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## **GARI PEACE & SUSTAINABLE DEVELOPMENT SYMPOSIUM**



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87/23A, Kohila Kotuwa Road, Neelammahara, Maharagama,  
Colombo, Sri Lanka.

Tel: +94 112 849 268

Mobile : +94 773 940 838 / +94 715 279 696

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# GLOBAL ACADEMIC RESEARCH INSTITUTE

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## PROCEEDINGS

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87/23A, Kohila Kotuwa Road, Neelammahara,

Maharagama, Colombo, Sri Lanka

Tel: +94-112-849-268 / Fax: +94-112-849-426

Mobile: +94-773-940-838 / +94-715-279-696

For Registration: [registration@gariteam.com](mailto:registration@gariteam.com)

For Help: [helpdesk@gariteam.com](mailto:helpdesk@gariteam.com)

WhatsApp / Viber: +94-773-940-838

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## **PREFACE**

Global Academic Research Institute is proud to present GARI PEACE & SUSTAINABLE DEVELOPMENT SYMPOSIUM 2022 which is a series of successful research symposium. The Inaugural Session and the Technical Sessions were conducted in Galle Face Hotel, Colombo, Sri Lanka. The conference was organized into different disciplines which empirical, conceptual and methodological papers were received from academics, practitioners and public policy makers were accepted paying austere attention to the academic standards of the papers. To maintain consistency, authors were prescribed to follow the academic writing format of the GARI Publishers. The reviewing process was apparently transparent where papers underwent a double blinded review process by eminent subject specialists in respective areas. Thus, refereed full papers selected to be presented at the conference were published here. We do not assume any responsibility for any errors or omissions in the research papers which rests solely with the authors.

Special thank goes to Key note addresses & Co-chairs made by Senior Professor. R.M.G. Rajapakse (Department of Chemistry, University of Peradeniya), Dr. H. M. K. Shantha Wanninayake (Faculty of Arts, University of Peradeniya) The organizing committee special Appreciation Online Research Publications Partner NLSL's National Digital Library and Repository in Sri Lanka, an International Academic Affiliation with Jagadguru Kripalu University - India, Department of Community Medicine, Mysore Medical College and Research Institute - India, International Federation for Fitness Health, Physical Education & Iron Games - Saudi Arabia, Australasian Institute of Ayurvedic Studies - Australia, Kathmandu School of Law – Nepal, Noble School of Business, India.

Journal Partner as GARI Publishers and GARI International Journal of Multidisciplinary Research, all other GARI affiliated academic partners, Further the support given by GARI Tours as Travel partner, Official Creative Partner Sameera Artco & MICE official Partner Sri Lanka Convention Bureau. The conference committee expresses deep gratitude to the panel of reviewers for the priceless service rendered. Finally, the committee extends sincere thanks to the presenters and participants for the valuable contribution and active participation.

Conference Committee  
**PSD 2022**

### **About GARI**

Global Academic Research Institute (GARI) is an International Scientific Research Conference Organizer in collaboration with International Universities & Institutions. GARI has brought together leading academic and industry experts from the global community who process diverse experience and expertise in verity of scholarly or scientific disciplines. We established on 2010 as independent service provider then wider range of experience GARI became a powerful arm of scientific research conference organizer in the industry.

## GARI AFFILIATIONS

National Digital Library and Repository – Sri Lanka



The National Library is mainly a research and a reference library and it is the main library and information centre in Sri Lanka. It intends to provide library resources as well as information to all Sri Lankans through the National Library. Powers and responsibilities of the National Library were clearly spelled out for the first time and this was a fulfillment of a long felt need. It has become a herculean task to organize and introduce this new institution to the country and to the general public.

Jagadguru Kripalu University - India



Jagadguru Shree Kripaluji Maharaj envisioned a university that not only provides quality education but also aims at all-round personality development of the students, turning them into leaders in their chosen fields. The faculty at JKU are experts in their respective fields, with an intense desire to teach and guide the students to success. Regular interactions with industry leaders and opportunities to be part of various conferences and seminars broaden the students' horizons.

Kathmandu School of Law – Nepal



Kathmandu School of Law, established in 2000 AD as an affiliate of Purbanchal University, is a community-based, non-profit academic institution that upholds its unrestrained commitment for a pragmatic, research-based and community responsive legal education in the country. It was conceptualized within the ambit of non-profit movement dedicated to serve the need of an academically sound and functionally feasible legal education in Nepal.

#### Australasian Institute of Ayurvedic Studies – Australia



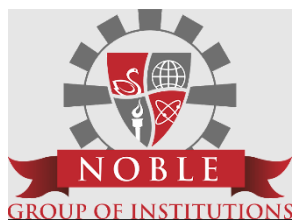
The Australasian Institute of Ayurvedic Studies is synonymous with quality and authentic education in Ayurveda. The Institute was founded in 1999 in Auckland, New Zealand and is proud to be the only training Institute in Australasia offering recognized Ayurvedic qualifications in both Australia and New Zealand.

#### International Federation for Fitness Health, Physical Education & Iron Games - Saudi Arabia



IFFPHPEIG was established in year 1995. It is one of the largest upcoming federation around the world. The Federation was established by the Honorary President Dr. Kaukab Azeem

#### Noble School of Business - India



Noble Institution will be a learning community that is focused on developing youngsters who will become leaders in an era of global competitiveness and technological advancements.



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## **SCIENTIFIC TEAM**

Dr. Abdul Rehman - University of the Punjab, Pakistan  
Dr. S Ramaratnam - Jagadguru Kripalu University, India  
Prof. Hend Ezzeldin - Ain Shams University, Egypt  
Dr. Mohammad Mujaheed B. Hassan - Universiti Putra Malaysia  
Prof. Dr.Rashmi Gujrati - Panjab University, India  
Dr. Chandana Kasthurarachchi - University of Colombo, Sri Lanka  
Prof. Dr. Dimiter Georgiev Velev - University of National and World Economy, Bulgaria  
Prof. Dhaval M. Dave - Bentley University, USA  
Dr. Seema Yadav - Galgotias University  
Prof. Aref Maalej - Engineering School of Sfax, Tunisia  
Dr. A. Arun Kumar - Osmania University, India  
Ratchaphon Amsuk - Valaya Alongkorn Rajabhat University, Thailand  
Prof. Luminita Andrei Cocarta - University of Iași, Romania  
Dr. P. Karthikeyan - Kongu Engineering College, India  
Dr. Milos D. Duric - University of Belgrade, Serbia  
Dr. Jill Nash - Bournemouth University, UK  
Dr. Jagbir Singh Kadyan - University of Delhi, India  
Dr. Terseer Hembem - University of Riverside, USA  
Prof. Dr. Ugur Demiray - Anadolu University, Turkey  
Dr. C.G. Shyamala - Mercy College, India  
Dr. Keratso Georgiadou - DUTH, Greece  
Dr. Narendra P. Parchure - Symbiosis Centre for Distance Learning, India

# **AN EXPLORATIVE STUDY ON PROFESSIONAL NEGOTIATORS' STRATEGIES TO DETECT DECEPTION**

Frieder Lempp, Maïis Testa

*IÉSEG School of Management, Paris, France*

## **ABSTRACT**

The purpose of this study is to explore the experiences of professional negotiators encountering deception when dealing with their counterparts. Based on interview data, the authors provide a taxonomy of the strategies negotiators adopt to detect deception and identify their training needs regarding the detection of deceptive behaviour. Data was collected from 20 practising commercial negotiators in France by way of semi-structured interviews. A thematic analysis of the data revealed three dimensions pertinent to the experience of deception that negotiators perceived as particularly important: the frequency of deception; the type of deception; and the consequences of deception. Further, the analysis revealed five factors that negotiators believed influenced their ability to detect deceptive communication: body language and micro-expressions; contradictions and inconsistencies; emotional intelligence; and verbal style. Finally, the strategies described by negotiators to detect deception could be classified according to three categories: active listening; asking questions; and intuition. Participants overwhelmingly expressed that there is a lack of training on deception in negotiation. It is, therefore, suggested that the results of this study inform the development of training courses on the detection of deception. In particular, it is recommended that training courses should cover the following topics: 1) how to anticipate and avoid deceptive behaviour; 2) how to effectively respond to deceptive behaviour; 3) the role of emotional intelligence in detecting deceptive behaviour; 4) active listening and asking questions; 5) the role of intuition in detecting deception.

Keywords: Negotiation, Deception, Communication, Body language, Emotion

# USE OF SECOND LANGUAGE FOR CO-EXISTENCE AND ETHNICAL RECONCILIATION AMONG THE CROSS-CULTURAL COMMUNITIES IN SRI LANKA

<sup>1</sup>Abdul Halik A.F, <sup>2</sup>Rifka Nusrath G.M

<sup>1</sup>English Unit, T/Mu/Al-Hilal Central College, <sup>2</sup>DELT, Faculty of Arts and Culture, South Eastern University of Sri Lanka

## ABSTRACT

Sri Lanka is one of the countries with multiculturalism and multilingualism. The use of second language Sinhala/Tamil does build mutual understanding, brotherhood, social integration and ethnical reconciliation among the multicultural communities in Sri Lanka. This study explores how the use of second language creates ethnical co-existence and social harmony among multicultural society in Sri Lanka. This study was a descriptive survey research and quantitative approach was applied in data collection and presentation. In this study, 200 people from all the communities nationwide were selected as sample population through systematic sampling technique. The sample includes civil societies, religious leaders, community-based organizations, youths, academics and students. The research instrument of this study was a survey questionnaire. The findings-based conclusion of this study reveals that 76% of the participants were unable to speak the second language Tamil/Sinhala. As a result, 50% of the participants do not have cross-cultural relationship or friendship. Moreover, this study concludes that due to lack of second language proficiency, cross-cultural communication lacks which generates misunderstanding and misconception about other religions and their cultural practices, beliefs and customs. It instigates separatism and racism in the country. Second language speaking ability can build positive cross-cultural

communication which gives opportunity to understand other religions and their cultural value, and build ethnical harmony among multi-cultural communities in Sri Lanka. Lack of communication is the primary factor for separatism among multi-lingual people. The reason for communication barriers is lack of second language proficiency. Therefore, Based on the suggestions given by the majority of the participants, it is recommended that schools should include second language (Sinhala/Tamil) as a compulsory subject in the school curriculum from primary education, and establishment of schools based on religion and language should be banned.

