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Humanism in Purananuru

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Abstract - Humanity is nothing but treating human as humankind and showing love towards them regardless of their age and racistic nature. The expression of love and humaneness differs according to the situation. The prominent reason for the emergence of the theory of humanity is in order to know the essence of human life and to prevent the hindrance that is making the mankind not to relish the true essence of humaneness. One should know that people around them are also human being who has the same feelings, emotions, rights and respecting all of those is also the definition of humanity. Treating and showing love towards people regardless of their caste, religion and language defines humanity. This research article explores the essence of humanity in the so called resistance literature.

Key Words: Sangam Literature, Purananuru, Humanity, Biological Thinking, Hospitality and Charity.

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புறநானூற்றில் மனிதநேயம்

முனைவர் இரா. ஜெபமணி
தமிழ்த்துறைத் தலைவர் மற்றும் துணை முதல்வர்
புனித ஜாண்ஸ் கலை மற்றும் அறிவியல் கல்லூரி, அம்மாண்டிவிளை

ஆய்வுச் சுருக்கம்: *மனிதனை மனிதனாக மதித்து அன்பு காட்டுவதே மனிதநேயமாகும். இந்நேயமானது வயது மற்றும் இன வேறுபாடின்றி, அனைவர் மனதிலும் தோன்றக்கூடியதாகும். அவை வெளிப்படும் விதம் சூழ்நிலைக்கேற்ப மாறுபடுகின்றன. மனித வாழ்வின் பண்புகளை உணரவும் அதன் இன்பங்களை நுகரவும் முடியாமல் தடுக்கப்பட்டு இழிவுக்கும், பழிக்கும் ஆளாக்கப்பட்டுக் கிடந்த மனிதனை மீட்டெடுக்கவும் மாண்புறச் செய்யவும் வந்த உயரிய கோட்பாடே மனிதநேயமாகும். தன்னைச் சுற்றி இருப்பவர்களும் மனிதர்கள்தான். அவர்களுக்கும் உணர்வுகளும் உரிமைகளும் உண்டு என்பதை உணர்ந்து மதித்து வாழ்வதே மனிதநேயமாகும். சாதி, மதம், மொழி இவற்றின் பெயரால் மனிதனை ஒதுக்காமல் அன்பு காட்டி, உடன் உறை மக்கட்கு உற்றுழி உதவி பசிப்பிணி நீக்கி வறுமையிலிருந்து காப்பாற்றுவதே மனிதநேயமாகும். புறநானூற்றில் மனிதநேயப் பண்புகள் உள்ளன என்பதை இக்கட்டுரை விளக்குகின்றது.*

முக்கியச் சொற்கள்: *சங்க இலக்கியம், புறநானூறு, மனிதநேயம், உயிரியல் சிந்தனை, விருந்தோம்பல், தொண்டு*

மனிதநேயம்

மனித மனமானது மென்மையானது; அன்பிற்காக ஏங்கக்கூடியது; பயனை எதிர்பாராதது அன்பினைப் பெறும்போது மகிழ்கின்றது. மனித இனத்தின் இன்ப துன்பங்களில் பங்குகொள்ளும் உயரிய மனவுணர்வே மனிதநேயமாகும். உயிரின ஒருமைப்பாட்டிற்கும், மனித இன வளர்ச்சிக்கும், சமுதாய மேம்பாட்டிற்கும் மனிதநேயப் பண்பே அடித்தளமாக அமைகின்றது. விருப்பு வெறுப்புக்களைத் மனதில் வைத்திருந்தாலும் பிறர் ஒருவர் துன்பப்படும்போது உடுக்கை இழந்தவன் கைபோல ஓடோடிச் சென்று உதவிக்கரம் நீட்ட முன்வருபவனே மனிதநேய மிக்கவர். இன்றைய அறிவியல் வளர்ச்சியினால் மனித மனமானது பிறரை மதிக்காமல் அன்பு செலுத்தாமல் அலைபேசியே வாழ்க்கை என வாழ்ந்து கொண்டிருக்கின்றனர். அதனால் அன்பு, பாசம், நேயம் ஈகைக்குணம் இல்லாமல் வாழ்க்கையை இழந்து கொலை, பாலியல் வன்புணர்வு, மணமுறிவு போன்றவற்றால் நீதிமன்ற வாசலில் காவல் இருக்கின்ற மக்களின் எண்ணிக்கை அதிகரித்துகொண்டே இருக்கின்றது. அனைத்து மனிதரின் மன ஓரத்திலும் மனிதநேயம் என்ற பண்பு இருந்து கொண்டேதான் இருக்கின்றது. இடத்திற்கு இடம் காலத்திற்குக் காலம் மாறுபடுகின்றது. மனிதநேயத்தை வளர்ப்பதும் தக்க வைத்துக்கொள்வதும் இன்று கிராம மக்களிடையே அதிகம் காணப்படுகிறது.

வாழ்வியல் சிந்தனை

மனிதனின் வாழ்வும் தாழ்வும் நிலத்தைப் பொறுத்து அமைவது இல்லை. அந்த நிலத்தில் வாழக்கூடிய மக்களைக்கொண்டு அமைகின்றது. மனிதனை மனிதனாக மதித்து மனிதநேயம் மிக்கவனாக வாழ்கின்ற நிலம் நன்மை பயக்கும் என்று சங்ககாலப் புலவர்கள் அனைத்து காலத்திற்கும் பொருந்துமாறு பாடல்களில் குறிப்பிட்டுள்ளனர். மனிதன்

இவ்வுலகில் பொறுப்பு மிகுந்தவனாக இருக்கவேண்டுமென்பதை

"நாடா கொன்றோ காடா கொன்றோ
அவலா கொன்றோ மிசையா கொன்றோ
எவ்வழி நல்லவர் ஆடவர்
அவ்வழி நல்லை வாழிய நிலனே"

(புறம்-187)

என்ற பாடல் வரிகள் விளக்குகின்றன.

செல்வத்தின் பயனே ஈதல்

தான் பெற்ற செல்வத்தைத் தான் மட்டும் அனுபவிக்காமல் இல்லாதவர்க்கும், இயலாதவர்க்கும் பகிர்ந்து கொடுக்கும் மனபக்குவம் உடையவனாக இருக்க வேண்டும் என்பதை,

"உண்பது நாழி உடுப்பவை இரண்டே
பிறவும் எல்லாம் ஓர்ஒக்கும்மே
செல்வத்துப் பயனே ஈதல்"

(புறம் - 189)

என்ற பாடல் வரிகள் மூலம் நக்கீரர் விளக்குகின்றார். "பகிர்ந்துண்டால் பசியாரும்" என்ற பழமொழிக்கேற்ப ஈகைப்பண்பில் தலைசிறந்தவர்கள் தமிழர்கள். தன்னை நாடி வருபவர்கள் உணவின்றி வாடிவிடக்கூடாது என்பதற்காகவும், பசிப்பிணியைப் போக்குவதற்காகவும் உணவுச்சாலைகளை அமைத்தனர் என்பதனை,

"பசிப்பிணி மருத்துவன் இல்லம்
அணித்தோ சேய்ந்தோ?"
"பைதற் சுற்றத்துப் பசிப்பகையாகிக்
கோழியோனே கோப் பெருஞ்சோழன்

என்ற வரிகள் விளக்குகின்றன.

நண்பரின் நேயம்

கடையெழு வள்ளல்களில் தலையானவரெனக் கருதப்படுபவர் பாரி வள்ளல். இயற்கை வளங்கள் நிரம்பப்பெற்ற பறம்பு மலையைச் சிறப்பாக ஆட்சி செய்து வருகின்றார். வீரத்தால் வெல்ல முடியாத பகைவர்கள் சூழ்ச்சியால் பாரியை வென்றனர். இவரது மறைவினால் நிலைகுலைந்த நண்பர் கபிலரோ பாரி இறந்த பின்னர் தமக்கென வாழாமல் பாரியின் மகளிர்க்குத் தந்தையாக நின்று தக்க இடத்தில் மணம் செய்து வைக்கின்றார்,

"இவரியார் என்குவை யாயி னிவரே
ஊருடவிலவலர்க் கருளித் தேருடன்
முல்லைக் கீந்த செல்லா நல்லிசைப்
படுமணி யானைப் புறம்பிற் கோமான்
நெடுமாப் பாரி மகளிர் யானே
தந்தை தோழ னிவரென் மகளிர்
அந்தணன் புலவன் கொண்டு வந்தன்னே"

(புறம்-201)

என்ற வரிகள் புறநானூற்றுக் கால அன்பு உண்மையானதாக இருந்தது என்ப விளக்குகின்றன.

பிசிராந்தையார் கோப்பெருஞ்சோழரின் நட்பு சிறப்பானது. இருவரும் நேரடியாகப் பார்த்ததில்லை. உறையூர் என்ற ஊரில் மன்னர் செல்வ செழிப்புடன் காணப்பட்டார். பிசிர் என்ற ஊரில் பிசிராந்தையார் வறுமையில் காணப்பட்டார். இத்தகைய வேறுபாட்டிலும் அன்பின் மிகுதியினால் இருவரும் நட்புடன் இருந்தனர். மன்னனோ உலக வாழ்வில் வெறுப்புற்று நாடு துறந்து உண்ணாநோன்பு இருந்தார்,

"தென்னம் பொருப்பன் நன்னாட்டுள்ளும்
பிசிரோன் என்ப என் உயிர் ஓம்புனே"

(புறம் -215)

பிசிராந்தையார் தம்மைக் காண வருவார் என்ற உறுதிப் பாட்டில் மனம் வருந்தி ஏக்கத்தில் உயிர் துறந்தார்.

இன்றைய காலச் சூழலில் நண்பனாக வலம் வருகின்றவர்களிடையே சிறிய பிரச்சினைகள் தோன்றும் போது தன்னோடு பயணித்த நண்பன் என்று பார்க்காமல் கொலை செய்கின்ற நிலைகள் அதிகரிப்பதால் இளம் தலைமுறையினருக்கு நட்பு, நேயம் என்பன புரியாமலே போகின்றன.

விருந்தோம்பல்

விருந்தோம்பல் என்பது புதிதாக வருகின்றவர்களுக்கு உணவளித்தல் ஆகும்.

அரசர்கள் தம்மை நாடி வருகின்ற விருந்தினர்க்கு உணவு அளிப்பதற்கு முன்னதாக அவர்களுடைய அழுக்கான ஆடையை அகற்றி, புதிய ஆடையை அணிய வைத்து வயிராற அறுசுவை உணவை வழங்கி உபசரித்தனர் என்பதை

"நீல்நிறச் சிதாஅர் களைந்து
வெளியது உடீஇ என்பசி களைந்தோனே"
(புறம் 385)

என்ற பாடல் வரிகள் விளக்குகின்றன.

தமிழர் பண்பாட்டில் விருந்தோம்பல் என்பது தலைசிறந்த பண்பாகக் காணப்படுகின்றது. விருந்தினர்கள் அனிச்ச மலர் போன்றவர்கள். அவர்களை முகம் கோணாமல் வரவேற்கின்றனர் நிலையினை,

"மோப்பக் குழையும் அனிச்சம் முகந்திரிந்து
நோக்கக் குழையும் விருந்து"
(புறம் - 90)

விருந்தோம்பல் பண்பில் பாண்டியன் கிரஞ்சாத்தனைப் பற்றி ஆவூர் மூலங்கிழார் விளக்குகின்றனர்.

"உண்ணார் ஆயினும் தன்னொடு சூளுற்று
உணம் என இரக்கும் பெரும் பெயர்ச்சாத்தல்"
(புறம் - 178)

ஈகை

மன்னர்கள் தன்னை நாடி வருகின்ற இரவலர்களுக்கும் புலவர்களுக்கும் வாரி வாரிப் பொருட்களை வழங்கினர். ஈகைப் பற்றிய செய்திகளையும் ஈகையினால் ஏற்படக்கூடிய பயன் என்ன என்பதையும் பற்றி ஔவையார் பாடல்கள் விளக்குகின்றன. அதியமானிடம் ஔவையார் பரிசில் வேண்டி பாடி செல்கின்றார். அப்போது அதியமானோ உடனடியாகப் பரிசு பொருட்களைக் கொடுக்காமல் காலம் தாழ்த்துகின்றார். ஔவையாரோ வருந்துகின்ற தன் நெஞ்சைப் பார்த்து நெஞ்சே வருந்தாதே எவ்வளவு காலம் தாழத்தித் தந்தாலும் அது பயனள்ளதாக இருக்கும் என்ற நம்பிக்கையோடு இருக்கின்ற நிலையில் அதியமான் கொடுத்த நெல்லிக்கனியை பார்த்த ஔவையின் மனதில் நீடுழி காலம் வாழுகின்ற சிவபெருமானின் நினைவுதான் வருகின்றது.

"பால்புரை பிறைநுதல் பொலிந்த சென்னி
நீலமணி மிடற்று ஒருவன் போல
மன்னுக பெருக நீயே" (புறம்-91)

என வாழ்த்துகின்ற நிலை இங்கு சுட்டிக் காட்டப்படுகின்றது. ஈயென இரக்கின்றபோது இல்லை என்று கூறாது வாரி வழங்கியமையாலேயே புறநானூற்றில் ஈகைப் பற்றிப் பெருமையாகப் பேசப்படுகின்றது.

தொகுப்புரை

இயற்கையோடு வாழந்த மனிதன் தன்னைப் போன்ற பிற உயிர்களுக்கு துன்பம் வருகின்றபோது அவற்றை நீக்கி நல்வழிப்படுத்தினர். புரவலர்களைப் புகழ்ந்து பாடிப் பரிசில் பெற்று தங்களுடைய வறுமையைப் போக்கினர். புரவலன் தன்னை நாடி வருகின்ற எளியவர்களுக்கு பொன்னும் பொருளும் வழங்கியமையால் இரவலர்கள் மகிழ்ந்து இருந்தனர். அரசர்களிடம் பரிசுபெறுவதை மட்டும் குறிக்கோளாக கொள்ளாமல் அவர்களை நல்வழிப்படுத்துபவர்களாகப் புலவர்கள் இருந்துள்ளனர். புறநானூற்றுப் பாடல்களில் மனிதநேயப் பண்பு அதிகமாகக் காணப்படுகின்றது.

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Utilization of Internet Banking Services in Kanniyakumari District

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Abstract : In India Internet banking is changing the banking industry, having the major effects on banking relationships. Banks today operate in a highly globalised, liberalized, privatized and competitive environment. In order to survive in this environment banks have to use information technology. Indian banking industry has witnessed a tremendous developments due to sweeping changes that are taking place in the information technology. The present study is confined to the utilization of internet banking services users and their usage pattern. But it is limited to the internet banking service users of four nationalized banks namely State Bank of India, Canara Bank, Indian Bank and Indian Overseas Bank in Kanniyakumari District.
Keywords: Internet Banking, Information Technology

INTRODUCTION

The banking industry has undergone major transformation and faced a rapidly changing environment over the last four decades. These changes were mostly shaped by the financial deregulations eliminating the restrictions and promoting the competition within the market place. As a result of the changes, technology has emerged as a powerful strategic apparatus for banks to ensure profitability and market position. The banking sector has become the foundation of modern economic development and linchpin of development strategy. Banks in India need to be complimented on the inculcation of technology in a large way on their day to day operations. They have brought on the new wave of techno banking in the country. In a short span of less than two decades, customers of banks have felt the positive impact of technological solutions implemented by the banks.

A NEW APPROACH TO INTERNET BANKING

Today's world is one with increasing online access to services. One part of this which is growing rapidly is online banking. Combined with online retailers there is a lot of money changing hands, directed only by communication over the Internet. This is very convenient and the ready access to the Internet in all first world countries, coupled with the cost savings from closing bank branches, is driving the deployment and adoption of these services. Purely online transactions, however, lead to increased risk. None of the normal safeguards of real world transactions are present. Conversely, risk to the criminals is a lot lower the attacker can be in a

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completely separate jurisdiction from all the other parties in the transaction and the retailer sees nothing but a faceless, nameless connection providing card details.

Most of the development of online financial services has been reactive, doing the minimum amount of work to try and frustrate the attacks which are observed. It has also been quite piecemeal and uncoordinated. Almost all of the defenses have a simple attacker model which only considers those attacks which their prospective target has experienced in the world. Some of these systems manage to achieve their goals, but many of them are only partially effective at best.

In reaction to the defensive schemes developed by the targets of attacks, many criminals have started to become more sophisticated. This is still lost in the noise of the remarkably successful but simple attacks, which explains why very few people are working on more robust systems. Nevertheless, these new attacks prove that the criminals can adapt to break the defenses which are currently being rolled out.

❖ **E-Token**

World's most secure technology Public Key Infrastructure (PKI) offered to corporate and individual internet banking customers. Registered customers have digital certificate with banks to carry out their banking transactions with an additional layer of security. Hacking into customers internet banking by a hacker is impossible, as the E-Token is physically required by the user to login to the account. Even if customers username and password is leaked, no other user can login into their account without the E-Token. The data can be digitally signed using customer certificate from their E-Token to ensure integrity and authenticity.

❖ **Biometrics in Internet Banking**

Biometric is a measurable physiological and behavioral characteristic that can be captured and subsequently compared with another instance at the time of verification. Biometric technologies identify or authenticate the identity of a living person on the basis of a physiological or physical characteristic. Physiological characteristics include fingerprints scanning, iris configuration, facial structure and voice recognition. A basic biometric authentication system consists of five main components namely sensor, feature extractor, fingerprint or template database and matcher and decision module. Due to the fact that biometrics are unique for every individual and cannot be easily forgotten, it will protect customer information from being compromised by fraudsters.

OBJECTIVES OF THE STUDY

1. To know the factors to be considered for utilization of internet banking.
2. To analysis the reason for using internet banking.

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METHODOLOGY OF THE STUDY

The present study is an empirical study based on survey method. It is conducted among 400 customers of four nationalized banks. It examines the utilization pattern of the Internet banking service users of the study area and analysis the perception level of the sample respondents based on their satisfaction level and security issues in using the internet banking services. The required data were collected by personal interview utilizing a well structured and pre-tested interview schedule.

FINDINGS AND DISCUSSIONS:

FACTORS CONSIDERED WHILE USING INTERNET BANKING

In this context it is important to analyse the degree of satisfaction derived from the usage of internet banking service by the respondents. The analysis of the degree of satisfaction is done in three parts.

The first part explores the services which provide the highest level of satisfaction, by using seven point scaling technique. The second part identifies the key factors which provides satisfaction, by using factor analysis. The third part deals with the relationship of factorised components of satisfaction level and the independent socio economic variables such as age, marital status, educational qualification, occupation, monthly income, living area, bank to which the account holder transact through internet banking, number of years experience with internet banking etc. by using one way Anova test. The Levene test is used to test whether the homogeneity of variance is violated or not. If homogeneous of variance not violated (Levene's teat sign > .05) the F statistics of Anova is used. If the homogeneity of variance is violated (Levene's test sign < .05) the Welch and Brown Forsythe test is used.

Ranking of the Usage of Internet Banking Services on Satisfaction Level

In order to identify the satisfaction level of the users of internet banking services regarding the different benefits enjoyed, fourteen internet banking service benefits are identified. The respondents are asked to rate them on seven point scale. The result of the analysis is given below table 1.

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Table 1
Satisfaction Level of the Respondents on the Usage of Internet Banking Service

Sl. No.	Criteria	Sum	Mean	Std. Dev.	Rank
1	Internet banking provides easy bill payment options	2063	5.24	2.74	8
2	Convenient way of operating banking transactions	2194	5.57	2.91	3
3	Facility of fund transfer to third party	2042	5.18	2.75	9
4	Internet banking eliminates time constraint	2073	5.26	2.79	7
5	Access to current and historical transaction data	1696	4.30	2.29	14
6	Flexible virtual banking system	1969	5.00	2.63	12
7	Queue management and reduce lot of mental effort	2112	5.36	2.83	4
8	Easy to use and user friendliness	1999	5.07	2.68	10
9	Digital signature of security	2244	5.70	2.92	2
10	Anytime and anywhere banking facility	2308	5.86	2.96	1
11	Saving transaction cost	2089	5.30	2.72	5
12	Reliability of information presented by internet banking	1835	4.66	2.48	13
13	Faster fund transfer and internet banking provides unlimited access of accounts	1984	5.04	2.69	11
14	Real time access to information	2085	5.29	2.79	6

Source: Primary data

It can be inferred from the table 1 that, the degree of satisfaction level is high for three benefits of internet banking namely anytime and anywhere banking facility, digital signature of security and convenience way of operating banking transactions as these benefits have secured a score of 5.86, 5.70 and 5.57 respectively. The least level of satisfaction is secured by three benefits namely access to current and historical transaction data, reliability of information that

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presented by internet banking and flexible virtual banking system, the score being 4.3, 4.66 and 5.00 respectively.

Key Drivers of Satisfaction Level

This section analysis the key drivers of satisfaction level. Factor analysis is used to reduce the number of variables that influence the level of satisfaction of the respondents who use the internet banking services. It is a good way of identifying the key factors that drive the attitude of the respondents, from the fourteen statements used to find out the satisfaction level.

Bartlett's test of sphericity and Karser Meyer Olkin (KMO) measures of sample adequacy are used to test the appropriateness of the factor model and its results are shown below table 2.

Table 2
KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Mayer-Olkin measure of sampling adequacy		.861
Bartlett's Test of Sphericity	Approx Chi Square	3684.711
	df	91
	Sig.	.000

Bartlett's test is used to test the null hypothesis that the fourteen variables are not correlated. Since the approximate Chi square value is 3684.711 at 91 degrees of freedom which is significant at 1 percent level, the test leads to the rejection of the null hypothesis.

The value of KMO statistics is 0.861(>6) is also very high. Thus the factor analysis may be considered as an appropriate technique. In order to assign fourteen variables which have higher loading, the rotated component matrix table is extracted by following varimax with Kaiser Normalisation and its result is shown in table 3.

