicotine is an incredibly fast-acting medication. It reaches the brain within 15 seconds of breathing in. It is a totally toxic alkaloid which, in pure form, is a colorless, pungent and oily liquid with a stinky flavor. It is a constituent of tobacco and it's also produced synthetically. Although nicotine is notably toxic, the quantity inhaled whilst smoking is too small to result in death. It also acts as a vasoconstrictor. It is the prototype agonist of nicotinic cholinergic receptors, in which it substantially stimulates neurons and in the end blocks synaptic transmission (Fowles *et al.*, 2000).

Furthermore, past studies has shown that tobacco smoke has neurotoxic impacts and is related to an expanded danger of cognitive impairment. In any case, the effect of cigarette smoking on cognitive performance has remained contradictory.

Methods and Results

Study 01

In 2001, Ernst *et al.*, conducted a study using Forty-one adults, 14 smokers, 15 ex-smokers, and 12 never-smokers. Information from just 38 members was analyzed, because three never-

smokers experienced severe nausea after receiving nicotine. Inclusion criteria were age somewhere in the range of 21 and 45 years, IQ>85 and right-handedness. Smokers revealed a smoking history of at any rate 2 years, currently smoked in excess of 20 cigarettes/day, and had a score>5 on the Fagerstrom Test for Nicotine Dependence (range 0–10) . Ex-smokers revealed a history of past exposure to nicotine (≥ 5 cigarettes in lifetime), but no present smoking (nicotine abstinence for at least 2 weeks and no evidence of nicotine dependence for at least 3 years before the study). Never smokers smoked less than five cigarettes in their lifetimes (Ernst *et al.*, 2001).

Cognitive tasks

Reaction time is the critical variable assessed in this study. The study indicates that nicotine tends to influence reaction time, but not accuracy (Table 3). The factors analyzed for these analyses were Group (smokers, ex-smokers, never-smokers) and Session (nicotine, placebo). Two of these undertakings, the Two-Letter Search Task and the Logical Reasoning Task, were chosen as a result of their reported sensitivity to nicotine withdrawal and subsequent acute nicotine administration (Ernst *et al.*, 2001).

Table 1. Mean and Standard Deviation (SD) of Reaction Time (ms) and Accuracy on the Four tests performance

	Smokers (n=14)		Ex-smokers (n=15)		Never-smokers (n=9)	
	Placebo	Nicotine	Placebo	Nicotine	Placebo	Nicotine
Two letter search						
Reaction time	5055.1	4668.2	4942.6	4659.2	5172	4836.7
SD	1889.1	1443.2	1534.9	1530.4	1936.4	1809.2
Logical reasoning						
Reaction time	4358	4619.5	4619.7	4484.7	4612.2	4554.3
SD	1523.6	1397.7	1605.6	1469.3	1335.5	1402
Two-Back						
Reaction time	559.4	570.1	508.1	499.3	454	440.9
SD	103.8	108.5	115.7	118.8	83.7	73.3
Three-Back						
Reaction time	603.9	590.4	515.6	523.6	492.9	471.8
SD	111.7	120	153.2	155	108.4	52.6

Two-Letter Search Task

Investigation of the mean response time demonstrated no significant Group $\times$ Session interaction but a significant main impact for Session [$F(1, 35) = 8.6, p = .006$], reflecting shorter response time in the nicotine session (mean $\pm$ SD: 470.5 $\pm$ 152.7 ms) than in the placebo treatment session (mean $\pm$ SD: 503.8 $\pm$ 172.2 ms). Primary impact of Group was not significant.

Logical Reasoning Task

Analysis of reaction time showed no significant interactions or main impacts.

N-Back Tasks

In both Two-Back and Three-Back undertakings, the Session $\times$ Group interaction and main impact of Session were not significant. In any case, the main impact of Group was significant

for the Two-Back Task [$F(2, 35) = 3.7, p = .036$] and at a pattern level for the Three-Back Task [$F(2, 35) = 3.20, p = .06$]. In the two tasks, response time was longest in smokers (mean $\pm$ SD: Two-Back 564.8 ± 102.4 ms; Three-Back 597.2 ± 100.3 ms), shorter in ex-smokers (mean $\pm$ SD: Two-Back 503.7 ± 115.6 ms; Three-Back 519.6 ± 145.6 ms), and shortest in never-smokers (mean $\pm$ SD: Two-Back 447.5 ± 76.5 ms; Three-Back 482.3 ± 77.0 ms).

Study 02

In 2017, Alhussien conducted two tests using of two groups. The smoking group consisted of 22 male volunteers, with a mean age of 24.4 ± 5.30 (Mean $\pm$ SD) years who were considered as regular cigarette smokers for at least 1 year and who smoked at least 1 cigarette per day. These 22 cigarette smokers were matched with a group of 30 non-cigarette smokers (control) who had never smoked, who were healthy male volunteers with mean age 23.31 ± 2.68 (Mean $\pm$ SD) and were matched with the smoking group for age, sex, ethnicity, and socioeconomic status. This control group primarily consisted of university students, as well as technicians, secretaries, research assistants, and receptionists in Saudi Arab (Alhussien *et al*, 2017).

Attention-switching task (AST)

AST measured the participants' ability to switch attention between the direction of an arrow and its location on the screen and to ignore task-irrelevant information in the face of interfering or distracting events. This test was designed to measure top-down cognitive control processes involving the prefrontal cortex. This test is a sensitive measure of frontal lobe and 'executive' dysfunction. The test displayed an arrow, which can appear on either side of the screen (right or left) and can point in either direction (to the right or to the left) (Alhussien *et al*, 2017).

Pattern recognition memory (PRM)

This is a test of visual pattern recognition memory in a 2-choice forced discrimination paradigm. A sequence of visual patterns was presented in the center of the screen. These patterns were designed so that they cannot easily be given verbal labels. In the recognition phase, the participants were required to choose between a pattern they had already seen and a novel pattern (Alhussien *et al*, 2017).

Table 2. Comparison of cognitive functions between smoking groups compared to their matched control group.

Parameters	Control groups	Smoking Groups	p-value
AST-Latency	411 $\pm$ 58.3	591 $\pm$ 128.3	0.001
AST-Congruent	393 $\pm$ 51.3	525 $\pm$ 1128.9	0.001
AST-Incongruent	430 $\pm$ 70	619 $\pm$ 137.8	0.001
PRM	91.8 $\pm$ 7.9	88.5 $\pm$ 7.4	0.101

There was a decline in the cognitive function parameters, including AST-Latency; 411 $\pm$ 58.3 in the control group vs. 591 $\pm$ 128.3 in smokers ($p=0.001$); AST-Congruent in control group was 393 $\pm$ 51.3 vs. smokers 565 $\pm$ 128.3 ($p=0.001$); AST-Incongruent in control 430 $\pm$ 70 vs. smokers 619 $\pm$ 137.8 ($p=0.001$); PRM control 91.8 $\pm$ 7.9 vs. smokers 88.35 $\pm$ 7.4 ($p=0.101$) (Alhussien *et al*, 2017). Figure 1 shows that comparison of cognitive function of smokers and control group within a bar graph.

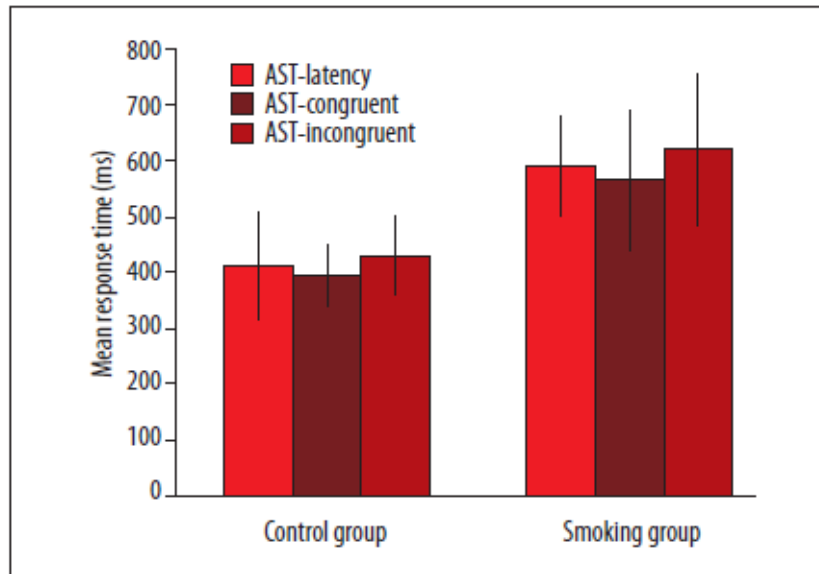


Figure 15 Comparison between cognitive function of smokers compared to their matched control group for attention-switching task (AST) latency, AST congruent & AST incongruent conditions (Alhussien *et al*, 2017).

Study 03

In 2019, Pushpa & Kanchana, conducted a study using 60 subjects of age group 18-30 years of smokers and non-smokers of Tumakuru. Study gathering included 30 smokers with <10 pack years. Smoking pack-year was determined utilizing the formula (Number of cigarettes smoked every day × Number of years smoked)/20. Control group included age, sex, and education level coordinated 30 non-smokers. Subjects were clarified about the protocol of the investigation and written informed consent was taken. Subjects were asked to refrain from consuming caffeine for 3 h before the examination. The examination was held between 9:30 am and 11:30 am toward the beginning of the day. Comprehension areas evaluated were psychomotor speed – Digit Symbol Substitution Test, Sustained attention – Digit Vigilance Test, Executive functions (fluency and working memory) – Category Fluency Test, and Verbal N-back test, separately (Pushpa and Kanchana, 2019).

Digit Symbol Substitution test

This is the test for continued consideration and reaction speed. Quick processing of data is expected to substitute the images accurately and rapidly. A hundred numbers were randomly printed out on a paper. The subjects were inquired to draw a circle over even numbers and a triangle over odd numbers. The time (in a seconds) taken to substitute an image for the majority of the 100 digits were noted (Pushpa and Kanchana, 2019).

Digit Vigilance test

In this test, numbers 1–9 were randomly organized with 30 digits for every line and 50 rows on the sheet of paper. Every one of the digits was set in all respects intently. The subject needs to concentrate just on the objective digits 6 and 9 and needs to drop these digits as quickly as possible without leaving the objectives or dropping numbers incorrectly. The time is taken (in a moment or two) to finish the test frames the score (Pushpa and Kanchana, 2019).

Category Fluency test

In this test, subjects were asked to create the names from whatever number of animals as could be expected under the circumstances in 1 min. Subjects were asked to avoid the names of fish, snakes, and birds. The quantity of names produced shaped the score of the test (Pushpa and Kanchana, 2019).

Verbal N-Back test

The study included 60 subjects Group A – 30 smokers and Group B – 30 non-smokers. Subjects in both the groups were well matched with respect to age ($P = 0.761$), Body mass index (BMI) ($P = 0.842$), and education ($P = 0.943$). Smokers performed poorly at tasks that measured psychomotor speed ($P < 0.001^{**}$) and sustained attention ($P < 0.001^{**}$) as compared to non-smokers. (Table 3) There were no significant changes in tests measuring executive functions – Category Fluency Test ($P = 0.781$) and Verbal N-Back test ($P = 0.911$) between smokers and non-smokers (Pushpa and Kanchana, 2019).

Table 3. Comparison of cognitive test scores of smokers & non-smokers

Cognitive tests	Smokers	Non-smokers	P-value
	Mean $\pm$ SD	Mean $\pm$ SD	
DSST (s)	147.35 $\pm$ 28.32	128.17 $\pm$ 14.6	0.001 ^{**}
DVT (s)	171.34 $\pm$ 27.21	133.28 $\pm$ 9.87	0.001 ^{**}
Category fluency	12.06 $\pm$ 1.44	12.27 $\pm$ 1.21	0.781
Verbal N-Back	8.31 $\pm$ 0.79	8.47 $\pm$ 0.81	0.911

Results and Discussion

Smokers performed poorly at tasks that measured psychomotor speed and sustained attention as compared to non-smokers. The results show that young adult smokers should quit cigarette smoking. Prevention of early cognitive impairment in smokers has to be the top priority so as to reduce the public health burden globally (Pushpa and Kanchana, 2019).

Compared to non-smokers, middle-aged smokers experienced faster cognitive decline in global cognition and executive function. In ex-smokers with at least 10-year cessation there were no adverse effects on cognitive decline (Sabia *et al.*, 2012).

Overall, the regions activated during performance of the working memory according to PET (Positron emission tomography) and functional MRI (magnetic resource energy) is dorsolateral prefrontal, anterior cingulate, and inferior parietal areas (Arbor, 1998). Functional link of prefrontal cortical activation with task performance, accuracy was better as activation was stronger in the prefrontal cortex in both ex-smokers and smokers. Regional differences in activation were seen between ex-smokers and smokers during placebo, especially regarding hemispheric lateralization. While ex-smokers demonstrated enactment activation in the left hemisphere, smokers indicated activation in the right hemisphere (Ernst *et al.*, 1998). Smoking increases cognitive decline and cessation of smoking decreases the

rate of cognitive decline in later life. Loss of gray matter density in the thalamus and frontal cortex may contribute to the compromising of attention, memory and executive functions (Almeida *et al.*, 2011).

Conclusion

Smoking causes pathophysiological changes in the brain, (Mazzone *et al.*, 2010) including oxidative damage, an inflammatory response, atherosclerotic lesions, thrombotic lesions, interrupts the blood-brain barrier and disrupts cell junctions. In addition, cigarette smoke alters brain structures such as the thinner frontal cortex frontal aberrations of the gray matter and decreased insulation functional connectivity between the orbitofrontal cortex, Upper frontal gyrus, temporal lobe and insula (Zhos *et al.*,). Smoking also leads to changes in blood counts and decreases the cerebral flow in the anterior, middle and posterior cerebral brain the arteries. Cytotoxic compounds present in cigarette smoke including carbon monoxide, ketones, aldehydes, nitrosamines, and dihydroxybenzenes can alter neuronal and cellular functions membrane function of the cerebral hemisphere. In addition, cigarette smoke contains higher levels of free radical species that promote oxidative damage to neuronal cell anatomy and physiology (Glutathione *et al.*, 2003). All of these factors could contribute to cognition impairment in smokers. Individuals are at increased risk cognitive decline and dementia later in life (Song *et al.*, 2017).

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THE CONNECTION BETWEEN SCHIZOPHRENIA AND HALLUCINATIONS

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Abstract

Schizophrenia is often a specific reaction to severe anxiety. When continuous incidents of trauma occur, it could lead to a severe form of schizophrenia. Hallucinations occur due to an absence of external stimuli; this is said to be one of the core symptoms of schizophrenia. The main types of hallucinations that involve with schizophrenia are auditory hallucinations and visual hallucinations. Schizophrenia mainly falls into paranoid schizophrenia; it also has negative and positive symptoms. Treatment such as cognitive behavioral therapy, electro convulsive therapy; small electrical currents are passed on to the brain resulting in a seizure which has shown to eradicate symptoms for a short period of time, and drug treatment can be used to control the symptoms for schizophrenia. Hopefully, in the future, this illness can be viewed differently and supporting these patients equally in society.

Keywords: Antipsychotic Drugs, Hallucinations, Paranoia, Schizophrenia, Trauma

Introduction

In the olden days, hallucinations were thought to be different forms of demons or angels. In some cultures, the community still assume they could be a work of a supernatural spirit. Hallucinations are images that are seen by the patient but they have little control over them. This condition usually occurs in the elderly. Also, sometimes the patients are reluctant to admit they are hallucinating as they will be labeled as mentally unstable. Hallucinations occur as sensory stimuli are absent; they are also completely different from illusions which are distortions. This is said to be one of the core symptoms of schizophrenia (Menon *et al.*, 2003).

Hallucinations can affect the vision, sense of smell, taste, hearing, or bodily sensations. It can be categorized as visual hallucinations and auditory hallucinations. Visual hallucinations can affect people who are going to sleep and also other pathological states where their sleep is disturbed. These hallucinations are described involving seeing bright animals and human figures in bright colors even during the day completely awake. Auditory verbal hallucinations are voices that are present but in the absence of an external stimulus. They are also one of the main symptoms of schizophrenia (Dierks *et al.*, 1999). It's been diagnosed and shown that alterations in the connectivity between the frontal and parietotemporal speech related areas may be the cause of auditory hallucinations (Hubl, 2004). As a result of reality discrimination, inner speech is mistaken for a real event. These can interfere with their self-generated thoughts and memories (Johns, 2001). Schizophrenia is a mental disorder that could affect a person's life. There are many triggers, one of the results is stress, mainly due to traumatic incidents. These people tend to lose reality, having hallucinations and delusions. Paranoid schizophrenia is a kind of psychosis, which means the mind doesn't agree with reality. This can show up in different ways and at different times, even in the same person (Goldberg, 2019). The symptoms can be divided into two parts known as positive and negative. Positive symptoms are experiences that are not real such as hallucinations. Negative

symptoms are when the patient loses motivation and lack of emotion (Andreasen and Olsen, 2015).

Methodology

Case 1

Schizophrenic Disorder in A Nigerian Family

Miss. P is a 49-year old woman, who is single and unemployed. She was first diagnosed with a psychiatric disorder at the age of 23. Six months later she stopped taking her prescribed medications, thinking it would result in side effects (Omoaregba *et al.*, 2009).

She experienced disturbances in her sleep, where she would laugh loud for no reason and respond to questions asked her by relatives with irrelevant answers. She often remained indoors, would not associate with her family members. She believed that she had been instructed through visions to 'keep by herself pure and stay in isolation till Christ comes' that she had been the 'wife of Jesus the Christ', and She declined meals prepared by her mother believing it's been poisoned (Omoaregba *et al.*, 2009).

Mrs. Y is a 40-year woman that is old who's separated from her husband and unemployed. She explained that whenever she had tried working, the co-workers she would facilitate financially became jealous and would plot to kill her. She could not justify or give proof of how these individuals tried to hurt her. She admitted to hearing voices that advise her 'to fulfill her calling as a priestess,' these voices additionally discuss among themselves saying 'she would be a good person given that she obeys the call' (Omoaregba *et al.*, 2009).

She was unable to take care of her children and would alone leave them in her home for several times while she went about her 'job' being a priestess. She was agitated during the interview, her concentration and attention were poor, and she lacked insight (Omoaregba *et al.*, 2009). The family included two sisters they are Miss. P and Mrs. Y, there was no mental illness in their medical history records. Both the sisters were diagnosed to have paranoid schizophrenia. Miss P was given clozapine with a dosage of 450mg a day. This improved her mental state and she started having better social interaction and her hallucinations decreased (Omoaregba *et al.*, 2009).

Miss. Y was treated with trifluoperazine 20 mg a day. She still did not alter her beliefs. Her mom insisted if she continued to practice as a priestess that y would not be allowed to get back house to live with them. Her presence in the home, it had been believed attracted spirits that are evil harm them through the incantations she had to recite when consulting or praying for her customers. Later she had been encouraged to live alone as it helps overcome her illness (James and Eze, 2009).

Case 2

50-year-old Male with Schizophrenia

A 23-year-old male was with a continuous illness of 8 years of treatment with schizophrenia. He had multiple first rank symptoms and hallucinations in different modalities. One of the hallucinatory experiences was that the presence of simultaneous auditory and visual hallucinations. He could see a doll-like figure of a human being in the surroundings. He could see a doll-like figure of a being that is individual the environmental surroundings. He could see the figure that is doll-like other real items and could see the movements of its different areas of the body. He could hear commanding auditory that is verbal from the doll with lip

movements. These auditory that is verbal would threaten him of consequences if he did not stick to the instructions. He experienced it every for 6 years and had acted out on these voices' day. He attempted suicide homicide and thrice once over the last 6 years intoxicated by these hallucinations (Kumar *et al.*, 2019).

The physical examination showed that he was well. A magnetic resonance imaging scan of the brain was reported normal. He was started on clozapine, and the dose was gradually increased to 300 mg/day over 4 weeks with regularly while monitoring the adverse effects. This drug reduces his hallucinations rapidly, from being at the peak of 7 which is extremely severe to 1 where no hallucinations are present (Kumar *et al.*, 2019).

Treatment and therapies for schizophrenia

Drug treatment for hallucinations in schizophrenia

The first treatment option for hallucinations in schizophrenia is antipsychotic medication, which can rapidly decrease its severity. They relate to working with dopamine antagonistic activity in the brain. One of the drugs is called clozapine, it works effectively against hallucinations (Manford and Andermann, 1998). This drug works effectively against patients whose illness was difficult to treat in trials. It blocks the dopamine receptors with the dopamine antagonistic activity thus restoring the dopamine and serotonin levels in the brain, this improves the levels of thinking and the mood decreasing the levels of hallucinations (Reynolds, 2004). Olanzapine, amisulpride, ziprasidone, and quetiapine are equally effective against hallucinations. Clozapine is the drug for patients who are resistant to 2 antipsychotic agents (Sommer *et al.*, 2012). Adverse effects such as disabling movement disorders and involuntary facial movement can be observed. These drugs won't cure the mental condition but it reduces the symptoms (Adams *et al.*, 2000).

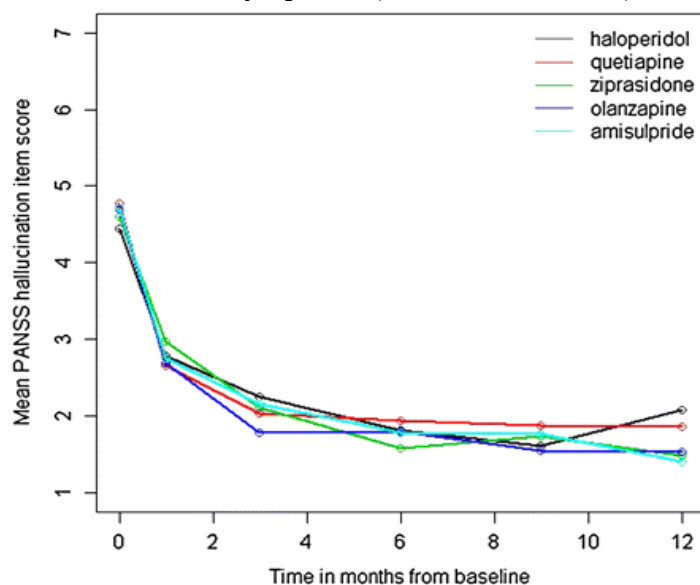


Figure 1 Antipsychotic medication effecting hallucination severity

Source: (Sommer *et al.*, 2012)

Discussion and Conclusion

In this research, the connection between hallucinations and schizophrenia are discussed. Hallucinations are an interesting phenomenon seen in schizophrenia and other psychotic

disorders. Clozapine is said to be the most effective treatment on the prognosis of schizophrenia (Kumar *et al.*, 2019). Symptoms such as the inability to distinguish what is going on in the patient's mind, Frontotemporal functional connectivity is reduced in schizophrenia and may result in hallucinations (Lawrie *et al.*, 2002). Studies are further carried out to study the nature of these symptoms and the main symptoms are delusions and hallucinations. A loss of the sense of awareness leads directly to such symptoms of schizophrenia (Corcoran, *et al.*, 1995; Currie, 2000).

The main cause of the disorder continues to be unknown after a century of learning schizophrenia. Treatments, especially pharmacological treatments, have experienced wide usage for nearly half of a century, yet there is proof that is little these treatments have substantially improved outcomes for most of the patients with schizophrenia.

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**SCREENING OF DIFFERENT IMPORTED RICE PRODUCTS SOLD IN THE
LOCAL MARKET BY PCR FOR THE PRESENCE OF DNA RELATED TO
GENETICALLY MODIFIED PLANT ELEMENTS**

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Abstract

Rice is one of the first crops to develop a genetic sequence. Even though about 40% of rice products in Sri Lanka are imported, precise compositions of GM elements remain unrevealed. Hence this study aims to screen for common possible GM element contaminations in imported rice products in the Sri Lankan market using PCR. Research was conducted with three randomly selected anonymous rice products claimed to be imported. Primers used for the detection of GM elements in this study are CaMV promoter and NOS terminator. TRNL bands from post PCR were visualized in gel electrophoresis for all the samples. Two samples produced positive results for CaMV (~195 bp) and NOS (~180bp) primers. According to the base-pair length and the resolution, it is assumed that the phylogeny may closely resemble with the *Oryza sativa Indica*. Resolution of the samples are different this may due to lower intraspecific variations in p6 loop of TRNL. Sample 2 and 3 samples may contain GMO. Therefore, it is assumed that GMO containing imported rice products are sold in the local market. This abides the law prevail in Sri Lanka. But the results are limited due to the limited sample size, and limited no. of trials. Hence further analysis of more samples and repetition of the assay will strengthen the results obtained.

Key Words: CaMV ,GMO, NOS, PCR, CaMV, TRNL

Introduction

Rice (*Oryza sativa*) is the staple food in Sri Lanka. But ~40% of rice are imported from other countries (Fernando, 2017). Golden rice was developed by Ingo Potrykus and Peter Beyer to produce provitamin A. GM rice is currently available in countries such as US, Canada, Australia etc.(Qaim, 2011). Simultaneous presence of CaMV promoter and NOS terminator is considered as a structural indicator for GM elements in plants (Xu et al., 2014) (Figure 1).



Figure 1: Construct of GM plant genes

TRNL gene from (UAA) intron, in the chloroplast is a confirmation for the presence of plant DNA (Roosens et al., 2009). Presence of GM elements can be assessed using PCR, Gel Electrophoresis is then integrated as downstream analysis to visualize the GM Elements.

Methodology

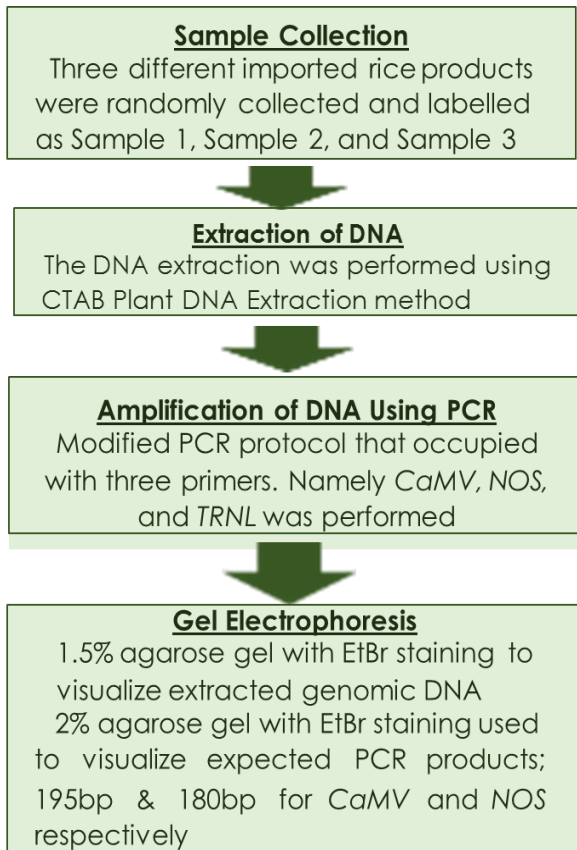


Figure 2: General Methodology of the Study

Table 1: Depiction of PCR conditions required for the primers (35 cycles were performed) (Randhawa and Firke, 2006).

PCR Conditions		
Step	Temperature (°C)	Time (Mini.)
Initial Denaturation	94	3
Denaturation	94	1
Annealing	58	1
Elongation	72	5
Final Hold	4	5

35 CYCLES



Results

Detection of Plant DNA Using Gel Electrophoresis

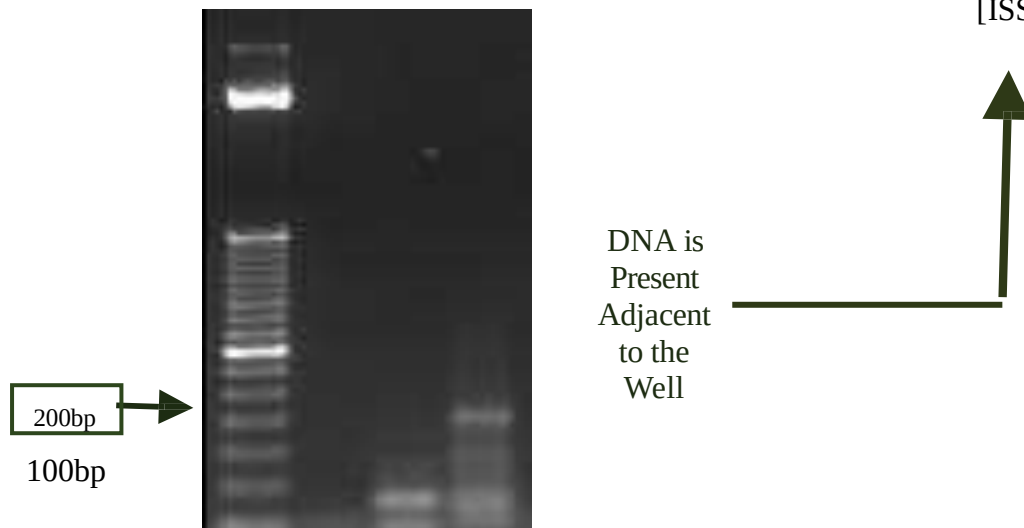


Figure 3: TRNL PCR Products Visualized in 2% Agarose Gel Electrophoresis with EtBr Staining, under UV for TRNL Gene Detection. M – 50bp DNA ladder, Lane 1- Sample 1, Lane 2 Sample 2, Lane 3- Sample 3, Lane 4- Water Extraction, Lane 5- Positive Control, Lane 6-Negative Control.