Key words: Co-existence, Cross-cultural Communities, Ethnical Reconciliation, Second Language

## INTRODUCTION

Sri Lanka is one of the South Asian countries which consist of multiple communities and languages. The multiple communities include Sinhalese, Tamils, Muslims, Christians, Burger and Malay. Razick et al (2020) state that the multiple languages include Sinhala, Tamil, English and Malay. Sri Lanka seems to be a home to multi-cultural communities, and it is the responsibility of the people across various religions, and communities to develop and maintain harmony with each other. There are major three languages spoken in Sri Lanka, namely: Sinhala, Tamil and

English. Sri Lanka provides equal privileges to all the religions and respects their cultural values, and religious beliefs and customs. However, misunderstanding and misconception on other religions are generated by certain majority and minority individuals. It occurs due to lack of communication and mutual relationship between communities. When there is positive communication among the cross-cultural communities, people will have an opportunity to learn about other religions and their significant principles, cultural value and religious practices. There shall be fewer possibilities for misconceiving other religions. Second language ability can be a strong bridge to communicate with multi-cultural communities. Positive communication could build understanding and relationship among multi-cultural and multi-lingual people. The relationship will give the opportunities to understand about other religions, and their religious beliefs and practices, cultural values which obviously build co-existence and ethnical harmony. Therefore, there is a need to learn second languages in a country.

As reviewing other relevant studies, Wedikandage, (2014) points out that the need of fostering multilingual competence among both teachers and students can reach its goal of greater intercultural understandings and communication between the various ethnic groups. Similarly, Bannett, (1990) finds that cultural pluralism is a commitment to achieve educational equality, developing curricula that build understanding about ethnic groups, and combating oppressive practices. Therefore, it is obvious that second language skills seems important to communicate between majorities and minorities in Sri Lanka, and build peace, co-existence and reconciliation among the cross-cultural communities.

### **Objectives of the study**

In this study, the following objectives are addressed according to the primary aim and problem of the study.

1. To explore how the second language (Sinhala or Tamil) proficiency builds co-existence and ethnical reconciliation among the multi-cultural communities in Sri Lanka

2. To identify whether lack of second language proficiency among the cross-cultural community generates misconception about other regions and their religious practices, cultural values and customs

### ***METHODOLOGY***

This study was a descriptive survey research. This study uses quantitative approach in data collection and data presentation. Further, the sample size of the study was 200 which include: religious leaders, academics, students, social activists, community-based organizations and civil societies. Systematic sampling technique was chosen to collect the sample population. The data analysis methods were both descriptive and statistical. A survey questionnaire was chosen as the data collection tools of this study which was designed to gather opinions among the participants. The questionnaire questions were given in all three languages (Sinhala, Tamil and English. The primary data were collected through Google Form Link.

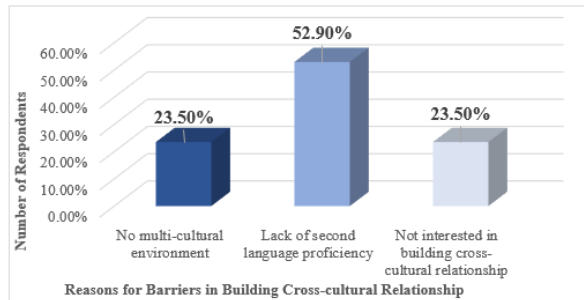
### ***FINDINGS***

This section presents the major findings of the questionnaire with the aim of achieving the objectives the study.

#### **Reasons for the Barriers in Building Cross-cultural Relationships**

The following bar chart presents the factors that hinder for not having relationship with cross-cultural communities in Sri Lanka.

Figure 1 - Reasons for the Barriers in Building Cross-cultural Relationships



Participants’ Response to the Questionnaire

The following table shows participants’ response to the questions in the questionnaire.

Table1 - Participants’ Response to the Questionnaire

No	Questionnaire questions	Participants’ Response				
		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1.	“Second language proficiency of our country is vital to build ethnical reconciliation among the multicultural and multilingual communities in the country”. Do you agree with the above statement?	40%	33%	12%	4%	11%
2.	“Due to lack of second language proficiency and communication, misconception and misunderstanding are created about the value of other religions, religious practices and customs, and cultural value”. Do you agree with the above statement?	31%	43%	9%	10%	7%
3.	“Positive communication with majorities and minorities in Sri Lanka can build co-existence and ethnical reconciliation. So, to communicate with majorities and minorities, second language Sinhala and Tamil language proficiency is important”. Do you agree with the above statement?	52%	31%	5%	9%	3%
4.	Do you agree that every individual in the country should have second language proficiency to build brotherhood and to understand the value of other religions?	46%	29%	7%	7%	11%

## CONCLUSIONS

This study can be concluded based on the findings that second language proficiency (Sinhala/Tamil) is significant for everyone in the country to grow cross-cultural relationship. As a result of lack of second language speaking ability, people fail to communicate with other communities, and build positive relationships. So that second language ability will be an opportunity to understand other communities' religion and their cultural value, religious practices, customs and principles. Misunderstanding and misconception about other communities occur due to lack of communication. Use of second language (Sinhala/Tamil) can build co-existence and ethnical harmony in the country when there is positive communication takes place between other communities.

Further, according to the suggestions given by the participants, the issue of lack of second language skills in Sri Lanka can be overcome and the second language ability among all the communities can be enhanced when the followings are implemented.

- Schools in Sri Lanka should implement second language (Sinhala/Tamil) as a compulsory subject in school curriculum from primary level.

- Establishment/function of schools based on ethnicity, religion and language should be banned.

- The government, civil society organizations and community-based should organize second language training programmes, cross-cultural understanding and religious co-existence programmes for students, youth and employees.

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# AN EVALUATION OF FACTORS CONTRIBUTING TO CONSTRUCTION DISPUTES IN HIGHRISE BUILDING PROJECTS SRILANKA: PROJECT MANAGER'S PERSPECTIVE

<sup>1</sup>Suleka Udani de Silva, <sup>2</sup>Bamunuachchige H.M.

<sup>1</sup>*Faculty of Computing, Engineering & Built Environment, Birmingham City University, United Kingdom,* <sup>2</sup>*Faculty of Engineering & Construction, International College for Business & Technology, Sri Lanka*

## **ABSTRACT**

This study evaluates the critical factors contributing to construction disputes and depicts the importance of dispute mitigation practices especially within the Sri Lankan context and the importance of Project Manager's role towards dispute mitigation process as well. The study was conducted through exploring the existing literature encircling with construction disputes and mitigation practices. Secondary data were reviewed in order to gather general factors which are directly contributing to Construction disputes in different contexts. This step was strengthened by 10 semi structured interviews with industry professionals. Identification of critical factors at their initial stage could be more beneficial than focusing on dispute resolution was the main key finding of this study. Therefore it is essential to administer dispute factors subsequently analyzing their impact and cause towards the project completion. This study systematically interprets the Project Manager's contribution towards dispute mitigation align with the project phases as well. It is essential to adopt CPM schedule and implementing change management strategies are concluded on behalf of preventing overlapped construction schedules. Adequate risk Management and well-structured documentation management are also potential mitigation practices that could be utilized in

accordance with project execution phase. This study recommended to adhere alternative project delivery methods such as IPD, ILD, and PPP etc. Further-more the usage of modern innovative applications such as BIM, and RFID are recommended. The implications of this study are that the industry should adopt innovative procedures as dispute mitigation remedies by comprehensively analyzing their benefits and challenges in accordance with project's level of complexity. Therefore proper planning and scheduling should be embarked at the project initial stage. However better improvements to this perception can be prompted only if there is a methodical mechanism within the cultural and ethical practices of the industry.

Keywords: Construction Disputes, impacts, project Manager

## **INTRODUCTION**

Generally, Construction industry is recognized as a high hazard industry which consist a distinct range of complicated activities such as conceptualization, designs, alterations, modifications, maintains, demolishes, civil structuring works, mechanical, electrical and plumbing works and similar activities as well. Therefore a large number of parties are involved in project



execution. This complex nature of a construction project eventually leads to complex conflicts and disputes among involved parties. (Hibberd & Newman, 1999) Disputes might occur at any type of scale of a construction project. Accordingly, these disputes have a potential tend to transform into more rigorous and multilayered with the scale and type of construction. (Ashworth, 2005) The issues related with construction disputes are a global phenomenon and the costs affiliated with dispute resolution processes are considerably large.