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Table 3
Factors Influencing the Utilization of Internet Banking Services
(Rotated Component Matrix)

Sl. No.	Factors	Component	
		Effectiveness of Benefits (Factor I)	Users' Convenience (Factor II)
1	Convenient way of operating banking transactions	.854	
2	Facility of fund transfer to third party	.844	
3	Internet banking provides easy bill payment options	.754	
4	Faster fund transfer and internet banking provides unlimited access of accounts	.718	
5	Real time access to information	.715	
6	Internet banking eliminates time constraint	.668	
7	Saving transaction cost	.569	
8	Access to current and historical transaction data	.403	
9	Anytime and anywhere banking facility		.794
10	Easy to use and user friendliness		.777
11	Digital signature of security		.750
12	Flexible virtual banking system		.566
13	Queue management and reduce lot of mental effort		.560
14	Reliability of information presented by internet banking		.482

Source: Computed data

It can be noticed from the table 3, that first column has the eight variables namely convenience way of operating banking transactions, facility of fund transfer to third party, internet banking provides easy bill payment options, faster fund transfer and internet banking provides unlimited access of accounts, real time access to information, internet banking eliminates time constraint, saving transaction cost and access to current and historical transaction data that have higher loadings of .854, .844, .754, .718, .715, .668, .569, .403 respectively. These eight variables are related to the effectiveness of the benefits enjoyed by the respondents and these variables are named as Factor- I that is Effectiveness of benefits.

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The second column shows that the six variables namely anytime and anywhere banking facility, easy to use and user friendliness, digital signature of security, flexible virtual banking system, queue management and reduce lot of mental effort and reliability of information that presented by internet banking have high loadings of .794, .777, .750, .566, .560, .482 respectively. These six variables are in one component which is based on users' convenience. This is named as Factor II that is users' convenience.

Thus the satisfaction level is extracted into two factors, the first one based on the effectiveness of the benefits enjoyed by the respondents and second one based on the users' convenience. The result of factor analysis by principal component analysis to find out how many factors are to be extracted is given below in table 4.

Table 4

Factors Affecting Satisfaction Level

Sl. No.	Extracted factors	Number of variables	Initial Eigen Values		
			Total	% of variance	Cumulative
1	Effectiveness of benefits	8	7.171	51.22	51.22
2	Users' convenience	6	1.286	9.185	60.40

Source: Computed data

It is clear from the table 4 that, the last column shows that two factors can be extracted, which account for 60.40 percent out of these fourteen variables. It means after extraction and rotation principal component analysis only two variables effectiveness of benefits and users' convenience affects the satisfaction level.

CONCLUSION

Internet banking products and services will continue to grow across various divides and platforms. This hybrid model offers multi-channel strategies covering all categories of consumers, while distributing/reducing transaction costs for banks. As Internet costs decrease in future, the growth of Internet related products and services such as Internet banking will increase. The ability to carry out banking transactions through the Internet has empowered customers to execute their financial transactions within the comfort of their homes. The success of internet banking not only depends on the technology but also to the large extent, on the attitude, commitment and involvement of customers and to what extent they reap the benefits from internet banking services.

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Relationship Between Principals' Leadership Behaviour and Their Type of College - A Study

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ABSTRACT

The purpose of this study was to identify the Leadership Behaviour of the College principals in Kanyakumari District as well as to examine if a statistically significant relationship existed between the Leadership Behaviour and their Type of College. This study employed a survey questionnaire. The questionnaire included two parts, Demographic Questions and Leadership Behaviour Questions. 130 sets of questionnaires were sent to all 130 College principals in Kanyakumari District using Drop-off and Mail-survey method. Analysed data using SPSS and Applied Pearson Correlation, One way ANOVA to test hypothesis. The findings of the study reveal that there was no statistically significant relationship between the type of College of the Principals' and their leadership style.

Keywords:*Leadership Behaviour, Principal, Relationship, Type of College*

INTRODUCTION

Education is the mirror of the society, showing its strength and weakness, hopes, biases and key values of its culture. Modern education aims at imparting knowledge, skills & attitude required by the youngsters to become functional in their respective societies. Colleges are therefore indented to serve as agents for developing individual citizens within a country. In essence, colleges are institutions were students are groomed to appreciate what the society in which they live stands for and are equipped in order for them to contribute to the advancement of their society.

Research on managers (formal leaders) in different settings suggests that Leadership style, Decision-making style, and Motivation are the three important factors for managerial effectiveness (Bass, 1990). The manager, a decision maker and the motivator in the field of higher educational institution is "The principal", who is the chief of the institution. This article investigates the three important dimensions of principals' behavior: viz., Leadership style,

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Decision making style and Motivation Profile. Leadership style describes the behavior of the leader by Autocratic Leadership, Democratic Leadership and Laissez-Faire Leadership; Managerial decision-making style describes the typical way in which the principal solve problems and make decisions. Four functions are used to describe Decision making behavior: Directive, Analytical, Conceptual and Behavioral; and Motivation profile describes the need for the Motivation: Achievement Motivation, Affiliation Motivation, and Power Motivation.

ROLE AND IMPORTANCE OF COLLEGE PRINCIPAL

The principal is the key person in the academic hierarchy of the college. According to University Grant Commission, the principal is responsible for ensuring quality of education, administering college admission, scheduling classes, determining the work load of teachers, faculty development, evaluation of campus programmes, students discipline, allocating finance within the limits set by the governing body, maintaining relations with the university, government, alumni, other support agencies and general public and overall coordination and management.

The principal is the major component of college management. The tone and efficiency of the college largely depend on his ability and skill, personality and professional competence. The principal is the keystone in the arch of college administration. He is the hub of the educational effort. In the college management, the principal occupies a unique position. He is in the strategic centre of a well instructional relationship – teacher pupil, teacher –parent and teacher –teacher. It is he who arranges their co-ordinate efforts.

The activities of the colleges are determined by what the principal does. He/She influences everyone else's behavior, his/her values are contagious, his/her good sense of ethics instills respect and trust in the system, he/she communicates a powerful message about what is important, how people are to be treated and how the college should operate daily. It implies that the principal is therefore expected to accept responsibility for whatever students and staffs do and lead, both by word and action, creating a college climate that facilitates effective teaching and learning.

PRINCIPAL'S LEADERSHIP BEHAVIOR

The climate and effectiveness of a college change drastically owing to a change of leadership is another important problem analyzed by the researcher. The college climate in various ways mirrors the principal's personality and he/she can promote or destroy a college through the climate he/she creates. The researcher in some situations, have witnessed a change in the climate of a particular college shortly after a new principal's assumption of duty. In some cases, students begin to show better attitude towards college and college work; the teacher are more hardworking, striving to meet the new principal's expectations and standard. The impact of the new principal is felt to the extent that by the end of the academic achievement. The teachers are not only mere active, but they also put in their best for the accomplishment of the college goals. In some other situations, the opposite is the case so much that the students and other stakeholders grossly dissatisfied with the performance of the principal and the college initiates the transfer of the principal. These instances prove that the type of leadership prevailing in the college is vital to the organizational climate and the principals are the key figures who can so change the work climate that all the teachers are motivated to work hard with the result that the goals of the colleges preserved.

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OBJECTIVES OF THE STUDY

Following are the objectives of the present study:

- To analyse the Demographic profile of the College principals in Kanyakumari District.
- To study the relationship between the Leadership Behaviour of College principals in Kanyakumari District and their Type of College.
- To provide suggestions based on the findings of the study.

HYPOTHESIS

H1. There is no relationship between the Leadership styles of college principals in Kanyakumari District and their Type of College.

H2. There is a relationship between the Decision making styles of college principals in Kanyakumari District and their Type of College.

H3. There is no relationship between the Motivation Profile of college principals in Kanyakumari District and their Type of College.

METHODOLOGY

The present study is conducted in Kanyakumari District, which is a tiny district in Tamil Nadu. The population for the purpose of the study is the College Principals in Kanyakumari District. The researcher has taken five types of Colleges in Kanyakumari district viz., Arts & Sciences (n=24), Engineering Colleges (n=31), Polytechnic Colleges (n=21), Nursing College (n=20) and Education Colleges (n=34) as the target group for the purpose of this study. As the researcher had taken whole population of the target group as a population for the purpose of this study, it is a census survey. This study employed a survey questionnaire.

ANALYSIS AND INTERPRETATION

Table.1.Demographic profile of the College principal (Frequency and percentage)

Variables		Frequency	Percentage
Gender	Male	51	39.2
	Female	79	60.8
Age Group	Below 40	10	7.7
	41-45	17	13.1
	46-50	32	24.6
	51-55	47	36.2
	56 & Above	24	18.5
Type of College	Arts & Science	24	18.5
	Engineering	31	23.8

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	Polytechnic	21	16.2
	Nursing	20	15.4
	Education	34	26.2
Teaching Experience Group	Less than 10	5	3.8
	Between 10-15	8	6.2
	Between 16-20	19	14.6
	Between 21-25	32	24.6
	Between 26-30	44	33.8
	Above 30	22	16.9
Administrative Experience Group	Less than 2	13	10.0
	Between 2-3	17	13.1
	Between 4-5	34	26.2
	Between 6-7	27	20.8
	Above 8	39	30.0

Source : Primary data

The frequency and percentage analysis of the college principals demographic profile viz., Age, Teaching experience, Administrative experience Type of College and Gender reveals that most respondents were in the age range of 51-55, followed by the age range of 46-50, 33.8% of the respondents were having teaching experience between 26-30 years followed by 24.6 % of respondent who has teaching experience between 21-25 years, 30.0% of the respondents have above 8 years of administrative experience followed by 26.2 % of the respondent who have administrative experience between 4-5 years, most respondents were from education n=34 (26.2%) followed by engineering colleges n= 31(23.8%) and the data showed that out of 130 valid responses, 51 Principals were male and 79 Principals were female. (See Table. 1)

H10.There is no relationship between the Leadership styles of college principals in Kanyakumari District and Type of college.

To test this hypothesis, a descriptive analysis was applied. It was found that the respondents who is in Arts & Science college scored in (Moderate range) level of intensity on Autocratic leadership style and the respondents in Engineering, Polytechnic and Nursing college also scored in (Moderate range) level of intensity on Autocratic leadership style and only the respondents who is in Education College scored in (High range) level of intensity of this style; the same way for Laizzes-faire Leadership style only Arts & Science college scored in (Low range) level of intensity and all the respondents in Engineering, Polytechnic and Nursing college also scored in (Moderate range) level of intensity for the same style . It shows there is no significance difference between the Leadership styles and Type of College. Therefore the null hypothesis is accepted. Table 6.23 shows the results in more detail.

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Table 2.Leadership Style (Means and standard deviations) among the Respondents' Type of college

LEADERSHIP STYLE	ARTS & SCIENCE (N=24)	ENGINEERING (N=31)	POLYTECHNIC (N=21)	NURSING (N=20)	EDUCATION (N=34)
AUTOCRATIC	17 (5.830) Moderate range	20 (6.730) Moderate range	18 (7.589) Moderate range	20 (7.546) Moderate range	22 (7.284) High range
DEMOCRATIC	19 (6.231) Moderate range	21 (6.908) High range	18 (7.695) Moderate range	20 (8.001) Moderate range	22 (7.296) High range
LAIZZEZ- FAIRE	14 (6.536) Low range	17 (6.167) Moderate range	16 (7.060) Moderate range	18 (8.211) Moderate range	20 (8.588) Moderate range

To confirm the above result, one way ANOVA test applied to test the significance of difference between Leadership Styles and Type of college. The result of ANOVA shows no significant differences between all the Leadership styles and Type of College. For Autocratic leadership style $F(4,125)=2.068$, $p=.089$, for Democratic Leadership style $F(4,125)=1.438$, $p=0.225$, and for Laizzes-faire leadership style $F(4,125)= 2.989$, $p=0.21$, all that shows type of college not significantly differed at all the Leadership Style at $p < .05$. significance level. Thus **the null hypothesis is accepted**. Table 6.24.Shows in detail.

Table 3
One way ANOVA between Leadership Style and Type of College

		Sum of Squares	df	Mean Square	F	Sig.
AUTOCRATIC	Between Groups	405.390	4	101.347	2.068	.089
	Within Groups	6124.679	125	48.997		
	Total	6530.069	129			
DEMOCRATIC	Between	298.206	4	74.551	1.438	.225

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	Groups					
	Within Groups	6481.363	125	51.851		
	Total	6779.569	129			
LAIZZEZ-FAIRE	Between Groups	653.708	4	163.427	2.989	.021
	Within Groups	6835.400	125	54.683		
	Total	7489.108	129			

H11.There is no relationship between the Decision making styles of college principals in Kanyakumari District and Type of college.

To test this hypothesis, a descriptive analysis was applied. It was found that the respondents who is in Engineering college scored in (Dominant) level of intensity on Directive Decision style and the respondents in Education college scored in (back-up) level of intensity on directive decision style and the respondents who is in Arts & Science College scored in (least-preferred) level of intensity of this style; this shows difference in relation to Decision style of the respondent on Type of college. As there is difference, this hypothesis is rejected by the analysis. Table 6.25 shows the results in more detail.

Table 4. Decision making styles (Means and standard deviations) Among the Respondents' Type of college

DECISION MAKING STYLE	Arts & Science (n=24)	Engineering (n=31)	Polytechnic (n=21)	Nursing (n=20)	Education (n=34)
DIRECTIVE	57 (13.300) Least preferred	85 (6.212) Dominant	99 (9.221) Very Dominant	79 (14.661) Back-up	69 (.896) Back-up
ANALYTICAL	102 (11.700) Dominant	103 (1.275) Dominant	78 (16.935) Least preferred	79 (12.162) Least preferred	96 (11.765) Back-up
CONCEPTUAL	100 (9.800) Very Dominant	46 (21.128) Least preferred	66 (18.516) Least preferred	89 (7.057) Dominant	82 (8.435) Back-up

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BEHAVIOURAL	48 (13.712) Least preferred	72 (6.781) Very Dominant	71 (5.675) Very Dominant	63 (12.822) Dominant	41 (7.269) Least preferred

To confirm the above result, one way ANOVA test applied to test the significance of difference between Decision Making Styles and Type of college. The result of ANOVA shows significant differences between all the four decision style and Type of College. For Directive Decision style $F(4,125)=110.342$, $p=.000$, for Analytical Decision style $F(4,125)=32.747$, $p=.000$ for Conceptual Decision style $F(4,125)=64.446$, $p=.000$ and for Behavioral Decision style $F(4,125)=71.583$, $p=.000$, all that shows type of college differed significantly at all the Decision Style at $p < .01$ significance level. (See. Table 6.26) Thus the **null hypothesis is not accepted** (rejected).

Table 5.
One way ANOVA between Decision Style and Type of College

		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
DIRECTIVE	Between Groups	24604.501	4	6151.125	110.342	.000
	Within Groups	6968.276	125	55.746		
	Total	31572.777	129			
ANALYTICAL	Between Groups	13793.306	4	3448.327	32.747	.000
	Within Groups	13162.663	125	105.301		
	Total	26955.969	129			
CONCEPTUAL	Between Groups	48552.898	4	12138.224	64.446	.000
	Within Groups	23543.225	125	188.346		
	Total	72096.123	129			
BEHAVIOURAL	Between Groups	21151.421	4	5287.855	71.583	.000
	Within Groups	9233.779	125	73.870		
	Total	30385.200	129			

H12.There is no relationship between the Motivation profiles of college principals in Kanyakumari District and Type of college.

To test this hypothesis, a descriptive analysis was applied. It was found that the respondents who is in Engineering, Nursing and Education college scored in (back-up) level of intensity on Achievement Motivation and the respondents who is in Polytechnic College scored in (least-preferred) level of intensity and Arts & science scored in (Dominant) level of intensity

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of this style ; same way the respondents who is in Arts & Science and Engineering college scored in (least-preferred) level of intensity on Affiliation Motivation and the respondents who is in Polytechnic and Education College scored in (back-up) level of intensity and Nursing college scored in (Dominant) level of intensity of this style ; this shows difference in relation to Motivation profile of the respondent on Type of college. Therefore the hypothesis is rejected by the analysis. Table 6.27 shows the results in more detail.

Table 6 Motivation profile (Means and standard deviations) Among the Respondents' Type of college

MOTIVATION PROFILE	ARTS & SCIENCE (N=24)	ENGINEERING (N=31)	POLYTECHNIC (N=21)	NURSING (N=20)	EDUCATION (N=34)
POWER	4 (3.956) Back-up	4 (3.961) Back-up	3 (2.473) Back-up	2 (.510) Least preferred	2 (.589) Least preferred
AFFILIATION	1 (.986) Least preferred	1 (.567) Least preferred	5 (3.383) Back-up	7 (2.359) Dominant	4 (2.785) Back-up
ACHIEVEMENT	6 (3.956) Dominant	5 (3.961) Back-up	2 (.995) Least preferred	3 (1.922) Back-up	5 (2.711) Back-up

To confirm the above result, one way ANOVA test applied to test the significance of difference between Motivation profile and Type of college. The result of ANOVA shows significant differences between the Motivation profiles and Type of College. For Power Motivation $F(4,125)=5.597$, $p=.000$, for Affiliation Motivation $F(4,125)=32.411$, $p=.000$, and for Achievement Motivation $F(4,125)=8.151$, $p=.000$, all that shows type of college differed significantly at all the Motivation profile at $p < .01$ significance level. Thus the **null hypothesis is not accepted** (rejected). Table 6.28.Shows in detail.

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Table 7
One way ANOVA between Decision Style and Type of College

		Sum of Squares	df	Mean Square	F	Sig.
POWER	Between Groups	173.606	4	43.401	5.597	.000
	Within Groups	969.387	125	7.755		
	Total	1142.992	129			
AFFILIATION	Between Groups	612.523	4	153.131	32.411	.000
	Within Groups	590.585	125	4.725		
	Total	1203.108	129			
ACHIEVEMENT	Between Groups	303.440	4	75.860	8.151	.000
	Within Groups	1163.337	125	9.307		
	Total	1466.777	129			

MAJOR FINDINGS

The findings of the study reveal the following:

- The majority of College Principals in Kanyakumari District were female. This result may give us an indication that females tend to work in Colleges more than males.
- Most of the Principals in the Colleges were above 50 years of Age.
- The majority of the College Principals in Kanyakumari District had a high range of years of administrative experience.
- Most of the College Principals in Kanyakumari District had more than 25 years of Teaching Experience.
- There was no statistically significant relationship between the type of College of the Principals' and their leadership style.

SUGGESTIONS FROM THE FINDINGS

Based on the findings and conclusion of the study the following implications were pointed out and provided suggestions accordingly, which are as follows:

- The researcher suggests that college principals must be aware of different leadership behavior, so that they switch in to the particular style in order to overcome the situation. Mech (1993) stated that when the managers are aware of their decision styles and orientation, they are more able to balance between the strength and weaknesses of their own and others' decision modes. While there are preferred styles and a predominant

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orientation among Principals, some may not be the most effective in all situations or environments; therefore it is suggested that Principals to find ways to take advantage of the benefits provided by the other styles.

- As exist in the higher education, the newly appointed Principal should be given compulsory orientation programme that enable them to face the new challenges in the field of education effectively. This will also ultimately generate in them ideal Leadership qualities.

- In case of leadership there is no difference with the type of College, whereas Decision Making and Motivation show statistically significant relationship with the type of College and there is statistically significant relationship existed in between Decision Making style and Motivation Profile of the College Principal. The Principals in Engineering and Polytechnic Colleges are very dominant towards Behavioural decision style whereas, the Art & Science College Principals are very dominant towards Conceptual decision style. The Principals in Arts & Science Colleges are very dominant towards Achievement motivation whereas, the Principals in Nursing Colleges are dominant towards Affiliation Motivation. It is because of the difference in the private and aided and also it is because of the difference in the management. Thus the researcher suggests that the rights, duties, power and responsibilities of any type of college principal should be the same in order to create favorable climate for students and teachers.

CONCLUSION

From the study it is clear that the College Principals in Kanyakumari District are not alike in the adoption of their Leadership behavior. Each Principal has his or her own style. Some of them have more than one dominant style; some have more than one back-up style, while others use some of the styles rarely. Sternberg (2001), states that according to Webster's Dictionary (1967), "A style is a distinctive or characteristic manner, or method of acting or performing." It means that the Principals use different methods for leading, Motivating and make decisions. In addition each style has its strength and weaknesses, so knowing more about each leadership style, Decision making style and Motivation profile, will lead the College Principal to be more able to use the strengths of other modes and to balance against the weaknesses of their own approaches and therefore enhance their ultimate effectiveness.

All the results of this study will be useful to the researchers for comparing the variables in leadership studies. The abstract of this study will be a legend to the related literature of leadership studies.

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Research Article

STRUCTURAL, OPTICAL AND PHOTOCATALYTIC STUDIES OF ANATASE-RUTILE MIXED-PHASE UNDOPED AND SILVER-DOPED TITANIUM DIOXIDE NANOPARTICLES

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ABSTRACT

Undoped and silver-doped titanium dioxide (TiO_2) nanoparticles are prepared by the Sol-Gel process using Titanium iso-propoxide (TTIP) as a precursor. The synthesized nanoparticles are characterized by powder X-ray diffraction (PXRD), Fourier transform infrared spectroscopy (FT-IR), UV-VIS spectroscopy and photocatalytic studies. The powder X-ray diffraction characterization results showed that the thermal treatment at 500 °C leads to the formation of anatase-rutile mixed phase TiO_2 nanoparticles. The formation of TiO_2 nanoparticles is also confirmed from the dominant FT-IR peaks observed below 650 cm^{-1}. The UV-VIS spectroscopy shows that the silver-doping causes narrowing the optical band gap value of ~2.89 eV. Photocatalytic investigation shows that the silver-doping leads to higher degradation efficiency of 86.35%.