TRNL PCR

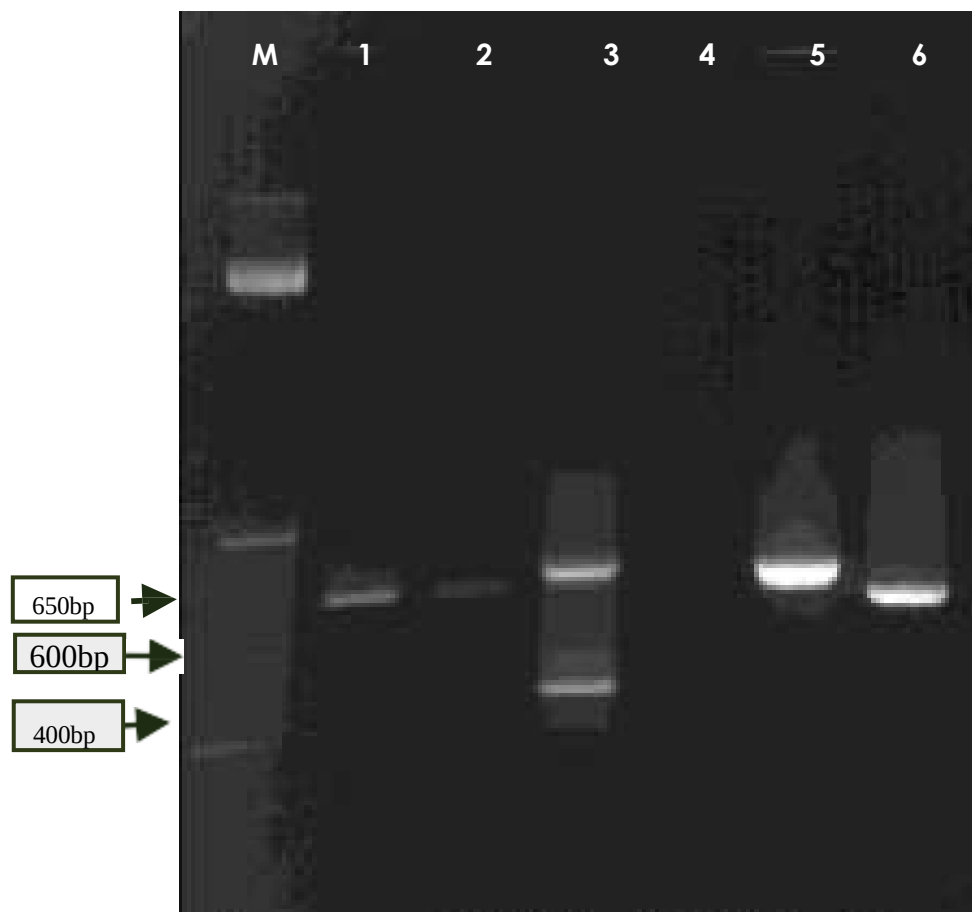


Figure 4: TRNL PCR Products Visualized in 2% Agarose Gel Electrophoresis with EtBr Staining, under UV for TRNL Gene Detection. M – 50bp DNA ladder, Lane 1- Sample 1, Lane 2 Sample 2, Lane 3- Sample 3, Lane 4- Water Extraction, Lane 5- Positive Control, Lane 6-Negative Control

CaMV PCR

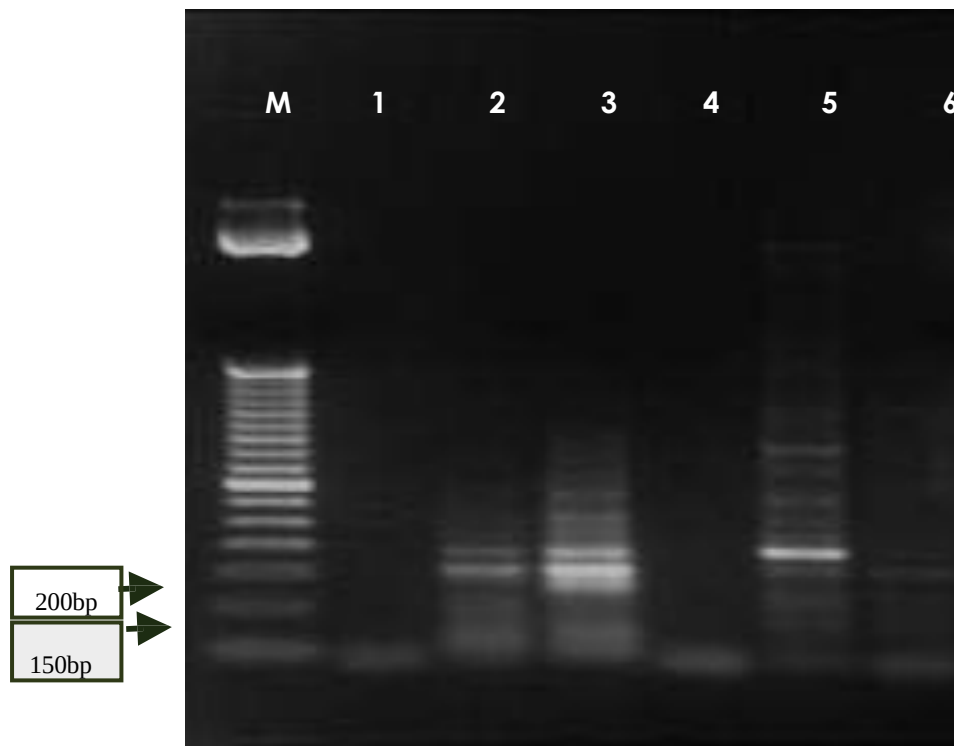


Figure 5: CaMV PCR products visualized in 2% Agarose Gel Electrophoresis with EtBr Staining, under UV for CaMV promoter Detection. M – 50bp DNA ladder Lane 1- Sample 1, Lane 2- Sample 2, Lane 3- Sample 3, Lane 4- Water Extraction, Lane 5- Positive Control, Lane 6-Negative Control.

NOS PCR

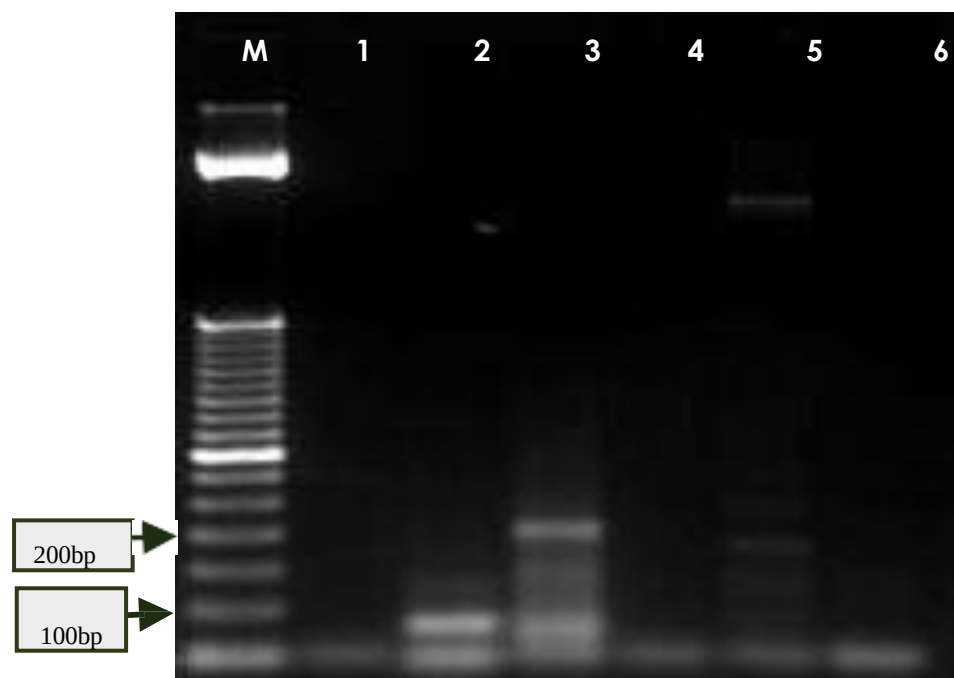


Figure 6: NOS PCR products visualized in 2% Agarose Gel Electrophoresis with EtBr Staining, under UV for NOS promote Detection. M – 50bp DNA ladder Lane 1- Sample 1, Lane 2- Sample 2, Lane 3- Sample 3, Lane 4- Water Extraction, Lane 5- Positive Control, Lane 6-Negative Control.

Discussion

Sample Collection

Samples were randomly selected from three different brands from three different countries. This was to achieve more discrete data (Kelley et al., 2003).

DNA Extraction

DNA in Sample 1 was not well visualized		
Higher amount of EtBr leads to more intercalation of DNA providing DNA higher density (Gomes-pereira and Monckton, 2017)	May due to the large size genome of the rice and DNA may be degraded in processed food (Eckardt, 2000)	Higher agarose concentration may decrease the migration speed, and larger DNA fragments may not separate (Ylmaz, Ozic, and Gok, 2012)
Hence PCR was proceeded with TRNL primer pair		

TRNL Gene

Bands for samples were visualized around ~600-630bp, hence it is assumed that phylogeny of the type of rice present in the products resembles *with Oryza sativa Indica Group* (615bp) (James and Schmidt, 2004). Different intensities may occur due to different resolutions of the p6 loop (Taberlet et al., 2007). Sample 3 may contains 2 types of rice varieties possessing heterozygous locus and may also possible with protein contamination (Paillard, Primot, & Valle, 2009).

CaMV Promoter

Sample 2 and 3 indicate positive bands at ~195 bp. Intensity of the bands may correlate with the, quantity of the GM elements present, hence suggesting that sample 2 has a less abundance of GM (Tozzini et al., 2000). Both samples indicated bands at 150bp. This may possibly due to intragenic regions that contain regulatory sequences and single- strand interruptions (Podevin & du Jardin, 2012).

NOS Terminator

Bands were observed in sample 2 & 3 at ~180bp. As per the intensity, can assume that GMO is less abundant in sample 2. But this cannot be confirmed because the intensity of the positive control is also relatively less. Both samples possess prominent bands at 100bp. According to the study of Randhawa and Firke, can assume that the NOS terminator of the *Oryza sativa* plant could resemble at 100bp (Randhawa and Firke, 2006).

Conclusions and Recommendations

Therefore two samples are positive for CaMV promoter and NOS terminator. It is assumed that abundance of GM elements in sample 2 is relatively lower than the sample 3. Presence of GMO was not labelled in these products. As per Food act no.26 of 1980 in Sri Lanka, GMO should be labelled. Defaulters of this law are subjected six- month jail term and a fine (Senarath & Karunagoda, 2012). But results are limited due to the limited no. of sample size,

and limited no. of trials. Hence further studies are demanded to achieve persistent and an unbiased conclusion.

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DETECTION OF BACTERIA OTHER THAN ‘LACTOBACILLUS’ SPECIES IN LOCALLY PRODUCED CURD SAMPLES BY POLYMERASE CHAIN REACTION

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Abstract

Curd is a naturally enriched medium prepared by fermenting milk using a lactic acid producing bacterium. It is widely consumed in Sri Lanka for its organoleptic properties and therapeutic benefits. However, curd can easily get contaminated if high sterile standards are not maintained during its preparation and storage. This research mainly focuses on investigating small-scale locally produced curd for possible contaminants that could cause a medical implication to the consumer. The methodology of this research is based on; serial dilution, DNA extraction, gram staining, *Lactobacillus* specific PCR, agarose gel electrophoresis, universal bacterial PCR and gene sequencing. The results of this research confirmed a contamination by the pathogenic strain *Staphylococcus Hominis* in curd sample B. This research has showed the necessity of screening small-scale produced curd and the importance of educating local manufacturers about the sterile standards required in collection of raw milk, curd production and storage.

Key Words: Curd contaminants, DNA Extraction, Gene Sequencing, Medical Implications, Polymerase Chain Reaction,

Introduction

Curd is a fermented milk product with a huge popularity, owing to its organoleptic properties and therapeutic benefits (Hendawitharana, 2012). Some of these benefits are; stimulating the function of immune cells like: intestinal epithelial cells, dendritic cells and Tcells, ability of some *Lactobacilli* strains to activate natural killer cells and neutrophils in the body (Panesar, 2011), consumable by lactose intolerant individuals (Yamashita et al., 2012).

Curd is traditionally prepared by boiling milk and filtering to remove any impurities. Afterwards, it is cooled to room temperature and some curd made from a previous batch is added as a starter culture. The milk is then placed in containers (clay pots, plastic containers, etc.) and sealed well. *Lactobacillus* species is most commonly present in the starter culture.

Curd can easily get contaminated during the collection of raw milk, preparation and storage when sterile conditions are not maintained. Some common contamination sources are milking cattle, storing and transferring of raw milk where the temperature should be kept at 4°C to prevent proliferation of microorganisms them from proliferating, during pasteurization, post pasteurization contaminations, mixing of raw and pasteurized milk, temperature fluctuations, etc. (Erkmen and Bozoglu, 2016). Commonly fermented products can get contaminated by spore-forming bacteria such as ‘*Bacillus licheniformis*’, ‘*Bacillus cereus*’, ‘*Bacillus subtilis*’, Psychrotrophs like *Pseudomonas fluorescens*, *Pseudomonas fragi* and coliform bacteria such as; ‘*Citrobacter*’, ‘*Enterobacter*’, ‘*Escherichia*’.

If the dairy products get contaminated by bacteria such as *Escherichia coli*, diseases like mild diarrhoea, haemorrhagic colitis and haemolytic-uremic syndrome (Pal, 2016) can occur. *E. coli* also causes urinary tract infections (UTIs), gastroenteritis, intraabdominal infections. In

gastroenteritis, the patient will experience symptoms like; diarrhoea, fever and abdominal pains. Some diagnostic methods used for detection of contaminants present in curd are; Universal Bacterial PCR, Agarose gel electrophoresis, enzyme linked immunosorbent assay (ELISA), Blocking ELISA, Indirect ELISA, Real-time PCR, Ruggedized, advanced pathogen identification device (RAPID) and Multiplex PCR.

This research focuses on detecting different bacterium other than ‘Lactobacillus’ species in small-scale locally produced curd samples in the local market using ‘Polymerase Chain Reaction’. This research also specifically focuses on culturing curd samples in Luria-broth media. It focuses on investigating the presence of a curd contaminant with the aid of techniques such as PCR, Agarose Gel Electrophoresis, Gene sequencing and observing bacterial colonies grown in Luria- Bertani media using gram staining.

Methodology

Samples were selected from three different small-scale local vendors who were located in three different geographical areas. All the samples were made using buffalo’s milk who were at the household itself and the samples used a starter culture known as “muhun” (in Sinhala language). This is a culture composed of curd from previous batches. The samples obtained were labelled as “A”, “B”, “C”, to maintain anonymity. Serial dilution was used to dilute each sample to eight concentrations. These five dilutions were selected from each sample for culturing; 10-1, 10-2, 10-4, 10-6, 10-8. The petri dishes were then cultured using Luria-Bertani media and incubated for 24 hours at 37°C.

Petri dishes were observed for colony growth and plates that had colonies were used for gram staining. Simultaneously, colonies were also isolated for DNA extraction (Boiling method). A sterilised inoculation loop was used to collect colonies to 1.5ml ‘Eppendorf’ tubes that had 200 µl of distilled water. The tubes were sealed using parafilm and kept in a dry bath, at 100°C for 5 minutes. Upon cooling, the tubes were centrifuged at 12000 rpm for 5 minutes and the supernatant was transferred to un-used tubes. The tubes containing the supernatant were stored at -20°C, until required for PCR (Ribeiro Junior et al., 2016). This protocol was carried out for different types of colony’s growing in the same petri dish.

The DNA extracted through the boiling method was amplified using Lactobacillus PCR. The primers used were; LbLMA1-rev: 5P-CTC AAA ACT AAA CAA AGT TTC-3P and a second primer R16-1: 5P-CTT GTA CAC ACC GCC CGT CA-3P (Dubernet, Desmaures and GuÃ©guen, 2002). Gel electrophoresis was done to identify the amplified PCR products. 12 µl aliquots were loaded to wells in 0.5xTBE buffer. The gels were stained using 20 µl of Ethidium Bromide and visualised under UV transilluminator. 50bp DNA ladder was used at a volume of 4.5 µl as a reference marker.

Universal Bacterial PCR Universal bacterial PCR carried out for the DNA samples that did not show intense bands in gel electrophoresis. It was conducted to identify amplify genomic material of other microorganisms. The universal primers RW01 (59-AAC TGG AGG AAG GTG GGG AT-39) and DG74 (59-AGG AGG TGA TCC AAC CGC A39) which flank an; 370-bp region in the 16S rRNA gene was used (M. MATAR et al., 1998).

Samples that presented intense bands from ‘universal bacterial’ PCR products were selected and sent for gene sequencing to Macrogen Inc. Korea. The forward tracer sequence and the reverse tracer sequence was aligned using MEGAX software. One of the sequences was

reverse complemented before alignment. The alignment was then analysed using NCBI BLAST software.

Results

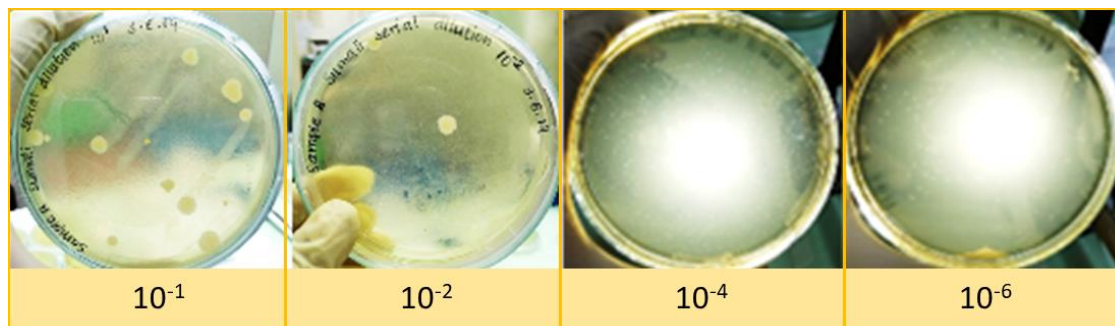


Figure 16: Cultured petri dishes of Sample B

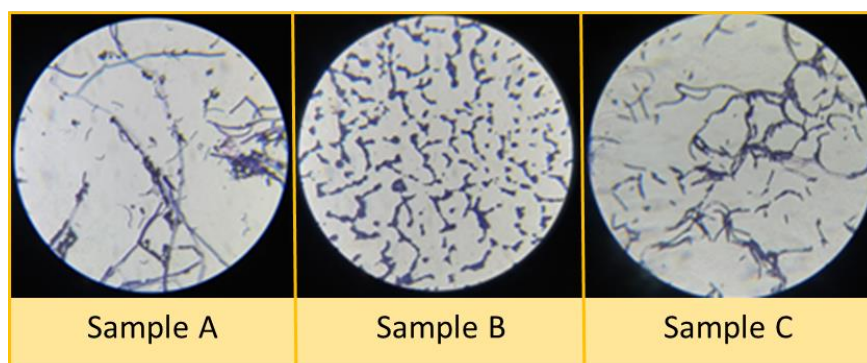


Figure 17: Gram Stain observations of Samples A, B and C

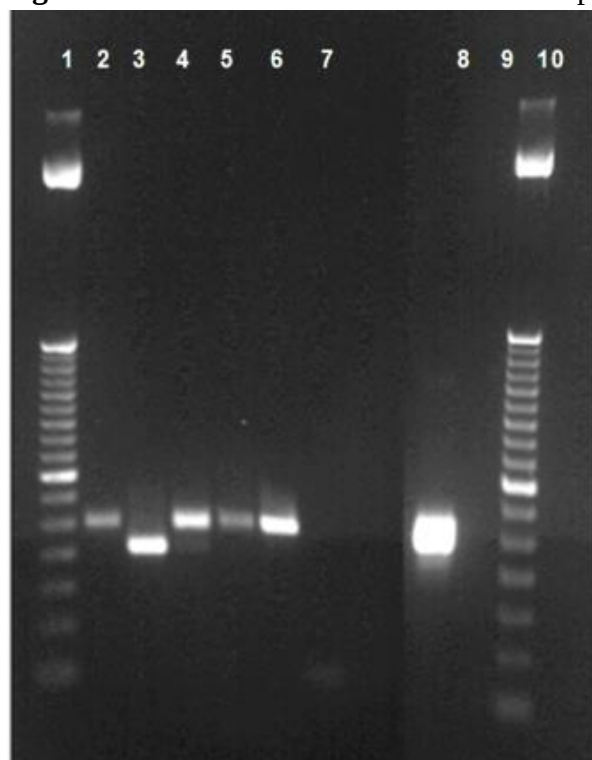


Figure 18: Lactobacillus PCR products agarose gel diagram

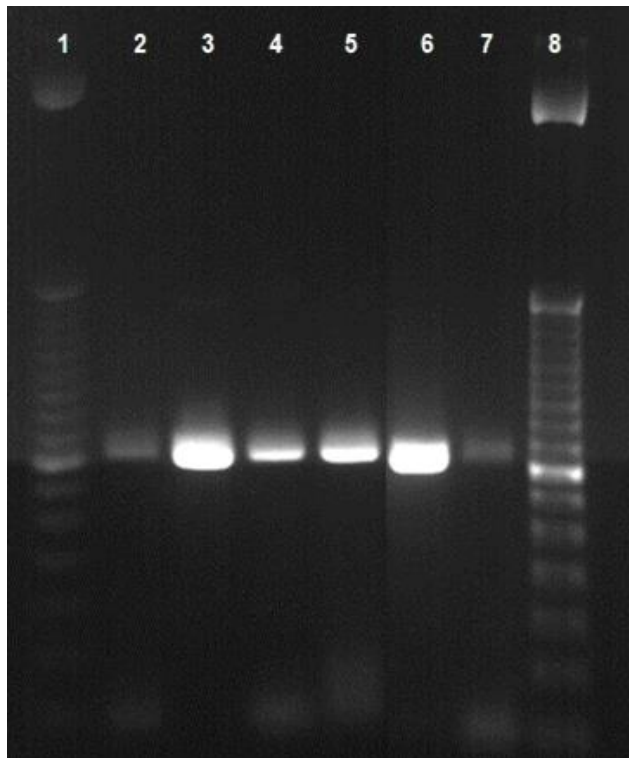


Figure 4: Universal Bacterial PCR products agarose gel diagram

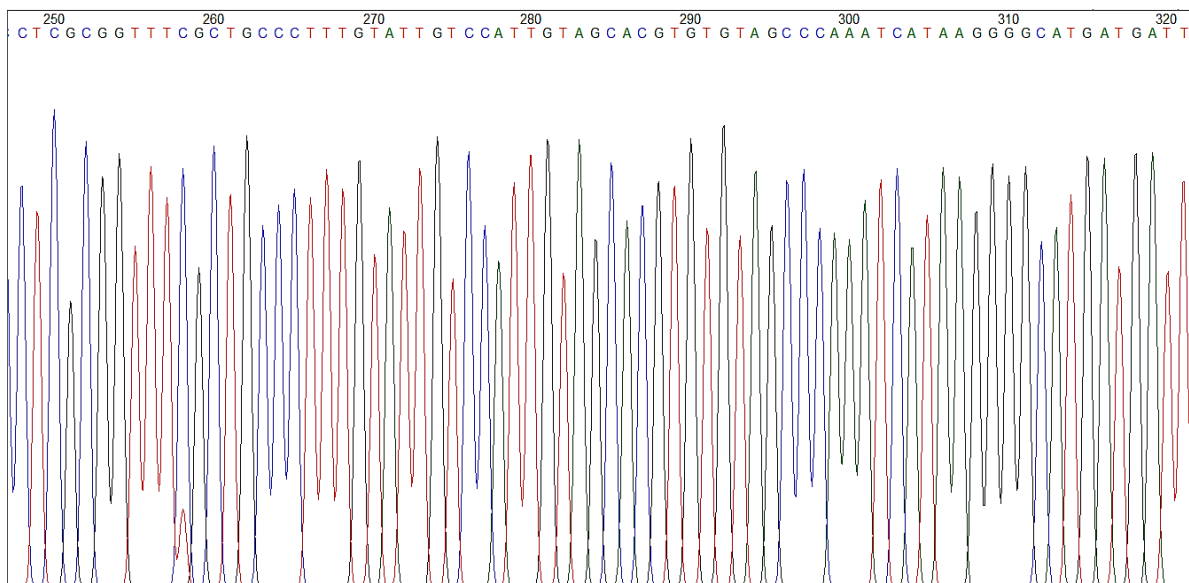


Figure 5: Chromatogram of reverse tracer sequence of Sample B

Descriptions	Graphic Summary	Alignments	Taxonomy

Sequences producing significant alignments

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☒ select all 100 sequences selected

[GenBank](#) [Graphics](#) [Distance tree of results](#)

	Description	Max Score	Total Score	Query Cover	E value	Per. Ident	Accession
☒	Staphylococcus hominis strain 309-4 16S ribosomal RNA gene, partial sequence	606	606	31%	5e-169	99.40%	gil1279497343IMG557806.1
☒	Staphylococcus chromogenes strain 34B chromosome, complete genome	601	3585	31%	2e-167	99.10%	gil1714042014ICP031470.1
☒	Staphylococcus agnetis strain 12B chromosome, complete genome	601	3574	31%	2e-167	99.10%	gil1714039377ICP031266.1
☒	Staphylococcus chromogenes strain 17A chromosome, complete genome	601	3602	31%	2e-167	99.10%	gil1714031411ICP031274.1
☒	Staphylococcus hominis strain 19A chromosome, complete genome	601	3591	31%	2e-167	99.10%	gil1714026535ICP031277.1
☒	Staphylococcus chromogenes strain 20B chromosome, complete genome	601	3591	31%	2e-167	99.10%	gil1714022118ICP031471.1
☒	Staphylococcus haemolyticus strain PL565 16S ribosomal RNA gene, partial sequence; 16S-23S ribosomal RNA intergenic spacer	601	601	31%	2e-167	99.10%	gil1700448935IMK015864.1
☒	Staphylococcus hominis strain PL562 16S ribosomal RNA gene, partial sequence; 16S-23S ribosomal RNA intergenic spacer, comp	601	601	31%	2e-167	99.10%	gil1700448934IMK015863.1
☒	Staphylococcus lugdunensis strain PL554 16S ribosomal RNA gene, partial sequence; 16S-23S ribosomal RNA intergenic spacer, c	601	601	31%	2e-167	99.10%	gil1700448926IMK015855.1
☒	Staphylococcus lugdunensis strain PL553 16S ribosomal RNA gene, partial sequence; 16S-23S ribosomal RNA intergenic spacer, c	601	601	31%	2e-167	99.10%	gil1700448925IMK015854.1
☒	Staphylococcus lugdunensis strain PL552 16S ribosomal RNA gene, partial sequence; 16S-23S ribosomal RNA intergenic spacer, c	601	601	31%	2e-167	99.10%	gil1700448924IMK015853.1
☒	Staphylococcus lugdunensis strain PL551 16S ribosomal RNA gene, partial sequence; 16S-23S ribosomal RNA intergenic spacer, c	601	601	31%	2e-167	99.10%	gil1700448922IMK015851.1
☒	Staphylococcus hominis strain PL549 16S ribosomal RNA gene, partial sequence; 16S-23S ribosomal RNA intergenic spacer, comp	601	601	31%	2e-167	99.10%	gil1700448921IMK015850.1
☒	Staphylococcus haemolyticus strain PL548 16S ribosomal RNA gene, partial sequence; 16S-23S ribosomal RNA intergenic spacer	601	601	31%	2e-167	99.10%	gil1700448920IMK015849.1
☒	Staphylococcus haemolyticus strain PL546 16S ribosomal RNA gene, partial sequence; 16S-23S ribosomal RNA intergenic spacer	601	601	31%	2e-167	99.10%	gil1700448917

 Feed

Figure 06: NCBI BLAST analysis of reverse tracer sequence of Sample B

Discussion

The results of the cultured petri-dishes showed colony growth in different dilutions, as shown in figure 01, where; first dish: dilution plate 10^{-1} had two different type of colonies growing second dish: dilution plate 10^{-2} had only a few bigger size colonies growing, third dish: dilution plate 10^{-4} had a higher number of small sized colonies, fourth dish: dilution plate 10^{-6} had small size colonies growing but with a less frequency than seen in 10^{-4} . Likewise, in the other sample's colony growth could be seen however some dilutions like sample A; plate 10^{-6} had no growth. A possible reason for this could be improper homogenisation during serial dilution, leading to less growth of visible colonies. In sample A, plate 10^{-8} showed an unusual growth with a morphology that closely resembled fungal growth. This could be due to a contamination occurred during serial dilution preparation or when spreading the diluted sample on the media. In sample C; there were fast growing and slow growing colonies present in several dilutions.