Despite the construction disputes are inherent in a construction project which may resulted in this lagging circumstances and performance issues as well. (Cooper, Williams, Kitt, Recan, & Torre, 2018)

### **Research Problem and Justification of Research**

It is evidently proved that there are plenty of factors contributing to construction disputes in numerous researches. But there is lack of studies have been conducted through project manager's perspective. During recent decade, several studies have captured most of dispute trends but yet there are plenty of loop holes remaining. (Cooper, Williams, Kitt, Recan, & Torre, 2018) This study is intended to highlight those loop holes which are contributing adversarial construction disputes in project manager's perspective while relating to Sri Lankan region.

### **Research Aim**

The aim of this research is to provide an evaluation for factors contributing towards construction disputes and to offer recommendations for dispute mitigation practices.

### **Research Objectives**

1. Identify most critical factors contributing towards construction disputes.

2. Investigate the cause and impact of those factors

3. Evaluate possible remedial practices in project manager's perspective and provide recommendations for better dispute mitigation.

## ***METHODOLOGY***

Research methodology depicts the systemized procedure of research process which facilitates the identification and the analysis of Data. (Wilkinson, 2000) This systematic process starts with a panoptic literature survey and a primary data collection survey. Previously published studies were reviewed and analyzed to ascertain applicability and efficacy in Sri Lankan context. Secondly Qualitative method was adopted by conducting semi structured interviews to examine the perspective of industry professionals regarding the construction dispute factors. Accordingly the Research Onion model by (Saunders, Lewis, & Thornhill, 2016) was adopted as the research design. Therefore this research philosophy caters through ontology idealism, Epistemology interpretivism, and Axiology value laden assumptions. Moreover the pertaining research approach is deductive, while rendering the research strategy of grounded theory. The research choice was selected as qualitative method accustomed by 10 semi structured interviews in coordinating with cross sectional time horizon. Meanwhile the literature survey not much rendered the all-knowledge gaps, semi structured interviews were carried out to furnish all the objectives in order to ascertain the fundamental aim of the research. In total 10 interviews were undertaken from several expertise levels. The sample of interviewees consisting of 05 Project Managers, 01 Site Mangers, 01

Chartered Quantity Surveyor, 01 Arbitrator and 02 Chartered Project Engineers.

## RESULTS

This chapter includes the summary of primary and secondary data gathered in order to demonstrate the conclusion of the research. When considering published literature focused on construction dispute factors, Sri Lankan context have a limited

number of studies which considered similar range.

Meanwhile the literature survey not much rendered the all knowledge gaps, semi structured interviews were carried out to furnish all the objectives in order to ascertain the fundamental aim of the research. In total 10 interviews were undertaken from several expertise levels. Following Figure 1 summarizes overall results gathered

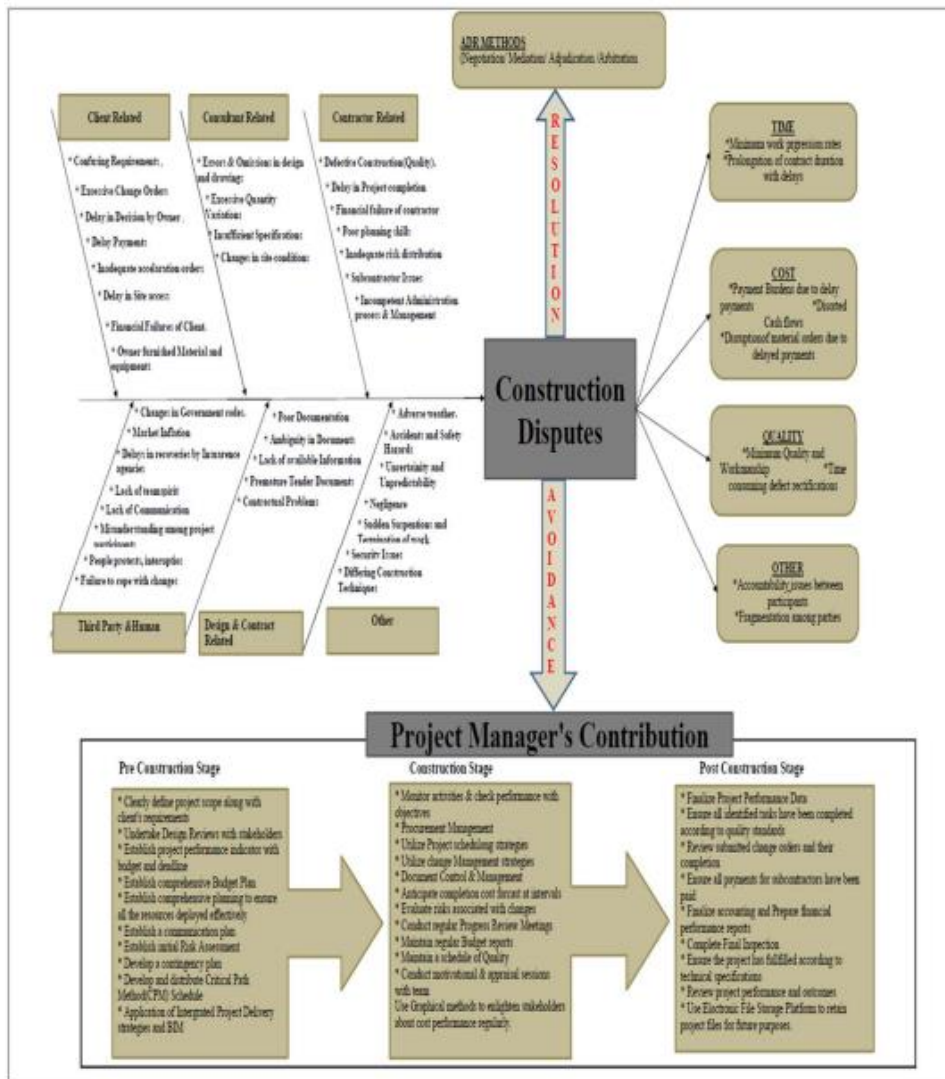


Figure 1 – Conceptual Framework for Dispute Mitigation

## ***DISCUSSION***

While the literature survey captured most critical factors in worldwide context, interview survey had rendered those factors in Sri Lankan context comprehensively. Identified factors were categorized under 6 sub topics such as client related, Contractor related, Consultant related, Third Party and human behavioral related, Design and Contract related and other external. Design and Contract Related Factors were most weighed rather than others. Contractual conflicts and premature tender documentations are having higher influence while ambiguity and poor document controls, unavailability of information and project indemnity terms are performing greater influence towards construction disputes. Project Manager is possessing a considerable influence towards both dispute occurrences and Dispute mitigation. Adherent of proper planning and scheduling at the project initial stage is the most important practice rather than enduring adverse consequences. Hence it is beneficial to utilize project Manager's role towards dispute mitigation rather than application of Dispute Resolution processes after the emergence of disputes. Therefore, adoption and maintenance of CPM schedule, Implementation of change management and risk management strategies are considered as diligent remedies on behalf of preventing adversarial disputes. In addition, utilization of alternative project delivery methods such as IPD, ILD, and PPP, usage of modern innovative applications such as BIM, RFID, Virtual Reality (VR) in Construction and maintenance of well-structured documentation management are also potential mitigation practices that could be utilized in accordance with project execution phase.

## ***CONCLUSION***

The accomplishment of objectives of this research were gained through both primary and secondary data collection procedures.

Objective 01- Over 40 factors were identified from reviewing existing findings categorized under 6 sub topics and each factor were reviewed critically by referring to multiple literature sources. Design and contract related factors had the higher impact rather than other factors.

Objective 02- This objective was fulfilled by receiving the answers of expertise group while referring to existing literature findings. Severe time and cost overruns, fragmented business relationships, distorted cash flows, reduced project progressions, Minimum quality and workmanship, structural failures and collapses, negative attitudes towards company reputation were the general impact of those factors

Objective 03- This area of study didn't highlight in literature broadly. Therefore, the opinions of industry professionals were truly facilitative in achieving this objective. Finally, the mitigation practices were manifested under preconstruction, construction and post construction stages for better implication. There were several limitations whereas finding expertise industry professionals as the respondents were difficult due to the prevailing Covid-19 pandemic situation, moreover this study was conducted in a limited geographical location and a limited timescale as well. Meanwhile this particular research only focused to project manager's perspective, it would be more comprehensive by expanding this singular perspective to other roles as well. Moreover, this study only limited to High-rise building projects and this also can be developed to capture all the remaining construction project types.

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# A STUDY OF THE VISUAL EXPRESSION OF THE CONTEMPORARY ARTIST ON THE WAR AND POST-WAR LANDSCAPE

T. Vinoja

*Department of Visual & Technological Arts*

*SVIAS, EUSL, Sri Lanka*

## **ABSTRACT**

Sri Lanka's three-decade-long civil war ended in 2009 and a decade after that, the losses, the pain everything is still remembered as scars. These memories are stabilized by local Artist, both during and after the war. In particular, it depicts the tragedies and experiences of the creators of the show, as well as expression of positions such as recollection and sharing documentation. Instead, land or landscape is seen as one of the main topics is discussion. Questions about the role of spectacles on the landscape and its relevance are still relevant today. Likewise, this study aims to discover the technological approach of such landscape architects and to contextualize the changes that took place in these visual works in the post-war and the post-war contexts and the level of concept behind them.