Keywords: Titanium dioxide, Silver-doping, Optical properties, Photocatalysis

1. INTRODUCTION

Titanium dioxide a well-known semiconducting nanomaterial found major applications in the field of photocatalysis [1]. TiO_2 exist in three polymorphs namely, anatase, rutile and brookite. Due to the large bandgap (~3.2 eV) values of these three crystallographic forms their potential applications excellent only in the UV region [2]. The major factor which affects the photocatalytic efficiency is rapid recombination of photogenerated electron-hole pairs [3]. One of the effective ways for splitting-up of this photogenerated electron-hole pair is doping with silver ions [4]. Numerous methods such as ball-milling [5], combustion method [6], microwave method [7], solvothermal method [8], hydrothermal method [9], and sol-gel method [10] have been adapted to synthesize silver doped TiO_2nanoparticles. Among these methods, the sol-gel process is the most promising technique for synthesizing silver-doped TiO_2nanoparticles.In this paper, nanosized undoped and silver-doped TiO_2 nanoparticles are prepared by the sol-gel technique. The structural properties of the nanosized undoped and silver-doped TiO_2nanoparticles are characterized by PXRD and FT-IR. The optical property of these samples was investigated by UV-VIS Kubelka-Munk absorption. The photocatalytic efficiency of undoped and silver-doped TiO_2 nanoparticles are investigated by the photodegradation of methyl orange (MO) solution under visible light illumination.

2. EXPERIMENTAL

2.1. Materials

Titanium tetra-isopropoxide (TTIP, 97%, Sigma Aldrich), Ethanol (RANKEM), Deionized water, Silver Nitrate (Merck).

2.2. Preparation of TiO_2Nanoparticles

Undoped and silver-doped TiO_2 nanoparticles are prepared by the simple sol-gel route by using the precursor TTIP and deionized water. In this procedure, 10 ml of deionized water is added to 100 ml of ethanol taken in a beaker under room temperature. The mixed solution is stirred well up for ten minutes. Now the pH of the solution is adjusted in the acid range by using nitric acid. Then 15 ml of TTIP is added dropwise to the above mixed solution. While adding TTIP hydrolysis reaction takes place and the TiO_2 nanoparticles are obtained in the form of a gel in the beaker. The gel is filtered, dried, powdered and calcinated to 500 °C. For the silver-doping

suitable amount of doping material (1 wt% Ag^+) is added to the water and dissolves before mixed with ethanol.

2.3. Characterization

The synthesized undoped and silver-doped TiO_2 nanoparticles are characterized by various sophisticated techniques. Powder X-ray diffraction (PXRD) spectra are recorded by using XPERTPRO diffractometer with diffraction angle 2θ in the range10-80° using Cu-Kα radiation of wavelength 1.54060 Å. FTIR spectra are recorded by using BRUKER-TENSOR 27 model FTIR instrument.UV-VIS diffuse reflectance spectra are carried out by using the VARIANCary 500 Scan model spectrometer.

2.4. Photocatalytic activity

The photocatalytic activity of undoped and silver-doped TiO_2 nanoparticles are evaluated by checking over the degradation of azo dye methyl orange (MO) under visible light (18 W, fluorescent lamp) excitation. For this typical study, 50 ml of 10 ppm aqueous MO solution is taken in a 100 ml beaker. 0.1 g of undoped and silver-doped powdered TiO_2 nanoparticles are dispersed separately in this solution. The solution is irradiated with UV light up to 210 min. Every 30 min, 5 ml of MO solution is taken out and is centrifuged immediately to remove the catalyst. The degradation efficiency of undoped and silver-doped TiO_2nanoparticles is viewed through UV-Vis absorption spectra of MO solution. The standard curve between concentration and absorption, the value of $((C_0-C_t/C_0)$ x 100%) is calculated, signified as the degradation percentage. Figure (1) shows the image of the photocatalytic experimental reactor.

1. Fluorescent lamp
2. MO solution
3. Stand

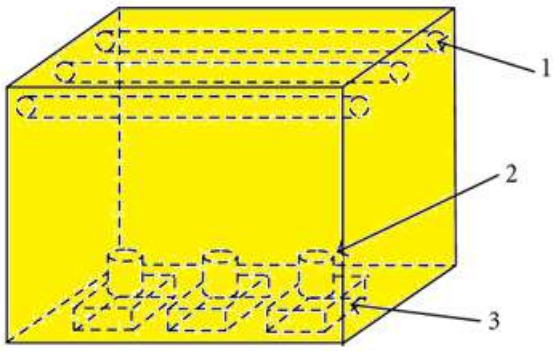

Fig.1: Image of the Photocatalytic Experimental Reactor

3. RESULTS AND DISCUSSION

3.1. Powder X-ray diffraction Analysis

Figures (2&3) show the PXRD patterns of undoped and silver-doped TiO_2 nanoparticles. The peaks are very sharp which specifies that the crystallinity is increased due to calcination. Both the spectra shows anatase-rutile mixed-phase $TiO_2$with high-intensity peaks of rutile and lower intense peaks of anatase phase.

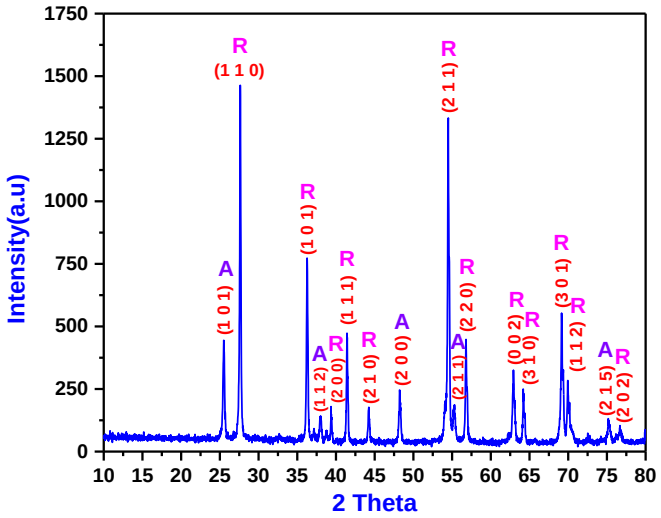

Fig. 2: PXRD pattern of undoped TiO_2 nanoparticles

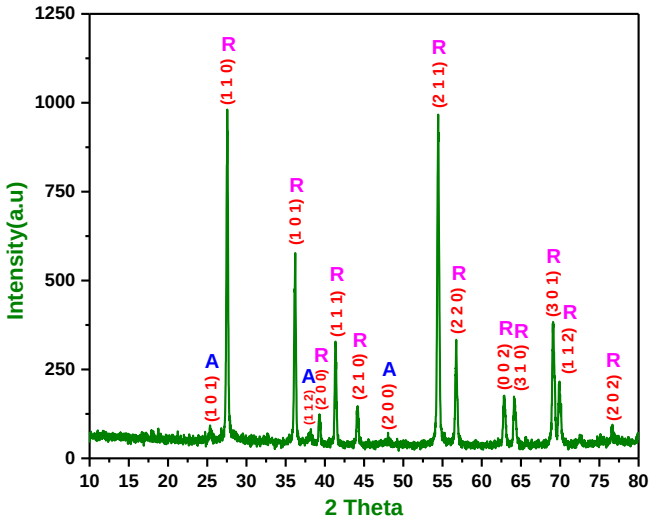

Fig.3: PXRD pattern of silver-doped TiO_2 nanoparticles

The spectrum of undoped TiO_2shows twelve peaks appears at 2θ values 27.63, 36.27, 39.38, 41.43, 44.21, 54.49, 56.80, 62.91, 64.25, 69.13, 69.94, and 76.68 are nominated as (1 1 0), (1 0 1), (2 0 0), (1 1 1), (2 1 0), (2 1 1), (2 2 0), (0 0 2), (3 10), (3 0 1),(1 1 2),and (2 0 2) planes of rutile phase, respectively. Furthermore, The spectrum of silver-doped TiO_2shows twelve peaks exist at 2θ angles at 27.57, 36.22, 39.26, 41.36, 44.13,

54.45, 56.74, 62.82, 64.16, 69.07, 69.86and 76.59 are corresponding to the planes of rutile phase(1 1 0), (1 0 1), (2 0 0), (1 1 1), (2 1 0), (2 1 1), (2 2 0), (0 0 2), (3 1 0), (3 0 1),(1 1 2),and (2 0 2), respectively [11]. The undoped TiO_2 spectrum shows five characteristic diffraction peaks of anatase about 2θ values at 25.50, 38.04, 48.24, 55.32, and 75.23, which are corresponding to the Miller indices of planes (1 0 1), (1 1 2), (2 0 0), (2 1 1), and (2 1 5), respectively. The silver-doped TiO_2 spectrum shows three characteristic diffraction peaks of anatase about 2θ values at 25.41, 38.11, and 47.81 are assigned to the Miller indices of planes (1 0 1), (1 1 2), and (2 0 0), respectively [12].Moreover, in the case of silver-doped TiO_2spectrum the peaks of anatase are suppressed which suggests that the doping with silver ions promote the phase transformation from anatase to rutile at lower temperature calcination which agrees with the previous findings of silver-doped TiO_2nanoparticles [13]. The fraction of anatase-rutile is determined by the Spurr-Myers equation [14],

$$W_A = 100 / (1+1.265\ I_R/I_A) \quad (1)$$
$$W_R = 100 / (1+0.8\ I_A/I_R) \quad (2)$$

Where, W_R and W_A are the weight percentage of rutile and anatase. I_A is the intensity of anatase peak and I_R is the intensity of rutile peak. For undoped TiO_2nanoparticles the anatase-rutile weight ratio calculated from the above relation is 18:72, and for silver-doped TiO_2nanoparticles, it is found to be 3:97.

The average crystallite size of the undoped and silver-doped TiO_2nanoparticlesis determined by the familiar Scherrer formula [15, 16],

$$C_A = 0.9\lambda / \beta\cos\theta \quad (3)$$

Where C_A is the average crystallite size, λ is the wavelength of X-ray, β is the full-width half maximum (FWHM) and θ is the Bragg's angle of diffraction. The crystallite size obtained from the above formula is 54 and 60 nm for undoped anatase and rutile phase TiO_2 nanoparticles, respectively. Which is calculated from the (1 0 1) plane of anatase and (1 1 0) plane of rutile phases, correspondingly. For silver-doped TiO_2nanoparticles,it is estimated at 40 and 70 nm for anatase and rutile phase, respectively. Moreover, the ionic radius of Ag^+ion (1.26 Å) is much larger than Ti^{4+}ion(0.74Å) as a consequence that the silver ions cannot replace the Ti^{4+}ions.Hence, the silver ions are distributed on the surface of TiO_2 [17-20].

3.2. FT-IR Analysis

Figure (4) shows the FT-IR spectrum of undoped TiO_2 nanoparticles. The spectrum displays two low intense peaks located at 3426 and 1623 cm^{-1} the former is assigned to surface adsorbed water and later is assigned to O-H group. In addition to this, the spectrum flashes two high-intensity peaks exist at 659 and 537 cm^{-1} which is attributed to stretching modes of Ti-O bonds [21-23]. The silver-doped FT-IR spectrum (Figure (5)) have been seemed to be identical bands with a slight shift in peak positions. The peaks appear below 650 cm^{-1} are assigned to Ti-O and Ag-O vibrations [24]. These assessments agree with the previous findings [25].

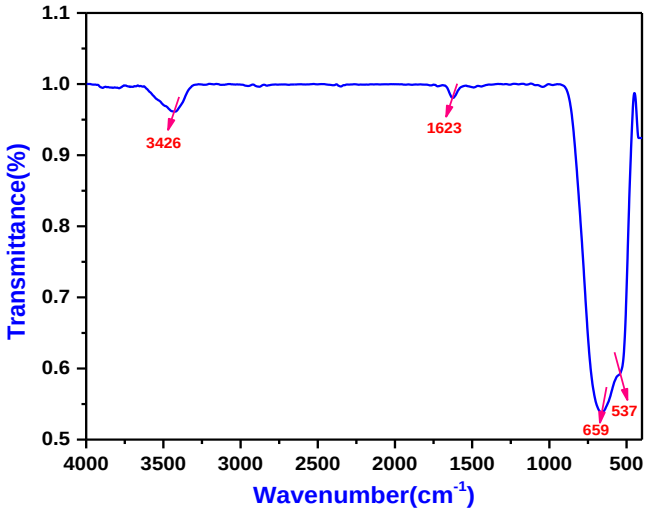

Fig. 4: FT-IR spectrum of undoped TiO_2 nanoparticles

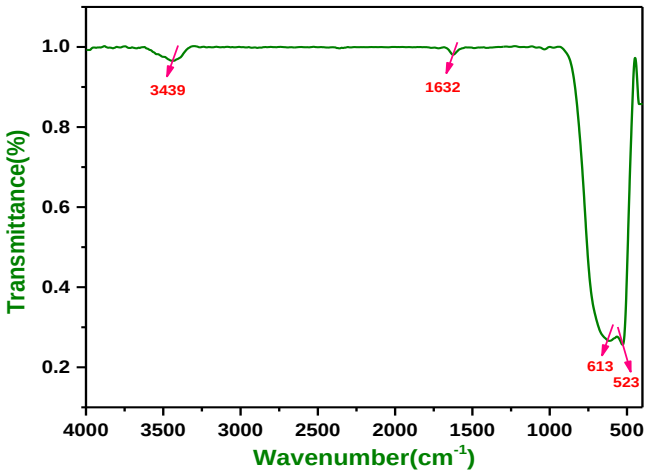

Fig. 5: FT-IR spectrum of silver-doped TiO_2 nanoparticles

3.3. UV-VIS spectral Analysis

In order to examine the optical band gap of the synthesized undoped and silver-doped TiO_2 nanoparticles diffuse reflectance spectral studies in the UV-VIS region is performed.

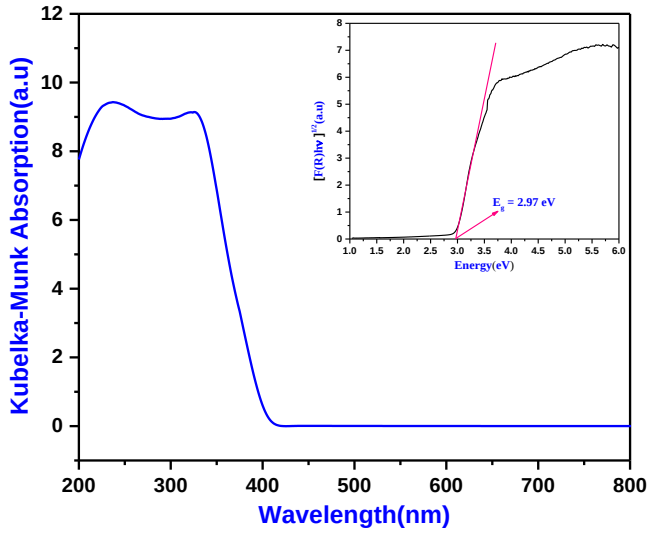

Fig. 6: UV-VIS Kubelka-Munk absorption spectrum of undoped TiO_2nanoparticles (Inner graph - corresponding Tauc Plot)

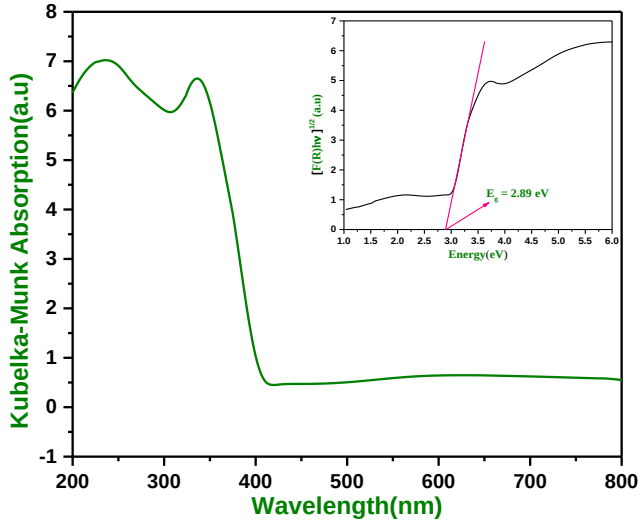

Fig. 7: UV-VIS Kubelka-Munk absorption spectrumof silver-doped TiO_2nanoparticles (Inner graph - corresponding Tauc Plot)

The diffuse reflectance spectrum is transformed into the Kubelka-Munk absorbance F(R) by using the relation [26],

$$F(R) = (1-R)^2 / 2R \quad (4)$$

The optical band gap value of undoped and silver-doped TiO_2 nanoparticles are evaluated from the Tauc's relationship [27-31],

$$[F(R)h\nu]^n = B\,(h\nu - E_g) \quad (5)$$

Where hν is the energy of the photon, B is the constant of proportionality, and n is the constant, which depends on the nature of the optical transition. The value of n is ½ for the indirect optical transition. Assuming the indirect band gap and plotting the graph between $[F(R)\ h\nu]^{1/2}$and hν along y and x-axis gives the Tauc plot. To determine the optical band gap from the graph a line is drawn from the maximum slope of the curve to the hν axis at $[F(R)\ h\nu]^{1/2}=0$ gives the value of indirect band gap.

For undoped TiO_2 nanoparticles, the band gap value obtained from Tauc plot is 2.97 eV. The optical absorption edge shifted to red light zone for silver-doped TiO_2 nanoparticles correspondingly the reduction in the optical band gap is observed, which is equal to 2.89 eV.

3.4. Investigation of Photocatalytic Efficiency

The photocatalytic efficiency of the undoped and silver-doped TiO_2 nanoparticlesis investigated under visible light using an azo-dye MO as a model pollutant.

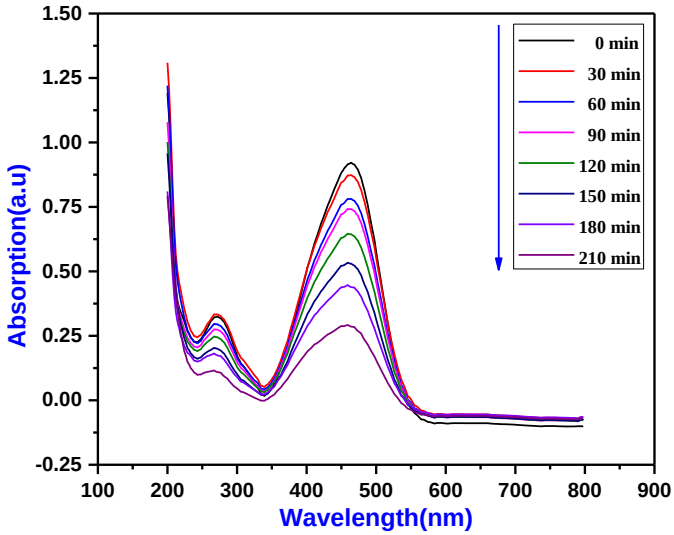

Fig. 8: Decolourisation of MO solution vs. Time in a typical photocatalytic experiment with undoped TiO_2performed under visible light irradiation

Figures 8 & 9 show the decolourisation of MO under visible light irradiation with undoped and silver-doped TiO_2, respectively. The photocatalytic degradation efficiency of undoped and silver-doped TiO_2 nanoparticles is shown in figure 10. The silver-doped TiO_2 shows the photocatalytic efficiency of 86.35%, which is greater than the photocatalytic efficiency of undoped TiO_2 (68.29%).

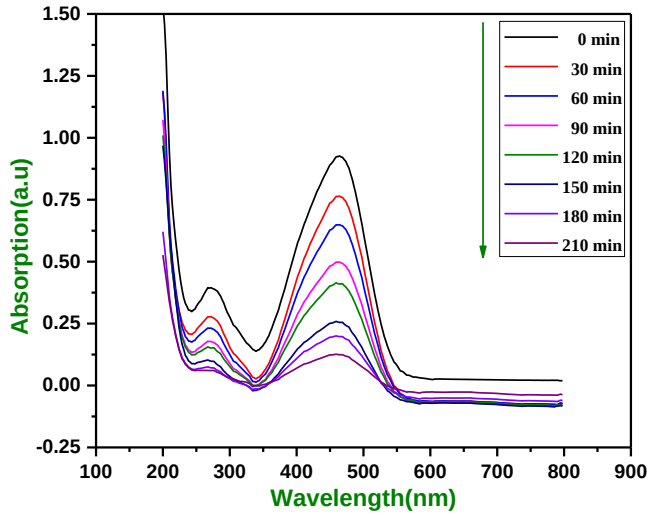

Fig. 9: Decolourisation of MO solution vs. Time in a typical photocatalytic experiment with silver-doped TiO_2performed under visible light irradiation

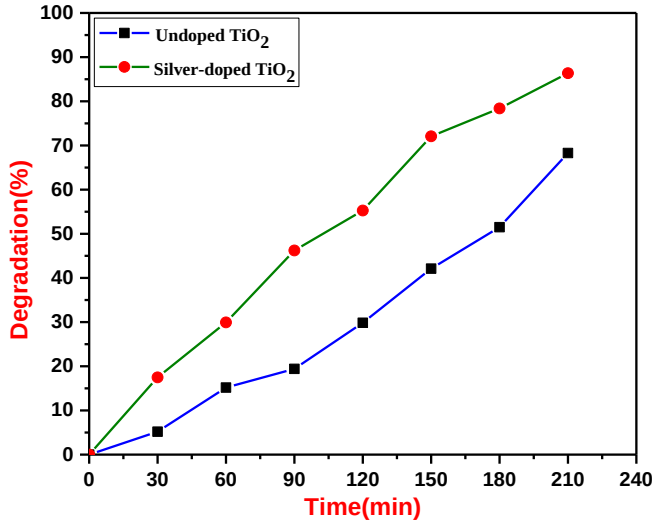

Fig. 10: Photocatalytic degradation efficiency of undoped and silver-doped TiO_2 nanoparticles

This improvement in photocatalytic activity is explained as follows. On account of illumination of TiO_2 nanoparticles with visible light of energy greater than or equal to the bandgap, an electron from the valence band excited to the conduction band and generates electron-hole pairs. The lifetime of these charge carriers is very short, so they are recombined instantly thereby by reducing the photocatalytic activity. Herein, PXRD result suggests that the silver ions are adsorbed on the surface of TiO_2. It follows that the silver ions act as a trapping site and capture the photogenerated electrons thereby inhibits the electron-hole pair recombination. Further, these electrons and holes produce superoxide ($O_2^{\bullet-}$) and hydroxyl ($OH^{\bullet}$) radicals which react with the water and degrade the MO solution efficiently [32-34]. Hence, the photocatalytic efficiency is more for silver-doped TiO_2 nanoparticles than undoped TiO_2 nanoparticles.