The gram staining observations showed the presence of a gram-positive bacterial colony growth in all the three samples as shown in figure 02. In all the samples, the bacteria were stained in purple and were rod-shaped.

The agarose gel electrophoresis results of *Lactobacillus* PCR clearly showed the presence of *Lactobacillus* species in all the samples through intense bands as seen in figure 03. The agarose gel electrophoresis results of 'Universal Bacterial' PCR demonstrated that all the three samples have bacterial genomic material.

For further confirmation gene sequencing was carried out using the 'Universal Bacterial' PCR products. However, gene sequencing did not provide the expected tracer sequences of each sample. The chromatograms of almost all forward and reverse tracer sequences had background peak except the sample B, reverse tracer sequence. Sample B reverse tracer sequence was individually analysed in NCBI BLAST. The tracer sequence had a 99.42% identity value to the "*Staphylococcus Hominis Strain*". This confirms that sample B is

contaminated and it is possible the bacterium contaminated the raw milk used for fermentation as its mode of transport is through skin contact of animals or humans. This strain causes infections in individuals who has compromised immune systems (Jiang et al., 2012).

Conclusions and Recommendation

In conclusion, sample B is contaminated with the bacterium, '*Staphylococcus Hominis Strain*'. It is an opportunistic and nosocomial pathogen that might cause infections in immune compromised individuals (Jiang et al., 2012). Reportedly it is able to cause potentially life-threatening infections, such as infective endocarditis (Kessler, Kimbrough III and Jones, 1998). This research has shown the necessity of focusing on screening in small-scale produced curd for contaminants. As most local manufacturers lack the resources to maintain high standards during production and preparation of curd, authorities should provide take measures to educate them about the requirements. Furthermore it is important to continuously monitor small scale produced curd for potentially pathogenic microorganisms.

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A STUDY ABOUT STUDENT'S QUALITY OF SLEEP AND SLEEPING PROBLEMS VIA SLEEPING HABITS

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Abstract

This study describes the importance of the hygiene of sleep. The main aim of the study was to determine the quality of sleep and whether sleep hygiene behaviors of university students were associated with sleep quality. (196 students aged ≥ 18 years). The prevalence of poor sleep quality (total PSQI score > 5) was 44.8%. Male students (47.2%) had statistically significant higher odds of poor sleep quality. Perceived stress level and symptoms of depression and life style were strongly associated with sleep quality. Standardized questionnaires were completed by students, containing questions about sleep habits, exercise habits, caffeine, tobacco and alcohol use, and subjective sleep quality (using the Pittsburgh Sleep Quality Index). Correlation and regression analyses tested for associations among sleep hygiene behaviors, and sleep quality. Teaching students how to effectively manage sleep can improve their well-being is our conclusion.

Key Words: PSQI, Sleeping hygiene, Academic performance, Sleep quality, Life style, BMS

Introduction

A good quality night sleep is essential for physical and emotional well-being of young adults. Health needs are often-overlooked by school and university students in today's fast paced society. Sleep deprivation not only affects the physical health, but also the psychological state and mental health and those with mental health problems are more likely to have insomnia or other sleep disorders. (Cameron A,2010) Erratic sleep schedules and late bedtimes are very common among university students. It has been found that sleep difficulties as the second factor affecting student's individual academic performance, first being "stress". This is crucial as research has shown that students who do not follow a regular bedtime and rise time schedule are more often to be poor sleepers. (Tailor,2012)

Literature review

This research examines the quality of sleep via sleeping habits and life choices among adults. We spend one third of our lives sleeping.

Sleep is an essential part of human life. Without sleep the mind and body cannot function. It's a necessity that we cannot survive without. It is said that one can survive only so long without sleep before dying. That only proves how important sleep is. It supports our learning and gets rid of unnecessary thoughts. The brain never pauses, it's always working. (Meghan, 2015)

"The campus students do not get enough sleep" has been the common idea though there's a limited research supporting this statement. The National Sleep Foundation reports that inadequate sleep can cause many problems and even can be life-threatening. (Kathryn, 2014) Previous studies highlight that poor sleep quality of students is linked to have a high level of tension, depression, irritability, confusion and commonly lower understanding and life satisfaction. Unfortunately, students who experience academic complications do not realize the poor sleep habits may contribute to the difficulties. (Tsai,2014) Sleep is clearly an

important aspect of successful academic and personal life in campus, yet previous sleep studies suffer from short comings. Sleep hygiene has been defined as those behaviors that are believed to promote improved quantity and quality of sleep (Coren,1994). Research in other healthy adult populations shows that evening activities and conditions while falling asleep affect sleep quality. Other sleep hygiene recommendations include decreasing schedule irregularity; nighttime exercise; and caffeine, alcohol, and tobacco use. Activities in bed, such as reading or watching television, have also been associated with subjective measurements of poor sleep (Walter C *et al.*, 2010).

Methodology

A cross sectional survey was conducted via a sample of students being at academic year 2018 - 2020, in order to analyze the quality of sleep of students, via sleeping habits. A sample of 196 students (107 female and 89 male) mean age 20-25 was taken in this survey.

Data Collection

Data collection was completed by a common method. Questionnaires were distributed among participated students. It was containing 4 sections which are anthropometric measurements, PSQI, external factors and internal factors in order._We had used the PSQI method to calculate the quality of sleep. It's a freely available tool. The 19 self-rated PSQI items are added to give seven components (Cameron A, 2010). These are subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Each component has a score that ranges from 0 to 3. All component scores are added to obtain a global score. A PSQI global score greater than 5 is indicative of significant sleep disturbance. (Walter C *et al.*, 2010)

Data Analysis

To describe the data gathered, Ms Excel 2016 software was utilized in this survey. Statistical analyses were performed using SPSS v.21.0 (Cameron A *et al.*, 2010)

Results

Of the 400 students, 196 students had participated in our survey. There were 107 females and 89 males. No data was collected from students who were refused to participate. 74% of students were undergraduate and bio medical science students were high in amount. Students who participated were from (65.3%) Kandy and others were from Anuradhapura, Polonnaruwa, Ampara, Gampaha, Kegalle, Badulla, Matale, Trincomalee, Rathnapura, and Nuweraeliya. The mean value of sleeping duration is 7.14 hours. 13 and 3 are the maximum and minimum hours that student had slept. High number of students (25%) had slept for 8 hours. Higher number of students (23.5%) had gone to bed at 11.00 pm. Also, a higher number of students (16.9%) had started there day at 7.00am.

Table 1: Results of PSQI

Male		Female	
Good	Poor	Good	Poor
52.8%	47.2%	57%	42%



Figure 19: percentage of quality of index

External factors

Physical fitness

Male students (66.7%) had reported that they don't have an active day and these students are identified as poor sleeper. Particularly students with poor sleeps had never followed a diet plan. Students who have poor quality of sleep had reported that they travel a long distance. Male students who had poor sleep (46.7%) had marked that they use electronic devices before going to sleep.

Sleeping hygiene

As a positive result we can determine that a very few numbers (3.6%) of students had faced cramp while sleeping. As a positive result 40.3% of students had strongly agreed that they don't snore. High percentage of students with poor sleep are having snoring problems. Males who share rooms are determined under poor quality of sleep

Internal factors

Stress, chemical intake and sleeping patterns

62.8% of students had reported that they are in stress. Though female students (38%) are more stress than male students (25%), 15.4% of male students had been examined under poor quality of sleep. Majority (62.2%) of participants had been discuss about the stress due to workload. Among them 45.2% students are under poor sleep. 68.2% of students had expressed that they had been stress due to study issues. However, among them 45.1% of students were considered as poor sleepers. The students who are having poor sleep had mentioned that they have relationship problems. Students without financial problems had a good sleep. High number of students with good sleep had strongly disagreed about having caffeine at night. Students who are having good quality of sleep had reported that they don't use tobacco. 60.2% students are not consuming alcohol and they are having a good quality of sleep. Male students who are having poor quality of sleep had experienced more nightmares.

Discussion

A proportion (54%) of students were classified as having poor sleep. Gender, level of education, educational stream, travelling distance, behavioral and psychological factors had affected the quality of sleep. Perceived stress level and symptoms of depression were strongly associated with poor sleep quality. Additionally, internal factors and external factors were related with poor sleep quality. This difference by sex could be explained by the significantly higher proportion of male students reported shorter sleep duration and bad subjective sleep quality in this study. Other studies have reported that female students were more likely to report longer sleep latency (Coren,1994), sleep disturbance and lower rating of their sleep

quality (Tailor,2012). Clearly, student sleep habits and patterns and their effect on student adjustment, academic performance, and health are underrepresented in the research literature. The current results are consistent with the few studies that have examined sleep habits and patterns of campus students. (Walter C *et al.*, 2010) A study reports that poor-quality sleepers reported drinking more alcohol than optimal-quality sleepers and were twice as likely to use alcohol to induce sleep as better sleeper. (Kathryn M *et al.*, 2011).

Conclusion

We recommend to avoid using electronic device before sleeping, decrease the consuming level of alcohol and to begin an active day with a diet plan to avoid sleeping problems. University students, should be made aware of the observed sleep problems and comorbid mental health outcomes. Improved sleep quality will likely benefit university students in their mental health status, daily activities and academic performance. Educational campaigns focused on helping university avoiding the build-up of a chronic sleep debt may be important in enhancing the academic performance and in reducing the development of psychiatric disorders later in life. By so doing, universities may be better positioned to reap the benefits of their efforts of expanding access to higher education to youths and young adults.

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INFORMATION TECHNOLOGY

COMPUTATIONAL INTELLIGENCE FOR MOVIE EDITING

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Abstract

Filmmaking is a multi-billion dollar industry in the modern world and the movie-making process can be subdivided into pre-production, production, and post-production. Post-production or popularly known as editing is a tedious process that involves a level of technical and artistic capability. The techniques that are still in use are decades old which involves the use of both a machine and manpower. In this study, authors have attempted to study the applicability of Artificial Intelligence for film editing. The study was conducted on identifying different methods of film editing and selected editing based on the shot size and emotion classification. A formula has been derived using a shot size character size ratio and based on it dataset has been developed. Develop application using CNN is able to identify the character emotions and shot type with higher accuracy, therefore, the study outcome suggests that AI can be successfully used in film editing.

Key Words: Key CNN, Shot type, Film editing

Introduction

Filmmaking is a multi-billion dollar industry in the modern world. Since it's humble beginnings in the late 19th century using the "kinescope" (a box like structure that showed moving pictures), it has evolved to be a powerful medium of communication, propaganda, and entertainment (silentcinemasociety, 2015).

The post-production stage in moviemaking takes up a longer duration of time, even than the production stage of the movie. The creation of a typical mainstream Hollywood movie generally ranges from 1-2 years of time (Follows, 2018) where nearly one year is allocated for the post-production stage. The Filmmakers have an arsenal of tools at their disposal to portray a story. With that, they have the ability to tell a story in an interesting fashion, without having to portray the story directly for the whole duration of the show, like in a Stage Drama. They achieve this by the use of different shots that are arranged in a careful pattern (Pruitt, 2017). As a Hollywood movie utilizes several thousands of shots during the shooting (Follows, 2018), cutting and joining them together can take ages as there are several factors that needs to be considered when joining two shots like the actor continuity, the dialogues, type of scene (whether emotional or an action scene etc), ASL (average shot length) along with a plethora of other variables (Mcgregor, 2017).

Artificial intelligence has been used in many domains successfully and its footmarks are now visible in movie editing as well. IBM Watson (Smith, 2016) was able to create a movie trailer from a full movie with the use of AI and also (IntelligentHQ, 2019) (Brown, 2019) suggest that features of AI are now embedded into modern industry editing tools, especially on automatic corrections of images and adding effects. The main aim of this study is to investigate the possibility of AI to assist the editor to select suitable shot types according to the script. The study is focused on identifying the shots and categories them, so the editors

will able to select from the category and use it according to the movie script. Shots can be mainly categories according to shot size and camera angle. In this study only shot size was selected due to complexity identifying the exact camera angle from an image. A shot can be categories according to the shot size as Extreme Long Shot– ELS, Long Shot / Wide Shot – LS / WS, Full Shot – FS, Medium Long shot /Medium Wide Shot – MLS / MWS, Cowboy Shot – CS, Medium Shot – MS, Medium Close Up– MCU, Close Up – CU, Extreme Close Up – ECU (studiobinder, 2019) and also to categories shot based on the facial emotions.

Methodology

In the movie editing process each editor has their own personal traits and beliefs. Therefore when selecting the sample movie shots author has requested six well-known movie editors in Sri Lanka to provide samples for each type of shot to avoid the personal attributes of a one. The dataset consists of 653 images from selected shot types and 600 images were used for the taring and rest were used for cross-validation tests. After analyzing the sample shots, it was evident that the frame height has variations depending on the movie types as well. Based on the findings, for the shots types' classification below mention, the algorithm is proposed.

Instead of calculating the actual face size, the height in which the face is displayed in the frame is calculated using the pixels.

$$\begin{aligned}\text{Character Face Height} &= \text{CH} \\ \text{Frame Height} &= \text{FH} \\ \text{CH to FH Ratio} &= \text{CH} / \text{FH}\end{aligned}$$

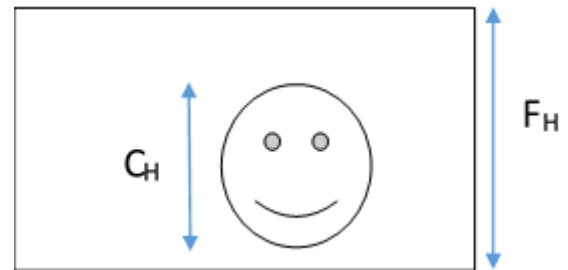


Figure 01: Frame to character ratio

Using the developed algorithm, the calculation is performed to find the ratio values for each shot type. Below is a sample ratio calculation done for shot type Cowboy.

$$\begin{aligned}\text{Face Co-Ordinates (px)} \\ X_1 &= 285 & Y_1 &= 103 \\ X_2 &= 263 & Y_2 &= 252 \\ \text{Frame Height (FH)} &= & &= 1080\text{px}\end{aligned}$$



Figure 1: Cowboy shot

$$\begin{aligned}\text{Character Face Height (CH)} &= (Y_2 - Y_1) \\ &= 252 - 103 = 149\text{px} \\ \text{CH to FH Ratio} &= \frac{149}{768} \\ &= \underline{\underline{0.194}}\end{aligned}$$

The following is a summary of the obtained values.

- By performing calculations on images of the same shot type, a minimum, and maximum range were identified.

- The obtained ranges were then corrected in accordance with the ranges of the neighboring shot type.

Table 1: Shot type range results

Shot Type	Obtained Range	Corrected Range
Extreme Long Shot	0.004<R<0.021	R<0.021
Long Shot	0.055<R<0.638	0.022<R<0.0638
Full Shot	0.12<R<0.128	0.0639<R<0.128
Medium Long Shot	0.114<R<0.132	
Cowboy Shot	0.1398<R<0.194	0.133<R<0.194
Medium Shot	0.291<R<0.376	0.195<R<0.376
Medium Close Up	0.400<R<0.562	0.377<R<0.562
Close Up	0.598<R<0.634	0.563<R<0.634
Extreme Close Up	0.82<R<0.869	0.635<R

As shown in Table 1 for the full and medium long shot it was unable to identify accurate range values. Underline reason for the unclear range is that a shot can be called as a “full shot” on the contrary some will call it as a “medium long shot” there for both shots can be classified into one group.

As the majority of the project deals with image processing, the Creation of this the software was done through Python 3.6 version owing to the plethora of image processing libraries available for python.

OpenCV 2 was used to detect the faces from the web camera input using the HAAR Cascade classifier (P. Viola, 2001). In the cascade classifier, all the face features are not considered at once instead the features are grouped into different stages of classifiers and applied one-by-one. Several dependencies were also used for the process Keras 2.0, Tensorflow 1.1.0, Pandas 0.19.1, Numpy 1.12.1, H5py 2.7.0, Statisticsopencv-python 3.2.0. From the inputted image frame application is identifying the character face. Identification of the face is done using Convolutional Neural network (CNN) developed based on the model “Real-time Convolutional Neural Networks for emotion and gender classification” (Arriaga, et al., 2013) and CNN was trained using FER-2013 Dataset which contained over 35000 images and IMDB gender Database which contained 460,723 images. The detected face then used for calculating the height of the face and frame height in pixels. Then it will be pass on to the ratio algorithm and calculate the ratio. Then the ratio will be passed on to the neural network for the classification of shot types.

Results

For the evaluation of the application Confusion matrix was used this was done with both training dataset and cross-validation set. Below shown testing to identify shot types with 50 attempts for each shot type.

Table 2: Confusion matrix for shot types identification

	ELS	LS	F S	M L S	CS	MS	MCU	CU	ECU
ELS	82%	8%	10%	0	0	0	0	0	0
LS	4%	86%	6%	4%	0	0	0	0	0
FS	0	0	78%	22%	0	0	0	0	0
MLS	0	0	22%	70%	8%	0	0	0	0
CS	0	0	0	0	96%	4%	0	0	0
MS	0	0	0	0	0	96%	2%	2%	0
MCU	0	0	0	0	0	2%	96%	2%	0
CU	0	0	0	0	0	0	2%	98%	0
ECU	0	0	0	0	0	0	0	4%	96%

After concluding the initial testing, classification accuracy test was conducted with 50 test cases that were not used in the initial training and has a mean average of 90% for correct classification.

Discussion

Based on the findings, it is evident that the application was very successful for the medium and close-up shot classifications but the results of long shots were not that significant for an AI accuracy level. The reason for this might have been the level of clarity of character face in a larger frame. Also, full shot and long shots result accuracy are low but as discussed in the early segment these two groups have some ambiguity on differentiation. Therefore can suggest that two segments need to be considered as one group and if so identification rate will be above 97%.

Conclusions and Recommendation

This research project dealt with understanding the creative task of video editing and how it can be automated using an Artificial Intelligence. The algorithm derived for classification of the shot type shown a higher level of effectiveness. Based on the results we argue that both those full shots and long shots should be categorized as one unless other distinguishing characteristics can be identified. The application developed can be used with a very minor modification to a live TV show editing since in live TV it is all about using shot types other than any editing techniques. Even Though this software is not close to being a fully functional software that can virtually replace the responsibilities of an editor, it provided insight on how AI can be used in film editing in the future. The algorithm can further tested with a larger dataset to improve the accuracy and also by considering other parameters like camera angle can further advance it.

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SMART WATER IRRIGATION SYSTEM FOR FARMERS IN SRI LANKA

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Abstract

The main objective of developing this system is to reduce the waste of water in farming. This system helps farmers to water plants based on their soil moisture levels. If the soil moisture level is below 50% then the motor starts watering the plant until it gets the moisture level 90% and then the motor automatically switches off. The system is developed through the NodeMCU ESP8266 board and other required sensors. Data saved in the online database through Wi-Fi. Web application is created to monitor the system activity. Any authenticated user can easily log in to the system and monitor the activity of the water irrigation of the farm. This system provides an efficient way of irrigating plants automatically without any human intervention.

Keywords: Firebase, NodeMCU ESP8266, Sensors, Arduino

Introduction

The agriculture industry is one of the main industries in developed countries. Khokhar(2017) 70% of the available freshwater consumption accounts for agriculture. This level increases with the demand for food consumption throughout the world. Science Friday (2019) Experts even predict the water wars. Water management is a major concern in the farming system in arid and semi-arid areas. To control the water wastage and manpower; an automated smart irrigation system needs into the agriculture industry.

This smart water irrigation system implemented through the NodeMCU ESP8266 controller and the atmosphere weather conditions that are calculated through soil moisture sensor, temperature, and humidity sensors. Besides, the microcontroller has wifi module, through that module all collected weather conditions data is sent to the cloud database and stored. The web page displays all the details about the system condition for the user.

The main objectives of the project can be listed as:

- Measuring the soil moisture, temperature, and humidity of the specific farming area with the help of the soil moisture sensor, and DHT11 digital temperature and humidity sensor.
- It provides easy maintenance of the smart water supply for the farmers, through the automated system all controls are covered by NodeMCU ESP8266 and their sensors.
- Give the proper interface to view all generated and automated information which are located in the cloud database. For viewing the details system has a web interface, through the web page user can login and view the details.

Significance of the system

If farmers who use this smart water management system can maintain some of the important things such as water level, energy, number of workers and fertilizer.

Through efficient irrigation, farmers can produce the same amount of crops by using less amount of water.

When using this system we dissolved the fertilizer (nutrients) in the irrigation water and supplied equally for each of the plants.

Through the same amount of water, the farmer can grow the higher value of more water-intensive (water consumption) crops.

It reduces the number of labors because it is done through the machinery and also it does not take more breaks so we can consume more time.

Through the saved data user can easily monitor the activity of the farm and the crops at a specific time.

Through the data system, developers can implement the system water by predicting the past data and manage water irrigation. (Through 2 or 3 sensors manage the water irrigation for the crops at a certain place)

Literature review

Joaquine Gutierrez (2013) propose the gateway units for handling the sensor's measurements, triggers the motors and transmits the data to the web application and the database. It will get the energy through the photovoltaic panels and it will have the communication like through the cellular internet interface, it will allow for the data inspection and water irrigation scheduling, to be programmed through the web page.

AcoSonali D.Gainwar and Dinesh V.Rojatkar's (2015) paper about the soil parameters like pH value in soil, humidity, moisture level, and the temperature are measured from the soil. Their system was fully automated, through the level moisture and other details in soil the motor pump will ON/OFF the water distribution.

V.R.Balaji and M.Sudha (2016) proposed paper their system will get the energy from the sunlight through the photo-voltaic cells. So their system does not need electricity for the work process. And here they will use soil moisture sensor and based on the sensor reading value the PIC microcontroller is used to ON/OFF the motor pump. And also in this system, they did not forecast the weather conditions.

G.Parameswaran and K.Sivaprasath (2016) proposed the system like a smart drip irrigation system by using the IoT, for here they will use the pH sensor, humidity and temperature sensor for the analysis. This irrigation details status will be stored or updated in the server or the localhost by using the personal computer. Here if the farmer needs to access the details he needs the internet connection.

S.Reshma and B.A.Sarath (2016) proposed IoT based automated irrigation system through the wireless network connection. They will use various sensors for measuring the parameters in the soil. And this system will give a web interface for the user to monitor and control the system remotely. In this system, they did not monitor the weather forecasting.

Methodology

The basic needs of the plant to grow is identified by analyzing two farm areas.

Those needs are water, air (carbon dioxide), light and nutrients to grow. So when comes to air and light it gets from the environment. But when comes to water and nutrients, sometimes it gets from the environment otherwise we should need to give it to the plants. Water and nutrients are collected by roots from soil. So soil moisture level is most important for plant growth. Then only plants or crops can give a good yield.

When seeing the system methodology the system was fully automated. And all the details will be collected from the environment and through the detailed analysis, the system will do water irrigation for the plants. Here in the first stage soil moisture sensor will be placed in the soil near the plants, and other sensors will be placed in the environment. Then every one-hour gap system will check the condition and collect the data. If the soil moisture is low in the plant's soil then the motor will automatically pump the water until satisfied soil moisture condition.

That period motor working time also calculated and after stopping the motor system will send the details through Wi-Fi connection of NodeMCU Esp8266 to the real-time firebase database. This will be done like a loop in every one hour. And the environment condition details will be sent to the database. Also, details will display on an LED display. If the users need to check their plant condition and about the smart system they can view the details on the web page interface by login their account.

On that page, all the details such as time, soil moisture, humidity, pressure, light, rain, and motor working period shows in a table view for easy view to the user.

If the user likes to calculate the usage of the system electricity and the water usage then by goto the calculation page and enter the specific time, motor working minutes and press the Calculate button, then it will display the usage and the amount. Through this, they can see the payments for electricity and water.

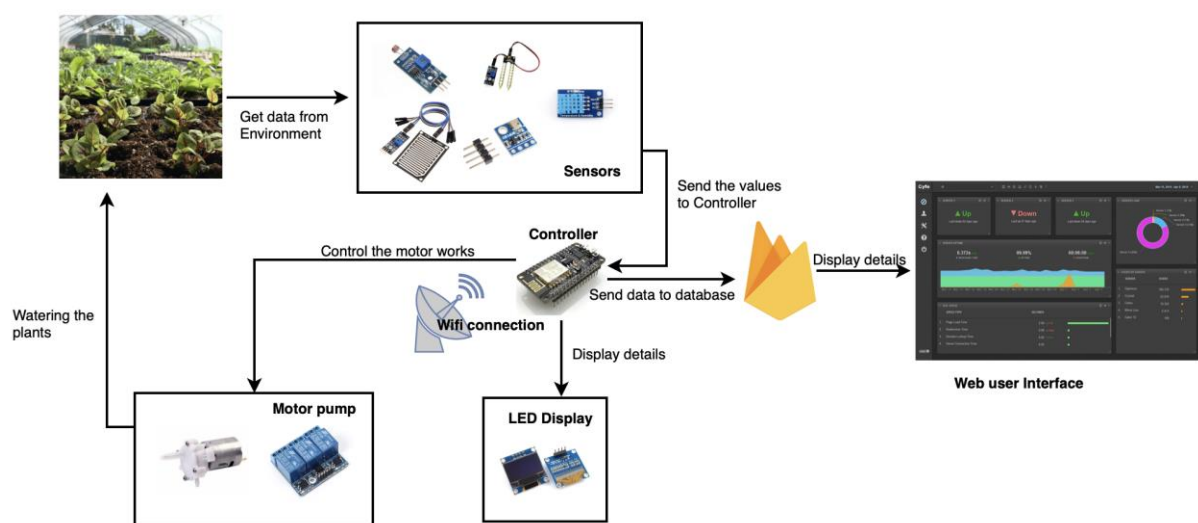


Figure 01: System Working Process

Results and Discussion

Time	Soil moisture Farm A	Motor works A	Soil moisture Farm B	Motor works B
13:32:36	47.66%	0.00min	59.59%	0.00min
13:32:51	94.92%	0.25min	54.98%	0.00min
14:10:40	92.58%	0.00min	45.66%	0.00min
14:10:55	91.50%	0.00min	93.36%	0.25min

According to the results all functions work as expected. All the sensors got the data from the environment, and if the soil moisture level is below 50% the system was starting the water irrigation for the plants until the soil moisture gets 90% and after getting 90% the motor was automatically stopped by the system. At that time the sensor's details were visible to the users if they log in the system and after the irrigation, they can see the motor working period also. So, when it comes to other related researches, most of the researches was saving the sensor's details but they did not display those details to their users, so users can't analyze the environmental and the farm conditions in their area. But through our system, they can easily analyze their farms and crops. And some others were doing the water irrigation by scheduling the time, but here irrigation was done according to the plants' soil moisture level. And also, other details were collected for doing the irrigation, more accurate in the later period by using the prediction methodology.

Conclusion and Recommendations

In the world, farming is the most important thing, because, without farming, no one can eat food but at the same time, water is essential for living in the world. Sometimes farmers waste water in farming. They use their traditional methods and experience to water the plants. With the help of the new technology, this sensor-based water management system helps to reduce the water and time-wasting in farming

Through the help of the sensors, the smart water irrigation system was developed and through the sensors all the environmental changes will be monitored and with that monitoring data system will trigger the motor when soil moisture goes below 50% and through the pipes, water irrigation will be done. The real-time database and the web application helps to develop the system because without the database, the system can't store any sensors values and a user can't see the details in the web application. And here the internet played a big role.