Keywords: Civil war, post-war contexts, Post-War Landscape

Tamil Translation

**போர் மற்றும் போருக்கு பின்னரான நிலவுரு மீதான சமகாலக்கலைஞர்களின் காண்பிய வெளிப்பாடு தொடர்பான ஆய்வு?**

இலங்கையின் மூன்று தசாப்தகால உள்நாட்டுப் போரானது 2009ம் ஆண்டுகளில் முடிவுற்றும் அதனைத் தொடர்ந்து ஒரு தசாப்தகாலங்களாயினும் போரினது இழப்புக்கள், வலிகள், எல்லாமே இன்றும் ஞாபகங்களாக வடுக்களாக காணப்பட்டுவருகின்றன. போரின்போதும் போரின் பின்னரும் இவ் ஞாபகங்கள் வடுக்கள் உள்நாட்டுக்கலைஞர்களினால் காண்பிய நிலைப்படுத்தப்படுகின்றன. குறிப்பாக இக் காண்பிய படைப்பாளிகளினது படைப்பாக்கங்கள் குறித்த நிலவுருவில் ஏற்பட்ட அவலங்களையும் அனுபவங்களையும் படிமமாக்குவதுடன், மீள நினைவூட்டல், பகிர்தல், ஆவணப்படுத்தல் போன்ற நிலைப்பாடுகளின் வெளிப்பாடுகளுமாகும் மாறாக நிலம் அல்லது நிலவுரு என்பதானது போரினது முக்கிய பேசுபொருளில் ஒன்றாக காணப்படுகின்றது. இவ்வகையே காண்பியக்கலைஞர்களினது நிலவுரு மீதான வகிபங்கும் அதன் தொடர்ச்சித்தன்மை பற்றிய வினாக்கள் இன்றளவிலும் பேசுபொருள்களாக காணப்படுகின்றன. அவ்வகையே, இவ்வாறான நிலவுரு மீது காண்பியக் கலைஞர்களின் உத்திநுட்ப ரீதியான அணுகுமுறையை கண்டடைதலையும், போர் மற்றும் போருக்கு பின்னரான நிலவரங்களில் இக் காண்பிய படைப்பாக்கங்களில் ஏற்பட்ட மாற்றங்களையும் அதற்கு பின்னாலான கருத்துநிலைகளையும் சில படைப்பாக்கங்களினூடாக சூழமைவுப்படுத்தலை இவ் ஆய்வானது நோக்காகக் கொண்டுள்ளது.

# **EXPLORING THE SYNERGIES AND RELATIONSHIPS BETWEEN URBAN RESILIENCE AND URBAN FOOD SYSTEM SUSTAINABILITY: A LITERATURE REVIEW**

<sup>1</sup>Tong Zou, <sup>1,2</sup>Ali Cheshmehzangi, <sup>1</sup>Ayotunde Dawodu, <sup>1</sup>Eugenio Mangi

*<sup>1</sup>Department of Architecture and Built Environment, Faculty of Science and Engineering, University of Nottingham Ningbo China, <sup>2</sup>Hiroshima University, Network for Education and Research on Peace and Sustainability (NERPS), Japan*

## **ABSTRACT**

Most current sustainable studies are focused on energy transition, while food system (FS) transition has been ignored until recently. The importance of FS sustainability has been gradually recognized as increasing severer FS issues with greater scales and faster speed resulting from more frequent and severer FS shocks elevating by multiple factors. To relieve FS issues and reduce the impacts of FS shocks, building FS resilience and fostering FS sustainability is essential. Meanwhile, cities consume most of the worlds' food and account for most greenhouse gas emissions, making them a hotspot for sustainability studies. It is known that improving a city's resilience can make it more sustainable or smart, while enhancing the city's sustainability does not necessarily make it resilient or smart. Meanwhile, improving a city's smartness can improve a city's resilience or sustainability, but urban smartness does not always enhance urban resilience or sustainability. It can be argued that urban resilience is at the centre of pathways to both urban sustainability and urban smartness. As for the urban food system (UFS), it can suggest that UFS's resilience holds the key to its sustainability while it complements smartness in fostering sustainability. Thus, it is vital to better understand the interactions between those key elements when assessing any proposed solutions and strategies for food system issues, sustainable urbanization, and achieving sustainable development goals. To reflect on this research gap, this study focuses on urban resilience and undertakes a bibliographic analysis to explore its relationships and synergies with urban food system sustainability.

Keywords: Food system sustainability; Resilience; Smartness; Synergies; UFS

# DEVELOPMENT OF STRATEGIES TO MINIMIZE THE STUDENT DROPOUT FROM THE ALTERNATIVE HIGHER EDUCATION SECTOR OF SRI LANKA

<sup>1</sup>Bandara W. B. K., <sup>2</sup>Chandike B. M. T., <sup>3</sup>Samaraweera G.C

<sup>1</sup>Director (Planning & Research), <sup>2</sup>Director (IT), <sup>1,2</sup>Sri Lanka Institute of Advanced Technological Education, <sup>3</sup>Professor and Head, Department of Agricultural Economics, Faculty of Agriculture, University of Ruhuna

## ABSTRACT

The principal objective of this study was to identify the reasons for the student dropout of Sri Lanka Institute of Advanced Technological Education (SLIATE) with a view of developing strategies to minimize the student dropout rate. A stakeholder survey was conducted to identify the reasons for the student dropout rate. Primary data was collected and the sample size was 10 for students and 5 for staff from each programme of each institute. SPSS statistical software was used for the analysis and descriptive analysis was performed. Strategies to improve the performance of the institute developed by performing PESTEL analysis and SWOT analysis. A TOWS matrix was developed using the SWOT analysis. Majority of students confirmed (66%) that the main reason for student dropout is to join other vocational training programmes which have job security. The second reason is part of the students selected for the national universities. The female dropout rate is (65%) higher than the male dropout rate (35%). Students were not satisfied with resource availability at the institute level. More than 80% of students were satisfied with the quality of teaching. Introducing a new programme and revising the existing curricula to match to the industry's needs, upgrading SLIATE into a degree awarding institute and signing MOU with UGC to select students for recruitment after selecting students for universities are some of the strategies to minimize student

dropout and to improve the performances of the institute.

Key words: Academic performance, dropout rate, strategic management

## INTRODUCTION

Sri Lanka Institute of Advanced Technological Education (SLIATE) was established in 1995 and the main purposes of establishing SLIATE were to reform and restructure the entire technical and vocational education system to meet manpower requirements of national development strategies (Annual Report, 2018). Dropout of a student can be explained as a person who leaves school, college, or university before completing a qualification, or a person who lives in an unusual way. According to Bandara et al., (2022) found that student dropout rate of SLIATE is 48% which is considerably higher than expected dropout rate.

As SLIATE is the only alternative higher education institute govern under the Ministry of Education, it is important to find the reasons for such dropouts to develop strategies to take corrective actions for such issues. It will definitely direct the institute to achieve the vision of the institute and contribute to the sustainable development of the country.

### Research Objectives

1. To identify reasons for the student dropout rate.

2. To develop strategies to improve the performance of the Institute

## METHOD

This study was conducted at SLIATE. All 19 regional centers governed under SLIATE were selected for the study. The survey was conducted targeting all HND programmes offered by SLIATE.

### Data collection

To identify reasons for the student dropout rate and factors affecting the institute's performance, a structured questionnaire was developed to conduct a survey. Primary data was collected from students and academic staff members of each institute randomly. The sample size was 10 for students and 5 for staff from each institute.

Develop strategies to improve the performance of the Institute

a. External Environmental analysis was conducted using PESTEL Analysis to

identify the macro environment of the institute. Data collected relevant to following factors

Political factors, Economic conditions, sociocultural forces, Technological factors  
Environmental factors,  
Legal/regulatory conditions

b. Internal Environmental analysis

Data was collected on internal strengths and weaknesses of the institute and external opportunities and strengths to conduct SWOT analysis.

## DATA ANALYSIS

SPSS statistical software used for the analysis of survey results. Data analyzed using descriptive statistics. PESTEL analysis and SWOT analysis was conducted. Based on SWOT analysis, number of possible alternative strategies were identified by developing TOWS matrix.

## RESULTS

### Major reasons for student dropout

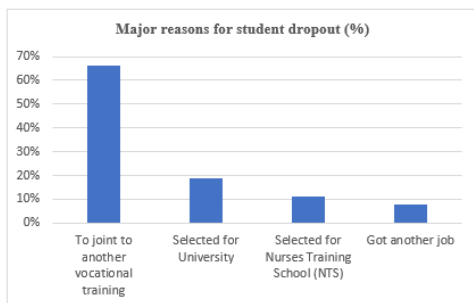


Figure 1: Reasons for student dropout

### Student dropout gender-wise:

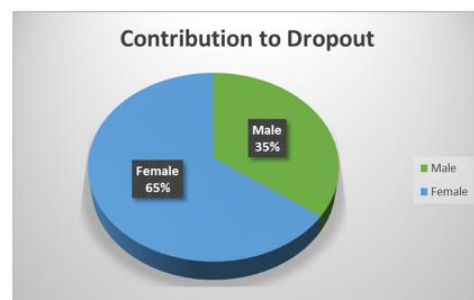


Figure 2: Gender wise contribution for dropout



**Quality of teaching**

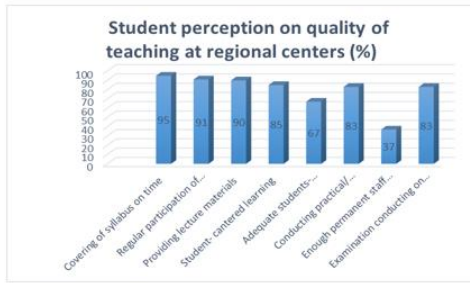


Figure 3: Quality of teaching

**PESTEL Analysis**

**Political factors:** Some of the politicians approve more funding facilities for SLIATE and vice versa is very common.

**Economic conditions:** The unemployment rate of HND students is effect on institute persistent. Therefore, employability rate is identified for all the HND programmes and curriculum revisions conduct to ensure the higher employability rate.