4. SUMMARY AND CONCLUSION

The undoped and silver-doped TiO_2nanoparticles are successfully synthesized by the simple sol-gel technique. Anatase-rutile mixed phase TiO_2nanoparticles are obtained after annealing to 500 °C. PXRD results suggest that the silver-ions are located on the surface of TiO_2due to larger ionic radius than Ti^{4+}.The FT-IR result indicates that the Ti-O and Ag-O vibrations have strongly appeared below 650 cm^{-1}. The UV-VIS spectral studies show that the absorption edge is red shifted for silver-doped TiO_2 nanoparticles. The silver-doped TiO_2 shows higher photocatalytic efficiency than undoped TiO_2.The presence of silver ions on the surface of TiO_2retards there combination rate of electron-hole pairs. Hence, the separation of charge carriers enhanced thereby increasing the photocatalytic efficiency of silver-doped TiO_2 nanoparticles. In conclusion, silver-doped TiO_2 nanoparticles are the effective photocatalysis than undoped TiO_2 nanoparticles for completely decolorizing azo-dyes.

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A STUDY ON PROBLEMS OF DISTRICT INDUSTRIES CENTRE (DIC) BENEFICIARIES IN KANYAKUMARI DISTRICT

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INTRODUCTION

The state government introduced District Industries Centre in Kanyakumari District at Konam, Nagercoil from 1st August 1978. The DIC serves as nucleus for providing the support and assistance required by small scale, rural and cottage industries. Powers of the Directorate of Industries and Commerce have been delegated to District Industries Centre, Konam, Nagercoil and the field officers of the Department. In this paper the researcher has made an attempt to study the concept of DIC, problems of DIC beneficiaries in Kanyakumari District and suggestions to the problems.

OBJECTIVES

The followings are the objectives of this study

1. To find out the problems of DIC beneficiaries in Kanyakumari District.
2. To analyze the problems of DIC beneficiaries in Kanyakumari District.

METHODOLOGY

The present study needed both primary data and secondary data. Primary data means the data collected originally, especially for the study. The researcher collected it through the questionnaire. The secondary data is the data collected by someone else used for the study. Likewise the researcher used secondary data collected from the reports, pamphlets of the DIC, Kanyakumari district and also through different articles, journals and magazines and websites. The list of entrepreneurs along with their basic profile was collected from District Industries Centre, Nagercoil and it was classified according to the year and type of organization. The total number of entrepreneurs according to the details obtained from the District Industries centre was 4967. Out of the total population of 4967 entrepreneurs from the year 2010 to 14, 3000 are Industrial/ Manufacturing entrepreneurs and 1967 are Trade and Service entrepreneurs.

This study employed a properly structured questionnaire, which was finalized after a through scrutiny of various questions by various experts. The questionnaire used in the study includes multiple- choice questions that helped the researcher to obtain the required qualitative data.

PROBLEMS & ANALYSIS OF ENTREPRENEURS

The problems of entrepreneurship can be divided into two groups.

INTERNAL AND EXTERNAL

Internal problems are those, which are not influenced by the external forces. External problems are the problems which result from factors beyond the control of an entrepreneur like, the availability of power and other infrastructure facilities required for the smooth running of the enterprise. These two types of problems are not mutually exclusive but they are co-related. The analysis of data requires a number of closely related operations such as establishment of categories to raw data through coding, tabulation and drawing inferences. The problems faced by the selected entrepreneurs are as follows.

LACK OF ADEQUATE CREDIT FACILITY

Finance is the lifeblood of any business. Financial problem is the basic problem of all the entrepreneurs. Finance is not only essential to start an enterprise but also to carry out smoothly the day to day business affairs. Finance is needed at every stage of the business. Even though entrepreneurs are allowed certain percentage of their investment as loans and subsidy mostly the amount is very minimum to a business. Adequate and timely supply of credit facilities is an important problem. This is partly due to scarcity of capital and partly due to weak credit worthiness of the entrepreneurs.

The following table shows the opinion of the entrepreneurs on adequacy of credit facilities.

Table 1. Opinion of the Entrepreneurs on Adequacy of Credit Facilities

Response of the Entrepreneurs	Industry Sector		Trade and Service		Total	
	No of Entrepreneurs	%	No of Entrepreneurs	%	No of Entrepreneurs	%
Sufficiently Adequate	-	-	-	-	-	-
Adequate	124	41.33	43	21.83	167	33.6
Inadequate	176	58.67	154	78.17	330	66.46
Total	**300**	**100**	**197**	**100**	**497**	**100**

Source: Primary data

The finance problem of lack of credit facilities faced by the entrepreneurs in the study area is shown in Table 1. Of the total entrepreneurs (497), 66.46 percent respondents have inadequate credit facilities and 33.6 percent respondents have adequate credit facilities of credit. Zero percent of these entrepreneurs have the opinion of sufficiently adequate. Therefore inadequacy of credit facilities is an important problems faced by the entrepreneurs in the study area.

TIME TAKEN FOR THE DISBURSEMENT OF LOAN

Capital is very essential at every stage of any business. The capital which is invested by the entrepreneurs may be of their own money or loan money. Mostly they arrange loan for their business. When they need money they may arrange for loans. So they must get loan money immediately but usually they find it very difficult to arrange for it, or after arranging in getting the loans. The loan applied for should be available as and when it is needed. Here the role of banks is very important. After being sponsored by the DIC the respective banks may take their own time for the sanction of loans. After sanctioning, they may take again time for the disbursement of loan.

Table 2. Time Taken by the Banks to Disburse Loan

Time taken by banks to Disburse loan	Industry Sector		Trade and Service		Total	
	No of Entrepreneurs	%	No of Entrepreneurs	%	No of Entrepreneurs	%
Less than 1 month	31	10.33	10	5.07	41	8.25
1-3 Months	124	41.33	72	36.55	196	39.44
3-6 Months	47	15.67	62	31.47	109	21.93
6-9 Months	57	19	39	19.8	96	19.32
9-12 Months	41	13.67	14	7.11	55	11.06
Above 12 Months	-	-	-	-	-	-
Total	**300**	**100**	**197**	**100**	**497**	**100**

Source: Primary data

Table 2 clearly shows that majority of respondents (39.44 percent) said that the time taken by the banks for the disbursement of loan is between 1-3 months. 21.93 percent respondents said that the banks take 3-6 months. 19.32 percent respondents said that the banks take 6-9 months 11.06 percent respondents said that the banks take 9-12 months. Only 8.25 percent of the respondents said that they have got the loans within 1 month.

Commonly the banks disburse the loan within 12 months ie one year, as months for the disbursement of loans. Anyhow 12 months may be considered as a long time for any businessman to get the loan amount. Therefore it is considered as a serious problem suffered by the entrepreneurs.

MARKETING PROBLEMS

The success of any enterprise depends as much on its production and marketing of the goods and services. In Kanyakumari District, markets are not properly organised, majority of the entrepreneurs are having marketing problems. In the absence of organised marketing, their products are compared unfavorably with the quality of the products of large scale units. They also fail to get adequate information about consumer's choice, taste and preferences of the types of product. This problem if continued, the entrepreneurs cannot exist in the market. Therefore it should be considered as a serious problem. Table 3 shows the marketing problems of entrepreneurs.

Table 3. Basis of Marketing the Goods and Services of Entrepreneurial Activities

Basis of Marketing	Industry Sector		Trade and Service		Total	
	No of entrepreneurs	%	No of entrepreneurs	%	No of entrepreneurs	%
Retail sale	196	65.34	102	51.78	298	59.96
Wholesale	52	17.33	51	25.89	103	20.72
Over the Counter	-	-	32	16.24	32	6.44
Any Other	52	17.33	12	6.09	64	12.88
Total	**300**	**100**	**197**	**100**	**497**	**100**

Source: Primary data

Table 3 of the total entrepreneurs (497) 59.96 percent of the entrepreneurs felt the problem of retail sale. 20.72 percent of these entrepreneurs realized the problem of wholesale. 12.88 percent of the entrepreneurs realized the problem in some other ways. 6.44 percent of the entrepreneurs of trade and service sector felt the problem of marketing over the counter.

PROBLEMS OF FOLLOW-UP ASSISTANCE RECEIVED BY THE ENTREPRENEURS

Entrepreneurs need various follow up assistance for the successful implementation of Entrepreneurship programme. The type of follow up assistance received by the respondents of study is given in table 6.7. They need many follow up Assistance like selecting the product

to be produced, or service to be rendered, conducting market survey, acquiring machinery and raw materials and marketing.

Table 4. Type of Follow-up Assistance Received by the Entrepreneurs from the DIC

Type of follow up assistance provided by the DIC under EDPs	Industry Sector		Trade and Service		Total	
	No of Entrepreneurs	%	No of Entrepreneurs	%	No of Entrepreneurs	%
Preparing the Project	102	34	75	38.07	177	35.61
Selecting product to be produced or services to be rendered	32	10.67	58	29.45	90	18.11
Conducting Market	52	17.33	12	6.09	64	12.88
Acquiring Machinery & Raw Materials	57	19	26	13.19	83	16.7
Marketing	57	19	26	13.19	83	16.7
Total	300	100	197	100	497	100

Source: Primary data

From the table 4, it is clear that 35.61 percent of the respondents find it very difficult to prepare the project. 12.88 percent of the entrepreneurs find it difficult to conduct market survey. 16.7 percent of the respondents find it difficult to acquire machinery and raw materials. 18.11 percent of the respondents find difficult in selection of product or service. Therefore, majority of the respondents are of the view that they find difficult in preparing project report or plan. Hence the major role of DIC must be in such a way to help them in the preparation of their project report. And they have to assist in all other fields also.

PROBLEMS DUE TO LACK OF EDUCATION

Due to low educational qualifications, the entrepreneurs have to face problems in different aspects viz., dealing with banks and government officials, dealing with customers, dealing with taxation formalities etc. Since majority of the respondents belongs to the low educational qualification, it is really a notable problem. The table 5 shows the details of Problems faced by the Entrepreneurs due to Lack of Education.

Table 5. Problems Due to Lack of Education

Nature of Problems	Industry Sector		Trade and Service		Total	
	No of Entrepreneurs	%	No of Entrepreneurs	%	No of Entrepreneurs	%
Dealing with the customers	**126**	**42**	**75**	**38.07**	**201**	**40.44**
Dealing with the Government officials and banks	**112**	**37.33**	**95**	**48.23**	**207**	**41.65**
Dealing with the taxation formalities	**62**	**20.67**	**27**	**13.7**	**89**	**17.91**
Total	**300**	**100**	**197**	**100**	**497**	**100**

Source: Primary data

Of the total entrepreneurs (497) in the study area, 41.65 percent of the respondents of these small sale industrial units are facing the problem of dealing with the government officials and banks due to lack of education. 40.44 percent of these entrepreneurs are facing the problems of dealing with the customers. 17.91 percent of the entrepreneurs are facing the problem of dealing with the taxation formalities. DIC must identify those beneficiaries with low level of education and help them in all the above fields. During the period of their training programme efforts may be taken to overcome it. Moreover, self- confidence also is created in the minds of such entrepreneurs at the time of their EDP- programme. Otherwise, it will become a great problem.

REPAYMENT PERIOD ALLOWED BY THE BANKS

The entrepreneurs expect the repayment period of the loan must be reasonable. They must feel that they are being able to start repaying the amount form the profit earned out of business. They may be able to repay when they stay strongly in their own legs. The bank must give time for them. The opinion about the repayment period allowed by the banks is given in table 6

Table 6. Repayment Period Allowed by the Banks

Opinion of the Entrepreneurs	Industry Sector		Trade and Service		Total	
	No of Entrepreneurs	%	No of Entrepreneurs	%	No of Entrepreneurs	%
Reasonable	150	50	121	61.42	271	54.53
Not Reasonable	150	50	76	38.58	226	45.47
Total	**300**	**100**	**197**	**100**	**497**	**100**

Source: Primary data

The table 6 clearly shows that among 497 respondents, 271 respondents (54.53 percent) opinion that the repayment period allowed by the banks is reasonable. The remaining 226 respondents (45.47 percent) opinion that the repayment period allowed by the banks is not reasonable. It is inferred that the majority of the respondents are of the view that the repayment period is reasonable. It is not enough. All the entrepreneurs who avail the loans should feel so. Hence the grounds of their arguments must be traced out and resolved. Otherwise, it will become a tedious problem against the repayment of loans.

RATE OF INTEREST CHARGED BY BANKS

Every body likes to get a loan at very low interest rate. Nobody is an exception to this wish. Banks charge interest to the borrowers and it pays its savers for keeping money in an account. The following table 7 shows idea about the rate of interest charged, by banks for the loans.

Table 7. Rate of Interest Charged by Banks

Opinion of the Entrepreneurs	Industry Sector		Trade and Service		Total	
	No of Entrepreneurs	%	No of Entrepreneurs	%	No of Entrepreneurs	%
Too High	85	28.33	27	13.71	112	22.54
High	157	52.33	123	62.44	280	56.34
Justified	58	19.34	47	21.32	105	21.13
Total	**300**	**100**	**197**	**100**	**497**	**100**

Source: Primary data

The interest rate problem faced by the entrepreneurs in the study area is shown in table 7 of the total entrepreneurs (497) in the study area, 56.34 percent of the respondents are facing the problem of high rate of interest, 22.54 percent of the entrepreneurs are facing the problem of too high rate of interest, 21.13 percent of these entrepreneurs are feeling the rate of interest is justified. The rate of interest is also a problem for them.

LEGAL AND PROCEDURAL FORMALITIES TO BE OBSERVED IN GETTING A BANK.

A study “Problems of small industries in Andrapradesh” has found that there is a delay in the disbursement of the loans due to the existence of procedural delays and instances of tangible securities.

Legal and Procedural Formalities are the important elements in any business function. In the opinion of the entrepreneurs about the legal and procedural formalities to be followed in getting a bank for the loan are many and very strict. Table 8 shows that the legal and procedural; formalities to be observed in getting bank. Usually the applicant entrepreneurs should suggest their nearby banker.

Table 8. Legal and Procedural Formalities to be observed in Getting a Bank

Opinion of the Entrepreneurs	Industry Sector		Trade and Service		Total	
	No of Entrepreneurs	%	No of Entrepreneurs	%	No of Entrepreneurs	%
Simple	15	5	44	22.34	59	11.88
Complicated	178	59.33	99	50.25	277	55.73
Rigid	107	35.67	54	27.41	161	32.39
Total	**300**	**100**	**197**	**100**	**497**	**100**

Source: Primary data

Table 8 clearly exhibits the opinion the entrepreneurs related to the legal and procedural. Formalities to be observed in getting a bank by the entrepreneurs in the study area, of the total entrepreneurs (497) in the study area, majority (n=277), 55.73 percent of the entrepreneurs opine that they had to complete very complicated legal and procedural formalities in getting bank for loans. (n=161), 32.39 percent of them exhibits the opinion that the formalities are very rigid. The remaining (n=59) 11.88 percent respondents say the formalities are simple. Therefore it is also considered as a main problem faced by entrepreneurs.

PROBLEMS OF ENTREPRENEURS (FRIED MAN'S RANK)

Table 9. Problems of Entrepreneurs

Problems of Entrepreneurs	Fried Man's Mean Value	Fried Man's Rank
Adequacy of Credit facilities	4.40	6
Time limit	4.59	3
Marketing problems	4.41	5
Follow up assistance	4.57	4
Lack of Education	4.35	8
Repayment	4.66	1
Rate of Interest	4.37	7
Legal & Procedural Formalities	4.65	2

Source: Primary data

Table 8 reveals that repayment is the major problem of Entrepreneurs and the second important is legal & procedural formalities, since those variables occupies the first and second ranks, whereas the last two ranks seventh and eighth are occupied by rate of interest

and lack of education respectively. As per the negative impact of these problems in their business it has been ranked by the respondents.

SUGGESTIONS

Based on the findings of the study and the personal conceptions the researcher has given the following suggestions. It provides

- Suggestions to DIC
- Suggestions to the Entrepreneurs

SUGGESTION TO DIC

- The various formalities and document to be produced are the great problems regarding Government institutions. DIC is not an exception to this. All these rules may be little bit liberalized, that may enable to increase the number of entrepreneurs in the districts. The credit facilities and subsidy allowed may be adequate for the entrepreneurs for their venture. It will help them to sustain in the field successfully.
- Assistance in all fields needed in the process of entrepreneurship must be provided to the entrepreneurs.
- DIC must make arrangements for the purchase of scarce raw materials and machineries to the entrepreneurs, which will be of great help to them.

SUGGESTION TO THE ENTREPRENEURS

The entrepreneurs should also consider certain points which the DIC officials felt as constraints against them.

- The entrepreneurs, after getting the loans, must realize their responsibility of repayment. They must confirm, they remit the installments correctly taking as their unwritten duty.
- The entrepreneurs should not misuse the assistances received from the DIC.
- The entrepreneurs should take this DIC loan as a boon and be thankful to the DIC. That intention can alone make them work hard and enhance their earnings and to repay the loans.

CONCLUSION

Thus the researcher has analysed the problems of selected entrepreneurs, (n=497) in Kanyakumari district. The entrepreneurs have expressed their problems during the process of their entrepreneurship. The researcher, based on all these problems, has given many valuable and practicable suggestions. On the following of such suggestions, the researcher is very confident that the problems will be of no more. And also DIC plays a vital role in entrepreneurship development in the study area.

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A Novel Detection of Bleeding Frame and Region in the Wireless Capsule Endoscopy Video

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***Abstract*—**Endoscopy process to find the bleeding parts in human body is a complicated work. In ancient mechanism they formally use the wired endoscopy to the patients it will leads to several drawbacks. Thus nowadays wired is changed with wireless capsule endoscopy to overcome the situational hazard of the physician. This is further enhanced by the wireless capsule endoscopy through which it can be used. Wireless Capsule Endoscopy (WCE) is in the form of capsule like format that is used for the further identification by the physician. Here the WCE capture videos of the inner organs. While the physician used to point out the issue, they want to focus on the particular video. There may be manual errors may occur. Thus it can be overcome by the proposed word based color histogram. This model is a promising model to compute the WCE video and predict the accurate result without the burden of the phycisian. It is proposed in this system by including a color features. In this model the RGB color feature is used to predict the bleeding frame. To classify the bleeding Frame two classification algorithms is used. They are Support Vector Machine (SVM) and K Nearest Neighbour (KNN) is proposed in this project. Bleeding frame is identification is maintained and performed with the help of proposed algorithm and techniques are simple and efficient.

***Keywords*—**WCE, Word based color Histogram, SVM, KNN

I. INTRODUCTION

Wireless capsule Endoscopy is an upcoming technique in the medical field. The technique that used to support in medical field is lacking in security and performance. The security is mentioned here as human protection. The device that is used to capture is simple and efficient. Performance is based on the accurate result provide by the devices. This is still far behind the idea. The main drawback of the system is manual prediction. Here the camera is embedding in the format of capsule. This should be used to capture the video when it is inhale by the patients. It will capture the video from the food vessel till to the mucosa region of the stomach area. WCE capture the videos in the form of the simple and reliable format through which it should be used to maintain under the reliable format through which it can be maintained under the simple and various format of the usage. The wireless endoscopy is an excellent tool to identify the bleeding region in a Mucosa Region. The captured video is run by the doctors to find the particular area to find the bleeding frame. But the drawback is when they continuously review the video they can make manual errors. Thus the prediction of the particular frame is inefficient. It can be overcome by the various methodologies. The wireless capsule endoscopy figure is shown below

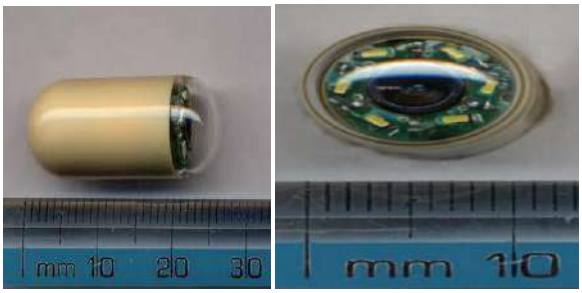

Figure 1. Wireless Capsule Endoscopy

In Fig 1: Wireless Capsule Endoscopy is shown inside the capsule a fine-grained camera is built inside the capsule. Thus this device is simple and never harm to the patients inner organs. The wireless Capsule Endoscopy is used to mainly detect the Gastro intestinal form to find the ulcer affected area. The camera is used to record the video from the patient intestine at each angle. Further it should be taken out and then

processed with the help of the computer to run the video and to find the bleeding area. This should not be considering as the accurate result formation because of the less consideration or eye contact the physician. To overcome the drawback the computation formulation is needed to propose. Thus several techniques are research in the earlier reviews. Here the main usage of the system should be helped to overcome the earlier drawbacks of the system. Here the proposed model is used to overcome all the hurdles.

Here the lots of reviews are maintained to forward the simple and efficient process to find the rapid bleeding detection process. In the wireless capsule endoscopy there are lots of minorities issues that should be consider for the future reviews. One of the models is used to gather the pixels of the video frame and then they used for the further prediction area. For grouping the pixel in the image they used super pixel formulation to group them. Most of the previous issues used segmentation formulation and then they propose the classification process. This should not be formulated as the simple process. Thus a simple and efficient process is implemented in the proposed mechanism by using word based color Histogram.

II. RELATED WORK

To find the bleeding area detection in the WCE images various popular ideas are proposed by the physician. They are context aware saliency detection [1] the process of this model is focus on the dominant object through which it should be used. Thus it focuses on the particular part time delay is highly occurring in this model. This can be overcome by the next newly derived mechanism that is Computer aided bleeding mechanism in WCE video. This model consists of the compute based vision to support the system to find the rapid bleeding area is proposed in the work [2]. This can be used to maintain under the simple and efficient process. Thus the drawback that occurs in the above model is latency issues. Here latency issues are termed as slow processing or slow computation. The next paper is based on the segmentation model through which the data are segmented using the particular segment transformation. Through this model the result is occur in the form of statistical order. So it is not obtain to overcome the issue. Then the upcoming model is based on the previous work used with the help of color features. The features depend on the CMYK model. Thus it should be maintain under promising and useful model for the entire mechanism through which it should be occur. During this process manual errors occur and it is not based on the error free model [6]. Another model to overcome the before issues are linear coding based classification. Thus the classification algorithm is used here to implement a simple parameter for processing. But the classification algorithms used in this model require more complexity. Thus it should be overcome for the further issues.