Through the system development agriculture production was improved in the future and IoT and automation are helping it. Through the development, farmers can do their work without any time, water and cost wastage. Thus, this system is a solution to the problem faced in the existing process of water irrigation. In future renewable energy sources (solar energy for power), mobile application, and remote-control access will be developed for the system.

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USING AUGMENTED REALITY TO REDUCE THE BUYER HESITATION WHEN BUYING FURNITURE AND INTERIOR DECOR IN E-COMMERCE PLATFORM

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Abstract

E-commerce has been getting so popular among the people of Sri Lanka. When coming to the selling of furniture and other home decors still the traditional approach selling is popular due to buyer preference of touch and feel the product. This study is focused on identifying the related shortcomings of online selling of furniture and home décor and attempt to reduce the gap with the use of augmented reality. AR mobile app developed is providing many features that allow the consumers to try selected product suitability with their current environment settings and it will lead to reducing the hesitation of buying online. Also, this app provides unique opportunities for sellers as well to reduce the cost of maintaining sophisticated showrooms and also small scale manufacturers to showcase their products with less investment.

Key Words: AR, E-Commerce, Interior Designing, Furniture, Home Decorating.

Introduction

E-Commerce provides many advantages to both consumer and seller, such as availability of larger product base, price comparison, and reach to a bigger market segment, etc. In the segment of the furniture and home décor due to the nature of the product and customer expectation utilization of e-commerce is somewhat limited (Eser, 2019). , user's decision making in purchasing the right product to match the interior space results up to a certain level of frustration such as making sure the furniture perfectly fitting the space after purchasing or matching with the interior color scheme and height, width, depth of the furniture space is very important (Williams, 2016). Another study (Barilliance, 2017) states that a high proportion of users would like to satisfy their purchasing requirements by touching and looking at the product.

The main purpose of this study is to reduce the gap buyer hesitation with the use of AR where the customer might able to get better experience and evaluate the product better in their desired location. Similar attempts were identified during the study of literature such as Houzz app and IKEA (Apple, 2019) and both were produced by leading companies.

This study has significant differences over existing market applications because the proposed application is going to be developed as a common platform where any of the sellers can use it and it provides opportunities for small scale sellers to reach to a larger audience and customers will be able to select from a larger product range.

Methodology

The application is developed based on the below architecture.

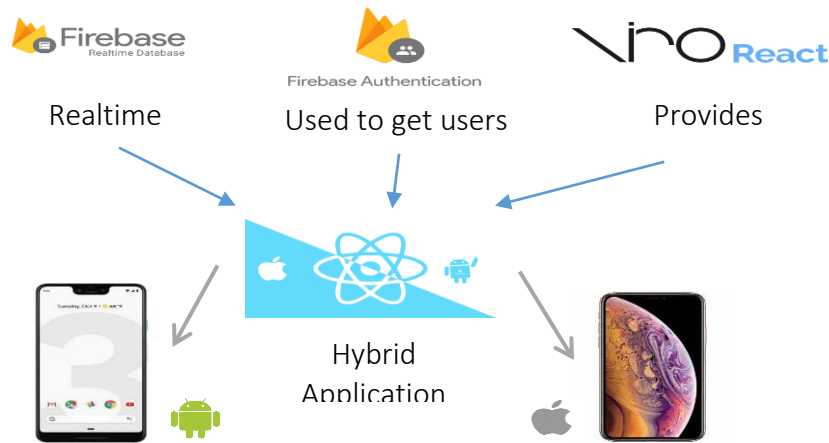


Figure1: System Architecture

The proposed application has been built using react native due to the cross-platform development capability provided using a single codebase which would be beneficial in developing the application in a short period of time rather than focusing developing on 2 different platforms.

In order to integrate AR to the application, Viro Media's Viro React framework was suitable since it includes the major AR Development kits in Android & IOS which is AR Core developed by Google & AR Kit by Apple.

Firebase is used as the database due to its efficient real-time storage capabilities which could provide dynamic data at an instant once data is added. Also, Firebase Google Authentication would be an added advantage since considering the global population a large percentage consumes Google's Gmail.

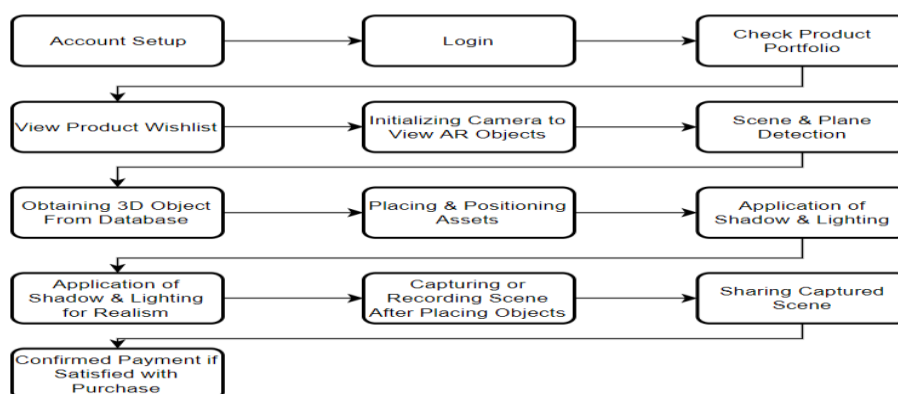


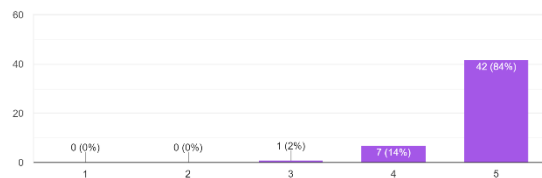
Figure 2: Application Workflow AR App

Results

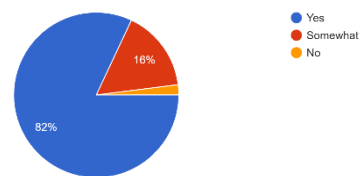
In order to identify the effectiveness of the application, it is essential to conduct an evaluation among the community. This checklist evaluation is conducted based on a checklist study for AR created by Marcelo de Paiva Guimarães & Valéria Farinazzo Martins which is also adapted to the ISO 9241-11. The evaluation has been configured towards interior décor applications (Guimaraes & Martins, 2019). After testing the app participants were given a questionnaire covering verifying usage satisfaction, verifying the cost-effectiveness of the application, verifying application's efficiency and verifying the effectiveness.

Results of usage satisfaction

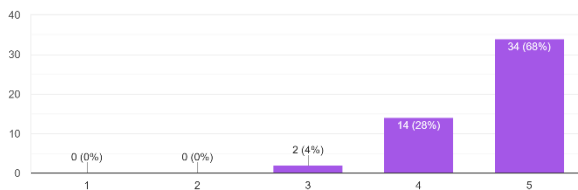
1. Are the virtual objects placed within your environment provides a satisfactory real time experience ?
50 responses



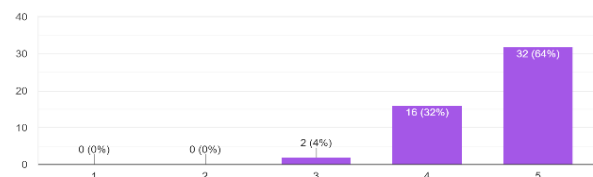
2. Are the Interaction components in the interface of the app provides a quick understanding of what they should be used for ?
50 responses



3. Are you Satisfied with the provided interaction Solution ?
50 responses

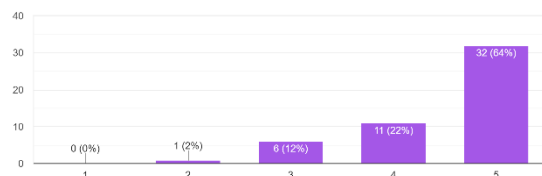


4. Are you satisfied with the movement capability provided by the App while the 3D object is in Place?
50 responses

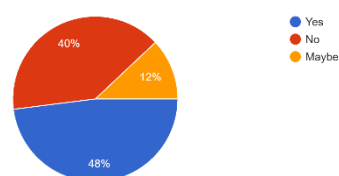


Results of the cost-effectiveness of the application

5. Are you satisfied with the app saving you money rather than visiting to the store to check the product.
50 responses



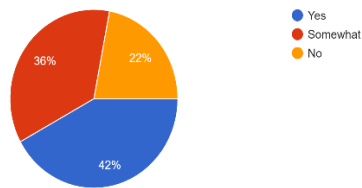
6. Does the application consume too much data in a level which it bothers you?
50 responses



Results for verifying application's efficiency

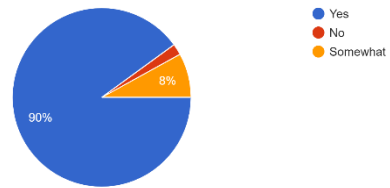
7. Does it take too long for the 3D Object to load once you've clicked it?

50 responses



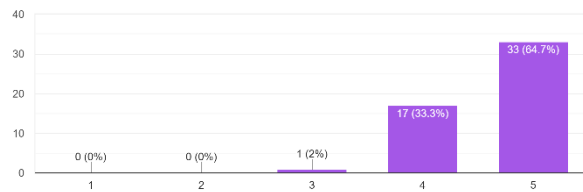
8. The AR Objects you've placed in the real world are they properly placed ?

50 responses



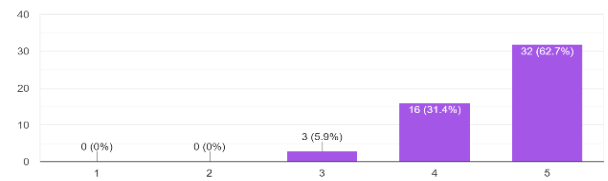
9. Are you Satisfied with the provided interaction Solution ?

51 responses



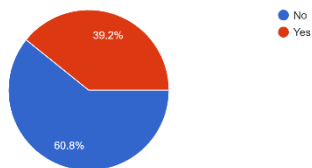
10. Are you satisfied with the movement capability provided by the App while the 3D object is in Place?

51 responses



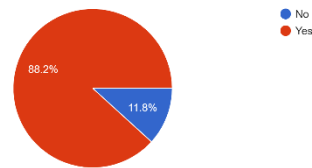
11. Are there any error prevention presented while the app is being used excessively ?

51 responses



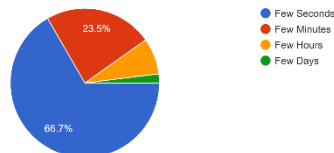
12. Will the Functionality of the app stay in your mind the next time you use it?

51 responses



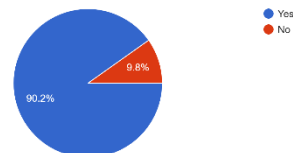
13. How long will this app would take for beginner level users to understand.

51 responses



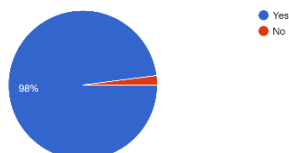
14. Is the user prompted with Instructions on how the app should work ?

51 responses



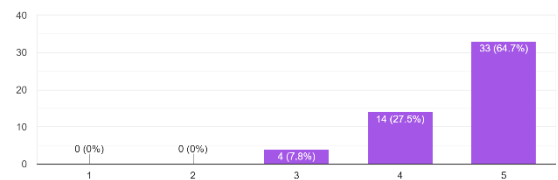
15. Does the application request permissions from you before using various sensors e.g. Camera, Gyroscope?

49 responses



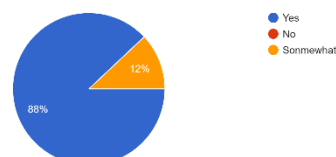
16. Is the tracking system stable enough?

51 responses



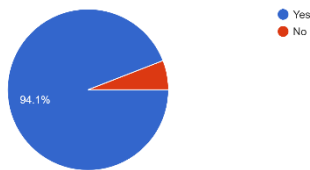
17. Does the application achieve the goal ?

50 responses

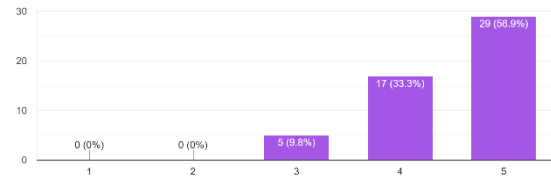


Results for verifying the effectiveness

18. Do the app let's you remove products easily ?
51 responses



19. Is managing multiple objects at a Scenery under a satisfactory level.
51 responses



Discussion

Based on the survey results it was able to identify the uses that we're satisfied with the real-time performance of the application which is due to the excellent optimization of Google Arcore & Apple's AR Kit. certain users process satisfied with the user interface of the camera module which has a simple layout. Users were also satisfied with the enhancement provided by the application to the E-Commerce Platform. However, there seem to be users suffering from slow load times which is due to the size of the 3D object & availability of less LTE coverage within some areas while testing was being conducted and users also confirm in the survey that they could manipulate the application since no warnings are given such as add many 3D Objects, etc. User's also highlighted the app could be easily caught up by novice users within seconds due to the universal familiar UI provided by the application. The user also confirms the app requests permissions for the very first time of launch which ensures the application doesn't breach the system illegally.

Conclusions and Recommendation

The application was successfully implemented using React native along with Viro media and the application was able to 3D objects from The E-Commerce store as expected. Based on the community feedback there are more enhancements that are needing to be considered such as optimizing 3D assets in the database, migrating to a database powered by an SSD would decrease the load times which some users are facing. Also, the application should be able to add an overlay over physical world objects and allowed to place computerized objects in their location there for the user does not have to move the physical product to place 3D Objects. Furthermore, adding animated characters will be an added advantage since they could provide an audio explanation of the product which would give an experience to the user as if he/she is communicating with the store managing person. Integrating artificial intelligence further where the application could suggest the user some interior decor objects would be much beneficial as in the point of sales as well as help customers to choose products much easier.

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IMPLIMENTING CV SHORTLISTING SYSTEM AS A SOLUTION FOR ISSUES IN CURRENT SHORTLISTING PROCESS

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Abstract

Nowadays most of the government companies and private companies are using a manual process to shortlist the CVs. At present government, institutions are receiving more than thousands of CVs in number. The shortlisting process is the activity which is choosing the best and suitable candidate among thousands number of applicant CVs. The manual process is not effective because it consumes much time to complete the process and the shortlisting process required human power also high. Due to the high manpower, the cost for the institutions is increasing rapidly and the applicants are not satisfied with the current shortlisting process due to the favoritism shown by the manual work. When checking all the CV one by one, the process output is not accurate and the final outcome also resulting in low quality. To overcome such issues in the manual process as a solution a new CV shortlisting system will automatically be shortlisting all candidate CV individually.

Key words: CV-Curriculum vitae, HR-human resources, Shortlisting, Recruitment, RNN - Recurrent Neural Network

Introduction

Human resource departments of the Sri Lankan companies are currently receiving more applications for their job advertisements. Selecting the most suitable candidate or shortlisting them has become a huge workload for the department. Manual process consuming plenty of time, and stressful them to pick up most suitable candidates. Due to the increasing work on shortlisting candidates, employees focus on human resource activities are drastically dropping. As a solution currently organisations are outsourcing their shortlisting process which is increased cost for them (Burns, 2016).

CV shortlisting system is proposed to address the above-identified issues. The proposed new system has the capability to shortlist the most suitable candidate with a 90% accuracy level. With this automated decision making capability organization can improve the response time to handle new recruitments in a productive manner. The proposed system contains two user levels which are admin and user. Admin's main function is narrowed to generate the selected candidates by the system and the user could able to view the outcome or score based on the process to shortlisting (Mia, 2016).

Research questions

Question 01

- What are the current CV shortlisting process issues?

Question 02

- What is the best solution to avoid those identified issues?

Research objectives

Objective 01

- To identify the current CV shortlisting process issues

Objective 02

- To provide a solution to overcome from the identified issues.

Methodology

Agile selected as system development methodology since highly flexible to develop the system within short time. Questionnaires are chosen to as a fact finding technique through qualitative data (Khan, 2016) since it might be vary from organisation's requirement.

Sample selection

To collect the sample data Sri Lankan private companies chosen as a country and selected HR departments from difference region of country to know the differences on their difficulty.

Related researches

CV shortlisting process issues have occurred in international companies in the past too. According to their researchers, organisations found a solution to the shortlisting process issue as follows. The researcher named Priyanka has purposed automated intelligent system in 2009 to resolve the problem which helped to create a CV format that was structured to the process automatically. By using the format applicants will be shortlisted based on their experiences. Even though it was productive the solution's main disadvantage is applicant ranking by working experience only. (B & M, 2011)

Stoneham has proposed an electronic shortlisting process and the main disadvantage is the electricity cost will be an additional cost to the company (Stoneham, 1994). Researcher Samad proposed a system in an automated platform via a web services system. This system increased efficiency and accuracy but the disadvantage is every applicant cannot apply through the webpage (Samad, 2012). Luk and Chicku conducted their research about a similar CV shortlisting system which is also a web-based system to enable applicants to process from there end. (Lifka, 2005) In 2007 Mehrabad and Baronjey also developed a similar CV shortlisting system. By using Recurrent Neural Network (RNN) (Meherabad & Bronjoy, 2007).

Recurrent Neural Network (RNN)

RNN is an AI technique which is connecting between nodes from a directed graph along with the temporal sequences. RNN uses memory to store input CV applicant's data. For the proposed solution RNN chosen because it designed to take a series of **input with no pre identified limit on size**. This technique could identify similarity while training CV and it will store previous CV input while generating output (Venkatchalam, 2019).

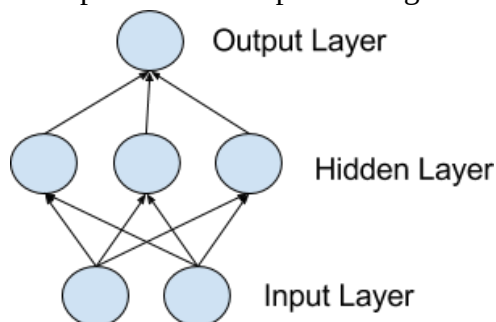


Figure 22: Recurrent Neural Network Layout

Data Set

The dataset prepared according to the trained CV. After inputting the CV to the system, data will store in the database. The dataset contains with hundred CVs. The dataset stores applicant name, qualifications, and working experience. Due to limitation dataset will input only qualifications and working experience. The application will be scored by three hundred and the final output will be divided by three. If the applicant gets over 90 scores, the applicant will be shortlisted for the job position.

Results

Training

When uploading the CV, it directly goes to the pending list and when it processes from key words it catches the educational qualifications and work experience. After recognizing it gives a value for the particular keyword.

Key words and marks

Table 1: Educational qualification

Key Word	Mark
BSc	120
Bachelor of Computer Science	120
Higher National Diploma	10
HND	10
MSc	60
Master of Computer Science	60
MBA	80
Master of Business Administration	80

Table 2: Working Experience

Key Word	Mark
ONE YEAR	1
1 YEAR	1
TWO YEARS	2
2 YEARS	2
THREE YEARS	3
3 YEARS	3
FOUR YEARS	4
4 YEARS	4
FIVE YEARS	5
5 YEARS	5
SIX YEARS	6
6 YEARS	6
SEVEN YEARS	7
7 YEARS	7
EIGHT YEARS	8
8 YEARS	8

NINEYEARS	9
9 YEARS	9
TEN YEARS	10
10 YEARS	10

According to above data the CVs are shortlisting will complete successfully with educational qualification and the work experience.

Below are the results of the data collection;

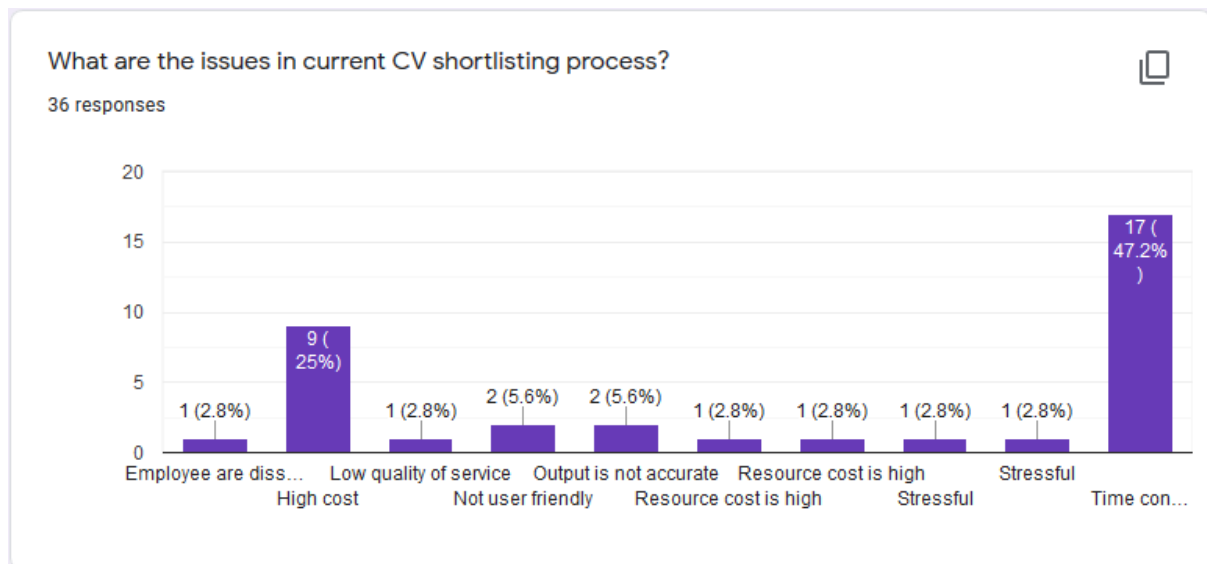


Figure 23: Question 1 Summary

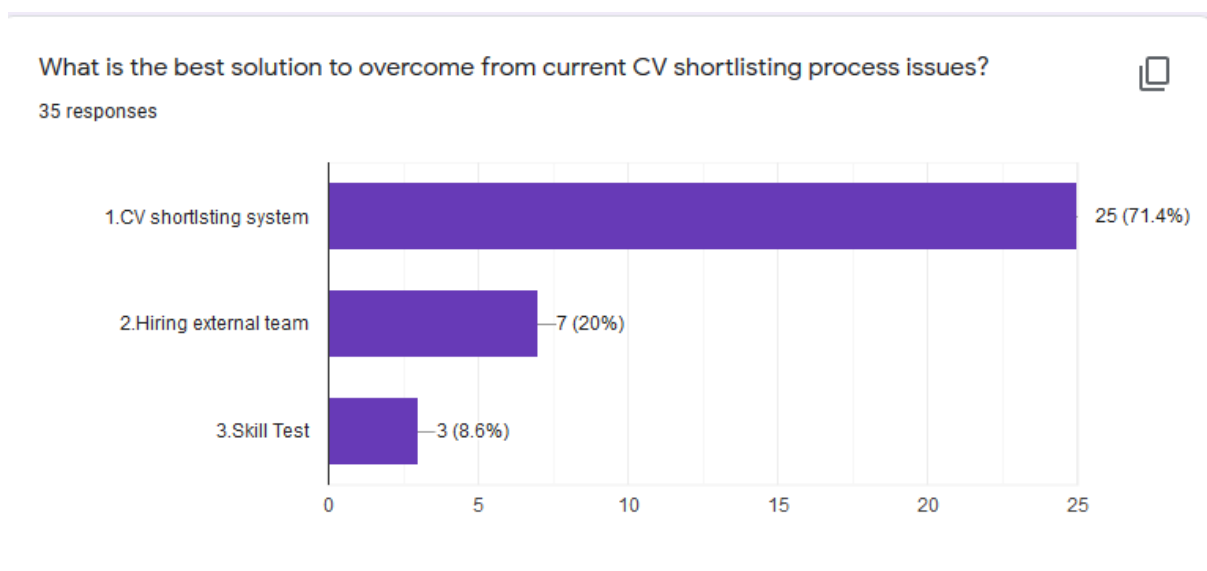


Figure 24: Question 2 Summary

Conclusion and recommendation

According to the previous studies the researchers conducted to find the best solution to solve issues in the shortlisting process. Through the literature review, it is clear to propose a system to overcome issues and difficulties by the HR team by using a web-based application using AI technique. Objectives that are determined are very thin and achieved by proposing an automated system. The successful demonstration of this system and the results prove the accuracy is 90% and the efficiency of using Recurrent Neural Network.

As future enhancements, adding more categories to score applicant CVs such as skills, professional qualifications or certifications, and volunteering and to support any formats as an input.

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LAW ENFORCEMENT RECORD MANAGEMENT SYSTEM & CRIMINAL FACIAL RECOGNITION

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Abstract

Currently, law enforcement record management is predominantly manually driven and has proven to be time consuming, inefficient, ineffective and also prone to errors over time. Therefore, computerizing these processes and incorporating a facial recognition system will help police stations to cut back on the time spent on less important, time consuming tasks and utilize this time on more important tasks. The record management system focuses on recording crime, arrests, criminals, etc. in a computerized manner, instead of maintaining manual records. Furthermore, the criminal facial recognition system is used to help identify criminals faster and more accurately with images, instead of hand drawn sketches which proves to be time consuming and inaccurate. The system is implemented using Python, Java Swing/AWT, MySQL and is tested by test automation using Junit testing as well as manually. Source code management and version controlling was achieved by GitHub while Jenkins services was used to build and roll out the system.

Key Words: Criminal facial recognition, Facial recognition, Law enforcement, Record management system

Introduction

Current law enforcement record management is predominantly manually driven. While these processes have been in place for decades, they have proven to be time consuming, inefficient, ineffective and also prone to errors over time. Computerizing these processes will help police stations to cut back on the time spent on less important, time consuming tasks and better utilize this time on more important tasks. Furthermore, computerized systems over time can help to reduce human interference.

A survey was published on Google Forms which was targeted to all those who will be receiving services from law enforcement and those who will be providing the service. The results were captured over a month and 320 responses were received. The questionnaire aided in acquiring data regarding the current process, identifying issues faced by users when interacting with the current process and capturing feedback data regarding proposed solution. A literature review and similar system analysis was carried out to gather a collection of related data to the system as well as to identify the requirements and drawbacks of the current methods.

Objectives

- Increase efficiency and accuracy of the processes by tracking the progress of casefiles and thereby eliminating manual data entering and redundancy in record keeping.
- Make the operations within the police station citizen-centric and interactive to provide a better service as well as to facilitate interaction and sharing of information within the departments of the police station.

- Ability to implement security levels to eliminate unauthorized access.

Scope

The proposed system will cover only the record management processes within the university and facial recognition of criminals. Other functions that takes place within the police station will not be covered by the system. In a typical scenario, the user will be able to log in to the system if the user is already registered with the system. A crime or arrest report can only be made when the user is logged in to the system, thereby helping to maintaining a list of criminals and victims. In addition, the system will allow users to log evidences related to crimes too. These records can be updated if the need arise depending on access level of the user. Users can search the criminal database for criminals, look through casefiles, generate statistics and also reports. An administrator will have the responsibility of managing the users of the system.

Literature Review

Since the introduction of Facial Recognition, the capabilities have improved over time. The differences in lighting conditions, different expressions in the face, aging over time and differences in head posture are some of the key issues that are encountered in facial recognition. (Trigueros et al., 2019). As for the technique used, deep learning methods have become more widely used over traditional methods (Trigueros et al., 2019). Deep learning methods are more accustomed to larger data sets, the availability of real-world variations and high level of accuracy by training (Trigueros et al., 2019).

Over time, CNNs and other deep learning methods were incorporated as they had the capability to be trained against a large dataset. Given the wider data sets and variation of subjects, Deep learning methods turned out to be more robust. However, the key drawback was that in order to perform well, a vast and diverse dataset was needed (Trigueros et al., 2019). Deep learning methods for facial recognition replaced traditional methods due to convenience, high accuracy and ease in scaling up the network (Trigueros et al., 2019). Therefore, CNN was used as the technology to develop the system.

Methodology

The development of the system was done by breaking the entire project into components. The security component will consist of the login functionality. The communication between the Record Management System and the Criminal Facial Recognition System is handled by the communication component. Socket programming is implemented to successfully communicate between the Record Management System as the server and the Criminal Facial Recognition System as the client.

Business Domain Component handles the business logic. All the data extracted through the UIs are manipulated in the business logic before passing it to the data layer. The database component will be used to store and retrieve data. A three-tier architecture is maintained therefore only the data layer communicates with the database through CRUD (Create, Read, Update and Delete) operations. The Data access component refers to the data layer that communicates with the database and the business logic.