**Sociocultural forces:** Societal values, attitudes, cultural influences, and lifestyles make impact on demand for particular programme.

**Technological factors:** Technological factors directly effect on institutions functions. According to the changing technology, syllabuses of the HND programmes are revised.

**Environmental factors:** Environmental factors do not directly effect on functions of ATIs.

**Legal conditions:** All the legal, regulatory conditions applicable for government institutes are applicable to the SLIATE

SWOT analysis and Tows Matrix

<b>TOWS Matrix SLIATE</b>		<u>Strength</u>	<u>Weakness</u>
<p><u>Opportunities</u></p> <ol style="list-style-type: none"> <li>Increasing demand for diploma courses based on the emerging local and global trends in technological education.</li> <li>Limited enrolment capacity for other state universities</li> <li>MOUs with other recognized universities and professional bodies to provide top up degrees</li> <li>Availability of training and internship opportunities</li> </ol>	<p><u>S O strategies</u></p> <ul style="list-style-type: none"> <li>MOU with UGC to select student Providing top up degree opportunities</li> <li>Upgrading SLIATE to a degree awarding institute</li> </ul>	<p><u>W O strategies</u></p> <ul style="list-style-type: none"> <li>Providing further educational pathways from universities and professional bodies</li> <li>Revising curricula according to industrial need.</li> <li>Introducing new programme with market demand.</li> <li>Providing human and physical resources.</li> </ul>	
<p><u>Threats</u></p> <ol style="list-style-type: none"> <li>Competition from other local and international higher educational institutes with more resources</li> <li>Lack of public awareness about ATI and diploma programmes</li> <li>Rapidly changing industrial requirement</li> </ol>	<p><u>ST strategies</u></p> <ul style="list-style-type: none"> <li>Improve the skill and competency of students to match to the industry</li> <li>Developing programmes to enhance entrepreneurs and industrial requirement</li> </ul>	<p><u>WT strategies</u></p> <ul style="list-style-type: none"> <li>Improve the quality of education to meet the industrial requirement.</li> <li>MOU with industries to enhance job opportunities</li> <li>Use of propaganda for image building</li> <li>Developing a quality assurance and accreditation system</li> </ul>	

Figure 4: Tows Matrix developed based on SWOT analysis

## **DISCUSSION**

As per the results, the main reason for student dropout was to join another vocational training programme which has job security. The second and third reasons were due to selection to the Universities and Nurses Training Colleges. The highest contribution for dropout was observed from female students (65%). The majority of the student population also female within SLIATE.

Students were satisfied about the library facilities IT lab facilities within the institute. Only 32% and 22% of students stated that library and IT lab facilities were low within the institutes.

The majority of students were satisfied (>80%) about covering syllabus, regular participation of academic staff for academic activities, providing lecture materials, Student-centred learning, conducting practical, tutorial appropriately and conducting examination on time (Figure 3). Hence, quality of teaching is in highly satisfactory level. Students and staff members were satisfied about the infrastructure facilities available at institutes (>50%).

Strategies developed to minimise student dropouts using TOWS matrix are given in Figure 4. Majority of students and staff requested to upgrade the institute to a degree awarding institute.

## **CONCLUSIONS**

Based on the results of this study, the following conclusions are made:

1. The main reasons for student dropout were to join another vocational training programme, selection for the university entrance and selection for NTS respectively.

2. Students were satisfied with the quality of teaching at institute level and programme level (>80%). Students were dissatisfied about the lack of enough permanent staff members for academic activities and results releasing on time.

3. Following strategies were developed and recommend to improve the performance of the Institute.

a) Introducing new programme which have high market demand.

b) Revising the existing curricula to match to the industry needs.

c) Upgrading SLIATE into a degree providing institute by amending the act.

d) Introducing part time and full-time certificate courses which can earn profit to the institute.

e) MOU with UGC to select student for recruitment after selecting students for universities

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**PHYSIOCHEMICAL AND NUTRITIONAL COMPOSITION OF THE PALMYRAH  
FRUIT PULP EXTRACTED FROM THE VARIETY OF BLACKED SKIN  
PALMYRAH FRUIT**

<sup>1</sup>Maathumai.S, <sup>2</sup>Vassanthini. R

<sup>1</sup>*Department of Export Agriculture, <sup>2</sup>Department of Biosystem Technology,*

<sup>1</sup>*Uva Wellassa University of Sri Lanka, <sup>2</sup>Eastern University of Sri Lanka*

***ABSTRACT***

This study analyses the physicochemical and nutritional composition of the variety of blacked skin palmyrah fruit pulp. The Blacked skin variety of palmyrah fruits were collected from different locations of the Batticaloa district and subjected to manual extraction of the pulp. The extracted pulp was filtered with a cleaned muslin cloth and packed in pre-sterilized glass bottles and stored at 4°C in a refrigerator for further analysis. Moisture, pH, Brix, fat, protein, total sugar, reducing sugar, Vitamin C, Na, K, and Ca level of the pulp were measured. The results exhibited that, the blacked skin variety of palmyrah fruit pulp consists of 79.62 % of moisture, 5.43 pH, 15.9 brix, and the fat content was 0.32g/100g, protein content was 0.12g/100g, the total sugar content was 7.56g/100g, reducing sugar content was 5.09g/100g, Vitamin C, Na, K and Ca level were 8.12mg/100g, 0.02 mg/100g, 0.034 mg/100g and 0.686 mg/100g respectively.

Keywords: Blacked skin variety, Palmyra fruit pulp, physicochemical properties

# USE OF VIDEO CONFERENCING FOR TEACHING AND LEARNING IN HIGHER EDUCATION

<sup>1</sup>Chandike B. M. T., <sup>2</sup>Bandara W. B. K.

<sup>1</sup>Director (IT), <sup>2</sup>Director (Planning & Research), Sri Lanka Institute of Advanced Technological Education

## ABSTRACT

Videoconferencing is considered a widely popular teaching and learning technique in educational institutes during the COVID 19 pandemic period. The objective of this study was to investigate the impact of videoconferencing on teaching and learning compared to classroom mode. The Study was conducted at Sri Lanka Institute of Advanced Technological Education (SLIATE) focusing Higher National Diploma in Information Technology (HNDIT) programme. Two centers under the supervision of SLIATE were selected. One group of students were exposed to the HNDIT subjects through videoconferencing and another group of students was exposed to classroom mode. Examination results were collected and compared the performance of students. Structured questionnaires were developed for the students and academic staff to identify the quality of teaching and learning via videoconferencing. Data were analyzed using SPSS statistical software. Descriptive statistics, paired sample T-test and correlation analysis were performed to compare the two methods. Microsoft Excel was used to analyze the survey results. There was a positive effect in videoconferencing compared to classroom mode. However, majority of students (41%) were neither satisfied nor unsatisfied about online teaching. Around 70% of students have used their mobile phones for online education. Around 16% of students stated that remote learning was

not effective. More than 63% of lecturers specified that absence of physical face-to-face interaction with students is a disadvantage in teaching and learning. Infrastructure development and providing loan schemes for students and training for academics would help in enhancing the effectiveness of videoconferencing.

Keywords – Video conferencing, teaching tool, Learning tool

## INTRODUCTION

Videoconferencing is a technology that allows users in different locations to hold face-to-face meetings without having to move to a single location together. Some free videoconferencing programs, such as Skype or MSN Messenger, are used increasingly in education to bring teachers and students separated geographically together (Eroz-Tug'a & Sadler, 2009). With Covid 19 pandemic situation most of the educational institutes used videoconferencing technology. However, there are many arguments regarding using of this technique from lecturers and from students regarding the effectiveness. Hence, it is important to identify the effectiveness of method in teaching and learning to check whether expected learning outcome achieved and to take corrective actions.

### Research objectives

1. To analyze the effectiveness in videoconferencing as a teaching and

learning mode compared to classroom mode

2. To identify the student and academic staff perception on online teaching and learning

## **METHOD**

Two study centers namely Gampaha and Galle were selected for the study. 150 students of the Higher National Diploma in Information Technology (HNDIT) programme were randomly selected for the study. The participants belonged to the age group of 20-23 and all of them belonged to the lower-middle socio-economic background. Number of IT lecturers selected for the study was 20.

## **DATA COLLECTION AND ANALYSIS**

Two online structured questionnaires were used to collect the primary data of the study to identify the quality of teaching

and learning activities via videoconferencing and in class mode. End semester examination results of the students for the subjects of the HNDIT Year 2020 (videoconferencing) and academic year 2019 (classroom) were collected from the examination branch of SLIATE Higher Educational Institute to analyze and compare the performance of students at the examination in online mode and class room mode.

The data collected from the questionnaire and the examination results were analyzed using Microsoft Excel and Statistical Package for Social Science (SPSS) respectively. Descriptive statistics, paired sample T-test and correlation analysis were performed to compare the two methods. Student performances were identified using descriptive statistical analysis. Mean 95% confidence interval for the mean, standard deviations, minimum and maximum value compared for each subject of two centers.