In [5], the proposed framework, the watermark message is first embedded in the black plane by modulating in frequency domain. In this paper, an algorithm based on Cox method for a color adjustment step is then followed to modify the CMY planes in order to minimize visibility of the watermark. One advantage of the proposed framework is that it can conceptually reach "zero" visual noise.

Even if taking color mismatching and inaccurate printer characterization into account, the perceptible watermarking noise is still much lower than many traditional methods. Thus, it allows significant increase in watermarking energy without sacrificing image quality. Another advantage is that it can easily enable "blind decoding". More specifically, the original image is not necessarily required in decoding phase

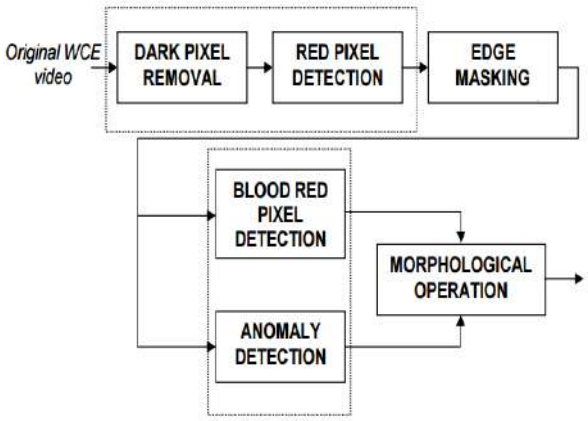

Figure 2. Existing Block Diagram

Disadvantages:

- In existing system there is no clear prediction of bleeding area
- Require large number of time.
- Not supported for uncompressed data
- Does not provide valid information

III. PROBLEM STATEMENT

The problem statement that identified in the previous mechanism is simple and should be used to maintain under the several methodology through which it can be used. Color segmentation is used as the drawback that used in the previous methodology. It should be research and form under the various mechanism through which it can be used for the further reviews. The main acknowledgement of the previous mechanism is simple but not consider as the efficient process. The previous color based scheme and the proposed model is not still processed with the help of the entire process mechanism. The computational time delay and the various issues is used to maintain and cover the area to overcome the research utilities of the concept. This can be overcome with the help of the previous model.

IV. PROPOSED METHOD

It should include important findings discussed briefly. Wherever necessary, elaborate on the tables and figures without repeating their contents. Interpret the findings in view of the results obtained in this and in past studies on this topic. State the conclusions in a few sentences at the end of the paper. However, valid colored photographs can also be published.

The Proposed model is based on the simple and efficient process to overcome the previous drawback. The model is based on the extraction process. It commonly uses color spaces such as RGB, HSV and LAB. Here the color space RGM is used. Choose any reference color space then extract suitable color feature to describe the bleeding frame. WCE may not include Blue, Violet. It concentrated in small region of the color space.

To overcome this new color feature is used to characterize the WCE images. The proposed color feature extraction method is used to obtain the specific color range of the WCE images. Randomly select 10% bleeding images and 10 % normal images from the training data set. Then calculate the corresponding cluster centers independently by inputting the pixel represented using image vectors in the color space to the K- means clustering procedure.

Bleeding in the gastrointestinal (GI) tract result from a number of etiologies, vascular tumors, ulcers and inflammatory lesions the general approach to diagnose the bleedings is to directly view the GI tract by different manners. The existing methods detect the bleeding frames from the normal ones in some degree. Majority of them extract the complete color features from a WCE image, ignoring the specific color range of WCE images

The proposed model designed with word based color histogram for bleeding detection in WCE images. It will find the most of the color information of the bleeding images. It calculates the color words by applying K-means clustering in WCE images in the specific color space. Then each WCE image is characterized as histogram of the cluster centers to represent the feature vector. Finally, SVM and K nearest neighbor are utilized as classifiers to detect bleeding frames. Secondly localization of the bleeding areas in the bleeding frames is focused. Inspect the bleeding images under different color spaces like RGB, HSI/HSV, CMYK, CIELAB, YUV, and XYZ and select the components that highlight the bleeding areas. Then create the first stage saliency map by combing these components together to strengthen the suspicious regions. Then combine all the saliency features of finding the color area. And predict the reddest situated area and fix that region.

The k-means clustering utilizes the color information of the WCE frame and reduces the dimension of the color features. The concentrated cluster centers from the bleeding data set. Then there dimensional color data map of each point in a WCE image the nearest visual words and calculate the number of each visual word. It produces a histogram value (w, d) where they denote ith visual word in the k-size color clusters. Using this method the WCE images are characterize as the word based histogram. The proposed color features are based on the histogram thus it preserves the robustness to the rotation and translation of the image contents. The word based color histograms makes the best of the range of the color information in the WCE images and represent the color distribution.

Advantages:

- Easy detectable
- Clear prediction of bleeding area in the frame
- The main use of this project is used to save the time for detecting the bleeding area.

ARCHITECTURE

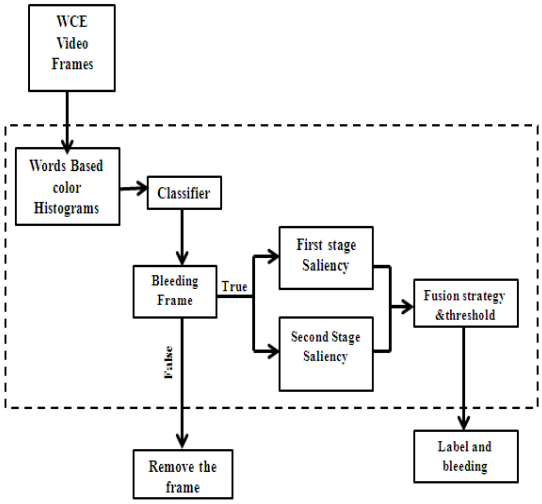

Figure 3. Proposed Block Diagram

V. IMPLEMENTATION

The Bleeding Frame detection is proposed in this model. Here Bleeding frame detection problem are analyzed and overcome by the proposed method model. This should be overcome with the help of simple and efficient process. The implementation of the propose model is represent in this chapter

In Extraction of bleeding frame is proposed by implementing the classification algorithm. Here two classification algorithm is used one is SVM (Support Vector Machines) and another one is KNN (K Nearest Neighbor identification. This can be used to follow the main reference of the system through

which it is simply classified and overcome by the proposed model. The main use of the project is used to find the best classification model to extract the bleeding frame. The more accurate result is finding out by training 10% of normal image with 10% of affected image. Thus the classification algorithm is trained toanalyze the minute difference between the normal one and the affected region of the image. the most useful prediction of the image is used to maintain under the simple and efficient access of the image through which it should be extend and protective.

After the successful completion of the proposed extraction the next process is the RGB histogram of the proposed model is used to find Bleeding detection of the model. The RGB color model is given in the below diagram Fig 4.

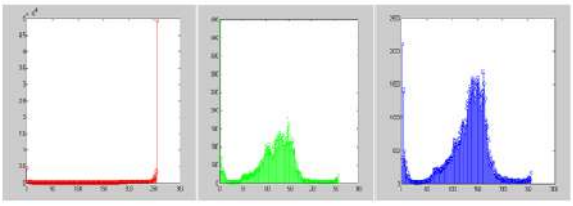

Figure 4. RGB color Histogram

If the red value peak signal is high means the Bleeding is present in the current frame. If green and blue value is higher than the Red value means the current frame is normal without bleeding.

The main concept of the RGB color histogram is used to maintain a simple and efficient process of the work to be maintained in the system. The current value is highly calculated using the word based color histogram. This is the proposed model technique through which it should be used to identify the bleeding detection model is used. The current identification model is used to overcome the burden of the identification system.

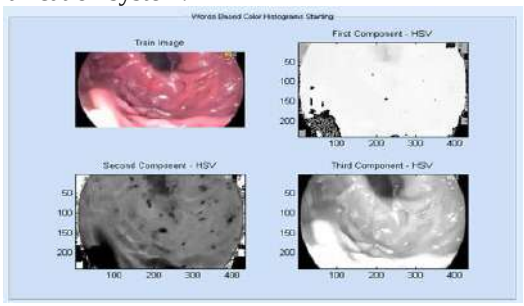

Figure 5. Bleeding Classification

The next process is purely designed to identify the bleeding area. Through which it should be used to find the bleeding classification after denoting the RGB value using Color histogram model. The next process is used to identify the bleeding frame. Thus it is identified by the proposed novel model. And the detection frame is stored in the separate folder. Thus it is simple and efficient process for storing the result.

VI. RESULT DISCUSSION

The existing model is based on the simple and efficient work through which it should be analyzed with the help of previous methodology to the normal ones. This can be used for further classification of the model and it should be used to maintain under simple classification through which it should be retrieved. This should be efficient for the simple model that can be used to process for the entire process thus it is an efficient process for finding the best methodology of the process to be under different processing mechanism. The data that is used here to compare the various process of the mechanism this should be easily process by the entire mechanism. The main use of this mechanism is still be used to process for the comparison of the entire mechanism.

The basic need of the mechanism is use to process by comparing the successive ratio of the detection of the bleeding frame and the localization of the model. This should be efficiently detectable by the performance and the evaluation The main use of this process is used to maintain under the main use of the proposed model. This should be used to formulate best performance of the area.

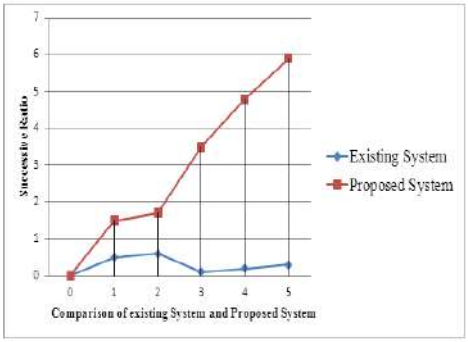

Figure 6. Graphical comparison between existing and proposed model.

Another comparison of the proposed model is used to include the technical comparison between the existing and the proposed. The proposed techniques such as word based color Histogram detection and Pyramid of Hue Histogram.

Accuracy	Successive Ratio	
	Pyramid of Hue Histogram	Word Based Color Histogram
10	1	5
30	2	25
60	5	55
Average	2.66	28.33
Percentage	8%	85%

TABLE 1. AVERAGE DETECTION OF PROPOSED TECHNIQUES

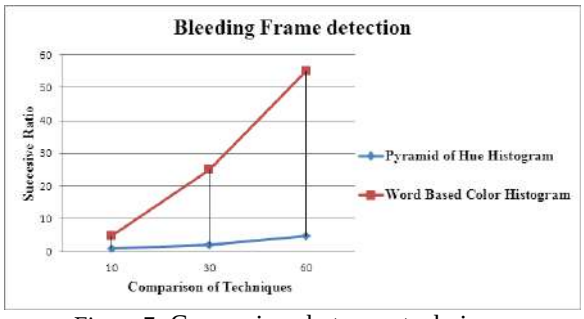

Figure 7. Comparison between technique

The Graph clearly shows the successive ratio of the proposed Back of words mechanism. The Existing segmentation model is a time consuming work and the proposed bag of words based color histogram is an efficient one. It is more useful and error free technique. Adopted and succeeded in the medical field to reduce the work of the physician.

VII. CONCLUSION

Finally the result concludes that by comparing various mechanisms in the previous issues it is simple and efficient and followed by the proposed methodology. Without any complexities the patients result is predict as accurate with the proposed mechanism. The classifiers that are used to maintained the model with simple and efficient. The mechanism can be used to reduce the burden of the physician. Thus it can be provided to find the bleeding area without any complexities. Thus this is the promising solution to overcome the issue. This should be used for the correct prediction mechanism for the proposed methodology. The main usage of the above mechanism is used to maintain the accuracy of the system. This should be used to overcome the drawbacks of the previous issues. Here the color feature that used in the above model is the RGB feature which is simple and efficient. In future a method is implemented to detect bleeding regions from WCE video. To find bleeding regions super pixel segmentation and adaptive neuro fuzzy inference system were used. Initially the video will be read. And it is converted into frames in that frames we are finding the edges using canny detector. Then we remove the edge by means of morphological dilation. After removing the edges, group the pixel based on color and location using super pixel segmentation. Image segmentation is the process of dividing an image into multiple parts that's used to identify relevant information in digital images. Finally classifier is used to find the bleeding and non-bleeding frames.

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Preparation and Photocatalytic Effect of Cu^{2+}-Doped TiO_2 Nanoclusters

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ABSTRACT

Cu^{2+}-doped TiO_2 nanoclusters are prepared by the sol-gel method. Scanning electron microscopy and X-ray diffractometry are applied to characterize their structural properties. The photocatalytic analysis is done by UV-Vis absorption spectrum. The results of X-ray diffraction (XRD) shows the presence of rutile peak with a strong orientation along (1 1 0) plane. Scanning electron microscopy (SEM) study shows the uniform distribution of agglomerated nanoclusters. EDS spectrum confirms the presence of doped metal ion Cu^{2+} in the TiO_2 crystal lattices. In this work, the photocatalytic effect of Cu^{2+}-doped TiO_2 on the degradation of methyl orange dye is studied. TiO_2 doped with 5 wt% Cu^{2+} gives an excellent result in the degradation of methyl orange.

1. Introduction

In this modern world, wastewater treatment is a challenging task by the textile industries. The most common effluents used by the textile manufacturers are synthetic organic compounds, such as dyes. Due to the stability of modern dyes, it is difficult to remove them from wastewater and may require tertiary and further treatments [1]. Semiconductor nanoparticles used in disposing of environmental pollutant by a method called Heterogeneous photocatalysis [2]. TiO_2 is a well-known photocatalyst for removing effluents from wastewater [3-5]. The photocatalytic efficiency of TiO_2 nanoparticles is improved by doping Cu^{2+} metal ions with TiO_2 [6]. In this article, we present a simple method to synthesize Cu^{2+}-doped TiO_2 nanoparticles and investigate the decolourizing effect on degradation of methyl orange (MO) dye under UV light irradiation.

2. Experimental Methods

2.1 Preparation of TiO_2 Nanoparticles

Cu^{2+}-doped TiO_2 nanoparticles are prepared by hydrolysis of TTIP (titanium tetra-isopropoxide) by deionized water. In this procedure, the suitable amount of doping material (Cu^{2+}, 1 & 3 wt%) dissolved in 10 mL of deionized water is added to 100 mL of ethanol taken in a beaker under room temperature. The mixed solution is stirred well up for ten minutes. Now the pH of the solution is adjusted in the acid range by using nitric acid. Then 15 mL of TTIP is added dropwise to the mixed solution of precursor and metal ions. During the addition TTIP hydrolysis reaction takes place and TiO_2 nanoparticles are obtained in the form of a gel in the beaker. The gel is filtered, dried and calcinated to 500 °C to get rutile crystalline phase TiO_2 nanoparticles. Fig. 1 shows the photograph of the synthesis method of Cu^{2+}-doped TiO_2 nanoparticles.

2.2 Characterization

The synthesized materials are characterized by various sophisticated techniques. Powder X-ray diffraction (PXRD) is carried out using XPERT PRO diffractometer with diffraction angle 2θ in the range 20-80º using Cu-Kα radiation of wavelength 1.54060 Å. Surface morphology is carried out using Carl Zeiss SUPRA 55VP model Scanning Electron Microscopy (SEM) instrument. EDS spectra are recorded using JEOL Model JED-2300 Energy Dispersive Spectrometer.

Fig. 1 Photograph of Synthesizing Cu^{2+}-doped TiO_2 nanoparticles

2.3 Study of Photocatalytic Activity

The photocatalytic activity of the Cu^{2+}-doped TiO_2 nanoparticles is evaluated by the photodegradation of MO aqueous solution with an initial concentration of 1 mg/L. Two UV-A (18 W) fluorescent lamp is used as the light source. The degradation of the solution is analyzed by recording UV–Vis absorption spectra of MO. According to the standard curve between concentration and absorption, the value of $((C_0-C_t/C_0) \times 100\%)$ is calculated, denoted as the degradation percentage. Fig. 2 shows the image of the experimental reactor.

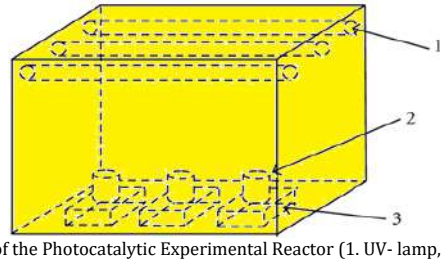

Fig. 2 Image of the Photocatalytic Experimental Reactor (1. UV- lamp, 2. MO solution and 3. stand)

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3. Results and Discussion

3.1 Powder X-Ray Diffraction Analysis

Figs. 3 and 4 show the PXRD patterns of 1 and 3 wt% Cu^{2+}-doped TiO_2 nanoparticles calcinated at 500 °C. Both the samples show similar peaks with various intensities. Sharpening of peaks indicates that the degree of crystallinity is high and the crystallites are higher in size due to calcination [7, 8]. All the peaks are identified and indexed in accordance with the JCPDS file JCPDS 21-1276 of a rutile crystalline structure [9]. Peaks of CuO is not found due to the lower content of Cu. The average crystal size of the Cu^{2+}-doped TiO_2 nanoparticles have been found out using the most intense reflection (1 1 0) by Debye – Scherrer formula, $D = 0.89\lambda/b\cos\theta$, where D is the mean crystallite size, λ is the wavelength of X-ray, θ is the Bragg angle, and b is the half width of the full maximum [11, 12]. The crystallite size of Cu^{2+}-doped TiO_2 nanoparticles are found to be 40 and 61 nm for 1 and 3 wt% Cu^{2+}-doped TiO_2 nanoparticles, respectively which is agrees with the earlier report of Gorska et al. [13].

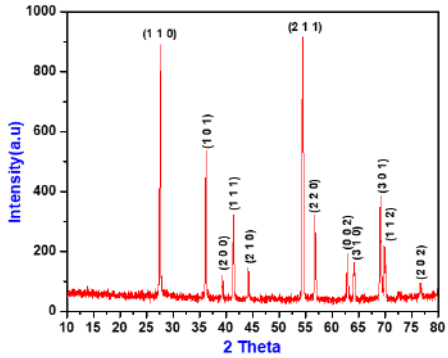

Fig. 3 PXRD pattern of 1 wt% Cu^{2+}-doped TiO_2 nanoparticles

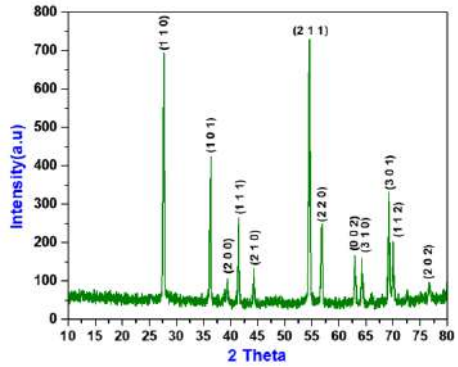

Fig. 4 PXRD pattern of 3 wt% Cu^{2+}-doped TiO_2 nanoparticles

3.2 Scanning Electron Microscopy (SEM) Analysis

Figs. 5 and 6 show the SEM micrograph of 1 and 3 wt% Cu^{2+}-doped TiO_2 nanoparticles. SEM micrographs show that the synthesized nanoparticles are spherical in shape and are agglomerated nanoclusters. Such a morphology is formerly obtained by Hamadanian et al. by the Sol-Gel method [14].

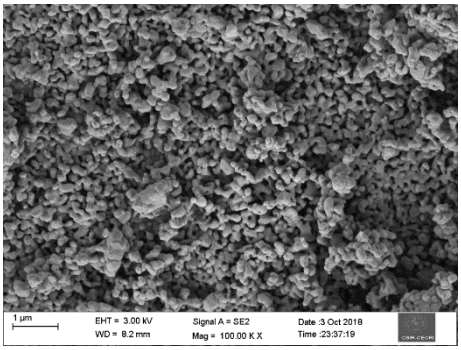

Fig. 5 SEM micrograph of the 1 wt% Cu^{2+}-doped TiO_2 nanoparticles

3.3 EDS Analysis

In order to prove the existence of Cu^{2+} in the TiO_2 crystal lattice, the EDS spectrum is recorded for 3 wt% Cu^{2+}-doped TiO_2 nanoparticles. Fig. 7 shows the EDS spectrum of 3 wt% Cu^{2+}-doped TiO_2 nanoparticles. The peaks of copper exist at 0.9, 8.0 and 8.8 keV. This confirms the incorporation of copper in the TiO_2 crystal lattice. In addition to these high and low intense peaks of Ti and O are clearly arising in the spectrum suggests bulk surface of TiO_2 [14].

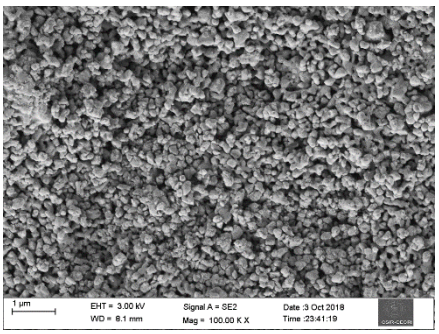

Fig. 6 SEM micrograph of the 3 wt% Cu^{2+}-doped TiO_2 nanoparticles

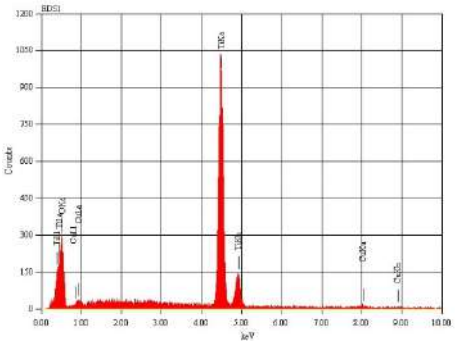

Fig. 7 EDS spectrum of 3 wt% Cu^{2+}-doped TiO_2 nanoparticles

3.4 Photocatalytic Activity Results

The photocatalytic activity of Cu^{2+}-doped TiO_2 nanoparticles is evaluated by examining the degradation of MO under UV light (18 W, UV-A fluorescent lamp) irradiation. For this typical study, 50 mL of 10 ppm aqueous MO solution is taken in a 100 mL beaker. 100 mg of powdered TiO_2 nanoparticles was dispersed in this solution. The solution is irradiated with UV light up to 210 min. Every 30 min, 5 mL of MO solution is taken out and is centrifuged immediately to remove the catalyst. The degradation efficiency of Cu^{2+}-doped TiO_2 nanoparticles is viewed through UV-vis absorption spectra of MO solution.