The facial recognition component uses the python facial_recognition library to recognize and manipulate subject faces. A known folder will have the known criminal images, while an unknown folder will have the image of the subject that is being searched for. Face

coordinates of all known images are compared with the unknown image. Encoding are then extracted and stored from the train folder for each subject (criminal) as well as for the test folder. Later, the test encoding is compared with each and every known encoding which will then return a list of true or false values. The obtained distance with the minimum value is likely to be the match to the image that is in the test image directory. Therefore, the index of the minimum distance value in the list is extracted. If the index is true it is a match, if the index is false it is not a match. If it is a match, then the same index is used to obtain the name which is then passed through a client socket to the Record Management component.



Figure 1 – Facial Recognition Model

Results and Discussion

The developed system will aid in improving efficiency and accuracy to the processes in the organization. The developed solution creates a means of efficient crime report management and all related record management functionalities as opposed to the previous manual system. Thus, it is efficient, accurate and less labour intensive, in addition to being more secure due to back up capabilities. The proposed project will add value by cutting down time taken on simple tasks, making things more manageable and ease of access. In addition, it will be convenient for the citizens to work with the police station employees as they can get their work done in a shorter span of time, accurately and without hassle. The project objectives were successfully met with the implementation. The existing inefficiencies and inaccuracies were addressed by computerizing the processes and providing a facial recognition component to accurately identify criminals. The processes are more citizen-centric and interactive and thereby helps to provide a better service to the community. The system helps to eliminate redundancies as records are well kept and managed by the use of a database. In addition, unauthorized access is eliminated by maintaining a good level of security.

At the implementation of the system coding standards and Human Computer Interaction (HCI) principles were considered. Java, Python and MySQL were used to develop the system. GitHub was used for version controlling.

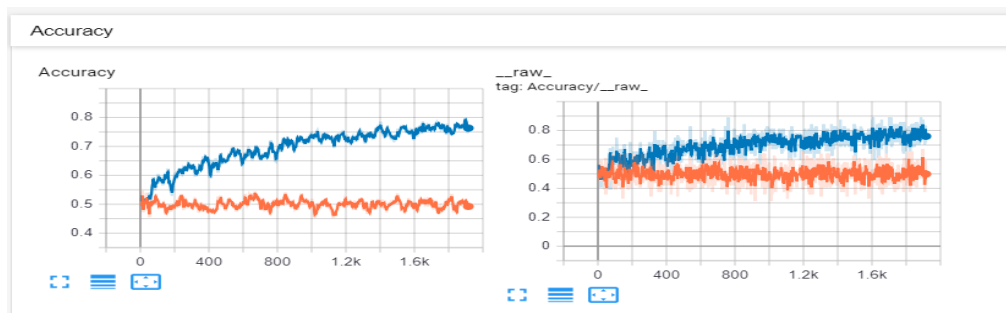


Figure 2 - Facial Recognition Accuracy

The above image depicts the accuracy of the neural network model. The accuracy of the model was at 76% and later improved to 93.3%. The system is capable of generating identified output of the subject within 922.13 Ms. The False Accept Rate (FAR) is 2% and the False Rejection Rate (FRR) is 0.9%.

Conclusions and Recommendations

In conclusion, the project was planned and approved, followed by research and questionnaire-based methods to gather the requirements. A feasibility study was done to identify the suitable budget, timeline and technologies prior to starting the project. In order for the project to run smoothly, resource identification and allocations for the entire project was done, followed by the designing where all design requirements were decided. The design documents were used for implementation and testing was done for the developed system. The risk management for the project was done at the planning stage to identify, analyse and monitor risks that may arise while operating the system.

The project gave insight into project development and software engineering as a whole. The challenges faced during the entire process improved managing, self-studying and bug fixing skills. The goal of this project was to deliver a Law Enforcement Record Management System & Criminal Facial Recognition System for the user, through which they can optimize their day to day workload, and it is successfully completed meeting all the stated requirements. The aim of the system is to encourage more time spent on strategic thinking and furthering organizational goals by saving time and creating efficient means of conducting the menial tasks required to be done by Law Enforcement officials. The system can be further expanded to provide a host of other functionalities and could even be expanded to help improve efficiency of other departments of the organization, making it an ideal solution for the modification and computerization of business processes.

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DETECTION AND RECOGNITION OF TRAFFIC SIGNS IN VISION BASED DATA

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Abstract

Traffic Sign Recognition system could be an important part of the Intelligent transportation system, as traffic signs assist the drivers to drive additional carefully and professionally. the most aim of this work is to give an efficient approach for detection and recognition of Srilankan traffic signs which are mainly stimulated by three methods, such as detection, tracing and classification. Data concerning color and geometrical form of traffic signs are used by the system for localizing the traffic check in the inheritable image. RGB color salience attention model of traffic sign makes use of an algorithmic program, that discriminates the sign candidate from different objects. Morphological form filter is exploited for extracting the geometrical data of the traffic sign. Nearest neighbor matching-based recognition is performed between localized candidate options and hold on Srilankan traffic sign database (SLTSD) options. Speed up sturdy options (SURF) of a traffic sign is employed in nearest neighbor matching to search out the likeness between the traffic signs. System strength is cross-examined for illumination, scale, rotation variations, similar color and form variations, a typical knowledge set is additionally thought-about to gauge the system performance. The simulation results illustrate that the projected system is functioning effectively under numerous dangerous condition

Key Words: Traffic signs, Detection, Morphological form, SLTSD

Introduction

Digital image processing has a wide area of applications, and almost all technical fields are impacted like medical science, Robotics, Artificial intelligence etc. in this digital era. Object detection and recognition is a part of image processing and becomes a major research area in the field of image processing and pattern recognition. Traffic sign detection and recognition have received an increasing interest within the last years. It is a multi-category classification problem and a challenging real world computer vision problem, which has been a research topic for several decades. Highway maintenance, sign inventory, Driver support systems, intelligent autonomous vehicles are some of the applications that the system with the capability of sign detection and recognition provides.

Sri Lanka is experiencing an increasing number of traffic accidents cause a serious danger to the citizens throughout the country. Accidents take place unexpectedly and unintentionally, cause damage, death, and injury too. According to the report of WHO age-adjusted death rate is 16.33 per 100,000 people and it takes 98th place in world rank. In Sri Lanka, deaths caused from road accidents are iteratively increasing within the last years. It has a high death rate by road accidents with 17.4% deaths per 100,000 persons also a srilankan dies every 3 ½ hours in road accidents. Inappropriate traffic sign detection and recognition system plays a major role in the increasing accident rate within the last years.

The difficulties of the traffic sign detection and recognition are involved with the performance of the real time existing system. Developing a traffic sign detection system on video based data is a challenging task, there are many factors influence on failure of successful detection and recognition of traffic signs. Inconsistent lighting conditions, blurring and fading effects, region establishments, motion artifacts, poor visibility, shadow occlusion, air pollutions, weather conditions (rainy, foggy, sunny) and also image distortions such as motion blur, vehicle vibration, and abrupt contrast images that can occur in an actual system. Occlusions of traffic signs due to the presence of objects such as trees, buildings, vehicles, pedestrians, or other signs are also important factors to be considered in the detection.



Figure 25: Non-Identical traffic signs, (a)occluded, (b)faded, (c)damaged, (d)multiple traffic signs at a time

Methodology

Real time traffic sign detection system has been developed by sequence of operations. The initial stage in traffic sign detection system(TSD) is locating potential sign image from a video or MP4 data.

Video acquisition

Videos are sequences of images are taken in different environmental conditions to collect the samples. The samples are collected from a camera (high resolution and high FPS) which is fixed in the left side of the dashboard of a vehicle. The images will be taken in different roads and highways in Sri Lanka from 8.00 A.M to 8.00 P.M in different lighting conditions. The main goal of this section is to create a database of Sri Lankan traffic signs under different variations.

Video segmentation

It is the process of partitioning a video sequence into disjoint sets of consecutive frames (set of pixels). Segmentation of video can be temporal, spatial or spatio-temporal. It simplifies the representation of an image into something that is more meaningful and easier to analyze. It locates boundaries and objects in images. Here we use the camera which contains 60fps. The video will be partitioned as 60 frames per second.

Image preprocessing

Image preprocessing is a main part of the sign detection and recognition system. In preprocessing, a sequence of operations will be performed. The main aim of this stage is to remove low-frequency background noise, normalizing the intensity of the individual particle images, removing reflections, and masking parts of images. Initially an input image is partitioned into a number of objects and an object image is then normalized. Filters will be applied on the images; threshold to select the regions of the image where the values of the pixels fall in the range of the target object. Morphological operations (erosion, dilation) will be applied to reduce the width of the image from many pixels to a unit pixel. The image

captured from the camera is of RGB nature. These are very sensitive to lighting variations. Proper color space conversion will be done to reduce the effect of lighting variations.

Feature extraction

One of the important steps is to eliminate noise from the image therefore to better deal with the Region of Interest (ROI). ROI is a portion of image that wants to filter or perform some other operation on. Appropriate filters have a good effect on accuracy and speed of the procedure without deleting any useful information. Here, for image smoothing and filling up the smaller region to extract the region of interest, filters will be used.

Detection

Traffic signs usually have a strict color schema (Red, Yellow, Black and white) and specific shapes (round, diamond and triangular), these inherent features distinguish them from other outdoor objects making them suitable to be processed by a computer vision system and it allows the system to distinguish traffic signs from the background scene. Detection stage is responsible for identifying Region of Interest (ROI) from the picture frame that is taken by the camera ROI is the most likely part of the image that may contain traffic signs. The detection stage sends ROI from the captured image as an input to the recognition stage suppressing the background regions. To attain a successful traffic sign detection system, following methodologies have been used to detect the traffic signs.

1. Color based method
2. Shape based method
3. Conventional neural network

Shape based detection

Shape being an important attribute of traffic signs, which is unaffected by the image quality. The shape of an object can also be utilized as a global feature to detect an object with a definite shape. This shape will be a straight line, polygons, circles, or the other irregular shapes. Object boundaries, edges, and contours will be utilized to detect traffic signs with a particular shape. During this section, we used the edge detection algorithms to detect the shapes of traffic signs.

Color based detection

Color based detection techniques aim to find the area of interest based on colors of interest using color based thresholding or segmentation techniques. Based on the traffic signs' characteristics, several color components are used to extract several kinds of traffic signs. Color processing can significantly reduce the amount of false edge points produces by low level processing operations. First Region of Interest (ROI) containing traffic signs is going to extract based on color segmentation, which helps to differentiate the traffic signs from other objects in the natural background. In color based detection color space conversion plays an important part, which converting RGB image into another from that simplifies the detection process. It separates the color information from the brightness information.

Detection based on Convolutional Neural Networks

Developing Convolutional Neural Networks (CNNs) architecture suitable for the dataset and experimenting with different parameters. CNN is Training to perform the detection. Here we used CNN with fixed layer and learnable layer for the detection process. The fixed layer can reduce the amount of interest areas to detect, and crop the boundaries very close to the borders of traffic signs. To accelerate the detection speed, color information is used to choose

the interested areas. Responses of images convolving with fixed layers are then feed to the learnable layers. The learnable layers can increase the accuracy of the detection of traffic signs significantly.

Recognition

Recognition of traffic signs has been addressed by a variety of classification techniques from simple template matching (e.g. cross- correlation similarity), to sophisticated Machine learning techniques (support vector, convolutional neural networks, Random forest). Before the recognition stage of road signs are detected and classified according to their color and shape information. Template matching, machine learning techniques used for classification. In the recognition stage individual road sign is recognized from its class. After the process of traffic sign detection, signs are recognized using a predetermined database of all the traffic signs in the system. The techniques are,

1. Convolutional Neural Network
2. Random forest
3. Support vector machine

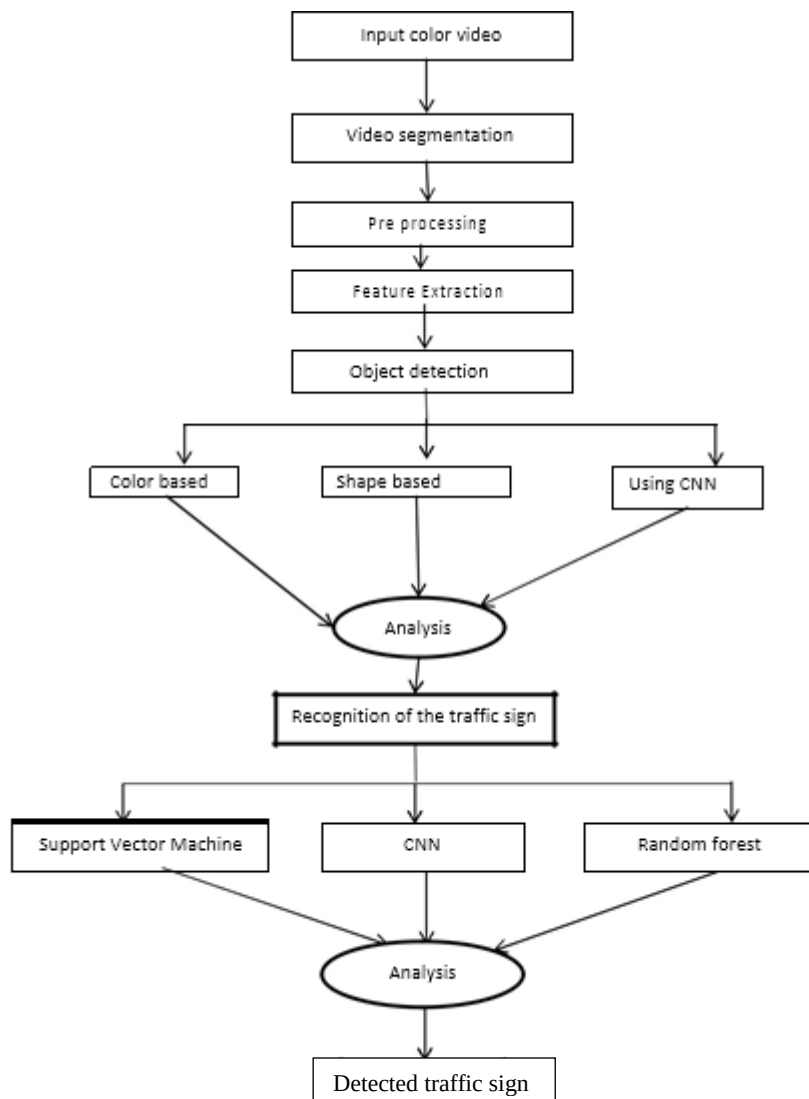


Figure 2: Flow Diagram - Methodology

The training database has been created from traffic sign images applying transformations in order to simulate real conditions, such as rotations, noises, grey-scale alterations etc. The overview of methodology of this system is represented in figure 2.

Results

To prove the effectiveness of the system, system method was tested on some video data, among these 50% of results have come with exact detection of traffic signs. The size of the recorded image is 320 by 240 pixels. Initially video file should be uploaded and move to the folder, then execute the program in anaconda prompt to generate the output video automatically, output video is consisting of traffic sign detections. Following figures show the detected signal from vision based data.



Figure 3: Color processing and detection of traffic sign

The recognition phase is built to confirm the detected candidate and determine the exact type of traffic sign. The following table demonstrates the accuracy of the traffic sign recognition system.

Table 3: Summary of Traffic sign recognition results

Number of detected signs	92
Number of recognized signs	51
Number of falsely recognized sign	41
Accuracy Rate	55.4%

In the tests, it has been concluded that several factors affect the detection performance. Variant lighting conditions, illumination of traffic signs are the main reasons of the false detection. the proposed method has a low detection rate as colour tends to be unreliable due to various factors as mentioned before.

Conclusions and Recommendation

The goal of this work is to develop an efficient traffic sign detection system for effective driving in Srilanka. In the image acquisition stage, the images were captured by high-resolution camera under different climate conditions. The image preprocessing was done by thresholding, noise removal and image segmentation. Then recognition process has been done by three different methods. The developed system has shown the results with respect to the accuracy of 55.5%. The system integrates color, shape, and motion information and takes into consideration of all the existing difficulties regarding object recognition in outdoor environments.

Apart from this, the performance of this system can be enhanced by merging the detection and classification tasks into one phase rather than performing them separately. By doing so, classification and detection can be improved, and by using sufficient, large databases for

learning, testing and evaluation of the proposed algorithm, detection rate of traffic signs can be increased.

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PERSONALIZED OBJECT RECOGNIZER FOR VISUALLY IMPAIRED INDIVIDUALS

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Abstract

Visually impaired individuals do require to apply a certain amount of work than the ordinary individuals in navigating across their most frequent places or in finding their mostly day to day used objects. The main goal of this application is to enhance or ease the individual's current way of interactions with his/her day to day entities. With the proposed application individuals with low vision will be assisted by voice narration on what object are they interacting with using image classification in AI without needing additional equipment. Develop application using CNN has shown a high accuracy percentage and efficient performance therefore this application would able to improve the life of visually impaired individuals.

Key Words: Artificial Intelligence, TensorFlow, Mobile Nets, CNN

Introduction

Visually impaired individuals are becoming more active community day by day but they face many challenges when interacting with the environment. When walking they use a white cane or assistant of a pet. When interacting with objects they fully rely on their touch. There are some high-end assistant devices that can provide assistant with the help of numerous sensors and camera inputs but these devices are very expensive therefore not adopted by many. The main aim of the study is to discover an affordable solution to assist visually impaired individuals to identify objects with high accuracy and with ease. In the modern world, most of the individuals are already having a smartphone, therefore, the intended solution was targeted to the mobile platform.

When considering the similar applications following applications were identified based on the number of users and popularity ratings on Google play. Object Recognition / Computer vision by BadLamb (Mrukwa, 2019), (Google, 2018) has basic object identifications but based on the user reviews this application has many flaws in the identification and also becomes nonresponsive at times. TaptapSee (Taptapseeapp, 2019), (Google Play, 2019) has somewhat better results comparing to BadLamb product but this needs to point at an object and tap to start also requires to talk back feature needs to be activated with settings. For object recondition, the app takes about 20-30 seconds.

The applications followed up consisted of datasets that use open source samples available across on the internet under various platforms. Our application will be consisting of a personalized dataset of images chosen from the relevant users' environment which will provide much better accuracy as well as faster results due to the use of lite models. The application will be based on a Tensorflow Lite Model whereas in order for the relevant user to use the application a family member or a close associate could use the GUI based interface

to upload images of the objects that the user is willing to interact with and generate the lite model to user's relevant application. Based on the generated model added to the application the user could starting detecting objects across the scene.

Methodology

The developed application is based on a TensorFlow lite model which is a converted model for lighter devices such as IoT devices or smartphones and provides solutions such as Gesture Recognition, Image Classification, Object Detection & Speech Recognition. Since this application is based on image classification Additional to TF Lite Mobile Net Architecture will be used which is specifically developed for mobile devices to create vision-based applications that are developed by Google. (Abhishek , 2018).

Importing Kera's framework to the project provides simplified syntax to access complex mathematical equations provided by TensorFlow Framework.

Identifying (Figure 8) upon the model being converted it will be generating a TF Lite pre-trained Model which will be afterward added to the Android App and with the Android Neural Network API (NNAPI) which is developed by the Android Developer Community & it is able to run computationally intensive operation for machine learning on Android Devices (Android Dev, 2019).

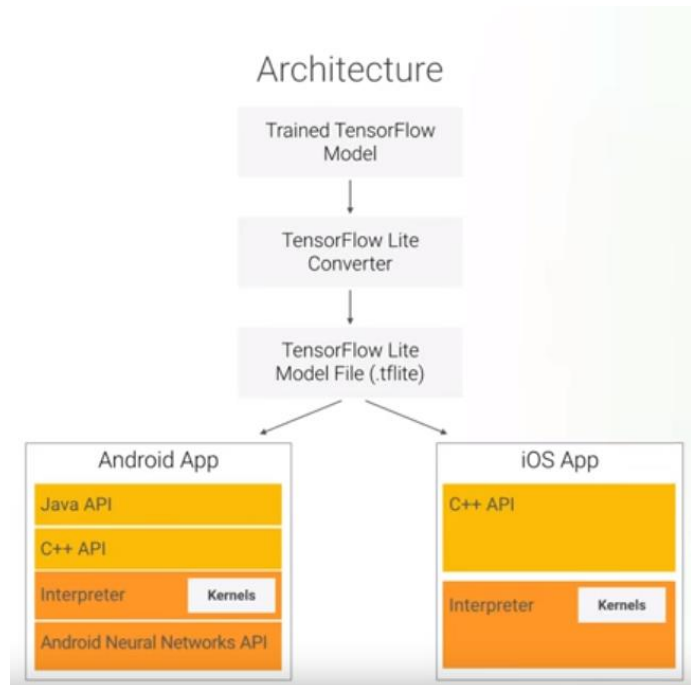


Figure 1: TensorFlow Architecture

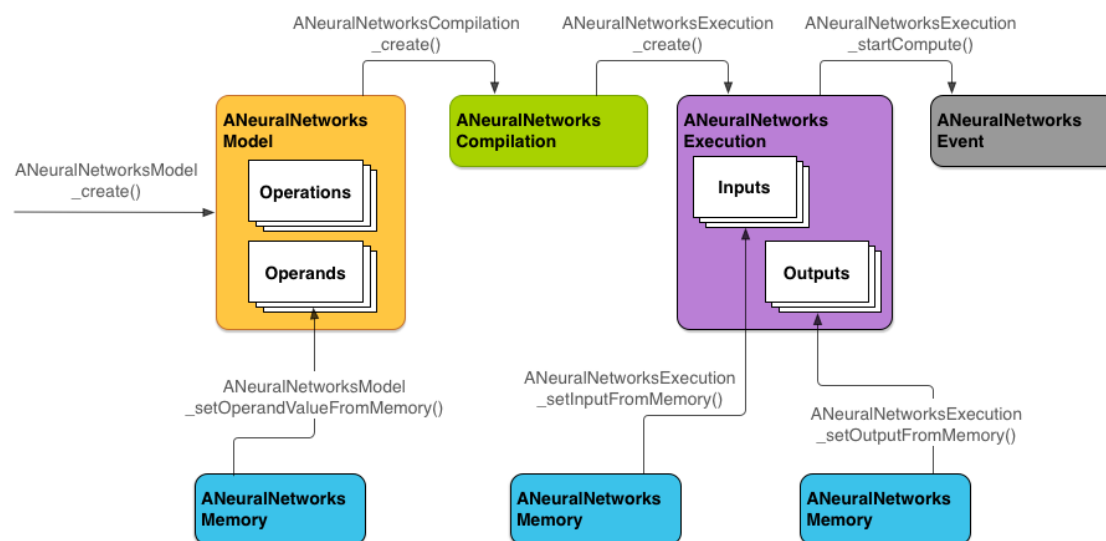


Figure 2: Programming Flow of Android Neural Network API

Mobile net model is specifically design and optimized for Mobile and embedded vision-based applications, it also consists of a streamlined architecture that uses depth-wise separable convolution which helps in building lightweight deep neural networks. This application uses an enhanced convolutional neural network that has the ability to classify colored images. Additionally, certain techniques will be implemented to solve common problems in the neural network which is named Overfitting (Udacity-Google, 2019). Considering max-pooling which deals with 3-Dimensional Convolved Output. The 3D convolved Output will be simplified and will create 3 2 Dimensional Arrays. SoftMax and Sigmoid are covered using the Keras library.

Dataset

The dataset covered more than 5000 images from the selected environments which included images of objects in different lighting conditions in different angles which were captured using a smartphone consisting of a 13mp camera.

Google Collab online python IDE was selected since it can import most of the python packages which will be used to create the pre-trained CNN Model (Mobile Net) and Android Studio will be used in creating the application and work with the pre-trained CNN Model (Tensorflow, 2019).

In the implementation initially, pre-training the model certain packages will be imported and then setting up the input pipeline & providing the dataset was done. To rescale images and creating a trained generator that specifies where the train dataset directory image size batch size. Also created the validation generator. After creating a base model for the pre-trained convnets, feature extraction conducted which will freeze the convolution base by the previous segment and feature extractor which will add a classifier on top of the base and train the top-level classifier.

Using Mobile Net V2 base model as a fixed feature extractor learning curves of training and validation & validation and accuracy loss was controlled. Finally converted the model to a TF Lite model and then download the converted models and labels to apply to the android app.

Results

For the evaluation of the application, the Confusion matrix was used this was done with both training dataset and cross-validation set. Below shown testing to identify furniture with 100 attempts with the verity of lighting and angle variations.

Table.1 Confusion matrix for furniture identification

	Main sofa	Sofa table	Side sofa
Main sofa	95.6	0	4.4
Sofa table	0.4	99.6	0
Side sofa	0.3	0	99.7

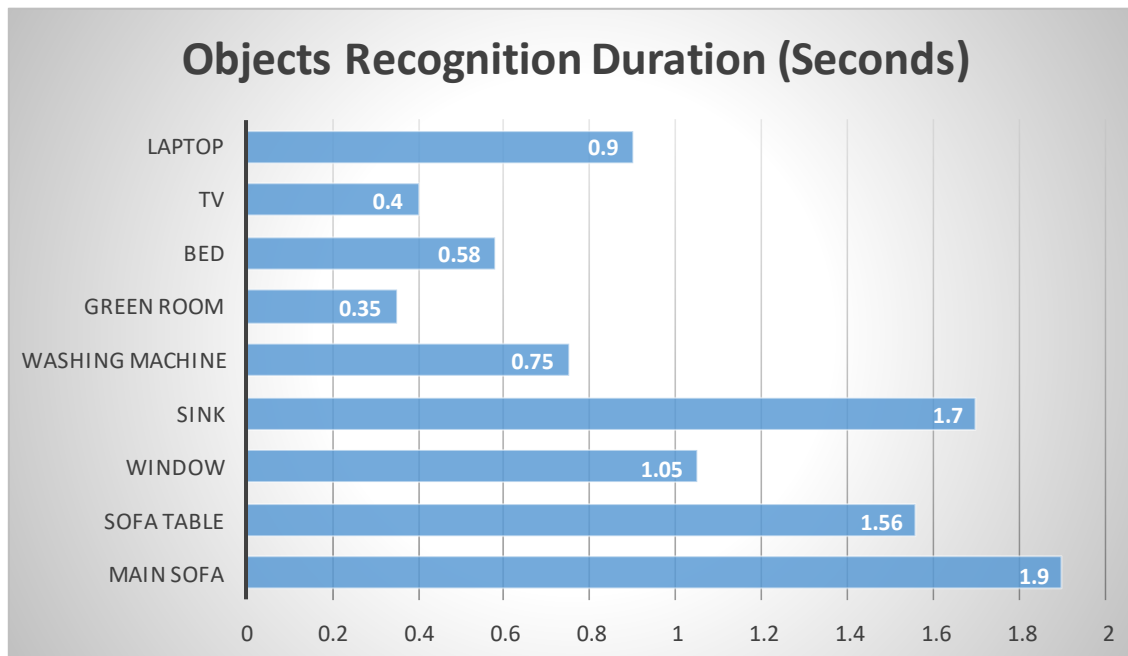
Table.2 Confusion matrix for Oven and Washing machine

	Oven	Washing machine	Other
Oven	95	1	4
Washing machine	0	99.6	0.4

Table.3 Confusion matrix for Room Space Area

	Green Room	Laptop	TV	Other
Green Room	92	0	0	8
Bed	99	0	0	1
Laptop	99	0	0	1
TV	99	0	0	1

After concluding the initial testing, a classification accuracy test was conducted with 100 test cases that were not used in the initial training and has a mean average of 93.5% that can be considered under high accuracy which is acceptable. The developed application was evaluated under noise conditions. A dataset with 5% and 10% noise ratio app produced average above 90% accuracy but with a 15% noise ratio average accuracy drops down to 84.5%.



The app functions in offline mode since it uses a lite model that provides satisfactory results whereas online solutions performance may be based on the availability of the network bandwidth.

During the testing, the app did not freeze and did able to provide voice narration of the identified objects around 2 -10 seconds.

Discussion

When considering the results of confusion matrix sample results, classification accuracy-test it is very much evident that this application has a higher-level accuracy rate. When observing the fail tests majority cases where having a high contrast color wall painting or higher light reflects that was creating a lot of noise on captured frame image. This could have been improved by training with a bigger dataset that includes training data under different angles and lighting. Also, the app work above a satisfactory level with noise in the dataset and

increasing the number of epochs app would be able to perform better even with a high noise ratio. The mobile application performs well with a high level of accuracy on mid-range mobile device (2GB Ram).

Conclusions and Recommendation

As seen in the above results the recognition accuracy is above 90% on most of the objects which is crucial since the user has no visual confirmation while interaction. The results were generated from the application under real-time thanks to the state-of-the-art convolutional neural network which required an acceptable amount of memory bandwidth from the smartphone which is a mid-range device that proves cost-effective since the user doesn't require to invest much on the device.