## **RESULTS**

*Table1: Comparisons of mean score for IT subjects online mode vs in-class mode*

Subject	Institute	Online mode mean score	In-class mode mean score
Free & open-source systems (FOSS)	Gampaha	55	37
	Galle	55	38
Computer architecture (CA)	Gampaha	32	27
	Galle	34	25
Professional issues in IT (PIIT)	Gampaha	32	44
	Galle	34	32
English for Technology (ET)	Gampaha	37	36
	Galle	45	40

Table 2: Comparison of mean subject score of online and in-class mode

Teaching Mode		Mean	Std. Deviation
Pair 1	FOSS online	55.24	19.153
	FOSS in class	37.51	19.417
Pair 2	CA online	32.77	17.416
	CA in- class	26.37	16.283
Pair 3	PIIT online	35.65	16.931
	PIIT in- class	39.03	25.321
Pair 4	English online	40.38	14.439
	English in-class	37.65	14.692

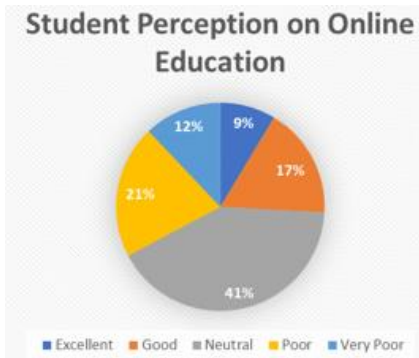


Figure 1: Student perception on online education

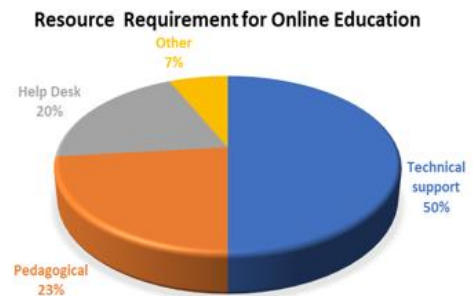


Figure 4: Resource requirement for online education

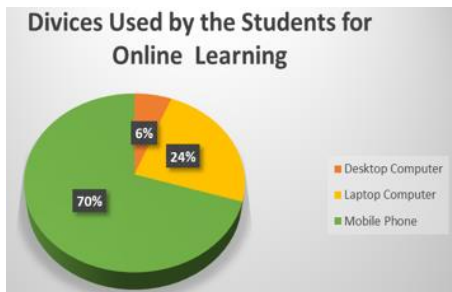


Figure 2: Devices used by the student for online learning

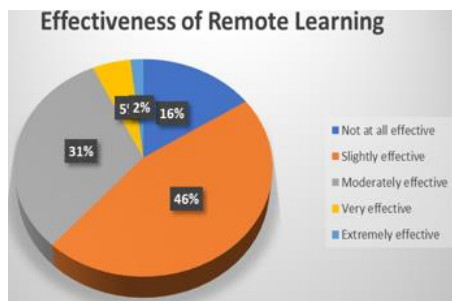


Figure 3: Effectiveness of Remote Learning

## DISCUSSION

### Effectiveness of videoconferencing

Students mean score for the subjects was higher in online mode compared to in-class. Students of Galle center have achieved higher mean marks than Gampaha center except for FOSS which have the same value for both centers.

### Student perception on online teaching and learning

Only 5% of students were informed that remote learning was very effective. Around 41% of students were neither satisfied nor unsatisfied with online learning. Further, 46% of the students were of the opinion that online learning is slightly effective. Around 70% of students use mobile phones as a device to join online lectures.

### Academic staff perception on online teaching and learning

More than 63% of academic staff in the view of lack of face-to-face interaction with students is a disadvantage in online teaching. Out of all responded lecturers, 80% were familiar with effective instruction for online teaching. However, around 50% of academic staff need technical support for the successful delivery of online lectures.

## **CONCLUSIONS**

1. There is a positive effect in video conferencing as a teaching and learning mode compared to classroom mode. However, this is depending on the type of subject taught.

2. Overall student perception of online teaching and learning was not at a satisfactory level. Around 41% of students were neither satisfied nor unsatisfied with online learning. The reasons were less facilities and equipment to use the online mode.

3. Academic staff perception on online teaching and learning

Majority of academics not satisfy about online teaching and learning due lack of face-to-face interaction with students which reduce the effectiveness. Part of academic staff (50%) need technical support for the successful delivery of online lectures.

## **RECOMMENDATIONS**

1. Identifying the infrastructure facilities that need to be developed to meet the success in videoconferencing is important to provide those facilities to the centers.

2. Providing loan scheme for students to purchase devices to connect to online education

3. Providing training for the academic staff on delivering of lectures in online platform

4. Enhance the use of online services and web conference tool to improve the effectiveness of the videoconferencing.

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# COMPETITIVE ADSORPTION OF CHROMIUM (III) ONTO NATURAL RED EARTH UNDER SIMULATED CONDITIONS

Chanaka Imalsha, Nadeesha H. Koralegedara, Rohana Chandrajith

*Department of Geology, University of Peradeniya,*

*Sri Lanka*

## **ABSTRACT**

Toxic heavy metal accumulation in different compartments of the environment can negatively affect human, animal, and plant health. The present study is focused on removing toxic metal ions using Sri Lanka red earth (RE), which is a natural adsorbent via adsorption technique. Specifically the adsorption of Cr(III) onto RE in the presence of As(III) in aqueous media is investigated. Batch sorption experiments were conducted using different initial concentrations of Cr(III) and As(III) with the optimum RE dose of 2 g/L. Both Cr(III) and As(III) showed a similar adsorption behavior (17% adsorption after 90 minutes) at lower initial concentrations (Cr(III) - 8.5 mg/L, As(III) - 7.5 mg/L). However, Cr(III) showed a significantly higher and rapid adsorption (85%) compared to As(III) (15%) when their initial concentrations are high (Cr(III) - 440 mg/L, As(III) - 320 mg/L). As the molecular concentration increases, the chances of collisions between molecule and RE surface is increased and that tend to increase mass transfer from solution phase to RE. Further, this indicates RE can adsorb Cr(III) more effectively than As(III) under the above experimental conditions. Kinetic data were best described by a pseudo-second-order model showing a significant interaction between ions (Cr(III) and As(III)) and FeOH and AlOH sites on the RE surface as chemisorption. In adsorption isotherm experiments, both ions best fit with Langmuir isotherm

indicating monolayer formation during the adsorption. This study confirms the application of RE in to remove Cr in aqueous media.

**Keywords:** Competitive Adsorption, Chromium, Natural red earth, Water treatment

## **INTRODUCTION**

Accumulation of toxic heavy metals in aquatic systems can cause severe health issues in plants, organisms as well as in human beings through direct injection and bioaccumulation. Several mechanisms such as adsorption, precipitation, ion exchange, filtration, oxidation, and phytoremediation are widely used to reduce or eliminate such toxic components in aquatic environments. However, among these methods, adsorption stands out due to its simplicity and higher efficiency. Identifying natural adsorbents which are readily available, efficient, and cost-effective is the new trend in water decontaminations. Such natural materials are especially valuable for economically depressed countries where expensive treatment methods cannot be adapted. Different polymers, activated carbon, and mineral oxides (Fe<sub>2</sub>O<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>) are some of the popular adsorbents that are used to remove heavy metals from aqueous solutions (Chai et al., 2021). Iron oxides receive great interest among mineral oxides due to their high affinity for trace metals. Most Fe- oxide and oxyhydroxide



minerals such as goethite, ferrihydrite make strong bonds with trace elements.

Red Earth (RE) is a naturally occurring substance that can be effectively used to remove heavy metals from aqueous media (Nikagolla et al., 2012; Pathberiya et al., 2019; Vithanage et al., 2006). This brick red-colored natural substance, is available in the north and northwest coastal belt of Sri Lanka (Koralegedara et al., 2021). The RE is made up of well-sorted, rounded quartz sand that has been covered with a red clay matrix with Fe-Al oxides and contains trace amounts of ilmenite and magnetite (Dahanayake and Jayawardane, 1979). The coating of RE is made of amorphous  $Al_2O_3$  and  $Fe_2O_3$ . As these ions react with water, they produce  $AlOH$  and  $FeOH$  (Vithanage et al., 2006).

Previous studies proved that RE can be used to remove heavy metal ions from aqueous solutions. The RE can be effectively used to remove Cr (III & VI) (Nikagolla et al., 2013; Pathberiya et al., 2019), As (III & V) (Vithanage et al. 2006; Vithanage et al., 2007) from aqueous solutions. However, these studies have not paid much attention to investigate the competitive adsorption behavior in the presence of more than one such trace element in an aqueous system. This is highly significant in the application of RE to treat wastewater, which usually contains multiple contaminants. Hence, the present study is focused on investigating the competitive adsorption of Cr(III) and As(III) in aqueous systems using naturally occurring RE.

## **MATERIALS AND METHODS**

Red earth samples were collected from the Aruwakkalu area, located close to Puttalam District, in the northwest of Sri Lanka. Samples were air-dried and sieved to obtain different size fractions. The wet sieving was performed to remove the loosely bound clay fraction attached to

sand grains. Different sized RE fractions are then used in preliminary experiments to find the most suitable size fraction for adsorption experiments. Cr(III) and As(III) stock solutions of 1000 mg/L were prepared by dissolving analytical grade 1.1104 g of  $CrCl_3 \cdot 6H_2O(s)$  and 0.431 g of  $NaAsO_2(s)$  in 1.00 L of deionized water ( $<0.05 \mu S_{cm}^{-1}$ ). A series of mixtures of Cr and As solutions for the adsorption experiments were prepared to dilute the stock solution with deionized water.