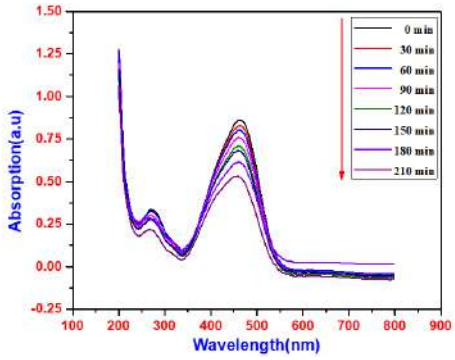

Fig. 8 Absorption spectra of methyl orange in photodegradation assisted by 1 wt% Cu^{2+}-doped TiO_2 nanoparticles

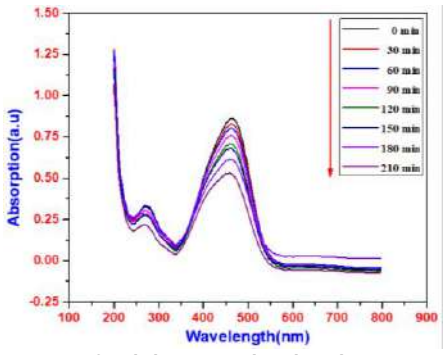

Fig. 9 Absorption spectra of methyl orange in photodegradation assisted by 3 W% Cu^{2+}-doped TiO_2 nanoparticles

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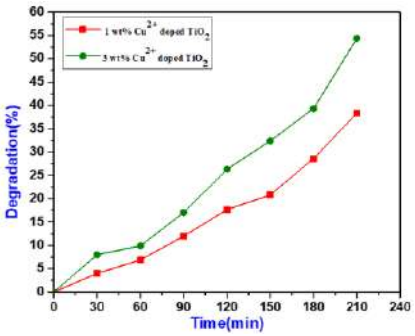

Fig. 10 Photocatalytic efficiency of 1 and 3 wt% Cu^{2+}-doped TiO_2 nanoparticles

Figs. 8 and 9 show the UV-Vis absorption spectra of MO excited with a UV lamp at different intervals of time. Photocatalytic performance of the Cu^{2+}-doped TiO_2 nanoparticles is tested by the UV light excitation and the results are shown in Fig. 10. It is found that both the Cu^{2+}-doped TiO_2 nanoparticles show average photocatalytic efficiency. But, 5 wt% Cu^{2+}-doped TiO_2 nanoparticles shows higher degradation of 54%, which is 16% higher than 1 wt% Cu^{2+}-doped TiO_2 nanoparticles. The photodegradation mechanism of MO by using Cu^{2+}-doped TiO_2 nanoparticles are proposed as follows [15,16].

$TiO_2 + h\nu \longrightarrow TiO_2\ (e^- + h^+)$

$h + OH^- \longrightarrow OH\cdot$

$e^- + O_2 \longrightarrow O_2^-$

Methyl Orange + $OH\cdot$ ⟶ Degraded products

Methyl Orange + O_2^- ⟶ Degraded products

UV irradiation of light energy greater than or equal to its band gap falls on Cu^{2+}-doped TiO_2 nanoparticles excites electrons from a filled valence band to an empty conduction band, supplying electron-hole pairs. The holes in the valence band react with adsorbed OH^- to produce hydroxyl radicals ($OH\cdot$), whereas the electrons (e^-) in the conduction band react with O_2 and produce superoxide O_2^- radicals. The hydroxyl and superoxide radicals react with MO giving rise to degraded products.

According to the earlier report of Hamadanian et al. [10] doping with Cu^{2+} causes suppression of the electron-hole pair recombination. Furthermore, which could be induced sub-band levels near the bottom of the conduction band and easily trapping photoinduced electrons. Hence, the separation of photoexcited chargers could be enlarged, resulting in the enhancement of the photocatalytic activity of TiO_2 under UV irradiation. Thus, the efficiency is improved in our prepared Cu^{2+}-doped TiO_2 nanoparticles.

4. Conclusion

In summary, rutile phase Cu^{2+}-doped TiO_2 nanoclusters are successfully prepared by the Sol-Gel method. The result of photocatalytic study proves the improvement in the photodegradation of MO under UV irradiation for both Cu^{2+}-doped TiO_2 nanoparticles. Hence, the Cu^{2+}-doped TiO_2 nanoparticles synthesized by the Sol-Gel method are the efficient and superior photocatalyst for wastewater treatment.

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BITOPOLOGICAL LABELING ON SIMPLE GRAPHS

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Abstract

B.D.Acharya [3] introduced the notation of set-valuation as set analogue of number valuation as introduced by A. Rosa [5]. For a (p, q) graph G = (V, E) and a non-empty set X of cardinality n, Acharya defined set indexer of G as an injective set-valued function $f: V(G) \to 2^X$ such that the function $f^*: E(G) \to 2^X - \{\phi\}$ defined by for every $f^*(v_1v_2) = f^*(v_1)\Delta f^*(v_2)$ for every $v_1v_2 \in E(G)$ is also injective, where 2^X is the set of all subsets of X and Δ is the symmetric difference of sets. For a graph G, there exist a set-indexer $f: V(G) \to 2^X$ such that the family $f(V)$ is a topology on X. A graph G = (V, E) is said to be a bitopological graph if there exist a set indexer $f: V(G) \to 2^X$ such that f(V) and $f^*(E) \cup \{\phi\}$ are both topologies on the corresponding ground set.

Key words: Topologically set-graceful graphs, bitopological set – indexer, bitopological graphs, Fork graph , Diamond graph.

Introduction :

The graphs treated in this paper are simple. For standard terminology and notations we follow F.Harary [4]. Given a graph G = (V, E), we can relate it to different topological structures. The relation between topology and graph theory is undergone many investigations. In 1983 Acharya [3] established another link between graph theory and point-set topology. He defined a set-indexer, Let G = (V, E) be a graph, X be any non-empty set and 2^X denote the set of all subsets of X. A set-indexer of G is an injective set valued function $f: V(G) \to 2^X$ such that the induced function $f^*: E(G) \to 2^X - \{\phi\}$ defined by $f^*(v_1v_2) = f^*(v_1)\Delta f^*(v_2)$ for every $v_1v_2 \in E(G)$ is also injective , where Δ denotes the symmetric difference of sets. In this

paper, we proved that Fish graph, Diamond graph, Fork graph and some constructed graphs are bitopological graphs.

Definition 1.1 :

A graph G = (V, E) is called a bitopological graph if there exist a set X and a set-indexer f with respect to X such that both $f(V)$ and $f^*(E) \cup \{\phi\}$ are topologies on X.

Definition: 1.2

Fish graph is the graph on 6 vertices and 7 edges.

Theorem : 1.3

The Fish graph F is bitopological graph..

Proof :

Let $V(F) = \{v_i / 1 \leq i \leq 5\} \cup \{u\}$ be the vertices of F.

Let the edge set be $E(G) = \{uv_i / 1 \leq i \leq 4\} \cup \{v_i v_5 / i = 3,4\}$

Let X = { 1, 2, 3, 4 }

Define $f: V(G) \to 2^X$ where X = { 1, 2, 3, 4 } by

$f(u) = X$

$f(v_1) = \phi$

$f(v_2) = \{1\}$

$f(v_3) = \{1,2\}$

$f(v_4) = \{2\}$

$f(v_5) = \{1,2,3\}$

Then, $\phi = f(v_1) \subset f(v_2) \subset f(v_3) \subset f(v_5) \subset f(u) = X$ and $f(v_4) = 2$

The edge sets $f^*: E(G) \to 2^X - \{\phi\}$ are labeled by $f^*(v_1 v_2) = f^*(v_1) \Delta f^*(v_2)$

$$= \{X, \{1\}, \{3\}, \{1,3\}, \{3,4\}, \{1,3,4\}, \{2,3,4\}\}$$

Therefore, all the edge sets are distinct.

Thus, both $f(V(F))$ and $f^*(E(F)) \cup \{\phi\}$ are topologies on X.

Hence F is bitopological graph.

Illustration : 1.4

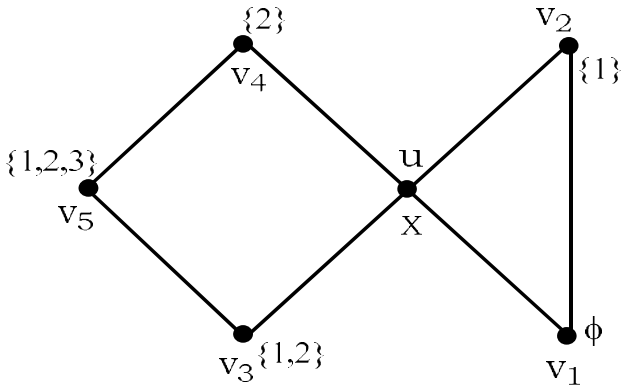

Fig 1: Fish graph is bitopological graph

Definition : 1.5

The Fork graph (Chair graph) is the 5 vertices tree and it has 4 edges.

Theorem : 1.6

The Fork graph G is bitopological graph.

Proof :

Let $V(G) = \{v_i / 1 \leq i \leq 5\}$ be the vertices of G.

Let the edge set be $E(G) = \{v_1 v_i / i = 2,3\} \cup \{v_3 v_i / i = 4,5\}$

Let $X = \{1,2,3\}$

Define $f: V(G) \to 2^X$ where $X = \{1,2,3\}$ by

$f(v_1) = \phi$

$$f(v_2) = \{1\}$$

$$f(v_3) = X$$

$$f(v_4) = \{1,2\}$$

$$f(v_5) = \{2\}$$

Then, $\phi = f(v_1) \subset f(v_4) \subset f(v_3) = X$ and $f(v_2) = 2$

The edge sets $f^*: E(G) \to 2^X - \{\phi\}$ are labeled by $f^*(v_1v_2) = f^*(v_1)\Delta f^*(v_2)$

$$= \{X, \{1\}, \{3\}, \{1,3\}\}$$

Therefore, all the edge sets are distinct.

Thus, both $f(V(G))$ and $f^*\big(E(G)\big) \cup \{\phi\}$ are topologies on X.

Hence G is bitopological graph.

Illustration : 1.7

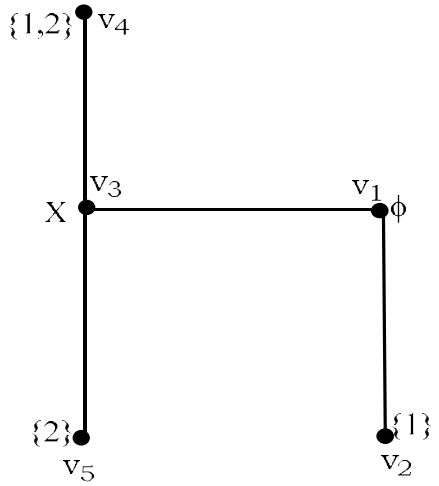

Fig 2: Fork graph is bitopological graph

Theorem : 1. 8

Let G be a graph obtained by attaching P_n with one vertex of K_3 , then G is bitopological graph for n = 1, 2, 3.

Proof :

Let $V(G) = \{u_i/1 \leq i \leq 2\} \cup \{v_i/1 \leq i \leq n, n = 1,2,3\}$ be the vertices of G.

Clearly G has n+3 vertices and n+3 edges.

Let the edge set be $E(G) = \{u_i v_i/i = 1,2\} \cup \{v_i v_{i+1}/i = 1,2,3\}$

Let $X = \{1,2,3\}$

Define $f: V(G) \to 2^X$ where $X = \{1,2,3\}$ by

$f(u_1) = \{1\}$

$f(u_2) = \{1,2\}$

$f(v_1) = \phi$

$f(v_2) = X$

$f(v_3) = \{2\}$

$f(v_4) = \{2,3\}$

Then, $\phi = f(v_1) \subset f(u_1) \subset f(u_2) \subset f(v_2) = X$ and $f(v_3) \subset f(v_4)$

The edge sets $f^*: E(G) \to 2^X - \{\phi\}$ are labeled by $f^*(v_1 v_2) = f^*(v_1) \Delta f^*(v_2)$

$= \{X, \{1\}, \{2\}, \{3\}, \{1,3\}, \{1,2\}\}$

Therefore, all the edge sets are distinct.

Thus, both $f(V(G))$ and $f^*(E(G)) \cup \{\phi\}$ are topologies on X.

Hence G is bitopological graph.

Illustration : 1.9

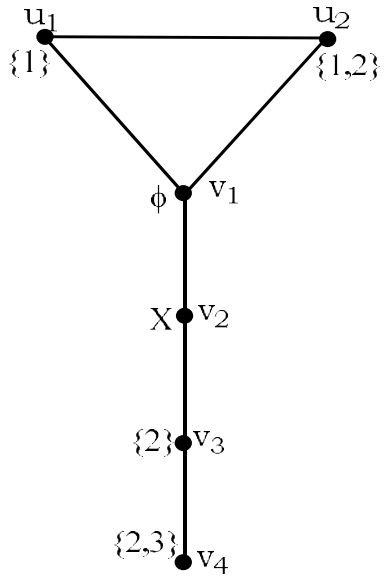

Fig 3: Bitopological graph K_3 with path

Definition : 1.10

A graph G = (V , E) is set graceful if there exist a non-empty set X and a set- indexer f : V(G)→ 2^X such that $f^*(E) = 2^X - \{\phi\}$

Theorem : 1.11

Let G be a graph obtained by attaching m = 3 paths of length n = 2 vertices with a single vertex adding one edge with the common vertex, then G is topologically set-graceful graph.

Proof :

Let m = 3 and n =2

Let $V(G) = \{v_i / 1 \leq i \leq 8\}$ be the vertices of G.

Let the edge set be $E(G) = \{v_0v_1\} \cup \{v_1u_i / i = 1,2,3\} \cup \{u_iw_i / i = 1,2,3\}$

Let $X = \{1,2,3\}$

Define $f: V(G) \to 2^X$ where $X = \{1,2,3\}$ by

$f(v_0) = \phi$

$f(v_1) = X$

$f(u_i) = \{i\}, i = 1,2,3$

$f(w_1) = \{1,2\}$

$f(w_2) = \{2,3\}$

$f(w_3) = \{1,3\}$

Then, $= f(v_0) \subset f(u_1) \subset f(w_1) \subset f(v_1) = X$, $f(u_2) \subset f(w_2)$ and , $f(u_3) \subset f(w_3)$

The edge sets $f^*: E(G) \to 2^X - \{\phi\}$ are labeled by $f^*(v_1v_2) = f^*(v_1)\Delta f^*(v_2)$

$=$ all the proper subsets of X.

Therefore, all the edge sets are distinct.

Thus, both $f(V(G))$ and $f^*(E(G)) \cup \{\phi\}$ are topologies on X and the edge set is $2^X - \{\phi\}$

Hence G is topologically set-graceful graph.

Illustration : 1.11

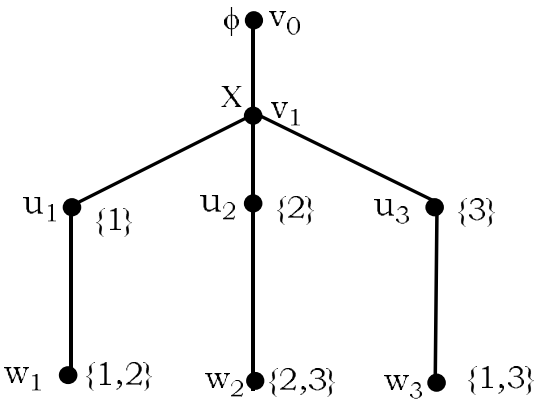

Fig 4: Topologically set-graceful graph graph

Theorem : 1.12

The Diamond graph G is bitopological graph.

Proof :

Let $V(G) = \{v_i / 0 \leq i \leq 3\}$ be the vertices of G.

Let the edge set be $E(G) = \{v_1v_2\} \cup \{v_0v_i / i = 1,2\} \cup \{v_iv_3 / i = 1,2\}$

Let $X = \{1,2,3\}$

Define $f: V(G) \to 2^X$ where $X = \{1,2,3\}$ by

$f(v_0) = \phi$

$f(v_1) = \{1,2\}$

$f(v_2) = X$

$f(v_3) = \{1\}$

Then, $\phi = f(v_0) \subset f(v_3) \subset f(v_1) \subset f(v_2) = X$

The edge sets $f^*: E(G) \to 2^X - \{\phi\}$ are labeled by $f^*(v_1v_2) = f^*(v_1)\Delta f^*(v_2)$

$= \{X, \{2\}, \{1,2\}, \{2,3\}\}$

Therefore, all the edge sets are distinct.

Thus, both $f(V(G))$ and $f^*(E(G)) \cup \{\phi\}$ are topologies on X

Hence G is bitopological graph.

Illustration : 1.13

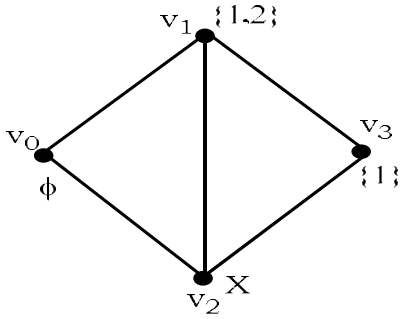

Fig 5: Diamond graph is bitopological graph

Theorem : 1.14

Let G be a graph obtained by V(G) = { v_i / 1 ≤ i ≤ 6 } and E (G) = { v_1v_{i+1} / i = 1, 2, 3 } ∪ { v_3v_5 } ∪ { $v_{i+1}v_6$ / 1 ≤ i ≤ 3 }, then G is topologically set-graceful graph.

Proof :

Let $V(G) = \{v_i/1 \leq i \leq 6\}$ be the vertices of G.

Let the edge set be $E(G) = \{v_1v_{i+1}/1 \leq i \leq 3\} \cup \{v_3v_5\} \cup \{v_{i+1}v_6\ /1 \leq i \leq 3\}$

Let $X = \{1,2,3\}$

Define $f: V(G) \to 2^X$ where $X = \{1,2,3\}$ by

$f(v_1) = \{2\}$

$f(v_2) = \{1,2\}$

$f(v_3) = \phi$

$f(v_4) = \{1\}$

$f(v_5) = X$

$f(v_6) = \{1,3\}$

Then, $\phi = f(v_3) \subset f(v_4) \subset f(v_6) \subset f(v_5) = X$ and $f(v_1) \subset f(v_2)$

The edge sets $f^*: E(G) \to 2^X - \{\phi\}$ are labeled by $f^*(v_1v_2) = f^*(v_1)\Delta f^*(v_2)$

$= \{X, \{1\}, \{2\}, \{3\}, \{1,2\}, \{2,3\}, \{1,3\}\}$

Therefore, all the edge sets are distinct.

Thus, both $f(V(G))$ and $f^*(E(G)) \cup \{\phi\}$ are topologies on X and the edge set is $2^X - \{\phi\}$

. Hence G is topologically set-graceful graph.

Illustration : 1.15

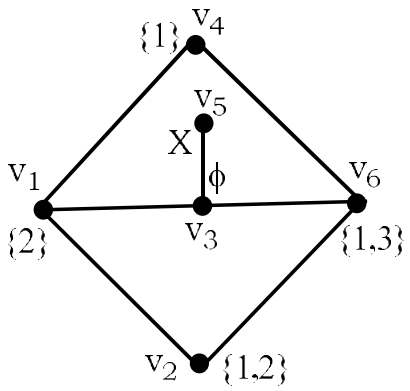

Fig 6: Topologically set-graceful graph

Theorem : 1.16

Let G be a graph obtained by deleting one edge with any vertex of David's star graph, then G is bitopological graph.

Proof :

Let $V(G) = \{v_i / 1 \leq i \leq 4\}$ be the vertices of G.

Let the edge set be $E(G) = \{v_1 v_i / i = 2,3\} \cup \{v_2 v_4\} \cup \{v_4 v_5\}$

Let $X = \{1,2,3,4\}$

Define $f: V(G) \to 2^X$ where $X = \{1,2,3,4\}$ by

$f(v_1) = \phi$

$f(v_2) = \{1,2,3\}$

$f(v_3) = X$

$f(v_4) = \{1\}$

$f(v_5) = \{1,2\}$

Then, $\phi = f(v_1) \subset f(v_4) \subset f(v_5) \subset f(v_2) \subset f(v_3) = X$

The edge sets $f^*: E\ (G) \to 2^X - \{\phi\}$ are labeled by $f^*(v_1v_2) = f^*(v_1)\Delta f^*(v_2)$

$$= \{X, \{2\}, \{2,3\}, \{1,2,3\}\}$$

Therefore, all the edge sets are distinct.

Thus, both $f(V(G))$ and $f^*\big(E(G)\big) \cup \{\phi\}$ are topologies on X.

Hence G is bitopological graph.

Therefore, all the edge sets are distinct.

Thus, both $f(V(G))$ and $f^*\big(E(G)\big) \cup \{\phi\}$ are topologies on X and the edge set is $2^X - \{\phi\}$

Hence G is bitopological graph.

Illustration : 1.17

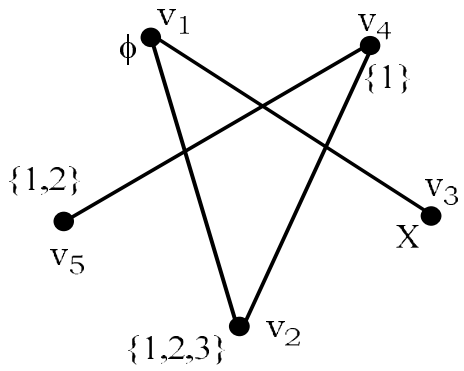

Fig 7: Deleting one edge of David's star graph is bitopological graph.