Considering future recommendations, the dataset can be further improved by capturing objects in front of a green screen background and as well as under different environmental lighting conditions which can be expected to provide much more accurate and reduce response time & overfitting.

The application can be further enhanced to a level that could calculate the distance of the existing object that the user is pointing to which can be achieved with a smartphone equipped with lasers or with the support of the Augmented Reality space measuring mechanism.

Embedding a personal assistant to the application may also further make ease to the individual to interact with the application and surrounding whereas if the app is having trouble detecting the object the assistant could ask the user to touch and feel the object and let know the application which would know the object next time when the user is interacting.

Also, this suggested solution will be applicable for upcoming google smart glasses which is powered by android which will be needed to be optimized in the future if release is expected. Furthermore, more models/architectures should be evaluated in the future to find a more acceptable performance based on the proposed scenario.

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MODERN ONLINE LIBRARY INFORMATION SYSTEM WITH BOOK RECOMMENDATION

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Abstract

Libraries worldwide have slowly shifted towards a more modern, web-based approach; where online resources have become integral in supporting education and research for all stakeholders of the libraries. One such outcome of this digitization is the introduction of online public access catalogues (OPACs) - an online library catalogue and information retrieval system - which was seen as a solution to ease the library catalogue searching process. However, as more libraries started implementing such systems in order to cater to the increasing needs of the patrons, the requirements to enhance the user friendliness and the ease of use of such systems were not widely discussed. In this age of information ‘data is everything’, and libraries have to realize this; but most libraries have not yet adopted data analytics. With the power of data, the library can provide enhanced value-added services to their patrons by improve their user experience with data-driven book suggestions and efficient catalogue searching. This study aims to identify the problems and provide suggestions to the improvement of OPAC with regards to catering to a more modern crowd.

Keywords: Book Recommendation, Insights, kNN Classifier, Library.

Introduction

Online library resources have become integral part of library institutions in supporting education and research for all stakeholders (Reitz, 2004). The modern library should focus on being more user-centric, by adapting to the needs and expectations of the modern society in order to cater to the intellectuals of the next generation; the millennials (Gen Y) and the centennials (Gen Z) (Velan, 2015). As people become more reliant on digital content; they expect more from their “local gateway of knowledge”; libraries have to move from their age-old transactional system and shift their dynamics towards a more relational system – a system which creates more value to the users (Paraschiv, 2019).

Libraries which realized the importance of automation and digitalization of their catalogues opted to either internally develop those platforms or chose to make use of existing solutions that would cater to both their needs and their budgets. For instance, the Koha, an open-source and web-based ILMS (Integrated Library Management System), with support for MARC (Machine-readable cataloging); is a feature-rich ILMS with capabilities for full-text searching, full-cataloguing, and circulation/acquisition/stock management. Although Koha offers advanced capabilities such as Boolean-based keyword/field search features, it still fails to cater to the heterogenous user base that frequently use library’s resources; these users vary widely in backgrounds, age, computer literacy and subject interests (Wanigasooriya, 2008). Most OPAC systems require intermediate-to-high levels of computer literacy in order for them to be used effectively, due to this most library-goers do not make use of these systems. An OPAC system needs to be designed in a way in which it can cater to a wide range of

users, from expert librarians that require systems with advanced searching capabilities, to common users who have experienced the ease of using online search engines and social media platform (and have come to expect library OPAC systems to provide the same) (Thanuskodi, 2012).

Most library patrons lack the skills (and the time) to properly navigate through the resources that are offered by a library, and therefore refrain from making use of them altogether. This leads us to formulate the question, ‘What techniques can libraries use to effectively engage and guide patrons in using their OPAC systems?’.

Our proposed hypothesis is to take on a fresh new outlook to redefine and modernize age-old OPAC Systems with a modern book management/library companion platform that provides enhanced value-added services to the library patrons, and data-driven insights to the library administration.

The primary objective of this was to build a modern, user-centric library platform which provides value-added services to the library patrons over the traditional (and overly complicated) feature set provided by the most OPAC systems.

The secondary objective was providing the library with data-driven insights helping them to streamline their day-to-day administrative activities. This would assist the both the administrative and managerial staff in streamlining their workflow and help them in mitigating business risks.

Methodology

Related Researches

There has been extensive research conduction on the topic of implementing a book recommendation engine into a library management system, where the majority of these recommender systems either using a collaborative-filtering or a content-based filtering method. As an example, Jomsri (2014) applies an association rule-based technique to identify the relationship between books and users by utilizing the historical user book loan data to explore and discover any interesting pattern between the variables in the large dataset.

Mooney and Roy (2000), explored the widely used collaborative filtering method to develop the book recommender system by using other user’s interested book ratings to recommend books to individual users, but they opted to use a content-based filtering method instead, since it was directly based on the book it was able to yield better results when compared to a collaborative-filtering based technique.

Another researcher (Pazzani, 1999), used a hybrid of content-based filtering and demographic filtering to achieve collaborative filtering; he made use of the demographic data of the users such as their age, gender and their literacy rate to recommend them restaurants. This was achieved by analyzing the user reviews that were given to the restaurants by the user, then using that data to create a sparse matrix and base the subsequent recommendation on that.

KNN (kNearest Neighbor) Classifier

The book recommendation engine used for this project was made possible due to the KNN Classification algorithm; KNN is known as a form of supervised machine learning, since it relies on a labelled data set to make the classification, this allows us to classify a given (unlabeled) data point based on a similarity measurement calculation by assessing an already existing data frame (a labelled dataset) (Sayad, 2019). By using the KNN classifier, we will

be performing a collaborative filtering approach, this is mainly due to the abundant availability of a large dataset (the *goodbooks-10k* dataset) with active feature set of six million user reviews for ten thousand books.

Dataset

The dataset which was used to train the book recommendation engine was the *goodbooks-10k* dataset (Zajac, 2017), the source of data comes from Goodreads, a social cataloguing website containing a vast bibliographic database on books. This dataset contains an amalgamated collection of user review data (as listed in the website), comprising of a total of six million user rating for a collection of ten thousand of the most popular books in their database. The dataset contains multiple .csv files where each of them lists down a sorted table on each category; for example, user reviews, book metadata, book tags (genre). For this project, only two data tables were used for training the kNN classifier; the table with the book metadata (books.csv), and the table containing the user reviews mapped to each book id (ratings.csv).

The book data table was filtered to only include the books whose written language (i.e. the specified as “language_code” in the table) was specified as English, and then a separate data frame was created combining the user reviews data frame to the book metadata data frame. The elements in the combined data frame was then further grouped by the “book_id” and an index count was performed, thus giving us the total amount of reviews for each individual book. This data frame was then further filtered to remove rows that have duplicated “user_id” or “book_id”.

(10000, 23)

	book_id	goodreads_book_id	best_book_id	work_id	books_count	isbn	isbn13	authors	original_publication_year	original_title	title
0	1	2767052	2767052	2792775	272	439023483	9.780439e+12	Suzanne Collins	2008.0	The Hunger Games	The Hunger Games (The Hunger Games, #1)
1	2	3	3	4640799	491	439554934	9.780440e+12	J.K. Rowling, Mary GrandPré	1997.0	Harry Potter and the Philosopher's Stone	Harry Potter and the Sorcerer's Stone (Harry P...
2	3	41865	41865	3212258	226	316015849	9.780316e+12	Stephenie Meyer	2005.0	Twilight	Twilight (Twilight, #1)
3	4	2657	2657	3275794	487	61120081	9.780061e+12	Harper Lee	1960.0	To Kill a Mockingbird	To Kill a Mockingbird
4	5	4671	4671	245494	1356	743273567	9.780743e+12	F. Scott Fitzgerald	1925.0	The Great Gatsby	The Great Gatsby

Table 2 - Example of Books Dataset

(5976479, 3)			
	user_id	book_id	rating
0	1	258	5
1	2	4081	4
2	2	260	5
3	2	9296	5
4	2	2318	3
5	2	26	4
6	2	315	3
7	2	33	4
8	2	301	5
9	2	2686	5
10	2	3753	5

Table 3 - Examples for User Ratings

Results

Training

The rating data frame is made into a sparse matrix in order for it to be fit into the KNN classifier model, which would classify the data based on the user reviews.

Distance metric: Cosine similarity

```
rating_matrix = csr_matrix(loader_rating_pivot.values)
from sklearn.neighbors import NearestNeighbors
model_knn = NearestNeighbors(metric='cosine', algorithm='brute')
model_knn.fit(rating_matrix)

[> NearestNeighbors(algorithm='brute', leaf_size=30, metric='cosine',
metric_params=None, n_jobs=None, n_neighbors=5, p=2,
radius=1.0)
```

Figure 26 - Training the KNN through Google Collab Jupyter Server

Recommendation

To get a book recommendation from the KNN-trained classification model, a “book_id” is supplied to the function, which would then return (or recommend) 5 books categorized based on their cosine similarity distance from the supplied value, this would determine similar books rated by the users who had given ratings for the specified book.

```
def get_recommendations_by_id(goodreads_id, topn=6):
    book_index = list(loader_rating_pivot.index).index(goodreads_id)
    distances, indices = model_knn.kneighbors(loader_rating_pivot.iloc[book_index,:].values.reshape(1,-1), n_neighbors=topn)
    print('Recommendations for {}:'.format(loader_rating_pivot.index[book_index]))
    for i in range(1, len(distances.flatten())):
        print('{}: {}, distance = {}'.format(i, loader_rating_pivot.index[indices.flatten()[i]], "%.3f"%distances.flatten()[i]))
    print()

get_recommendations_by_id(3) # Harry Potter and the Sorcerer's Stone (Harry Potter, #1)
get_recommendations_by_id(38447) # The Handmaid's Tale
get_recommendations_by_id(6310) # Charlie and the Chocolate Factory (Charlie Bucket, #1)
```

Recommendations for 3:

1. 5, distance = 0.320
2. 15881, distance = 0.327
3. 6, distance = 0.331
4. 2, distance = 0.343
5. 1, distance = 0.348

Recommendations for 38447:

1. 5470, distance = 0.694
2. 46756, distance = 0.694
3. 2657, distance = 0.703
4. 5129, distance = 0.708
5. 930, distance = 0.709

Recommendations for 6310:

1. 6689, distance = 0.541
2. 39988, distance = 0.543
3. 6327, distance = 0.616
4. 24178, distance = 0.619
5. 6319, distance = 0.622

Figure 27 - Getting the Book Recommendation

The results for the prediction are as follows:

Table 4 - Book Recommendation Evaluation

Book Supplied (Goodreads Book ID)	Books Recommended (Goodreads Book ID)	Cosine Similarity Distance
Harry Potter and the Sorcerer's Stone (Book ID: 3)	Harry Potter and the Prisoner of Azkaban (Book ID: 5)	0.320
	Harry Potter and the Chamber of Secrets (Book ID: 15881)	0.327
	Harry Potter and the Goblet of Fire (Book ID: 6)	0.331
	Harry Potter and the Order of the Phoenix (Book ID: 2)	0.343
	Harry Potter and the Half-Blood Prince (Book ID: 1)	0.348
The Handmaid's Tale (Book ID: 38447)	1984 (Book ID: 5470)	0.694
	Oryx and Crake (MaddAddam, #1) (Book ID: 46756)	0.694
	To Kill a Mockingbird (To Kill a	0.703

	Mockingbird, #1) (Book ID: 2657)	
	Brave New World (Book ID: 5129)	0.708
	Memoirs of a Geisha (Book ID: 930)	0.709
Charlie and the Chocolate Factory (Charlie Bucket, #1) (Book ID: 6310)	James and the Giant Peach (Book ID: 6689)	0.541
	Matilda (Book ID: 39988)	0.543
	The Witches (Book ID: 6327)	0.616
	Charlotte's Web (Book ID: 24178)	0.619
	The BFG (Book ID: 6319)	0.622

As listed in the table above, when the recommendation function is supplied with a Book ID (the same “id” that the Goodreads website gives to each book), it would return five Book IDs that are similar to the specified book. As you can from the result of the first function, when a book from the “Harry Potter” series is passed to the function, it recommends five other books from the same “Harry Potter” series where the cosine similarity is high (since the distance is a low 0.3). The second function, when supplied with the Book ID for “The Handmaiden’s Tale”, a science-fiction book with a story set in the dystopian future; similarly the books recommended by this function are all science-fiction books with stories featuring a dystopia (this concludes that all the recommended books fall under the same science-fiction genre, and the “dystopia” sub-genre). Finally, the third function which specifies a children’s book titled, “Charlie and the Chocolate Factory”, written by the British novelist Roald Dahl; surprisingly, four out of the five books that were recommended by this classification algorithm were written by the very same author (“James and the Giant Peach”, “Matilda”, “The Witches” and “The BFG”), with only the fifth book (“Charlotte's Web”) being written by a different author (but still it falls under the same genre of children’s book). As per the evaluation above, the KNN-based Book Recommendation Engine successfully classifies and recommends similar books on all three cases, thereby demonstrating the success of the evaluation.

Discussion

With the use of the KNN classifier algorithm, we can ensure that we are able to find books that are similar to Book b , first we find User u who has rated Book b and find other Books b^n rated by the User u and recommend those books. For us to accurately determine which books are similar we apply a similarity function (in this case, we use a cosine metric) between Book x (the supplied book) and Book y (the book that is to be recommended) and compare it against the User a ’s rating on the books. This cosine similarity function will allow us take into consideration the rating scale between different users, which helps the KNN find the

nearest K-neighbor for each book using the cosine similarity metric, and then use the weighted means to predict and recommend the books.

Conclusion

This book recommendation classifier was designed to provide the library patrons and the OPAC users a value addition over the traditional transaction-focused OPAC systems that are widespread in the library ecosystem. In this age of information ‘data is everything’, and libraries have to realize this; but most libraries have not yet adopted data analytics. With the power of data, a library can provide enhanced value-added services to its patrons while improving upon their user experience with data-driven book suggestions and efficient catalogue searching. Moreover, with the help of data gained from the user interactions, the library could analyze book trends (popular books, trending authors), user borrowing patterns, and calculate book return-rate. Ultimately, these types of insights can aid the library in evidence-based decision-making process (Romero, 2018).

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DESKTOP APPLICATION TO GENERATE STAFF ROSTERS – ROSTER MANAGEMENT SYSTEM.

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Abstract

The lifestyle of the people working according to a roster has been affected due to the roster. As per the researches carried out not only the employees but also the managers face various difficulties due to roster generation. The roster generation, the holiday allocation and the work stress are the key points that affect the people working with rosters.

The main reason for the issue is that there is no proper roster generation methodology, at the moment the rosters are generated manually by the management which is not very accurate and causes conflicts within the department and increases the stress levels of the employees and management. In order to solve this issue, the ideal solution would be to use artificial intelligence in order to generate fair rosters automatically.

In this system, the employees would be able to provide their roster requirements, the manager would be able to enter their language preference (since the system is for a call center), the necessary shift times, and the necessary number of staff members into the data base. Finally, the roster would be generated on button click and monitored before making it available to the employee. There would be 90% accurate rosters generated with 0 conflicts using the system.

Keywords: AI, GA (Genetic Algorithm), Roster

Introduction

Background

Rostering of staff in various organizations plays an important role, along with the development and expansion of the organization and the facilities they provide. The main reason why rosters have been introduced to the organization is to reduce Over Time pays and additional work stress that would lead to an unhealthy work environment for the employees.

But still, the generation of the roster too has led to many conflicts and unnecessary stress within the organization. The Roster Management System was proposed by carrying out a survey in an extended working hour bank in Sri Lanka. The people working in this department are between the age of 20 and 30. A few complaints that was brought forward are;

- The person making the roster is granting all of the requirements to the friends (favoritism).
- Rejection of requirements.
- Sudden leave that are requested due to unavoidable reasons are often rejected.
- Facing issues with the customers when there are no agents to communicate with the preferred language of the customer.

Among many complaints mentioned above are a few main complaints.

The issues highlighted by the management are as follows;

- Running short of staff due to sudden leaves, resignations and promotions.
- They work additional hours for roster generation.
- The management is responsible in completing the work even with short staff.
- The management rankings have been affected due to unnecessary complaints from the staff.

In order to solve the issues, a proper system for roster generation would be a good solution.

Objectives

- Generate fair rosters without any conflicts.
- To minimize the time wasted by the management.

Significance of the study

At the moment there are certain roster generation software's which needs a lot of human involvement. In those software's the necessary shifts and dates would appear on a sticky note and the manager would have to drag and drop the shifts under the employee names. This system is very similar to the existing manual system followed by the organization.

Another automated lecture timetable scheduling system was built by Jumoke Soyemi, John Akinode, Samson Oloruntoa in 2017. This system was built so that the timetable would be generated automatically using GA. (Soyemi, Akinode, Oloruntoa, 2017).

A research carried out by Ernst, Jiang and Krishnamoorthy has identified sixteen different processing models which are based on the rostering process such as the demand of employees for the work, off days, employee requirements etc. They've also addressed fifteen different industries which uses rosters to carry out their day to day activities such as nurse rosters, medical center rosters, etc. Considering all of the research and problems they have come across their final conclusion of using the GAs in order to develop the personal roster planning and scheduling system. (Ernst, Jiang, Krishnamoorthy, 2004).

In 2012 Mudra S. Gondane, Prof. D. R. Zanwar has carried out a research and developed a nurse scheduling system using GA. (Mudra S. Gondane, Prof. D. R. Zanwar, 2012).

Similarly, in 2011 Amol Adamuthe and Rajkumar Bichkar has developed a system to allocate daily task to employees in the **Genetic Algorithm Approach for Personal Timetabling** research paper.

Therefore, it is very clear that the best technology to use for the automatic roster generator is GA.

Methodology

The problem was initially discussed with a friend who already faces issues due to the manual rostering system in the organization, in order to clearly understand the problem and identify the most appropriate solution there was a interview session that was carried out with the manager and many other employees working according to the roster.

Then by carrying out many other online researchers and going through existing research papers and also discussing possible issues that can take place, the automatic roster generation was the best solution for the problem. And the ideal technology that could be used is the genetic algorithm.

Genetic Algorithm (GA)

In this project the GA is used as the AI. The GA follows the process of natural selection. The GA is used in order to solve complex optimization problems and since the rostering system has been considered as an NP – hard problem, the best solution for roster generation could be provided by the GA.

The GA is an algorithm that was introduced by considering the theory of natural evolution that was discovered by Charles Darwin. The five phases of GA are as follows,

The population is simply the set of data and factors that needs to be considered in order to get the necessary solution, this includes a set of values called **Genes** which are the variables and a string of **Chromosomes** which is the solution. In the roster management system, the **population** would be the data provided through the MySQL database which are the employees, shifts or time slots, departments and the languages the employees use to communicate.

Once the system accesses the data that are provided by the manager, the GA goes through the **selection** in order to select the best set of data. There after the **crossover** and **mutation** takes place.

The actual and more accurate result would be generated considering the **fitness**, the actual roster would be generated when the fitness factor is satisfied.

In order to generate a good roster, the fitness should be 1 and conflicts should be 0.

Below is a figure, which clearly shows the **Genes**, **Chromosomes** and **Populations** in GA.

Dataset.

The dataset was prepared considering the actual rosters which have been generated in the organization. The facts that have been taken into consideration in the manual system are the number of employees, working days and the shift times. In addition to this while preparing the database the number of employees, the languages the speak, the shift times, working days and the employee requirements have been maintained separately.

The granting of the employee special requirements does not involve AI even though they are maintained in the database, since the management needs to consider the requirements along with the proof and the priority of the requirements.

Shown below is an image of a roster which was generated manually by the organization in 2017.

Figure 1 – Manually generated roster 2017.

Results & Discussion

As a conclusion, the rosters are generated daily and the requirements are approved and adjusted by the manager due to the limitations.

Table 1: Fitness, Conflicts and overlapping shifts

Date	Fitness and Conflicts Fitness Conflicts	Overlapping Shifts for Agents (Yes/No)
Monday	1 0	No
Tuesday	1 0	No
Wednesday	1 0	No
Thursday	1 0	No
Friday	1 0	No
Saturday	1 0	No
Sunday	1 0	No

According to the above results, there have been fair rosters generated for each day with 0 conflicts and the time taken for each of this roster generation is less than a minute. Which makes it clear that there have been fair rosters generated with minimum human involvement and minimum time consumption.

The rosters generated for each day are as follows,

Class #	Dept	Employee (Employee_ID, Username)	Computer (Users)	Language (Id)	Shift (Id)
01	CC	Jane (1, 0)	C1 (5)	Sinhala (LS)	M4 08:30 - 17:00 (S4)
02	CC	Peter (2, 0)	C1 (5)	Sinhala (LS)	M3 11:30 - 20:00 (S7)
03	CC	Sashika (3, 0)	C1 (5)	Sinhala (LS)	M4 11:30 - 20:00 (S8)
04	CC	Wendy (4, 0)	C1 (5)	English (LE)	M2 07:00 - 15:30 (S13)
05	CC	Mohammed (5, 0)	C1 (5)	Sinhala (LS)	M2 11:30 - 20:00 (S6)
06	CC	Taylor (6, 0)	C1 (5)	Tamil (LT)	M1 09:30 - 18:00 (S9)
07	CC	Anne (7, 0)	C1 (5)	English (LE)	M3 08:30 - 17:00 (S3)
08	CC	Dinesh (8, 0)	C1 (5)	Sinhala (LS)	M1 07:00 - 15:30 (S12)
09	CC	Faznaine (9, 0)	C1 (5)	Tamil (LT)	M1 OFF (S10)
10	CC	Richie (10, 0)	C1 (5)	English (LE)	M1 11:30 - 20:00 (S5)

Solution Found in 5 generations

Figure 2 – Monday Roster.

Class #	Dept	Employee (Employee_ID, Username)	Computer (Users)	Language (Id)	Shift (Id)
01	CC	Jane (1, 0)	C1 (5)	Sinhala (LS)	T3 08:30 - 17:00 (S3)
02	CC	Peter (2, 0)	C1 (5)	Sinhala (LS)	T2 OFF (S11)
03	CC	Sashika (3, 0)	C1 (5)	Sinhala (LS)	T4 08:30 - 17:00 (S4)
04	CC	Wendy (4, 0)	C1 (5)	English (LE)	T3 11:30 - 20:00 (S7)
05	CC	Mohammed (5, 0)	C1 (5)	Sinhala (LS)	T1 11:30 - 20:00 (S5)
06	CC	Taylor (6, 0)	C1 (5)	Tamil (LT)	T2 11:30 - 20:00 (S6)
07	CC	Anne (7, 0)	C1 (5)	English (LE)	T1 09:30 - 18:00 (S9)
08	CC	Dinesh (8, 0)	C1 (5)	Sinhala (LS)	T1 OFF (S10)
09	CC	Faznaine (9, 0)	C1 (5)	Tamil (LT)	T2 07:00 - 15:30 (S13)
10	CC	Richie (10, 0)	C1 (5)	English (LE)	T1 08:30 - 17:00 (S1)

> Solution Found in 11 generations

Figure 3 – Tuesday roster.

Class #	Dept	Employee (Employee_ID, Username)	Computer (Users)	Language (Id)	Shift (Id)
01	CC	Jane (1, 0)	C1 (5)	Sinhala (LS)	W1 09:30 - 18:00 (S9)
02	CC	Peter (2, 0)	C1 (5)	Sinhala (LS)	W2 11:30 - 20:00 (S6)
03	CC	Sashika (3, 0)	C1 (5)	Sinhala (LS)	W4 11:30 - 20:00 (S8)
04	CC	Wendy (4, 0)	C1 (5)	English (LE)	W2 OFF (S11)
05	CC	Mohammed (5, 0)	C1 (5)	Sinhala (LS)	W3 11:30 - 20:00 (S7)
06	CC	Taylor (6, 0)	C1 (5)	Tamil (LT)	W2 08:30 - 17:00 (S2)
07	CC	Anne (7, 0)	C1 (5)	English (LE)	W1 OFF (S10)
08	CC	Dinesh (8, 0)	C1 (5)	Sinhala (LS)	W4 08:30 - 17:00 (S4)
09	CC	Faznaine (9, 0)	C1 (5)	Tamil (LT)	W1 07:00 - 15:30 (S12)
10	CC	Richie (10, 0)	C1 (5)	English (LE)	W1 08:30 - 17:00 (S1)

Solution Found in 5 generations

Figure 4 – Wednesday Roster.

Class #	Dept	Employee (Employee_ID, Username)	Computer (Users)	Language (Id)	Shift (Id)
01	CC	Jane (1, 0)	C1 (5)	Sinhala (LS)	TH2 11:30 - 20:00 (S6)
02	CC	Peter (2, 0)	C1 (5)	Sinhala (LS)	TH1 08:30 - 17:00 (S1)
03	CC	Sashika (3, 0)	C1 (5)	Sinhala (LS)	TH3 11:30 - 20:00 (S7)
04	CC	Wendy (4, 0)	C1 (5)	English (LE)	TH1 11:30 - 20:00 (S5)
05	CC	Mohammed (5, 0)	C1 (5)	Sinhala (LS)	TH3 08:30 - 17:00 (S3)
06	CC	Taylor (6, 0)	C1 (5)	Tamil (LT)	TH1 07:00 - 15:30 (S12)
07	CC	Anne (7, 0)	C1 (5)	English (LE)	TH2 07:00 - 15:30 (S13)
08	CC	Dinesh (8, 0)	C1 (5)	Sinhala (LS)	TH1 09:30 - 18:00 (S9)
09	CC	Faznaine (9, 0)	C1 (5)	Tamil (LT)	TH2 08:30 - 17:00 (S2)
10	CC	Richie (10, 0)	C1 (5)	English (LE)	TH2 OFF (S11)

Solution Found in 13 generations

Figure 5 – Thursday Roster.

Class #	Dept	Employee (Employee_ID, Username)	Computer (Users)	Language (Id)	Shift (Id)
01	CC	Jane (1, 0)	C1 (5)	Sinhala (LS)	F3 11:30 - 20:00 (S7)
02	CC	Peter (2, 0)	C1 (5)	Sinhala (LS)	F4 08:30 - 17:00 (S4)
03	CC	Sashika (3, 0)	C1 (5)	Sinhala (LS)	F4 11:30 - 20:00 (S8)
04	CC	Wendy (4, 0)	C1 (5)	English (LE)	F1 11:30 - 20:00 (S5)
05	CC	Mohammed (5, 0)	C1 (5)	Sinhala (LS)	F1 08:30 - 17:00 (S1)
06	CC	Taylor (6, 0)	C1 (5)	Tamil (LT)	F1 OFF (S10)
07	CC	Anne (7, 0)	C1 (5)	English (LE)	F2 11:30 - 20:00 (S6)
08	CC	Dinesh (8, 0)	C1 (5)	Sinhala (LS)	F2 OFF (S11)
09	CC	Faznaine (9, 0)	C1 (5)	Tamil (LT)	F3 08:30 - 17:00 (S3)
10	CC	Richie (10, 0)	C1 (5)	English (LE)	F2 08:30 - 17:00 (S2)

Solution Found in 11 generations

Figure 6 – Friday Roster.

Class #	Dept	Employee (Employee_ID, Username)	Computer (Users)	Language (Id)	Shift (Id)
01	CC	Jane (1, 0)	C1 (5)	Sinhala (LS)	SAT1 09:30 - 18:00 (S9)
02	CC	Peter (2, 0)	C1 (5)	Sinhala (LS)	SAT4 11:30 - 20:00 (S8)
03	CC	Sashika (3, 0)	C1 (5)	Sinhala (LS)	SAT2 07:00 - 15:30 (S13)
04	CC	Wendy (4, 0)	C1 (5)	English (LE)	SAT1 11:30 - 20:00 (S5)
05	CC	Mohammed (5, 0)	C1 (5)	Sinhala (LS)	SAT1 OFF (S10)
06	CC	Taylor (6, 0)	C1 (5)	Tamil (LT)	SAT1 07:00 - 15:30 (S12)
07	CC	Anne (7, 0)	C1 (5)	English (LE)	SAT4 08:30 - 17:00 (S4)
08	CC	Dinesh (8, 0)	C1 (5)	Sinhala (LS)	SAT2 08:30 - 17:00 (S2)
09	CC	Faznaine (9, 0)	C1 (5)	Tamil (LT)	SAT2 11:30 - 20:00 (S6)
10	CC	Richie (10, 0)	C1 (5)	English (LE)	SAT1 08:30 - 17:00 (S1)

Solution Found in 8 generations

Figure 7 – Saturday Roster.