### **Adsorption Experiments**

The substrate concentration of 2 g/L was selected as the optimal RE loading in all the experiments. Based on the previous studies that act as a homogenous solution when constantly stirred (Nikagolla et al., 2013). The effect of contact time on adsorption efficiency was determined by mixing the Cr(III)—As(III) mixture (5 and 3 mg/L, respectively) with RE (2 g/L) while collecting samples at 3, 6, 9, 12, 15, 20, 30, 40 and, 60 minutes time intervals. The concentrations of Cr(III) and As(III) were selected for the comparison purpose based on previous adsorption data carried out under non-competitive conditions. Different concentrations of Cr(III)-As(III) mixtures were prepared for the isotherm and kinetic studies. The collected samples were filtered through a 0.45  $\mu m$  filter and analyzed for the dissolved Cr and As concentrations by ICP-MS. The obtained optimum contact time was used in all further experiments.

## **RESULTS AND DISCUSSION**

As reported in previous studies RE has a strong affinity to adsorb both Cr(III) (Nikagolla et al., 2013) and As (III) (Vithanage et al., 2007) in aqueous solutions. When both Cr(III) and As(III) are available in the system, their affinity towards RE is considerably different (Fig. 1).

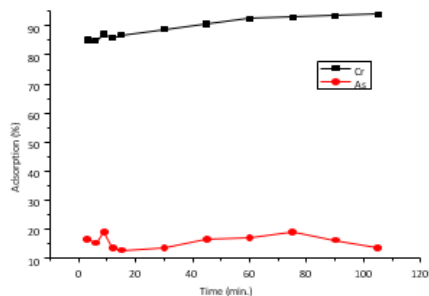


Figure 1: The plot of the effect of contact time Cr(III) (4.65 mg/L) under competitive conditions As(III) (3.39 mg/L) and adsorbent dose 2 g/L

During the initial 3 minutes time interval, about 85% of Cr(III) was adsorbed onto RE. However, only 16% of As(III) adsorption was achieved during that period (Fig. 1). This could be related to the difference in electronegativity, hydroxylation capacity, and the ionic potential of these ions. Cr ion is a positively charged ion, whereas As occurs as the negatively charged oxyanion (AsO<sub>2</sub><sup>-</sup>). It may also be due to the hydration energy and hydrated ionic radius of ions, with the lower hydration energy making adsorption easier (Ouyang, et. al., 2018). Even though the rate of Cr(III) adsorption onto RE in the presence of As(III) is decreased, the total Cr(III) adsorption was continuously increased with time and reached saturation at around 100 minutes. Arsenic(III) also showed a similar adsorption pattern, however, gradual desorption was observed after the maximum adsorption at around 75 minutes (Fig. 1).

The Cr(III) adsorption by RE under competitive conditions (Fig. 1) is compared with the non-competitive Cr(III) adsorption by RE reported by Nikagolla et al., 2013. Under non-competitive conditions total Cr(III) adsorption (100%) has been observed over a wide range of pH (2-10) for a RE dose of

2 g/L and initial concentration of Cr(III) (4.91 mg/L) within 10 minutes of contact time (Nikagolla et al., 2013). However, under competitive conditions (in the presence of As(III)), only about 85% Cr(III) adsorption was observed for similar initial concentration of Cr(III) (4.65 mg/L), with same RE dose (2 g/L) and at the contact time of 10 minutes. Hence, isotherm and kinetic models were studied to understand the Cr(III) adsorption mechanism by RE under competitive conditions.

### Isotherm Models

Langmuir isotherm postulates that adsorption occurs at specified homogenous sites on the adsorbent's surface and results in the formation of a monolayer, which may be described as the following equation.

$$\frac{1}{Q_e} = \frac{1}{Q_m \cdot K_L \cdot C_e} + \frac{1}{Q_m}$$

where,  $q_e$  is the equilibrium adsorption capacity (mg/g),  $q_m$  is the maximum adsorption capacity (mg/L),  $K_L$  is the Langmuir constant, and  $C_e$  is the equilibrium concentration in the solution (mg/L).

The Freundlich isotherm is an empirical model that implies non-ideal adsorption that occurs on a heterogeneous surface with varying adsorption energy. The isotherm also assumes the binding energies at each adsorption site differ. It assumes the energy distribution for adsorptive sites has a spectrum of various binding energies rather than single uniform energy and follows an exponential-type curve as shown in the following equation;

$$\log Q_e = \log k_f + \frac{1}{n} \log C_e$$

where,  $K_f$  and  $n$  are Freundlich constants;  $K_f$  is the capacity coefficient

that assists to obtain a measure of the adsorbent's relative adsorption capacity, while  $n$  is the intensity parameter.

Comparing the correlation coefficients of both models (Fig 2a & 2b), the adsorption of Cr (III) by RE in the presence of As (III) is more compatible with the Langmuir isotherm. Hence, the following assumptions can be made on the adsorption mechanism of Cr onto RE in the presence of As;

(1) All the adsorption sites in the surface of RE are homogenous

(2) There are no interactions between adjacent adsorbed molecules

(3) Adsorption is a mono-layered process in which each active site may only interact with one adsorbate molecule,

(4) Adsorption is a reversible process

(5) Adsorption follows a second-order reaction

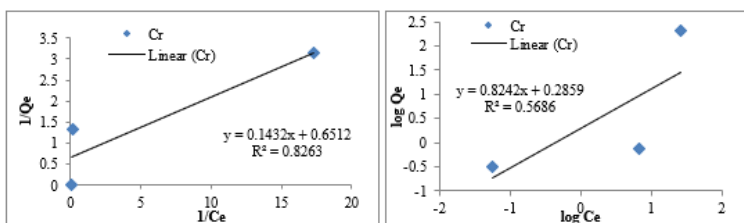


Fig. 2: Isotherm diagrams of Cr(III) adsorption onto RE in the presence of As(III) a) Langmuir isotherm, b) Freundlich isotherm

### Kinetic Models

Adsorption kinetics also governs the rate of adsorption, which influences the time necessary for the adsorption process to achieve equilibrium. Kinetic models can provide information on adsorption paths and the mechanisms which are crucial for designing the adsorption system.

#### Pseudo-first-order model

The pseudo-first-order model is based on the assumption that the rate of adsorption is directly proportional to the difference in saturation concentration and the amount of solid uptake with time. When adsorption occurs by diffusion via the contact, kinetics is often found to follow the pseudo-first-order rate equation. The linear version of the pseudo-first-order model is as follows.

$$\ln(Q_e - Q_t) = \ln Q_e - k_{ad} \cdot t$$

where,  $Q_t$ - Amount adsorbed (mg/g) at the time  $t$ ,  $Q_e$ - Amount adsorbed (mg/g) at equilibrium,  $k_{ad}$ - Pseudo first-order rate constant ( $\text{min}^{-1}$ )

#### pseudo-second-order model

The pseudo-second-order model assumes the chemisorption of the adsorbate on the adsorbents (Ho and McKay, 1999; Srivastava et al., 2006). The linear form of the pseudo-second-order model is as follows

$$\frac{t}{Q_t} = \frac{1}{kQ_e^2} + \frac{1}{Q_e} t$$

Where,  $t$  = time (min);  $Q_t$  = amount of adsorbed per g of adsorbent at time  $t$ ;  $Q_e$  = amount of adsorbed per g of the adsorbent at equilibrium;  $k$  = pseudo-second-order constant;

The best-fit model was determined considering the correlation coefficients ( $R^2$ ) (Table 2). The pseudo-second-order model best described the kinetic data for all concentrations of Cr(III). The rate-limiting stage in this model is surface adsorption, which involves chemisorption, where removal from a solution is caused by physicochemical interactions between the two phases. Chemisorption involves valency forces via electron sharing or exchange between sorbent and sorbate. In

this case, the adsorption rate is determined by adsorption capacity rather than adsorbate concentration (Ho and McKay, 1999). Since chemisorption is much stronger than physisorption Cr(III) may indicate a strong bond on  $>FeOH$  or  $>AlOH$  of RE surface (White, 2020).

Table 4.2 Comparison of the correlation coefficients of different kinetic models

Kinetic model		$R^2$ of Cr (III) in Cr-As mixture		
		(Cr (III) = 0.7 mg/L)	(Cr (III) = 8.5 mg/L)	(Cr (III) = 440 mg/L)
Pseudo order	first	0.5041	0.915	0.9394
Pseudo order	second	0.9998	0.9769	0.9998

## CONCLUSIONS

The efficiency of RE on Cr(III) adsorption under competitive (in the presence of As(III) and non-competitive conditions) was studied. In the presence of As(III), the Cr(III) adsorption by RE (at 2 g/L dosage) is observed as 84% after 3 minutes of contact time. The adsorption is best fit with the Langmuir isotherm and Pseudo-second order kinetic model. Modeled data suggest that surface adsorption occurred as a chemisorption process. The strong interaction between the adsorbates (Cr and As) and FeOH and AlOH sites on the RE surface was confirmed by FT-IR analysis. This study indicated the use of RE as an effective material to remove Cr(III) from contaminated aqueous solutions in the presence of As.