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A Womanistic Viewpoint of Alice Walker's The Third Life of Grange Copeland

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***Abstract*— Womanism focuses both on the plight and perseverance of 'woman of color' as it stems from the word 'woman'. The word first appeared in In Search of Our Mother's Garden by Alice Walker. The need for this word came from the early feminist movements, led in particular by white middle-class women who supported social reforms for women, as well as those movements that concentrated on problems primarily based on sexual inequality. Walker implements her idea in her first novel The Third Life of Grange Copeland that black women's liberation is not feasible until black women come forward to do a self-analysis and then self-realization to claim them self and be inside and outside the group. Although The Third Life of Grange Copeland is the story of Grange Copeland's title character, it also chronicles black women's desperate, thwarted, and resistant lives.The novel traces the three lives of the protagonist Copeland, or three stages in his life in which the third life is the most significant. Not only in Copeland but also in the woman characters who pass through three generations, the change is seen.Margaret, Mem, and Ruth's attempts and actions are to assert themselves and to ensure that they are in the community and then in society. Self-content is Margaret's attempt at self-declaration. The efforts of Mem are further applied to her household. In the third generation, Ruth is assured of self-realization and declaration from the entire black community, supplied with ample probabilities. This development, while gradual, is the redeeming aspect of the novel by Alice Walker.**

Keywords*— *Feminism, oppression, self-realization, womanism

I. Introduction

Womanism focuses both on the plight and perseverance of 'woman of color' as it stems from the word 'woman'. The word first appeared in In Search of Our Mother's Garden by Alice Walker: Womanist prose to which the author attributes the root of the word to. The black folk phrase of mothers to women's children, "You act womanly," i.e., like a woman... Typically it refers to outrageous, audacious, courageous, or intentional behavior. Wanting to know more than is considered 'healthy' for one and in greater detail. (In search of Our Mother's Garden 11 - 12)

The need for this word came from the early feminist movements, led in particular by white middle-class women who supported social reforms for women, as well as those movements that concentrated on problems primarily based on sexual inequality. Around the same time, the oppression of black women, whose plight was completely different from the experience of white women, was overlooked. The Black Woman or the Colored Woman.

Women of color, excluded and alienated from feminist thought, demanded that feminism must extend its scope to include the overlooked subjectivities in its study of women to concentrate on the question of difference, especially concerning race and class. Besides, as Patricia Collins said, "feminism as a movement that, at best, is dedicated exclusively to women and, at worst, to attacking black men."

II. Woman of Color

Walker notes that a womanist is a black feminist or feminist of color, insisting on introducing new demands and experiences into feminism as an African-American writer. She also notes that rescuing black women from the negative and misleading perceptions that conceal their true identity in American society is the focus of womanism. She emphasizes the power and potential of the black woman because she feels that a black woman's perseverance is derived from her experience, unlike a white woman, and so a 'womanist' is superior to a feminist. As the views of black women were not completely accounted for by feminism, Walker thought it would be important to find other words that could bear the weight of their experience. In one of their interviews, she described the purpose of this term as:

I need an organic word, that comes out of the culture... I don't choose womanism because it is "better" than feminism... I choose it because I prefer the sound, the feel, the fit of it, because I cherish the spirit of the Women (like sojourner) the word calls to mind, and because I share the old ethnic American habit of offering society a new word when the old word it is using fails to describe behaviour and change that only a new word can help it more fully see". (Ranveer, 147)

Walker implements her idea in her first novel The Third Life of Grange Copeland that black women's liberation is not feasible until black women come forward to do a self-analysis and then self-realization to claim themself and be inside and outside the group. Although The Third Life of Grange Copeland is the story of Grange Copeland's title character, it also chronicles black women's desperate, thwarted, and resistant lives. Walker explores the present relationship between black men and women in this novel and envisions a better future. Walker states her intention to write this novel as follows:

"wanted to explore the relationship between men and women and why" women are always condemned for doing what men do as an expression of their masculinity. Why are women so easily "tramps" and traitors" when men are heroes for engaging in the same activity? Why do women stand for this?". (In Search of our Mothers Garden 48, 49)

The above statement allows us to reflect on the significant female characters like Margaret, Mem, and Ruth in The Third Life of Grange Copeland. In various ways, these three victimized characters try to organize a movement to assert their 'self' and to get a meaningful place in their culture, then society.

III. Desperation of Black Women

The novel traces the three lives of the protagonist Copeland, or three stages in his life in which the third life is the most significant. The first step includes Grange Copeland, his beautiful young wife, and their son Brownfield, the stereotype sharecropper. Grange's first life was characterized by economic despair and psychological depression. He escapes from slavery and debt in the second level, pursuing the course of thousands of his predecessors, and goes to the illusionary North where his encounters are much bitter than his previous life. He returns to the south, old, responsible, and mature. Copeland's third life is a regression of his past deeds and a compensation for the previous two lives.

Not only in Copeland but also in the woman characters who pass through three generations, the change is seen. The oldest of the three is Margaret, the most illiterate and submissive. Grange,

dehumanized and brutalized by his oppressors, utterly discards his wife and son in exchange. He surrenders himself to the hands of Josie, his former lover, and prostitute, to console his wounded soul. A continuous loop is the life of the Copelands. They engage in quarrel for the entire week and Grange cleans himself on Saturdays, dresses well and walks out to his lover's inn, drinks, has sex and returns home, beats his wife and gets up with a hangover the next morning, and finds himself lying on his vomit. Copeland becomes morose out of despair. In the beginning, Margaret is conscious of the unfaithfulness of her husband, consoles herself by keeping herself clean, and awaits visitors who never arrive. Later, saddened by the rejection of her husband, she takes the same direction as her husband. Since her alternatives for diversions are so tiny. Margaret's condition is noted by Winchell as follows:

Margaret is one of the Women Walker describes as suspended. "Suspended in time in history when the options for Black Women were severely limited (Who) either kill themselves or ....are used up by the man, or by the children, or by whatever, the pressures against them. (Alice Walker 46)

The long waiting period ends when Margaret finally decides to pursue the direction of her husband. Her adultery is not disloyalty in the case of Margaret, it is a kind of self-assertion, asserting her being in the family. Her new life is with "New painted good looks and new fragrance of beds, of store-bought perfume and join" as noted by her son, Brownfield. (Copeland 60). Margaret is compelled to commit adultery because she only has two choices: death or prostitution. Margaret is relegated to prostitution as a rebellion against her husband, being uneducated and brought up in the deep, rural south where adultery is not a crime. She gives birth to a light-skinned son as a result of her life of debauchery, seemingly fathered by a white man. Unable to digest the truth, the relationship between his wife and his adversary, a white man, is permanently abandoned by Grange and disappears into the North. The effort by Margaret to turn the attention of her husband towards her is unsuccessful. She commits suicide after recognizing her mistake and experiencing the meaninglessness of her life without a partner. Winchell reflects on Margaret's attempt in her essay as follows: If the attempt of Margaret at self-realization is unconscious. It is inefficient, too. She has not achieved a degree of independence from Grange that would encourage her to feel that without him she will live.

As a redeemer, Mem, Josie's nephew, appears and rescues him from Josie. Brownfield is taught and perfected by the cherry brown, lean, trained Mem, and eventually marries him. Sadly, Brownfield chooses sharecropping as his job and unmistakably becomes his father's successor. Mem's life starts with a positive note and gets worse than her mother-in-law. Brownfield accuses his wife of refusing to perform his duties. Mem slowly loses her vitality because of poverty and soon becomes disgusting. Brownfield, suffering from complexity, is incredibly pleased with Mem's warped appearance.

But Mem, mentally warped, has not lost her mental power. Mem also makes a short, brave attempt to claim her husband, marginally better than Margaret. When her kids are refused education and left to hunger, her stamina comes to an end. Unlike Margaret who chose death, Mem refuses and takes care of the family by choosing a job, with trust gained through education. She wants to give her children a good education, a decent shelter, and good manners as an educated and cultured mother. As a

code of ethics, she also mentions ten commandments, makes Brownfield surrender, threatening him with a gun pointed at his head. The difference between the resistance of Margaret and Mem is important to remember. With the aid of time to act freely, Walker consciously creates more room for Mem and shows the possibilities of emancipation by degrees. Deprived of social and economic freedom, the efforts of Margaret rely only on the assertion that she is at least in the family. Thus, the stereotype of her generation is Margaret. The difficult efforts of Mem to change the current environment of the group of sharecroppers reflect the shift in time and a kind of maturation in the souls of the immediate generation. Mem's resistance is not just for her sake, it is also for her family's welfare. The resistance of Mem, Klaus Ensleen points out as, "Mem inadvertently discovers the constructive will to resist in herself, fanning the last embers of her vitality" (Afro - American Novel Since 1960)

IV. Envisaged Women

Her inability to grasp the essence of black people is a flaw in Mem's endeavor. Therefore, by a forced pregnancy that weakens her body, she is defeated by male forces. She rises from the burden like a phoenix and gives birth to Ruth. In a way, her third daughter, Ruth, is a true Pheonix, represented by the new power and a sign of the future envisaged. Mem's effort is valiant, though, and eventually, her soul is rubbed off from the picture. When Brownfield sees her getting out of a white man's car, he is instantly reminded of his mother getting out of his white oppressor's car, and Brownfield shoots her down without hesitation.

By making a change in narration, Walker makes Mem's death important. The death of Mem is narrated by Ruth. Ruth, as a witness, sees her mother as a faithful, trustworthy, and genuinely emancipated woman. The reminiscence of her valiant self-assertion, which has deep roots in the mind of Ruth, is left behind by Mem. Following the death of Mem, Ruth was taken over by her grandfather, Copeland. With the murder of Mem, Walker may have stopped the book, but as described in the title, The Third Life of Grange Copeland only gains importance with Ruth. She isn't in his third life, but she's in his third life. Walker wants Ruth to have her mother and grandfather's legacy. In the north returns to the south, Copeland endured bitter encounters as a matured, resurrected, and mellowing old man. A significant criterion for soul maturation is the recognition of irresponsibility.

Ruth is a product of her history, but a child of the future as well. "Winchell calls Ruth "Ruth, the precursor of late Walker women who have a chance to conquer violence and oppression to survive "whole" (Alice Walker, 52). Ruth goes to live with her Grange and Josie with her mother dead and her father in jail. Grange owns a farm with the aid of Josie and marries after his return from the north. Later, for Ruth's sake, he again abandons his wife and wholeheartedly devotes his remaining life to Ruth. He educates her, understanding the principles of education, to face the antagonistic white world as an important tool. For her, he would become everything.

With the caution of bigotry, he builds a wall around her. The rise of the Civil Rights Movement, however, changed Copeland's mindset. The moral courage and individual content of Ruth, which are the elements of resistance, are discovered in an event. She is surprised by a racist school book in which a nigger has been written by his fellow student to

describe Africa. She confronts her instructor and the class storms out. It is a strong proof of her moral strength that is vital to her survival. Ruth stubbornly refuses to go with him when Brownfield tries to take her under his authority, demanding the rights of a father. Grange, the man who has learned his duty, however, demands the same from his son in later years. Disappointed by his son's atrocity, Grange eventually shoots him down, and he is also killed as a result of his murder; leaving his granddaughter alone, hoping that Ruth will maintain his and his mother's legacy. According to Winchell:

Ruth is going to live in a changing world, changed by the absence of her grandfather, who on the last day of his life still looks to his granddaughter like "Ruth's idea of God", but changed as well by people like civil rights workers, who believe that working for the future is more important than assigning blame for past injustices. (Alice Walker 55)

V. Conclusion

Margaret, Mem, and Ruth's attempts and actions are to assert themselves and to ensure that they are in the community and then in society. Self-content is Margaret's attempt at self-declaration. The efforts of Mem are further applied to her household. In the third generation, Ruth is assured of self-realization and declaration from the entire black community, supplied with ample probabilities. This development, while gradual, is the redeeming aspect of the novel by Alice Walker.

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A Postcolonial Perspective of Margaret Laurence's This Side Jordan

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***Abstract*— Colonialism has been encountered by the majority of people living in the world today, and the literature created in different parts of the world and challenges the Eurocentric conceptions of culture are characterized by multiplicity, variety, diversity, and richness, Canadian literature, one of those many works of literature, relates its colonial past and way of thinking and feeling so profoundly rooted in its psyche, diversity and wealth. In the light of postcolonialism, the paper aims to include an in-depth study of Margaret Laurence's African literature. Her African novel This Side Jordan, written in this light, set in the Gold Coast in the 1950s, illuminates a specific time in African history and expresses an insight gained from contemplating its colonial past. The white people look down with scorn and disdain on the Africans. Gold Coast is in the process of Africanization, i.e. Europeans are being replaced by Africans everywhere and these white employers feel that Africans lack administrative capacity A white lady writing about African colonial encounters, her novel This Side Jordan exhibits her untroubled or serene double-consciousness. Besides, the novel depicts, together with their repressive mind-set, the troubles and turmoil of the English colonizers too. Laurence differs from other colonial authors in this and appears to be a human being who transcends the walls of hatred and bigotry.**

Keywords*— *colonizers, dominance, eurocentric, postcolonialism, transcends

I. Introduction

In the literature of recent days, Postcolonialism is a lively, widely used, and often-heard term. The word 'Postcolonial' applies to "all the culture affected by the imperial process from the moment of colonization to the present day" (Ashcroft 2). From the experience of colonialism, postcolonial literature has emerged and is created by subjects in the sense of colonial dominance. Colonialism has been encountered by the majority of people living in the world today, and the literature created in different parts of the world and challenges the Eurocentric conceptions of culture are characterized by multiplicity, variety, diversity, and richness, Canadian literature, one of those many works of literature, relates its colonial past and way of thinking and feeling so profoundly rooted in its psyche, diversity and wealth. In the light of postcolonialism, the paper aims to include an in-depth study of Margaret Laurence's African literature.

As a feminist author of authority, as a writer of Manawaka novels, Margaret Laurence (1926-1987), one of Canada's most admired writers, and also one of the greatest novelists of the twentieth century, has concentrated primarily on exploring various ages and facets of womanhood and coping with issues that most women face at one time or another. Her African fiction that "rooted her within a tradition of novel-writing" (Keith,

W.J. 74) has always been ignored but has recently acquired a new significance "as Canadians begin to come to terms with the postcolonial condition" (Riegel, Introduction xiv). This Side

Jordan (1960) shows the enduring influence created on her psyche by Africa, as a colonized country. The book, written after Laurence settled in Vancouver in Canada in 1957, won the 1961 Beta Sigma Phi award from a Canadian writer for the best first novel.

Laurence lived in Somaliland (now Somalia) in Gold Coast (now Ghana) for one year and almost five years - both the African nations were then British colonies and her stay allowed Laurence to witness and appreciate first-hand the realities of colonialism and colonial experience that Canada had before its Confederation of 1867. She found herself cast in the part of the colonizing master race in Africa, to her great discomfort. Nevertheless, this role-reversal, from a colonial in Canada to a colonizer in Africa, gave her "the double-perspective of re-viewing the effects of colonialism on a people as both an assumed colonizer and an actual colonial" (Salat 31-32). Her African novel This Side Jordan, written in this light, set in the Gold Coast in the 1950s, illuminates a specific time in African history and expresses an insight gained from contemplating its colonial past.

Two main characters, Johnnie Kestoe, the white Textile Firm Boss, and Nathaniel Amegbe, the black schoolmaster, are the subject of Laurence's This Side Jordan. A group of white characters — Major Bedford Cunningham and his wife Helen, James Thayer, and his wife Cora — helped Johnnie Kestoe. The African community consists of Victor Edusei, Charity, Lamptey, Nathaniel's family members, and Aye and Jacob Mensah, his wife, who owns the Future Academy where Nathaniel teaches. This indicates a strong demarcation between the white British characters (the colonizers) and the Black African characters in the fictional world (the colonized). In alternative chapters, each group makes its appearance and determines the distinction between the two groups. The novel traces in its conventional plot the fortunes of Johnnie Kestoe and Nathaniel Amegbe, both constantly but uncomfortably meeting each other. But in the end, in terms of fictional structure, they are brought together as their wives give birth in the same hospital at the same moment.

II. Colonizing Culture

The novel examines the influence of colonizing culture on the colonized as part of the postcolonial narrative. In Black Poets and Prophets, Frantz Fanon notes that colonizing culture aims at "deculturation through the process of systematic elimination of a raison d'etre of the colonized" (Salat 39). It dislocates the connections of the colonized culture with its inherited cultural and mythical past and fractures them. In the city of Accra, lives Nathaniel, the Mission trained son of the village Chiefs Drummer, belonging to the traditional Ashanti community. Nathaniel refuses when Uncle Adjei Boateng forces him to leave Accra to become a clerk to the Ashanti culture leader. Adjei accuses him "you have forgotten your land. You live in the city of strangers, and your god is the god of strangers, and strange speech in your mouth and you have no home" (This Side Jordan112). In his own country, Nathaniel becomes a rootless and alienated exile.

Nathaniel, however, concerning his identity emerging from the colonial mentality, is ambivalent and contradictory. His mission of education and migration to the city creates a contradiction between his abandoned hereditary socio-cultural and religious practices and the alien beliefs and values he has earned. In a metaphorical language, Nathaniel exposes his plight or rather the plight of the colonized in general:

We used to come out into the road the white men had forced through the forest, the great road. And

there was excitement! It seemed then that the world walked on that road. It seemed the world must be passing by on that road. I always wanted to know where that great road went and what was at the other end. (114)

Caught in the pit of culture-clash, belonging neither to traditional Ashanti culture nor to Western culture that is technologically superior, Nathaniel expresses a collective feeling: "I belong between yesterday and today" and ". that is nowhere" (115).

Through figures from African legend presented in ritual incantation, Laurence transmits Nathaniel's confusion of spirit and conflict. He dreams of his soul battling alone with the devil after midnight in his sleep, and the gods of the Ashanti culture do not come to his rescue and seem dead. “Sometimes I am known as Dr. Paludrine, sometimes Mr. Telephone, Q.C, or simply Sasabonsam Happy Boy” (83). He seeks Jesus' protection from the devil. On a milk-white horse, arrayed like the King of Ashanti, Jesus himself was riding. The conflict generates a feeling of inferiority, vulnerability, and inadequacy in Nathaniel's wrecked mind, leaving him powerless and isolated.

III. Pangs of Exile and Isolation

Not just Nathaniel, a group of whites who work in a British export company on the Gold Coast, the members of the White Empire live "a double exile" as they are "men who were or have become unfitted for life at home" (The Woodcock 47) Most of them were tragic figures: Bedford Cunningham, a perfect gentleman left in a morass of drunken failure; Johnny Kestoe, a London Irish slum man ready to betray all of his associates for the sake of promotion; and Johnny Kestoe's wife, Miranda, whose efforts to cross the black and white world end in Nathaniel's embarrassment and dishonour. "The exiles of three generations had met here to drink and to mourn the lost island home for which they longed but to which they did not want to return until they are old" (152) they met in the Club to have a drink. Settlers and the colonized alike experience the pangs of exile and isolation in a transforming world and Laurence perceives this to be the generality of the human condition.

Through mistrust, confusion, and hatred for each other, the black-white rivalry in a colonized Africa is brought out well in the book. Johnnie declares freely in the opening chapter of the novel that he does not like Africans. "Nathaniel, equally disgusted, feels hatred running like a fever in his blood, You Whitemen” (8). It is only at the end that the pressure of hate is released when Nathaniel physically assaults Johnnie and says, "Get out, you, you're going to go. Who's going to want you? Go 'you way” (240).

The white people look down with scorn and disdain on the Africans. Gold Coast is in the process of Africanization, i.e. Europeans are being replaced by Africans everywhere and these white employers feel that Africans lack administrative capacity- "Trustworthy, efficient men who can handle an administrative type of job - they just don't exist" (98) and again the Africans can (r) ruin it in a month-corruption - laziness - sheer ignorance"(99). They are sure that the Africans are not ready for freedom, and that, at least in their Textile Firm, they want to avoid Africanization. In reality, they do not want to lose their top spot in Africa - "here he had walked on Mount Olympus. He had dispensed justice as he saw it - rewards for the compliant one, punishments for the unruly" (195). They are resisting it because they knew well that if they had remained in England, they would have lived their lives only as kings. African

women are being victimized by their desire. When he knows the bitch Emerald to be a woman who doesn't even know Pidgin English and one who is, Johnnie feels betrayed and misled.

IV. Dominance of Whites

As a black representative, Nathaniel also expresses his deep disdain for the white man. He knows his hatred as fire and if it could, it would destroy him. But he was unable to make any agreement because he thought "our land - overnight, it seemed, became not ours" (228). The white men came to Africa to enslave the Africans, to take away the gold, the gems, the wood, and also their god, and to kill the graves, faith, culture, and souls of their kings. Contemplates with Nathaniel. "In return for our lives, they were willing to share their god with us, what generosity" (227).

The glorification of indigenous culture is part of all postcolonial literature and African culture is eulogized in this novel. Nathaniel says, "There must be pride and roots, my people" in one of his interior monologues (25). He believes deeply in the glory of ancient Africa, as a teacher of history and a teacher of African civilizations. "Ghana, rise again, your people proud, and without shame. Rise to be a glory to your people"(26). When he ceases despising or fearing his inherited history and embraces it, he is released from his uncertainty about his identity. "My home is here, here, here my home is here at last". My home is here, here, my home is here at last (296). The new roots can grow straight, but they have grown too strong to be cut off, "The new roots may grow straight, but they have grown too strong to be cut away" (296). Laurence equates her with Africa and Johnnie with England in the last scene in which Johnnie Kestoe rapes Emerald, to intentionally strengthen her didactic and polemical interest, "She was a continent and he an invader, wanting both to possess and to destroy" (249).

At the end of the book, this black-white dispute seems to be resolved when a girl is born to Miranda and a boy to Aya, almost at the same time Nathaniel cleanses his soul from his hate and dedicates his son to Africa - on the other hand, creating a new generation of independent Africans and Johnnie too, tones down his bigotry against the Africans and is willing to train Africans like Victor Edusei in his firm. Nathaniel has regained the trust of his worker, Jacob Abraham, and a new opportunity and new land with a new name are offered. "This was the prevailing spirit, not only of myself but of Africa at that time. This was the prevailing spirit, not only of myself but of Africa at the time" (salat 38).