Class #	Dept	Employee (Employee_ID, Username)	Computer (Users)	Language (Id)	Shift (Id)
01	CC	Jane (1, 0)	C1 (5)	Sinhala (LS)	SAT1 09:30 - 18:00 (S9)
02	CC	Peter (2, 0)	C1 (5)	Sinhala (LS)	SAT4 11:30 - 20:00 (S8)
03	CC	Sashika (3, 0)	C1 (5)	Sinhala (LS)	SAT2 07:00 - 15:30 (S13)
04	CC	Wendy (4, 0)	C1 (5)	English (LE)	SAT1 11:30 - 20:00 (S5)
05	CC	Mohammed (5, 0)	C1 (5)	Sinhala (LS)	SAT1 OFF (S10)
06	CC	Taylor (6, 0)	C1 (5)	Tamil (LT)	SAT1 07:00 - 15:30 (S12)
07	CC	Anne (7, 0)	C1 (5)	English (LE)	SAT4 08:30 - 17:00 (S4)
08	CC	Dinesh (8, 0)	C1 (5)	Sinhala (LS)	SAT2 08:30 - 17:00 (S2)
09	CC	Faznaine (9, 0)	C1 (5)	Tamil (LT)	SAT2 11:30 - 20:00 (S6)
10	CC	Richie (10, 0)	C1 (5)	English (LE)	SAT1 08:30 - 17:00 (S1)

Solution Found in 8 generations

Figure 8 – Sunday Roster.

The results of daily rosters generated within a week is shown above. And as per the results the daily rosters do not show any conflicts and therefore, proves that the system works 100% accurately.

Conclusion and Recommendations

As per the explanations provided above the roster management system is developed in order to solve the roster generation issue that takes place in the organization. The main objective of the project is to generate fair rosters and to limit the time wastage of the managers in order to generate rosters, which normally takes about 2 days.

As per the above solutions of the automatic rosters which are generated with a limited number of employees and shifts due to the insufficient time provided to complete the project, shows a positive impact by providing 100% accurate rosters, which would be amended by the manager comparing the employee requirements and the priorities of the requirements.

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SOCIAL SCIENCES

THE EFFECT OF PARENTING STYLES AND THE PREVALENCE OF DEPRESSION IN YOUNG ADULTS IN A COLLECTIVIST CULTURE

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Abstract

Despite there being a number of studies investigating the influence of parental authority on children's later mental health, there has been limited research conducted on young adults and Asian societies. This present study was designed to examine the relationship between parenting styles observed in a collectivist culture and symptoms of depression, anxiety and stress among young adults. A total of 150 participants (75 males and 75 females, all of whom were Sri Lankans) between the age range of 18 and 26 were asked to appraise the parenting they received and were then assessed on their current emotional states. The Parental Authority Questionnaire and the Depression Anxiety Stress scale were administered for these purposes respectively. The data was analyzed using a Pearson coefficient of correlation test, an Independent samples T-test and a Chi-squared analysis. The results revealed that three important things. (1) The authoritarian style of parenting is significantly positively correlated to depression, anxiety and stress. (2) The authoritative and authoritarian styles of parenting were the most commonly endorsed in the collectivist culture of Sri Lanka. (3) There was a significant difference between the measures of depression, anxiety and stress recorded for males and females.

Keywords: Authoritarian Parenting Style, Collectivist Culture, Depression, Young Adults

Introduction

According to the Ministry of Health, Nutrition and Indigenous Medicine (2017), it was stated that approximately 4.1% of the Sri Lankan population suffered from depression. There were an estimated 802,321 total cases reported in the country and current estimates suggest a higher figure. Global health estimates of the World Health Organization (2018) found that more than 300 million people worldwide were affected and lived with the disorder. Depression is the predominant mental health problem in the world, impacting nearly all demographics. Being a mood disorder, it adversely affects the way a person thinks, feels and acts. The feelings of sadness and loss of interest in once enjoyable activities, along with a variety of other physical and emotional problems, decreases the person's ability to function (American Psychiatric Association, 2018). Symptoms however, can easily go unnoticed or mistaken for normal moodiness and therefore it is necessary to identify these symptoms and contributory factors because despite being a treatable illness, at the far extreme it can lead to detrimental behaviors such as drug and alcohol abuse, sexual promiscuity, self-harm or even suicide (NIHM, 2000; Hankin, et.al., 1998; Birmaher, et.al., 1996, cited in Sharma, Sharma & Yadava, 2011). Being a leading cause of death among 15-29-year olds, Sri Lanka has one of the highest suicide rates in the world (Colombo Telegraph, 2017). The objective of this study is to explore if parenting styles influenced by a collectivist culture have a direct impact on the prevalence of depression in young adults. By looking into this phenomenon, we can

understand if, and how the role of parenting either positively or negatively affects the later mental health of children and their lives.

Methodology

Participants

The study had a total sample of 150 participants which included 75 males and 75 females. The age range of the young adult sample was from 18-26 years. The sample was selected from the International College of Business and Technology (ICBT), through the convenience sampling method. The snowball sampling method was also implemented to some extent when questionnaires in the form of Google Forms were circulated as online surveys. All participants were Sri Lankans and responses from participants of other nationalities were filtered and excluded from the sample.

Design

A cross-sectional quantitative survey design was used. The variables being examined were parental styles and levels of depression, anxiety and stress among young adults. The parental styles tested for were authoritative, authoritarian and permissive.

Materials

A demographic questionnaire was used for the purpose of filtering for Sri Lankan participants and obtaining confirmation of their age and gender. It contained questions pertaining to the participants' ethnicity, field of education, their parents' age, nationality, ethnicity and occupations as well.

The Parental Authority Questionnaire by Dr. John R. Buri (1991) was utilized to assess the appraisal of parental styles from the participants' point of view. It contains 30 items, rated using a 5-point scale (1=strongly disagree, 5=strongly agree). This questionnaire has been proved to be a psychometrically sound and valid measure of Baumrind's parental styles, with Cronbach's Alpha internal consistency values of .75 for Mother's permissiveness, .85 for Mother's authoritarianism, .82 for Mother's authoritative, .74 for Father's permissiveness, .87 for Father's authoritarianism and .85 for Father's authoritative (Buri, 1991). The scale has three subscales; permissive, authoritarian and authoritative/flexible, with items corresponding to each subscale so that scores on each scale may range from 10-50. Assessment for mothers and fathers are identical except for references to gender.

Levels of depression, anxiety and stress were evaluated by the Depression Anxiety Stress Scale (DASS) by Lovibond, S.H & Lovibond, P.F (1995). This is a 42-item self-report scale which has been proven to have high reliability and validity, with Cronbach's Alpha internal consistency coefficients of .96, .89 and .93 for depression, anxiety and stress respectively (Basha and Kaya, 2016). Items are rated from 0-3 indicating how much each statement applied to the person rating it, where 0="Did not apply to me at all" and 3="Applied to me very much or most of the time". The total scores acquired for depression, anxiety and stress fall under one of the five ranges of 'Normal', 'Mild', 'Moderate', 'Severe' and 'Very Severe'.

Method of Analysis

The Statistical Package of Social Sciences (SPSS) was used to analyze the data collected. Out of the data that was collected, the sum of the Parental Authority and Depression Anxiety and Stress subscales respectively, were ratio measures; age, gender, ethnicity, field of education,

and occupation of parents were nominal measures; and the responses to the Parental Authority Questionnaire and Depression Anxiety Stress Scale were ordinal measures.

Correlational analyses were carried out to determine if there was a relationship between (1) parental styles and depression, (2) parental styles and anxiety and, (3) parental styles and stress. A T-test was carried out to determine if there was a difference in levels of depression, anxiety and stress among males and females. Furthermore, a Chi-squared analysis was also performed to determine differences, if any, between the measures of depression, anxiety and stress for each of the styles of parenting recorded.

Ethics

Ethics approval was sought from the Ethics Approval Committee of Cardiff Metropolitan University – UK, before commencing the research. Factors such as future ethical issues that could arise due to the questionnaires and participants' confidentiality were addressed.

Results

Hypothesis 1: Is there a relationship between perceived parenting styles (authoritative, authoritarian and permissive) and the prevalence of depressive symptoms in young adults?

Pearson's coefficient of correlation tests was performed to investigate the relationship between each of the parental styles and depression, anxiety and stress respectively. The authoritative style of parenting was found to be negatively correlated to depression ($r = -0.32$, $N = 150$, $p < .001$), anxiety ($r = -0.08$, $N = 150$, $p = 0.362$) and stress ($r = -0.2$, $N = 150$, $p = 0.014$). It was found that the permissive style of parenting was also negatively correlated to both depression ($r = -0.19$, $N = 150$, $p = 0.021$) and stress ($r = -0.2$, $N = 150$, $p = 0.016$) but was positively correlated to anxiety ($r = 0.12$, $N = 150$, $p = 0.159$). However, the authoritarian style of parenting was moderately positively correlated to both depression ($r = 0.46$, $N = 150$, $p < .001$) and stress ($r = 0.42$, $N = 150$, $p < .001$) and positively correlated to anxiety as well ($r = 0.29$, $N = 150$, $p < .001$).

Hypothesis 2: Is there a difference, if any, between the measures of depression among males and females?

An Independent Samples t-test was also performed to determine if there was a difference in levels of depression, anxiety and stress among males and females. It was revealed that there was indeed a difference between the genders for depression ($t(148) = 2.2$, $p = 0.029$), anxiety ($t(148) = 1.37$, $p = 0.174$) and stress ($t(148) = 0.23$, $p = 0.816$), with males showing greater levels for each of the factors than females. Lastly, a Chi-squared analysis was computed to investigate if there were any differences present between the measures of depression, anxiety and stress for each of the parental styles recorded. The test revealed a significant difference between the measures for the permissive style of parenting ($\chi^2(31, N = 150) = 62.05$, $p = .001$) and the authoritarian style of parenting ($\chi^2(35, N = 150) = 68.88$, $p = .001$). The test showed no significant difference for the authoritative style of parenting ($\chi^2(31, N = 150) = 80.83$, $p < .001$).

Hypothesis 3: Which parenting style is the most commonly observed in a collectivist culture such as that of Sri Lanka?

All three styles of parenting; the permissive ($M = 31.06$, $SD = 7.75$), the authoritarian ($M = 32.41$, $SD = 7.62$) and the authoritative/flexible ($M = 34.9$, $SD = 7.18$), seem to be commonly observed in the sample population.

It is imperative to note that the results of this study appear to support the hypotheses that have been formulated. Significant positive correlations were found between the authoritarian style of parenting and depressive ($r = 0.46$, $N = 150$, $p < .001$), stress ($r = 0.42$, $N = 150$, $p < .001$) and anxiety ($r = 0.29$, $N = 150$, $p < .001$) symptoms whereas negative correlations were found with the permissive and authoritative styles. There was a difference between the measures of depression, anxiety and stress among the genders. Furthermore, significant differences between the measures of depression, anxiety and stress for the permissive ($\chi^2(31, N = 150) = 62.05$, $p = .001$) and authoritarian ($\chi^2(35, N = 150) = 68.88$, $p = .001$) styles of parenting were also found.

Discussion

The present study aimed to examine the relationship between perceived parenting styles and the prevalence of depressive symptoms in a Sri Lankan population of young adults. It also attempted to determine the most commonly observed parenting styles in the Sri Lankan culture and performed analyses to investigate the differences that were present between the measures of depression, anxiety and stress among males and females. The results of the analyses revealed that the authoritarian style of parenting was significantly positively correlated to depression, anxiety and stress in young adults. This finding is in line with the results of the study conducted by Sharma, Sharma & Yadava (2011) which concluded that the authoritarian style of parenting lead to higher levels of depression in adolescents. It is also consistent with the results of the study carried out by Uji, Sakamoto, Adachi & Kitamura (2013) which found that authoritarian parenting had a variety of negative effects on children's later mental health. This indicates that regardless of the child's age, those who grow up with parents who are highly demanding, controlling and use forceful measures to discipline their children mainly show symptoms of depression and in this case, anxiety and stress as well. It can then be thought that these individuals develop feelings of sadness and loss of interest in their activities, along with other depressive symptoms due to the lack of warmth, praise and affection from their parents. Harsh and demanding parenting styles were found to lead to futility, low self-esteem and psychiatric indisposition in children (Shek, 1999, cited in Uji, Sakamoto, Adachi & Kitamura). In contrast, research suggests that the permissive style of parenting was significantly negatively correlated to depression (Sharma, Sharma & Yadava, 2011) and that authoritative parenting had positive effects on children's later mental health (Uji, Sakamoto, Adachi & Kitamura, 2013) and these findings are also consistent with the findings of the current study which showed that the permissive parental style was negatively correlated to both depression and stress (but positively correlated to anxiety) and the authoritative parenting style was also negatively correlated to depression, anxiety and stress.

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**THE MEDIATING EFFECT OF A POSITIVE PSYCHOLOGY BASED
INTERVENTION ON THE LEVELS OF STRESS AMONG EMPLOYEES**

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Abstract

Positive psychology being an integral part of psychology has been conceptualized as an individual's state of development characterized by self-efficacy, optimism, hope and resilience. The purpose of this study is to identify whether there is a relationship between the PsyCap dimensions: optimism, hope, self-efficacy and resilience and level of work stress. Further, the secondary objective was to identify whether positive psychological intervention can improve the level of PsyCap. The study was conducted as an explorative study with 44 employees representing sales and operation and they were exposed to a two hours positive psychological intervention. Employee's level of PsyCap and stress were measured pre and post intervention and one week after the intervention using a self-reported questionnaire. Results indicated that there were statistically significant improvements in PsyCap dimension after the intervention and statistically significant reduction in level of stress. However, there was no correlation between PsyCap dimension and level of stress.

Key Words: Positive Psychology, PsyCap , Stress, Positive Psychological Intervention, PCI

Introduction

Today's world of business, financial, human, social, intellectual and psychological capital is considered as an investment rather than a cost. These capitals are used to make a differentiated organization with an idea of leveraging this in to a competitive advantage. Organizations invest millions to train their employees as they understand the value of human capital. Most of the entrepreneurs believe that success of their business largely depends on the human resource of that particular organization. Therefore, recruiting and retaining good employees is an integral part of the business strategies. Even though work stress has been a concern for decades, there was no growing body of research on work's stress. Benach, Margaret and Govern in 2010 and Luxemburg in 2004 pointed out that much of the research and studies were carried out in developed states and very little has been done in developing countries. Therefore, it is paramount to study these subjects in countries like Sri Lanka and this study will enhance the limited literatures which emphasizes on the effect of positive psychology and stress levels in the Sri Lankan context. The primary idea behind this study was to identify whether there is a relationship between the PsyCap dimensions: optimism, hope, self-efficacy and resilience and level of work stress. Further, the secondary objective was to identify whether positive psychological intervention can improve the level of PsyCap. Identification of that will help employers to be pro-active in managing and recruiting employees by way of developing training and coaching sessions for employees to manage their stress levels and be more productive in their work life. Further, recruitment strategies can also be crafted based on positive psychological capital characteristics which will enable organizations manage and minimize their cost of labour turnover and go for high productivity

levels. With regards to the employee, this study will give them an idea as to what can be done to manage their levels of stress which can lead to employee's wellbeing and higher productivity.

Methodology

Participants

Participants were recruited using a purposive sampling method from a general insurance company located in Colombo, Sri Lanka. They belong to the western region of that company and represented sales and operational job categories. The participants were full time employees and have being employed for a minimum period of one year. All training staff and non-permanent staffs were excluded from the sample and the selection criteria was limited to non-executives to senior manager designation. All assistant general managers and above staff were excluded from the sample. The recruitment was done on voluntary basis and a convenient sampling technique was used because of the busy schedule of the employees, mainly because of the difficulty in gathering employees for the training intervention on a fixed time. An email was sent to all operational and sales staff of the western region explaining the study and its purpose. Seventy employees showed interest in participating in the study however only 44 were present for the study. They were divided in to two groups mainly for the purpose of getting them for the positive psychological intervention. Both groups were given a positive interventional training (PCI) program which was conducted by the researcher on two different days. 22 participated in the PCI. The sample consisted of 44 participants where they were predominantly male employees who were between the age of 20 to 53 years of age; there were seven female participants between 22 to 52 years of age.

Procedure and materials

The study was designed with a true interventional design of a mixed group of participants who were subject to a pre-test, post-test (1) and post- test(2). Participants were recruited using a purposive sampling method and an email was sent to all sales and operational employees to be invited for the study. Equal number of participants were divided in to two groups representing sales and operational employees using simple random sampling method to allocate them to two groups. For the intervention, they were given a choice of two dates for them to select the date of their convenience. Two groups were represented in a mix of sales and operational staff. A

Psychological Capital Questionnaire: The PCQ (Luthans *et al.*, 2007) 24-item scale (Appendix A) and **Stress Scale** (Stanton *et al.*, 2001) consists of 15 items (Appendix B) were given to both groups before the interventional training program to measure the pre interventional psychological capital and the level of job stress. Both groups were exposed to a self – guided positive psychological brief training of two hours.

Positive psychological interventional training

The training was conducted with the intension of increasing participant's psychological capital. This psychological capital intervention (PCI) followed the guidelines outlined by Luthans *et al.* (2010) which includes individual exercises and a group discussion tailor made to impact the participants' levels of self -efficacy, hope, optimism and resilience.

Measurement of PsyCap

Both groups were tested for their level of Psychological capital using the 24 item Psychological capital questionnaire (PCQ-24) introduced by Luthans Youssef and Avolio in 2007 and the questionnaire was empirically validated by the same set of authors in 2007.

Measurement of stress

Participant's levels of stress were measured using the Stanton, Blazer, Para and Ironson's (2001) 15 items stress scale. This scale consists of threat and pressure subscales and was validated by Stanton et al., in 2001 with an alpha value from .77 to .83 and .73 to .86 respectively.

Results

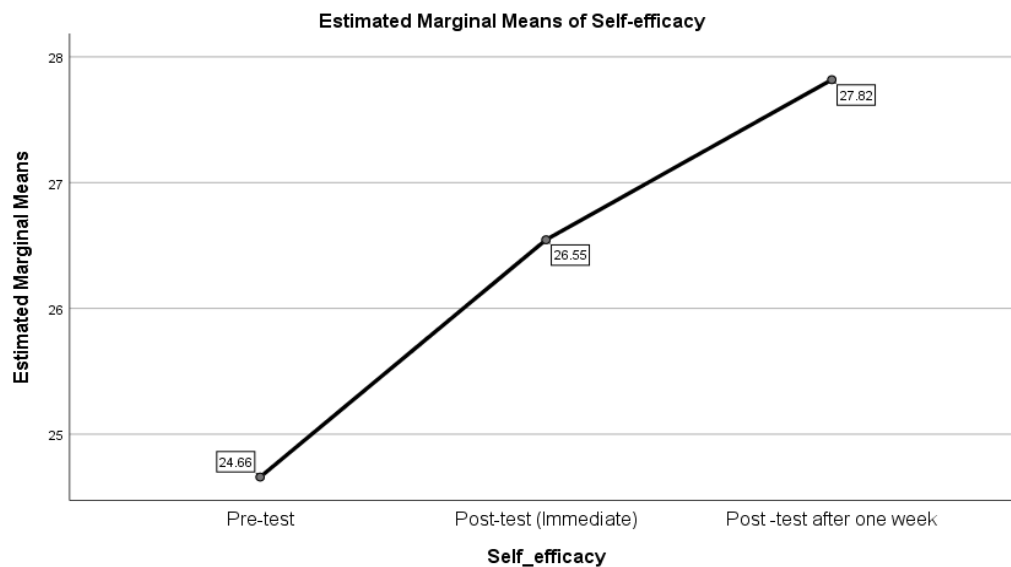


Figure 28: Estimated marginal of self-efficacy.

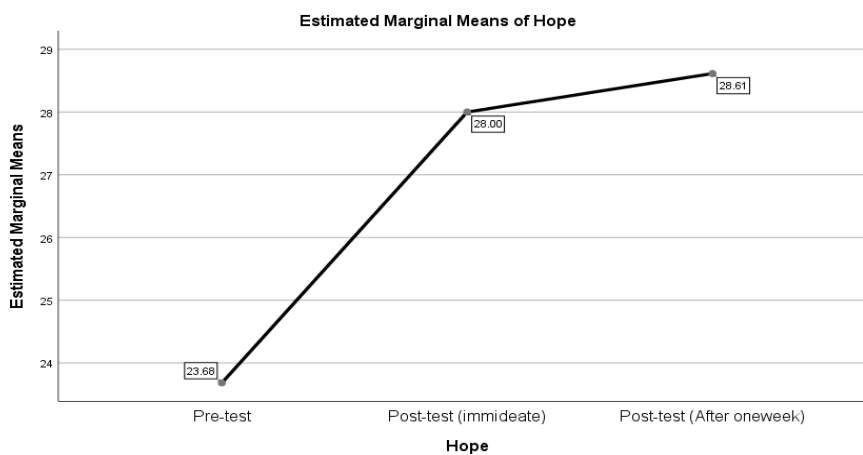


Figure 29:Estimated Marginal of hope

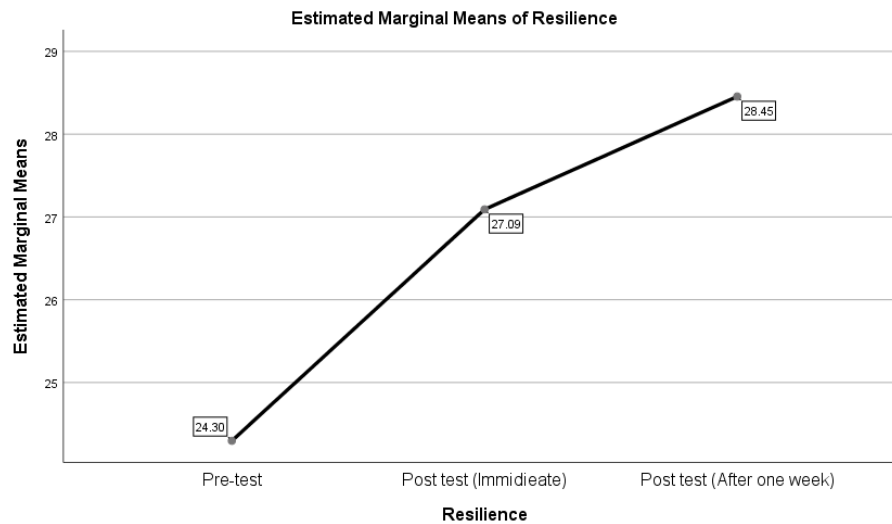


Figure 30: Estimated Marginal of Resilience.

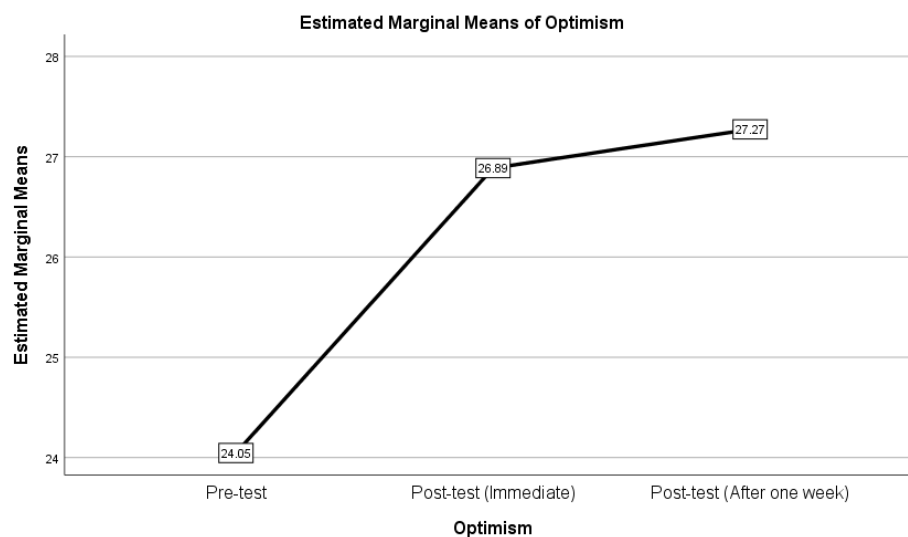


Figure 31: Estimated marginal of optimism.

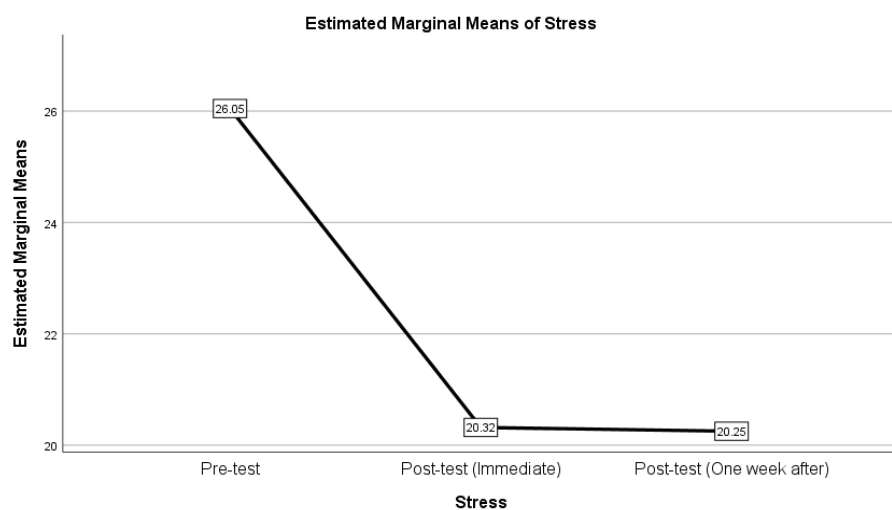


Figure 32: Estimated marginal of stress.

Table 1: Pairwise comparisons stress

Pairwise comparisons						
Measure: Stress						
		Mean Difference	95% Confidence Interval for Difference ^b			
(I) Stress	(I-J)	Std. Error	Sig. ^b	Lower Bound	Upper Bound	
1	2	5.727*	0.492	0.000	4.501	6.954
	3	5.795*	0.535	0.000	4.463	7.128
2	1	-5.727*	0.492	0.000	-6.954	-4.501
	3	0.068	0.389	1.000	-0.902	1.038
3	1	-5.795*	0.535	0.000	-7.128	-4.463
	2	-0.068	0.389	1.000	-1.038	0.902
Based on estimated marginal means						

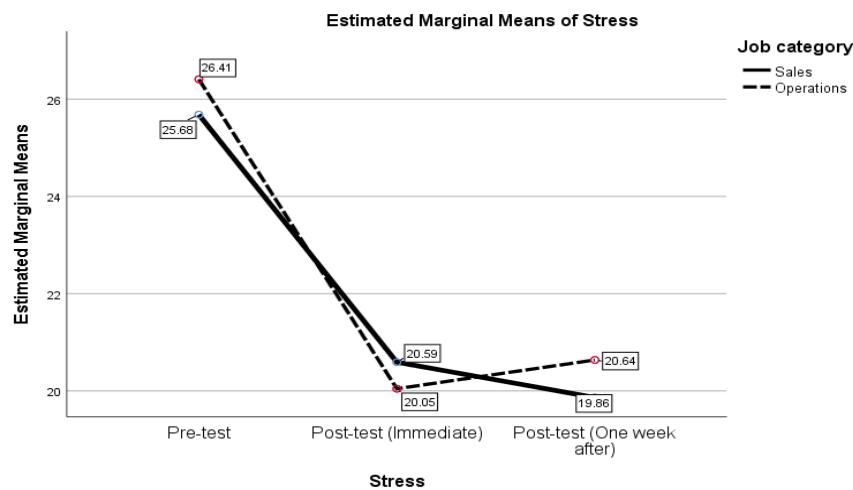


Figure 33: Estimated marginal of stress between job categories.

PsyCap

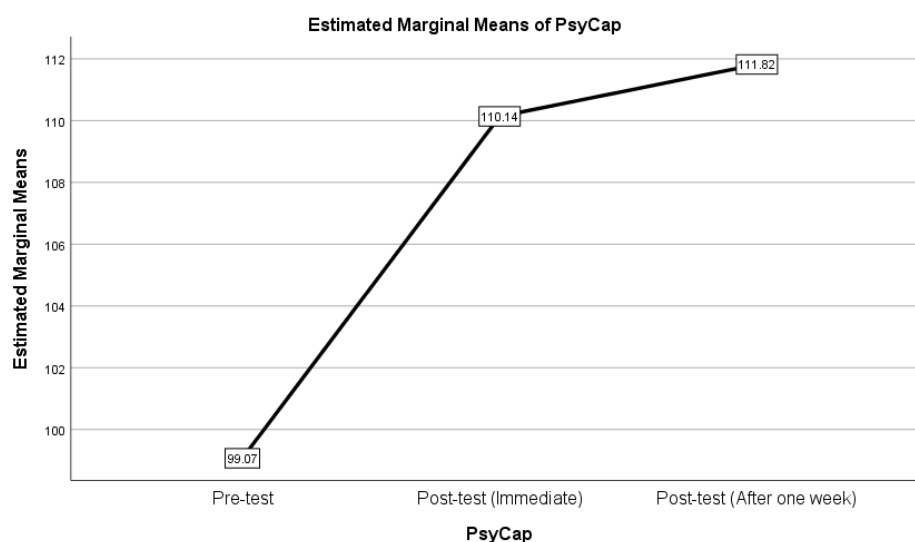


Figure 34: Estimated Marginal of PsyCap.