## Acknowledgment

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# AYURVEDIC MANAGEMENT OF ENDOMETRIOSIS WITH 1RY SUBFERTILITY – A CASE REPORT

Pushpamali, W.A.I

*Ayurveda Medical Officer, Isiwaree Weda Asapuwa, Sri Lanka*

## **ABSTRACT**

Endometriosis and infertility is a major condition among young ladies of worldwide. Endometriosis affects roughly 10%-15% (190 million) of reproductive age women and girls globally. At present, there is no known cure for Endometriosis, and treatment is usually aimed at controlling symptoms. The main complication of Endometriosis is impaired fertility. Approximately one third to one half of women with Endometriosis have difficulty getting pregnant. But according to Ayurveda medicine there are internal and external various drugs and treatments to cure Endometriosis and infertility. Various panchakarma treatments can use externally and various Kashaya, Kalka, Pills and other preparations can use internally to prevent and cure and manage Endometriosis and infertility.

Key words: Endometriosis, Infertility, Ayurveda Treatments

## **INTRODUCTION**

Endometriosis is an often-painful disorder in which tissue similar to the tissue that normally lines the inside of uterus. (Mayo clinic Family Health Book-5th Edition) It is a chronic disease associated with severe, life impacting pain during period, sexual intercourse, bowel movements, or urination, chronic pelvic pain, abdominal bloating, nausea, fatigue and sometimes depression and infertility. (WHO) At present there is no known care for Endometriosis and treatment is usually aimed at controlling symptoms. (WHO) Endometriosis may cause female infertility. (Mayo clinic Family Health

Book- 5th Edition) Main symptoms of this condition are painful period (Dysmenorrhea), pain with intercourse (Dyspareunia), pain with bowel movements or urination, excessive bleeding, and constipation. (WHO)

The main complication of Endometriosis is impaired fertility. Approximately one third to one half of women with Endometriosis have difficulty getting pregnant. (Mayo clinic Family Health Book- 5th Edition) For pregnant to occur an egg must be released from an ovary, travel through the neighboring fallopian tube, become fertilized by a sperm cell and attach itself to the uterine wall to begin development. Endometriosis may obstruct the tubes and keep the egg and sperm from uniting. But the condition also seems to affect fertility in less direct ways, such as by damaging the sperm or egg. (Halpern G, et al. (2015)

Treatments of Endometriosis usually involves medication or surgery. The approach patient and the doctor choose will depend on how severe her signs and symptoms are and whether she hope to become pregnant. Endometriosis can lead to trouble conceiving. If patient is having difficulty getting pregnant, doctor may recommend fertility treatments. Stimulating ovaries is the first treatment. But unfortunately stimulating ovaries is not satisfied treatment for the fertility condition of Endometriosis patients. (Jurkiewicz-Przondziona J, et al. -2017)

The present report deals with a case of Endometriosis with infertility. Written informed consent was obtained from the

patient for the publication of the present case report.

### **CASE DESCRIPTION**

A 28 years old female patient came to our clinic (2021/4/25) with the complaints of severe abdominal and pelvic pain during period, vertigo, vomiting, headache during menstruation, severe pain during sexual intercourse and constipation. High menstrual flow, large scanty, and dark brownish or blackish clots and bleeding she had. Patient was diagnosed as having grade iii Endometriosis and infertility condition for 3 years. Patient has been faced laparoscopy (2020/3/7) by Dr. Chaminda Mathota (Consultant Obstetrician and Gynecologist) under general anesthesia. But her situation was not reduced. She was attending our clinic on (2021/4/25) again with two right side ovarian chocolate cysts of 37.5 mm and

28.3 mm. Started Ayurvedic medical treatments, diet control with pathyapathya and regular exercise and continued it ((2021/4/25 to 2021/7/17) and again done USS abdomen and pelvic. There was no any chocolate cyst and the USS said that she has normal abdomen and pelvic. Her CA 125 was 34.2 u/ml. Again started Ayurvedic medications for infertility condition and she was getting pregnancy on 2022/2/27. Her LMP was 2022/2/27.

#### Diagnosis, Assessment and Treatments

History and clinical examination are reliable ways of diagnosing Endometriosis. Laparoscopy was done and it was the specificity test for diagnose Endometriosis. In present case the diagnosis of laparoscopy, USS Abdomen and Pelvis/ TVS, CA 125 has been made based on the combination of positive Endometriosis and infertility findings, physical examination findings imagine.

Table 1: Investigation Reports

Date	Name of Investigation	Report
2020/3/7	Laparoscopic right ovarian Cystectomy and ovarian reconstruction.	Right Endomerioma. Uterus is normal in size. Right 6 cm ovarian Endomerioma with adhesions to R/ tube and posterior surface of uterus. Left ovary is normal. Both tubes appeared normal. Adhesions in POD. Bowel loop adhered to anterior abdominal wall.
2021/4/22	USS abdomen and pelvic	2 right ovarian Endometriomas 37.5mm and 28.3mm
2021/5/1	CA 125	34.2u/ml
2021/7/11	USS abdomen and pelvic	Normal Pelvic and abdomen USS
2022/2/23	Urine HCG	Positive
2022/3/7	TVS	A single live fetus

A criterion of assessment in present case was based on the finding of Laparoscopy, CA 125, TVS/ USS abdomen and pelvic, Urine HCG reports. Total all reports were arranged before treatments and after treatments. The patient was treated with various

Panchakarma procedures like shirodharas, sambahana (applying rakthashodaka oil to body and massage), Vashpasveda (steambath using rakthasodaka decoction's steam), Nasna karma, Anuvasana Vasthi, Niruhana Vasthi, Upanaha Sveda, and Paththu for body purification

Table 2: Intervention

Duration	Medicine	Dose	Frequency	Anupana
2021/4/25- 2021/7/3	<i>Pippalimula Kashaya</i>	125 ml	Twice a day/ Before meal	Honey
	<i>Nawarathna Kalkaya</i>	5 grms	Twice a day/ Before meal	Kollu Decoction
2021/7/4- 2021/7/17	<i>Punarnavastaka Kashaya</i>	125 ml	Twice a day/ Before meal	
	<i>Kaishoru Guggulu</i>	2 pills	Twice a day/ Before meal	Lunuvila Decoction
2021/7/18- 2021/10/31	<i>Ukpuruk 8 Kashaya</i>	125 ml	Twice a day/ Before meal	King coconut water
	<i>Kanchanara Guggulu</i>	2 pills	Twice a day/ Before meal	Komarika Swarasa
2021/11/1- 2022/1/28	<i>Shatavari Gopakanya Kashaya</i>	125 ml	Twice a day/ Before meal	King coconut water
	<i>Phala Kalyana Grutha</i>	5 grms	Twice a day/ Before meal	Milk

Table 3: Panchakarma Intervension

Duration	Treatment
2021/7/4 – 2021/7/10	<i>Shirodhara Vashpa sveda and Sambahana (Body massage and Steam bath)</i>
2021/7/11	<i>Nasna Karma</i>
2021/7/12, 2021/7/14, 2021/7/15	<i>Anuvasana Vasthi- Thila Thaila 60 ml</i>
2021/7/13	<i>Niruhana Vasthi - Sahinda lunu 6 g -Madu 10 ml -Satakuppa Kalka 25 grms</i>



	- <i>Eranda Saphaka Kvatha 200 ml</i> - <i>Eranda Thaila 60 ml</i>
2021/4/25- 2021/7/3	Abdominal and pelvic massage ( <i>sambahana</i> using <i>Guduhi taila</i> ) <i>Gorakadi Upanaha Sweda</i> <i>Nirgundi saphaparni Paththuwa</i>

## **DISCUSSION**

Endometriosis and infertility is a major condition among young ladies of worldwide. Endometriosis affects roughly 10%-15% (190 million) of reproductive age women and girls globally. (WHO) At present, there is no known cure for Endometriosis, and treatment is usually aimed at controlling symptoms. (WHO) But in Ayurveda treatment several plants such as Curcumin, Pine barks, Chamomile, Peppermint, Vertex have been proved to control Endometriosis. (Ratini, M.on June 16/2021.)

The patient has been taking various drugs like painkillers and hormone treatments to cure and reduce her pain and to get pregnant. All these drugs were completely withdrawn and replaced Ayurvedic Medicines during the initial stages of treatment. Various drugs like Pippalimula Kashaya, Nawarathna kalka, punarnawashtaka Kashaya, kaishoru guggulu were added gradually. According to USS abdomen and pelvis of 2021/7/11 both Endometriomas were disappeared. There was a normal USS. Her all complains like severe abdominal and pelvic pain during period, vertigo, vomiting, headache during menstruation, severe pain during sexual intercourse and constipation were reduced gradually

within one month of treatment plan. Ukpuruk 8, Shatavari gopakanya Kashaya, kanchanara guggulu, Phala kalyana grutha like Ayurveda medicines help to mature follicles and to get pregnancy. Finally, she is pregnant and totally cured.

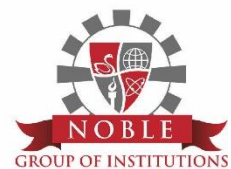
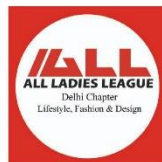
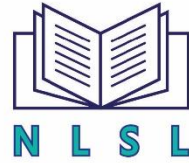
## **CONCLUSION**

The Ayurveda treatments for Endometriosis and infertility condition is very effective. It decreased the Endometriosis condition and it's complains and also manage the infertility condition successfully.

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