Discussion

The objective of the current study was to explore whether there is a relationship between PsyCap dimension namely self-efficacy, hope, resilience and optimism with work stress. The basic premise of that when an individual has a higher level of PsyCap dimension he or she can manage the level of stress that he or she faced which could result in more productivity, higher employee satisfaction, employee wellbeing, minimum employees' conflict and lesser attrition rate. In addition to the primary objective, the current study explores whether PsyCap can be improved through a short positive psychological interventional training. Hypotheses were drawn after reviewing the past literature and as per the first hypothesis, it was assumed that there is a negative relationship between the PsyCap dimension self-efficacy and employees level of stress. Results showed that the correlation between the two scale variable was $r(44) = -0.28$, $p = 0.065$. It was evident that the correlation was negative .028. However, it was not statistically significant as expected. Therefore, the first hypothesis was rejected based on the premise that there was no statistically significant negative relationship between self-efficacy and the employees' level of stress. These finding are in contrast to other studies which uncover a significant relationship between self-efficacy and level of stress (Klassen & Durksen, 2014; Holahan, Moos, & Schaefer, 1996). However, results of the study could have been influenced by the homogeneous nature of this study and the common characteristics of the participants, whereas the previous researches were done with a more representative sample with diverse characteristics and with a much higher sample size.

Further analysis on PCI and its impact on self-efficacy showed the that there were statistically significant improvements in self-efficacy after the intervention and even after one week of the intervention. Results confirmed past literature which showed the impact of PIC over self-efficacy (Luthans et al., 2008; Luthans et al., 2010; Ertosun et al., 2015).

Hope has been discussed by many scholars as a vital resource for human beings and may be a positive resource in stressful situations (Avey, Luthans, & Jensen, 2009). As hypothesized *Hypothesis 2*: Employees' level of hope is negatively related to their work stress. The result of correlation showed a positive correlation coefficient which has no statistical significance, $r(44) = .175$, $p = 0.26$. These results evident that there was no statistically significant relationship between employee's levels of hope and work stress which resulted in rejecting the hypothesis 2. The finding of the current study on hope and stress level and their statistically insignificant relationship is in contrast to finding of Avey, Luthans and Jenson in 2009. Even though the assumption of negative relationship between hope and stress were rejected the results showed an improving trend of hope of the participant after the PCI which proved that the PsyCap dimension of hope can be improved through a short positive psychological intervention. Further investigation of the level of relapsed after the intervention through a self-reported PCQ 24 hope scale showed that its effect has been sustained even after one week of PCI.

Hypothesis 3 :Employees' level of resilience is negatively related to their work stress was rejected based on the finding of the $r(44) = -0.016$, $p = 0.92$. The results showed that there is no statistically significant relationship between resilience and level of stress. Therefore, the results indicate that the development of resilience will not have a significant impact over level of stress. However, investigation of the impact of PCI on PsyCap dimension resilience showed that the resilience can be improved through a short PCI and as per the current study

that improvement is statistically significant and it showed the of that impact has improved with time.

Hypothesis 4 :Employees' level of optimism is negatively related to their work stress was rejected based on the results of the study $r(44) = 0.09$, $p = 0.55$ showed a statistically insignificant relationship between the two variables. Results highlighted a $r = .09$ which is positive but not statistically significant. The current study finding is in contrast to the finding of (Mensah and Kwesi A.,2016). Further, it was found that optimism can be improve through a PCI and it showed immediate results and it has been proved that the impact of improvement sustained even after one week of PCI.

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**A STUDY OF EXPECTATIONS, ATTITUDES AND CULTURAL BELIEFS
BETWEEN MARRIED AND UNMARRIED SRI LANKAN INDIVIDUALS TO
UNDERSTAND MARITAL RELATIONSHIPS**

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Abstract

This paper explores perceptions, expectations, attitudes and cultural beliefs (Plotnick, 2007) and its influence on unsuccessful marital relationships (Arnett, 2000) in The Sri Lankan Western Province. Several studies report that false or unrealistic expectations (Laner & Russell, 1994), negative attitudes, confused or misinformed beliefs, or twisted perceptions by either one or both partners, fuels problems that advances to detrimental consequences. Extremely limited research, even claimed by Jones & Yeung (2014) that only a single published article was found in relation to Sri Lankan marriages, was among the fundamental reasons behind topic selection. Being qualitative, the face to face interviews on the volunteered sample shed significant and rewarding insight in to the dynamic cognitions and behaviours. Strong traditional and religious emphasis for marriages by communities emerged in the results with striking differences across cultures especially how Sri Lankans aim on holding on to their marriages at all costs.

Key Words: Culture, Love, Marriage, Perceptions, Satisfaction.

Introduction

Getting married at some point in one's life is still the universal norm (Rahmani, Khoei, and Gholi, 2009) and marriage is praised to be the backbone of society. Changes across demography in the past few decades has not surpassed people being married as the normative status (Bennett, 2006) while the discipline of marriage continues to trend due to its association to people's lifestyles (Sassler & Schoen, 1999). The portrayal of a healthy societal structure across cultures is depicted by marriage and considered as the primary process of family unit creation. This paper ventures to contribute to the research on satisfaction, stability, and happiness in marriage; importance, and cultural differences in marriage; the impact of education on marriage; and future of marital norms from the perspective of Sri Lankan individuals.

Methodology

Sample

9 participants between the age group 19-50, married and unmarried individuals from Colombo, where two participants represented each of the four main ethnic groups in Sri Lanka, (Buddhists, Christians, Muslims and, Tamils), with the exception of one additional Buddhist married participant were chosen. Of the nine, four participants were males and five were females. Purposive sampling was the sampling technique used, where the four unmarried (teenage participants) were selected through volunteer-based sampling from an undergraduate campus in Colombo. Five of the married participants were teachers, who were also volunteer based, selected from the senior section of a reputed school in Colombo.

Procedure

Qualitative face to face, 30 to 45 minutes semi-structured interviews took place over a course of two weeks in empty campus classrooms, where participants' informed consent and withdrawal procedures was emphasized in order to maintain ethical considerations. Once participants gave verbal informed consent, they were required to sign the consent form, and thereafter permission to record the interview on a recording device was sought, which was immediately transferred to a password-protected laptop.

Data Analysis

Interviews were recorded and transcribed verbatim. Transcripts were analysed in a deductive manner using thematic analysis because it allows a more active role in research and grants personal reflexivity. Line-by-line coding was employed to identify categories that portrayed to be significant or overriding in the data after which cross-comparison was undertaken in attempts to discover broader generic themes and similarities, and distinguish significant differences if any to further understand the data.

Results

Table 1: Theme Table

1 The marriage dimension	In general
	The perspective of the unmarried & married
	Complexity of Marriage
2 Satisfaction, stability, and happiness in marriage	Physical, emotional & psychological satisfaction in marriage
	Dissatisfaction in marriages
	Sailing of unsatisfactory and unhappy marriages in Sri Lanka
3 Importance of marriage	Religious importance (Christianity)
	Social, economic and psychological benefits
	Society and religious cultural (Christianity, Buddhism, Hinduism, Islam) impact on marriage
4 Factors influencing a marriage and choice of spouse	Love in marriage
	Impact of marriage on lifestyles
	Factors in a spouse

	Readiness to marry
5 Cultural differences in marriages	Love marriage versus love marriage
	Interaction between families and in-laws after marriage
	Demographic trends in Marriage
6 The build-up of perception about marriages	Parental lifestyles and impact on children
	Divorce
	The compromises wives are expected to make
7 Impact of education on marriage	The need for education
	The mediums for education
	The content for education
8 Future of marriages	How and why it is affected
	The role of technology in marital relationships

Discussion

Marriage embraced as the universal norm (Rahmani et al., 2009), indicates a traditional value or/and religious affiliation in Sri Lanka. Why one decides to marry differs from individual to individual, but many embark on the journey of marriage because of the Sri Lankan cultural eminence given to marriage. Love marriages are on a gradual rise, however arranged marriages are the predominant mode of union in Sri Lanka, as many religious communities are not very welcoming towards love marriages. Spectacular cultural differences in marriages are unwrapped from the data in relation to satisfaction, stability, and happiness in marriage, where Sri Lankans, inclined towards collectivism, greatly disapprove divorce, forcing families to cling on to suffering marriages, unlike families in the West, where attention is given to both individual and family's happiness.

The data indicate no evidence in declining importance of marriage, but rather insists on its significance and claim that marriage is pursued because of various motives such as friendship, social and emotional support, mental well-being, love, and sex. These findings are consistent with prior research in the field (Marcussen, 2005) implying that despite marriage being a norm, it is not mindlessly undertaken, but is rather both an emotional and rational choice which brings forth benefits that people desire. Women viewing marriage as a route for freedom (Kefalas et al., 2011) was also portrayed in the Muslim participants' findings with regards to arranged marriages, as in Sri Lankan culture, rather than the religion, the Sri

Lankan Muslim culture seem to place many restrictions on women. The development of schemas consistent with global norms are evident in the categorization of marriages; love and arranged. In line with developmental idealism (Allendorf, 2013), arranged marriages are viewed to be traditional or old norms, whereas love marriages are perceived to be the modern counterpart. Respondents have a collective opinion on the unfavourable attitude towards love marriages in Sri Lanka, claiming it is due to either religious factors or traditions, yet did personally voice out several times on the vitality of love being present *after* marriage. The understanding drawn from this finding was that to a certain degree the norms still make love marriages challenging in Sri Lanka, and thus many have accommodated to the “arranged marriage” norm either willingly or unwillingly. However, their experience about marriage in either personal or vicarious situations built the foundations for satisfactory or unsatisfactory evaluations which consequently has lead them to strongly associate the importance of love after marriage.

While acknowledgement on the stability of marriages was parallel to scholarly articles, there was an overwhelming focus on satisfaction and dissatisfaction in marriages in the data. As implied by research, stability in marriage is of great concern for all (Carter et al., 2016). This intense focus on degree of satisfaction found in the data can be interpreted in the angle that, with more exposure to media and other sources, people’s own and vicarious experience on the different types of marriages across cultures have allowed them to distinguish that marriages do not have to be mandatory, or merely sought because of societal pressure. This analysis was based on the finding that divorces in Sri Lanka is still much a taboo, and women find it harder to escape bad marriages due to many social, legal and economic barriers (Cherlin, 2010). Another scope for assessing why unhappy marriages are not ended could be because of the strong values given to a family unit by the collectivist Asian culture (Hofstede, 1980). While their opinion on impact of bad marriages on children are consistent with the research (Cherlin, 2010), it is baffling as to why then divorces are made to seem so shameful and bureaucratic, making it challenging to escape bad marriages. Every single participant fiercely encouraged the awareness about marriage, more for the unmarried, in order to help equip the to-be-married with the appropriate tools and knowledge before entering marriage.

Limitations of the current study

The overall sample size being only nine in number is undeniable relatively limited small as expected qualitative studies. While care had been taken to prevent bias with regards to religion, minority groups such as Jews do exist; and due to resource limitations, the sample is also largely geographically under representative as all nine participants were from Colombo and thus, the results may not be extensively generalisable to all Sri Lankans. Notwithstanding the limitations faced, one of the core strengths of this study is that these results are of much value due to the scarcity of knowledge about Sri Lankan marriages (Jones & Yeung, 2014), and these insights help in understanding cognitions and behaviours of the Sri Lankans, and sheds light on how their marital perceptions are built and progresses to analyse the cultural differences in these perceptions and lifestyles.

Recommendations for future research

This paper is an introduction into understanding dimensions of marriage in Sri Lanka, and unquestionably calls for much more extensive research in order to gain a greater insight into this field. Topics such as complexity in marriage, and readiness to marry were touched only on the surface and the findings hint the endless possibilities of much knowledge through further research. While the findings emphasized on incorporating marriage education in schools and universities curriculum; impact, benefits, and reality of marriage and relationship awareness need to be investigated on other settings such as retreat centres, hotels, community agencies and corporate settings.

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THE IMPACTS OF DOMESTIC VIOLENCE ON THE MENTAL HEALTH OF WOMEN

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Abstract

Domestic violence, among all gender-based violence, has been recorded as the most common violence against women. It is a violent crime committed under the pretense of an intimate relationship. Although domestic abuse can be generalized for both men and women, it was found that women were the most who were victimized

The main aim of this study is to understand the mental health impacts that women experience due domestic abuse and its lifelong continuity. A qualitative approach taken towards this so to analyze the mental health of each victimized women, belonging to many different ethnicities, financial and social background as well the geographical background as well. Post participant interviews and the analysis of the results it was found that the participants had undergone severe mental health complications such as Post Traumatic Stress Disorder (PTSD), Depression, Anxiety, mood disorders and suicidal thoughts and attempts.

Key Words: Domestic violence, Mental health, Victimized women

Introduction

Domestic violence, also known as intimate partner violence, is a pattern of violent behaviour, aimed towards one partner by the other in the form of physical, mental or sexual abuse in order for the abuser to retain power and control over the other in an intimate relationship. Domestic violence cannot be categorized to a particular group of people as it has been recorded to occur universally. Domestic violence generally entails behaviour that cause physical harm, invoke excessive fear, extreme possessive actions and the invasion of personal space and free will.

Domestic abuse is not an abrupt behaviour, rather it comes to light at a gradual pace, and develops a severity over a prolonged period. It is a gradual onset where the perpetrator would begin the abuse slowly which would later grow into a full-fledged toxic relationship. The longer the victims remains in the relationship, the weaker they tend to become- physically and mentally. Most victims who face domestic abuse are prone to self-blame and would believe that the partner is justified in the use of violence on them. Domestic violence has victims of both men and women. It was discovered that there was a count of 85% of women undergoing domestic abuse as opposed to 3% of male victims in the United States of America. Hence, it can be concluded that, in context to a collectivist nation, domestic violence refers to violence against women.

Domestic violence has been largely associated with females. There had been a steady increase of domestic violence against women in the past two decades. The United Nations (1993) has given the definition to domestic violence as “any act of gender based violence results in, or is likely to result in physical, sexual or psychological harm or in suffering to women, including threats of such acts, coercion, or arbitrary deprivation of liberty, whether occurring in public or private life (Department of Census and Statistics, 2016). Women

around the globe, regardless of belonging to a developed nation or a developing nation, face domestic violence. Women tend to conceal the abuse they are facing due to many extrinsic as well as intrinsic factors, such as society, culture, concern for offspring, fear of retaliation, shame and guilt. Furthermore, this can be considered as a major affecting factor in regard to many national sectors.

As opposed to common belief that domestic violence is the physical and sexual violence, mental health and emotional stability are also compromised as well. In any situation, in regard to domestic violence, the abuser would subject the victim with sudden bouts of violence, which would later followed up with a heartfelt ‘apology’ and severe remorse, pacifying the victim. Although this honeymoon phase would see to the end of the abuse and violence, the cycle would repeat and this would lead the victim to anticipate the next outburst of violence, leaving them feeling intense fear and a loss of control over their own lives in their own home. This form of increased violence would lead to severe mental health disorders, such as Post Traumatic Stress Disorder (PTSD), Depressive disorders, substance abuse, anxiety, mood disorders, self-harm and suicidal thoughts.

This study is designed to closely analyze and study the impacts of domestic violence on mental health of women within a nation as Sri Lanka with a collectivist society, where battering of the significant other is solely justified as a patriarchal mark of power. It is also crucial to bring to light the impacts it leaves on its victims. The study is further intended to act as a cry of awareness towards this undetected and easily overlooked silent pandemic that is present within this community. Women should be enlightened on how they must handle being in this situation and to come forward and utilize the services and support units that are present during the early stages of such abusive relationships. This study, though would not eradicate the issue, but aims to subdue one of the most pressing issue present during the current timeline.

The main aim of this study is to identify the underlying long lasting impacts domestic violence imprints on the mental health of women. Further, this study aims to show the importance of breaking silence regarding this matter and implementing strong laws and policies that would not only protect the victims but also act as a barrier to prevent the happening of this situation.

Methodology

The study design designated to this paper was the qualitative approach covering a compilation of case studies. The qualitative approach was deemed more compatible for this study as each participant was analyzed deeply, to identify the mental health impairments due to the violence, without really touching the period of abuse. The focus fell on the underlying impacts that still seemed prevalent in the present situation of the participant.

The study was designed in two folds, the primary data collection and the secondary data collection. Each utilized a specific form of skills in order elucidate and emphasize the objectives presented through this study. As the study is a focus on women who were victimized due to domestic violence at some stage in life, the sampling process centered on married women between the ages of 18-45. They were recruited through Non-Governmental Organization (NGO) who specialize in aiding women in need of interventions, as well as through word of mouth, passed along friends, family and acquaintances of the researcher.

The participants were selected through the purposive sampling method. The requirement for the use of purposive sampling is because of the singular disposition of the study. The focus was on married women who had undergone domestic abuse, by the hands of the significant other, during a period of their life and had been removed from that toxic situation and the resulting mental health complications that would be present till date.

Results

Demographic Information

The demographic details obtained from the participants have been filtered to find the factors that affected or supported the outcome. Accordingly, age, religion, current marital and employment status, social class and their having children were selected as themes. In that manner, 13.3% of the participants belonged to the age group 18-25, with the remaining 26.7% in the 26-35 group and 40% in the 36-45 category. It can further be observed that 66.7% were Hindus, 26.7% were Christians and 6.6% were Muslims. Of the entire participant count, 60% remain married, whereas 20% of them are single and another 20% remain separated. 60% of the participants are employed while 40% are not. Among the participants 20% are from a lower social class and 80% are of the middle class. Finally, 73.3% of the participants have children and the 26.7% do not.

Analysis of Participants and Results

Of the all the participants, 60% decided to remain in the marriage, even after the cessation of the abuse, while the remaining decided to remain separated from their abusive partner. According to the data collected, all the participants suffered a form of psychological impact. Furthermore, 80 % of the participants exhibited mental health complications, such as Depression, PTSD, Anxiety, suicidal thoughts and self-blame, where as 20% of the participants showed great improvement in their mental health even though several of them had bouts of PTSD.

It was further observed that 13.3% of the participants showed improved mental health states while the remaining 86.7% exhibited long lasting impacts due to domestic violence. The regression seem to occur unconsciously and out of which some expressed the need to not experience this. This could be linked to the fact that the 13.3% of women were among the few who sought professional help during their recovery period.

40 % of the women sought professional help out of which 5% showed improved mental health status, while the remaining 60% had long lasting impacts. The reason the remaining 60% refrained from seeking help was due to the difficulty or the lack of awareness of these on how to utilize or on where to seek this help.

The major concern that many of the participants expressed was their concern for their children, who were also caught up during the abuse. 33.3% of the participants showed signs of experiencing both physical and mental abuse, and another 33.4% experienced only psychological abuse. From the entire participant count 66.7% had children involved in their domestic phase and was constantly subjected to thoughts and worry about them.

Finally, when requested to disclose more about the participants abusive period, 60% remained hesitant to speak on the subject and some seem visibly upset. The remaining 26.7% did not wish to make a comment or firmly refused to speak of it. 13.3% spoke freely of the matter and disclosed their experiences and thoughts.

Discussion

The analysis has shed empirical evidence on the fact that domestic violence does have an impact on the mental health of women. Long term impacts were observed with psychopathologies such as PTSD, Depression, anxiety and suicidal thoughts. The qualitative approach taken towards this matter allowed an in-depth view into the mental state of these women and helped gain a useful insight in to the extent of complications resulting from domestic violence. It can be stated that age was not a redeeming factor for the victims of abuse. Women from the age of 18 onwards face domestic abuse from their spouses at a given phase in their lives, but there seems to be a decline beyond the age of 40 as this could be that both they and their spouses are well past the youth period.

The mental health complications that occurred as a result of domestic violence were vast and were long term. Many women suffered depression, anxiety, chronic fear and worry, loss of autonomy, suicidal idealizations, chronic stress and low self-esteem and self-blame during the abusive phase itself. Alongside the physical battering that occurred they mostly wished to remove themselves and their children, if they had any, from their current situation. The fear of being stigmatized by the society as well as the abuse reaching critical level could have been the reasons for their silence. Following the, abuse, these mental health complications developed into psychopathologies such as PTSD, depressive disorders, anxiety disorders and suicidal ideations. For a majority these pathologies were seen as long term impacts and continued to suffer long after being removed from or after the cessation of the abuse. That being said, few of the participants showed significant improvement, even if it were not a full recovery, on their conditions. They had accepted their abusive phase and decided to move forward, even as a few have PTSD, with the help of professional services.

Not many women sought out professional help, such as counselling and other services, as many were unaware that such service were even provided for such causes. Among the few who knew of such services, actively sought out said services and decided to take their lives in a new direction. Many of the women faced extreme psychological dilemmas in regard to their own well-being as well as their children's. The abuse for many began due to their spouses being subjected to third party manipulations, stemming from the spouses own family. These women were left to yearn for their freedom as well as trust and compassion from their respective significant other and create a better and nurturing environment for their families.

Conclusions and Recommendation

In conclusion, the results were as expected, aside from the limitations, domestic violence does have an impact on the mental health of women. As previous studies stipulated, the most commonly found psychopathologies that discovered in the wake of this study were PTSD, depressive disorders, anxiety disorders and suicidal ideations. These health complications appeared to be long lasting but could be significantly improved when subjected to therapy. One of the most pressing concerns put forward was the lack of awareness present among the community about domestic violence and the stigmatization that follows. The laws and policies of Sri Lanka, although strong, does not really have a significant impact due to the cultural buffer present. Formulating movements that leave a strong presence on the society and providing required professional help to all those in need.

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FACTORS THAT AFFECT HAPPINESS IN MARRIAGES

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Abstract

The literature indicates that the quality of a marriage impacts health thereby associating marriage and psychological well-being. The state of marriages in Sri Lanka is such that the divorce rates are high and correlations exist between marital conflicts and suicide rates. However, there is a research gap in the nation compared to international research. The current study was motivated by these facts. The aim was to identify factors that affect happiness in marriages through a qualitative approach. Eight participants were interviewed using semi-structured interviews. The data was analysed and the resulting findings were indicative of the factors that influence marital happiness according to the participants. Overall, the results were similar across marriages with certain factors gaining more distinction over the others. Nonetheless, there were limitations and exceptions; these were weighed and discussed. Relevant recommendations were provided as well.

Key Words: Happiness, Married individuals, Qualitative research, Sri Lankan perspective

Introduction

Quality of marriage impacts health (Kamp Dush, Taylor and Kroeger, 2008) thereby establishing that marriage has the capability to have a positive effect on the psychological well-being as well (Wyke and Ford, 1992; Gove, Hughes and Style, 1983; Waite, 1995; Waite & Gallagher, 2000; Hewitt et al., 2010). However, Sri Lanka's divorce rate is fifty-odd percent (Aryaratne, 2016) whereas the rate of marriages has been on a decline (Perera, 2015), and marital issues are inferred as a causal factor of the rates of attempted suicide by women (Rajapakse and Tennakoon, 2016). This situation is worrisome especially because research associates negative consequences with bad quality marriage and the stigma attached to divorce (Overbeek et al., 2008; Derichs, 2014). Furthermore, there is little insight into marriage in a national context compared to the abundance of international research.

These concerns are what drive the proposed research. This discrepancy between foreign and national research is what the research project, primarily, wants to breach while focussing on marital happiness. Using this research, an investigation is hoped to be conducted into what the Sri Lankan married individuals, from different marital environments, think affects the happiness in their marriages.

In order to summarise;

Three research questions guided this study:

1. Does the married individual consider their marriage happy?
2. If yes/no, do they know what makes them happy?
3. Are these factors, that affect happiness in marriages, similar across marriages?

The relevancy and significance of this study are driven by:

- The lack of research in a national context compared to the abundance of international research.

- The unfortunate, mostly unspoken, number of marriages that suffer from deprived happiness.
- The associations between unhappy marriages and psychological issues.

The central objective of this research is to provide the Sri Lankan psychologists and society with information that will facilitate developments of happiness in marriages.

The theoretical framework mostly relied upon John Gottman's work and other relevant research papers.

Methodology

A qualitative approach was considered more appropriate to undertake this research because it provides in-depth information. The sample size was eight with an equal distribution of the sexes and from different religious backgrounds. The criteria were that the participants must be married for a considerable length of time in order for them to understand the workings of their marriage, and be willing to participate. In order to attain such a sample, purposive sampling was used. The participants were scouted through social media and contacted via email, phone or WhatsApp, and they were all provided with an ethically approved information sheet. The interviews were scheduled according to the participants' convenience and on average either took place at their homes or place of volunteering. The interview schedule was semi-structured and open-ended.

The following sections made up the interview schedule:

- An introduction of their marriage.
- Basic description of the spouse.
- A simple rating of marital happiness that eases into further questions about the positive aspects of the marriage (or lack thereof).
- Specific questions relating to Gottman's work as discussed in chapter two.
- Shared future plans.

These interviews were recorded for transcription and analysis. Interpretative Phenomenological Analysis (IPA) was used for analysis with the help of the application NVivo. Thereafter, the themes and subthemes were found. These results were tabulated for ease of comprehension. Each step of this research was undertaken adhering to ethical guidelines.

Results

Table 1. Summary of Results

Themes	Subthemes
The basics of marriage	Readiness for marriage
	Dynamics of marriage
	Commitment
	Companionship
	Children
	Finances
The married individuals	Individualism
	Different families

	Compatibility
Working as a team	Reciprocation
	Sacrifice
	Sharing responsibility
Communication	Understanding
	Conflict management (exception: abuse)
Interpersonal Qualities	Respect
	Autonomy
	Love and sexual intimacy

It is evident that there is a plethora of factors that affect happiness in marriages, mentioned here are the ones that this research yielded. The correlations between the factors are something that calls attention to; some factors are more important than the others and they all work together. It will be inadequate to further summarize the results or try to arrange them in order of importance.

Discussion

Reflecting on the thoughts before the research was conducted, the researcher had a few expectations of what the factors that affect happiness in marriages would be. This was not only in order to avoid researcher bias but also because of the sheer fact that the experience of marriage is unique to each person. Although this is true, that is, there are exclusions to every finding, a positive observation would be that such exceptions were not widespread. The participants came to a commonplace with regards to most of the factors which were demonstrated in the results with special focus being placed on the factor ‘communication’. This importance of communication coincides with John Gottman’s research. The three models of marriage – institutional model of marriage, companionate marriage and individualized marriage – were studied and related with the research findings. The marriages of the participants were mostly an integration of interdependency and independence; it was a culmination of the positive aspects from the three models. It is interesting to note that regardless of the participants coming from a generally older generation one can see the incorporation of modernized views as well. As for the direct similarities and differences between the research and previous literature, the similarities outweigh the differences according to various studies. Moore et al.’s (2004) attributes of a healthy marriage come the closest to this research’s findings. A list of the parallel factors is commitment, communication, conflict resolution, satisfaction, fidelity, lack of domestic violence, interaction, intimacy, children and support.

The study could have been better in terms of the methodology. The participant size was eight, however, due to a technical mishap participant #64’s interview was not transcribed completely. More participants would have produced more data, in turn, strengthening the generalizability by a small proportion. Perhaps participants from places out of Colombo would have been a great addition too. Besides, the questionnaire employed could have been developed in a manner that guided the participants towards broader themes. For instance, marital happiness in relation to the demographics of marriage (education, age difference, etc.), religion and culture would have been pertinent subjects to look at. The results were high

in the number of factors but similar across marriages. This and the participants' given prominence to the factors, assisted in condensing the information but not at the risk of loss of information.

Conclusion and recommendations

The main research question could be summarized as 'what are the factors that affect happiness in marriages?'. The answer to this lies beyond a single statement. The most substantial implication of this research is in terms of the future of marriage counselling. What this discovery implies is that there are many avenues that could be explored to develop a marriage and its quality. The contribution towards marriage counselling from such a perception could mean that there are various promising options. Nonetheless, it would be an overestimation to base the claim on a single qualitative research. As for future research, more qualitative research that takes into account, for example, young couples from the current generation or divorced and/or separated couples. In addition, prospective research of contexts in marriage (e.g. marriage and communication) might narrow the research area findings while providing more specific results. These researches could be utilized to develop a questionnaire that would advance marriage research and counselling.

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