V. Conclusion

Laurence, as she said in Prophet's Camel Bell. "I believed that the overwhelming majority of Englishmen in colonies could properly be classified as imperialists and my feeling against imperialism was very simple - I was against it" (16) is against imperialism. A white lady writing about African colonial encounters, her novel This Side Jordan exhibits her untroubled or serene double-consciousness. Besides, the novel depicts, together with their repressive mindset, the troubles and turmoil of the English colonizers too. Laurence differs from other colonial authors in this and appears to be a human being who transcends the walls of hatred and bigotry.

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A DEEP SURVEY ON IRIS RECOGNITION METHODS

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ABSTRACT

Identifying or verifying one's identity using biometrics is attracting considerable attention in these years. Among all the biometrics authentication methods, iris recognition appears to be a very attracting method because of its high recognition rate. Human Iris system is the main biometric security system when securing device-accessing and software accessing. It authenticates the user as the authorized person. Iris recognition is practically being a challenging task because of the intensity level variation and the tedious iris-matching process. In the literature, many methods are published to solve this problem. Computer Aided Design (CAD) mechanism analyzes the performance of the matching system. This paper carries the survey work on ten papers belonging to the automatic iris recognition system. This comparative work is performed by standard analytic measures. Here in, the performance level is assessed by the merits and demerits of the iris recognition methods. The preprocessing method, features and matching methods are analyzed in this work.

Keywords

Bio-metrics, Security, Iris recognition, Neural network.

1. INTRODUCTION

IRIS recognition has emerged as one of the most promising technologies to provide reliable human identification. A high grade recognition accuracy is achieved by existing state-of-the-art iris recognition algorithms by acquiring images via near infrared (NIR) [33][34][35]. This characteristic make the iris recognition as one of the most popular modalities for the very-large scale applications, such as in Aadhar project [36] to identify millions of citizens, or in border-crossing control system in UAE [37]. The modern papers are also support iris recognition from distance. These peculiar characteristics shape the iris recognition to use in the forensic and high security surveillance applications [37][38][39].

Security is the crucial issue on authorizing the user for accessing devices and software. Nowadays people are used to secure the database with the help of biometric analysis. The confidentiality is guaranteed by this kind of applications. Due to the easy access most of the application and organization support and evaluate the biometric application with simple usage functional. The recognition model is the tedious architecture to verify the original data from the database [1][3][4].

Normally the input of the iris scanned and the process of matching taken place by some steps. Most common methodology is to provide simple application scenarios. The steps involve are image acquisition, segmentation and normalization, classification and finally recognition part [2][5][6][7][8][9]. To recognize the iris normal methodology are used to process and support mechanism are used. These mechanisms sometimes act tedious even though proper scaling is given [10][11][12][13][14]. The methodology used to process by analyzing the input sequence with similar steps [15][16][17][18][19][20]. To avoid those complexities several methodologies has been implemented to approach the application with ease of support [21][22][23][24][25].

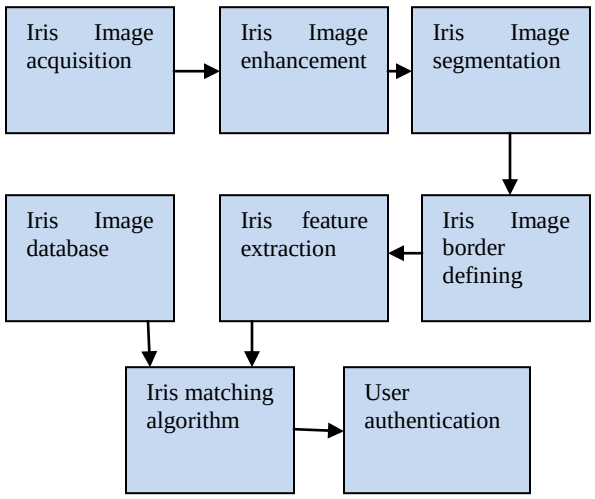

Fig.1. General block diagram of iris recognition.

Fig.2. Sample iris images form Casia dataset.

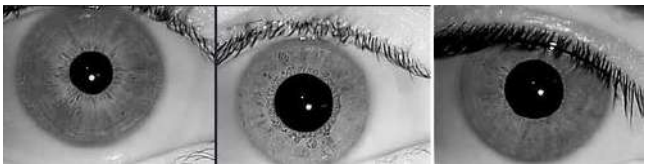

Fig.3. Sample iris images from IIT Delhi dataset.

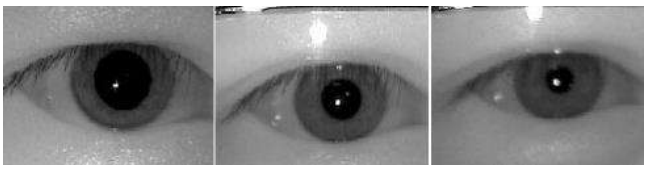

Fig.4. Sample images form Institution of Automation dataset.

The Fig.1 reveals the general block diagram of the iris recognition system. The Fig.2 represents the CASIA dataset sample images. The Fig.3 shows the sample images from IIT Delhi iris dataset. The Fig.4 presents the samples of Institute of Automation dataset.

2. SURVEY METHOD

This paper makes a survey with the following six recent papers in Iris recognition. They are,

- Iris Recognition using Edge Matching (IR-EM) [41]
- Iris Recognition using Stabilized Iris Encoding (IR-SIE) [32]
- Iris Recognition using Matching Score(IR-MS) [26]
- Iris Recognition using Swarm Optimization (IR-SO) [27]
- Iris Recognition using CNN Feature (IR-CNN) [29]
- Iris Recognition using Neural Network(IR-NN) [28]
- Iris Recognition using CPU based System (IR-CPU) [30]
- Iris Recognition using Segmentation support (IR-SS) [31].
- Iris Recognition using Capsule Network (IR-CN) [42]
- Iris Recognition using Gradientface based Normalization (IR-GFN) [43].

2.1. Iris Recognition using Stabilized Iris Encoding (IR-EM)

A non-orthogonal view iris recognition system is presented by the author Chia-Te Chou et al. This method consists of a segmentation module, an iris feature extraction module and a classification module. This method develops a dual-charge-coupled device camera to capture four-spectral (red, green, blue, and near infrared) iris images. This spectral iris images contain meaningful information for simplifying the iris segmentation task.

The core segmentation module is an intelligent random sample consensus method. This segmentation method robustly detects iris boundaries in a four-spectral iris image. A circle rectification method is adapted to mitigate the off-axis iris distortion. This helps to match iris images acquired at different off-axis angles.

The elliptical pupillary boundary assists to compute the rectification parameters. The multiscale step/ridge edge-type map is generated using a iris descriptor. The Gaussian and the Laplacian of Gaussian filters are the key matters to extract the edge-type maps. The iris matching is done by edge-type matching. This matching model works based on the concept of classifier ensembles. The standard metrics used in this approach are iris recognition accuracy and equal error rate. The iris matching accuracy obtained by this method is 80.91%.

2.2. Iris Recognition using Stabilized Iris Encoding (IR-SIE)

This method presents a iris recognition system from the distantly acquired face or eye images [32]. The inputs are acquired using both NIR and visible imaging, under less constrained environments. This type of input needs encoded iris features and knowledge about fragile bits. Herein, two main modules are developed and they are:

- Local consistency of iris bit
- Weight map.

This method efficiently handles the fragile bits while simultaneously rewarding more consistent bits.

Zernike moment based phase encoding of iris features shapes the characterization of local iris features. To maintain the local region variations, the Zernike moments-based phase features are extracted. These features are absorbed from the partially overlapping regions. The global and localized iris features are computed using a joint strategy concept. The name of the core method of this approach is robustly encode iris features using phase information of the Zernike moments.

This method is tested by three benchmark databases such as UBIRIS.v2, FRGC and CASIA.v4-distance. This method accomplishes a better accuracy on iris recognition. This approach is evaluated using the standard metric like iris matching accuracy and Equal error rate. The irsi recognition accuracy obtained by this method is 81%.

2.3. Iris Recognition using Matching score method (IR-SS)

Fancourt et al. [26] report an Iris recognition method which uses non-polarity model. This method contains matching score model. But the scoring value is used to process for the supporting vector through which the additional function is used to be recognized. The prior section established that increasing the curvature of the iris surfaces in a comparison universally decreases the matching scores. While minor effects are present in frontal iris images, the effects are much greater in non-frontal images. Secondly and surprisingly, the existence of the refracting cornea does not universally degrade matching scores. For non-planar irises, the presence of the cornea actually improves matching performance in every case except for frontal images.

The merit of this method is error free fast computation. The demerit is to be considered is it does not support for non-planar iris method. This method provides 83.67% accuracy rate for detection. The database used in this research is LG4000. The feature cover in this survey is Intensity of Cornea.

2.4 Iris Recognition using Swarm optimization (IR-SO)

The author sathish rapaka et al. [27] describes the sequence of performing a simple wavelength is divided into two phases: the stages of training and recognition. In the training stage, wavelet is used modulus maxima to locate the iris Region Of Interest (ROI) as the preprocessing step. Secondly, the statistic features of the ROI are extracted by multi-scale Gabor filter, and at last it apply Gabor Analysis (GA) to select features respectively to form feature space, and save as template library.

In the recognition stage, the test samples also are operated by preprocessing and feature extracting, and then are recognized by SVM one-to-one. The training sample includes the iris localization, Feature Extraction, Feature selection that is trained and stored in the database.

The proposed method is validated on the CASIA v3 Interval and UBIRIS v1 database. The proposed method is robust for non-ideal iris images and achieves a lower EER of 0.6%. The merit is accurate model for segmentation. Demerits are not supportive for noise based input. The feature based upon identical Iris Model for localization.

2.5. Iris Recognition using CNN Feature (IR-CNN)

Neda Admati [29] proposed a survey on two stages Iris based segmentation model. The methodology introduced by the scientist is declare to design a robust architecture for designing the paradigm through which it should be designed and produce the application framework. In the first stage, the rough iris boundary is obtained from the input image to define ROI for next stage. The resultant image from Stage 1 includes parts of the upper and lower eyelids and other areas, such as skin, eyelashes, and sclera.

The results of testing on the CASIA-iris V3 database and UCI machine learning repository databases. Merits are the methodology increase generalization performance. Demerits are there is no proper classifier in the above model. The performance evaluation based upon 88.24%.

2.6. Iris Recognition using Neural Network (IR-NN)

Kien Nguyen [28] proposed the survey of Iris images are taken by CASIA iris image database. The feature extraction is done by using wavelet transform. Data sets will be prepared using features obtained by the feature extraction technique. These obtained features are fed to the ANN for the classification.

The images from CASIA iris image database are taken. It contains 7 images of 108 persons of one eye at two sessions. They are of 320 x 280 bitmap images. The iris recognition system consists of image acquisition, iris segmentation, normalization, feature extraction and matching. A high quality image must be selected for iris recognition. In iris pre-processing, the iris is detected and extracted from an eye image and normalized. At first stage, the training of recognition system is carried out using Gray scale values of iris images [28]. Neural network is trained with all iris images. After training neural network performance validation is done.

2.7 Iris Recognition using CPU based System (IR-CPU)

The first and most popular iris recognition algorithm was introduced by pioneer Dr. J. Daugman [30]. There are also many other proposed methods to perform iris recognition. Ives et al. have developed an alternate iris recognition algorithm, referred to as the Ridge Energy Direction (RED) algorithm that will be the focus of this work. The RED algorithm has been shown to have comparable performance to state-of-the-art algorithms that have been previously published. In particular, the three parts of the RED algorithm have been fine-tuned to produce highly accurate iris recognition achieving 99.999% and 99.603% accuracy on the Bath2000 [28] and CASIA I [29] databases, respectively. In comparison, algorithm resulted in 99.526% and 99.630% accuracy on the same Bath2000 and CASIA I databases, respectively.

2.8 Iris Recognition using Segmentation support (IR-SS)

A new segmentation method for noisy frontal view iris images which is captured with minimum cooperation based on the Fourier spectral density [31] has been proposed in this paper. This approach computes the Fourier spectral density for each pixel with the aid of its neighborhood and then executes row-wise adaptive thresholding, and thus results in a binary image which gives the iris region in a fairly accurate manner. This segmentation method can also be used in order to calculate limbic as well as the pupil boundaries. This is having the advantage that, this has lower computations as compared to that of [26], [27]. The drawback is that, limbic boundary detection should be improved. The performance rate should be increased by 70%.

2.9 Iris Recognition using Capsule Network (IR-CN)

The author Tianming Zhao et al. presents an Iris recognition technique for biometric recognition [42]. This method uses deep learning method because of its' unique representations viz. automatic learning, high accuracy, and strong generalization ability. The deep convolutional neural network (CNN) is the core method which is used in major case of biometric verification. The drawback of it is the poor anti-noise capacity in image classification and is easily affected by slight disturbances. CNN also requires a large number of training samples. The modern development of capsule network has high recognition accuracy in classification modules.

This work uses a deep learning method based on the capsule network architecture for iris recognition. Herein, the structure detail of the network is adjusted to grant a high grade routing algorithm. This routing method works based on the dynamic routing between two capsule layers, so that better iris recognition can be achieved. This method supports limited sample based learning, which is the advantage of this method. This is possible because of Migration learning.

Three predefined trained models namely VGG16, InceptionV3, and ResNet50 are built-up in this work. This method achieves 89% iris recognition accuracy. These networks are branched into a series of sub-network structures. This division is performed according to the number of their major constituent blocks. They contribute as the convolutional part which absorbs primary features.

The test datasets used here are JluIrisV3.1, JluIrisV4, and CASIA-V4 Lamp. This work is also tested in simulated strong and weak light environments. The advantage of this network is the stableness. Another advantage is that it can also learn part-whole relationships. This method is more robust one in iris recognition methods. The demerit is the high cost in hardware conversion.

2.10 Iris Recognition using Integrated Gradientface-Based Normalization (IR-GFN)

The author Maulisa Oktiana et al. illustrates a Cross-spectral iris recognition scheme [43]. The Cross-spectral iris recognition means the capacity of the system to identify the iris images acquired in different electromagnetic spectrums. An iris captured in the near-infrared spectrum (NIR) is matched with an iris obtained in the visual light spectrum (VIS) to boost the recognition performance. The challenge of cross-spectral iris recognition is the illumination factor between NIR and VIS images.

This work concatenates the Gradientfaces based normalization technique (GRF) to a standard (conventional) iris recognition method. This phenomenon alleviates the illumination artifact. The Gabor filter and Difference of Gaussian (DoG) filter are merged with the GRF filter to get better result. The texture descriptors viz. Binary statistical image feature (BSIF) and Local binary pattern (LBP) are also merged with this work.

This method is evaluated using the standard metrics such as iris recognition accuracy and EER. The average iris recognition accuracy of this method is 87.9%. This work finalizes that the best cross-spectral iris recognition performance is accomplished when the GRF is integrated with the Gabor filter and the BSIF.

The advantage of this method is the cross-spectral behavior in matching the NIR and VIS imaging. Moreover this is an illumination invariant modal. The demerit of this method is that it is not robust to noisy environment.

2. ANALYSIS AND DISCUSSION

Table 1: Iris recognition Accuracy analysis

Methods name	Recognition Accuracy
IR-EM	80.91%
IR-SIE	81%
IR-MS	83.74%
IR-SO	83.6%
IR-CNN	88.24%
IR-NN	87.16%
IR-CPU	78.36%
IR-SS	76.61%
IR-CN	89%
IR-GFN	87.9%

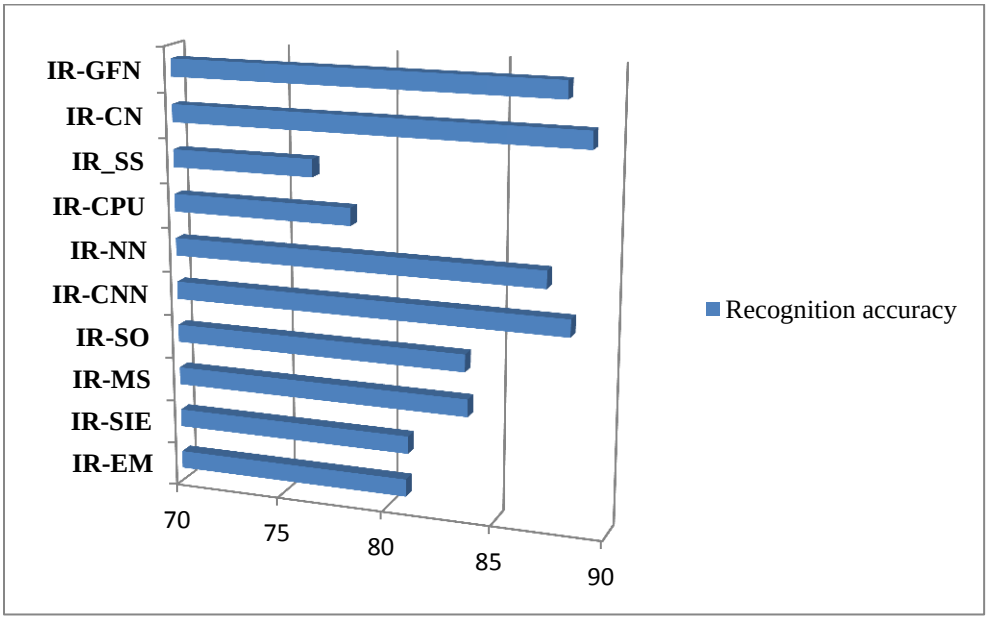

Fig.5. Iris recognition accuracy analysis.

Table 2: Analysis on merits and demerits

Methods	Merit	Demerit
IR-EM	Robust against spoofing	Four cameras are required
IR-SIE	Recognition at distance is possible	Not efficient on less constraint dynamic illuminated images
IR-MS	Error free fast computation	Does not support non-planar Iris Model
IR-SO	Accurate Data	Does not tolerate Noise Input
IR-CNN	Increase Generalization	There is no robust model for classification
IR-NN	Automatic Feature Generated paradigm	Computation complexity is high
IR-CPU	Computational power is high	Does not support for large database
IR-SS	Support large item set with real world approach	Recognition rate is low
IR-CN	For training small samples are enough	Hardware conversion cost is high
IR-GFN	Cross-spectral behavior in matching the NIR and VIS imaging	Not robust to noisy environment

Table 3: Analysis on preprocessing, feature and recognition method

Methods	**Publication**	**Year**	**Pre-processing**	**Features**	**Recognition method**
IR-EM [41]	IEEE	2010	Normalization	Edge type features	Edge type matching method
IR-SIE [32]	IEEE	2014	Reflection detection	Local and global Zernike features	Cross phase matching
IR-MS [26]	IEEE	2018	Iris Tissue Non Polarity	Cornea Intensity	Matching Score
IR-SO [27]	IET	2018	Multilevel Thresholding for Iris	Identical Iris Localization	Swarm Optimization

IR-CNN [29]	IET	2018	Gabor Features	Stability and uniqueness	CNN
IR-NN [28]	IEEE	2017	Gabor Wavelets	Eye Position	NN
IR-CPU[30]	IET	2018	Hamming Distance based comparison	Eye Color	CPU
IR-SS[31]	IEEE	2018	Classical encryption Algorithm	Euclidean distance	SS
IR-CN [42]	IEEE	2019	Localization and Normalization	Intensity values	CNN based Capsule network architecture
IR-GFN [43]	IEEE	2019	GRF	Gradient values	Hamming distance method

The table 1 reveals the iris recognition accuracy. The Fig. 5 illustrates the iris recognition accuracy of the ten methods as graphical chart. The table 2 analyzes the merits and demerits of the ten methods. Table 3 describes the pre-processing method, features and recognition method along with the details of the ten papers.

3. CONCLUSION

This survey is targeted to make a study on iris recognition methods. This paper analyses ten papers on iris recognition methods. This performance analysis can be used to have a better study on the iris-recognition systems. The names of the ten methods used in this paper, are IR-EM, IR-SIE, IR-MS, IR-SO, IR-CNN , IR-NN , IR-CPU, IR-SS, IR-CN and IR-GFN. The IR-CN method provides best recognition accuracy for iris-recognition. The second best method is the IR-CNN method. In most of the papers, the neural network technology and deep learning technology are used. This survey paper can be used as a tool to search better iris- recognition schemes to progress the research of young researchers. The most recent papers in iris recognition are considered for analysis in this research.

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Synthesis, X-ray Single Crystal Structure, Molecular Docking and DFT Computations on *N*-[(1*E*)-1-(2*H*-1,3-Benzodioxol-5-yl)-3-(1*H*-imidazol-1-yl) propylidene]-hydroxylamine: A New Potential Antifungal Agent Precursor

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Abstract: Mycoses are serious health problem, especially in immunocompromised individuals. A new imidazole-bearing compound containing an oxime functionality was synthesized and characterized with different spectroscopic techniques to be used for the preparation of new antifungal agents. The stereochemistry of the oxime double bond was unequivocally determined via the single crystal X-ray technique. The title compound **4**, $C_{13}H_{13}N_3O_3 \cdot C_3H_8O$, crystallizes in the monoclinic space group $P2_1$with a = 9.0963(3) Å, b = 14.7244(6) Å, c = 10.7035(4) Å, β = 94.298 (3)°, V = 1429.57(9) Å^3, Z = 2. The molecules were packed in the crystal structure by eight intermolecular hydrogen bond interactions. A comprehensive spectral analysis of the title molecule **4** has been performed based on the scaled quantum mechanical (SQM) force field obtained by density-functional theory (DFT) calculations. A molecular docking study illustrated the binding mode of the title compound **4** into its target protein. The preliminary antifungal activity of the title compound **4** was determined using a broth microdilution assay.

Keywords: crystal structure; imidazole; benzodioxole; oxime; DFT

1. Introduction

The incidence of systemic fungal infections (mycoses) has increased drastically in recent years, mainly in immunosuppressed or immunocompromised individuals with AIDS, cancer or undergoing organ transplantation [1,2]. Failure of the available antifungal agents to treat fungal infections is primarily due to dramatic increase in resistance to the conventional antifungal drugs leading to morbidity and mortality in patients facing life-threatening fungal infections. In order to overcome

this serious problem, the development of new alternative antifungal drug therapies with improved efficacy, broader activity and favorable safety profile has attracted a great deal of interest [3,4].

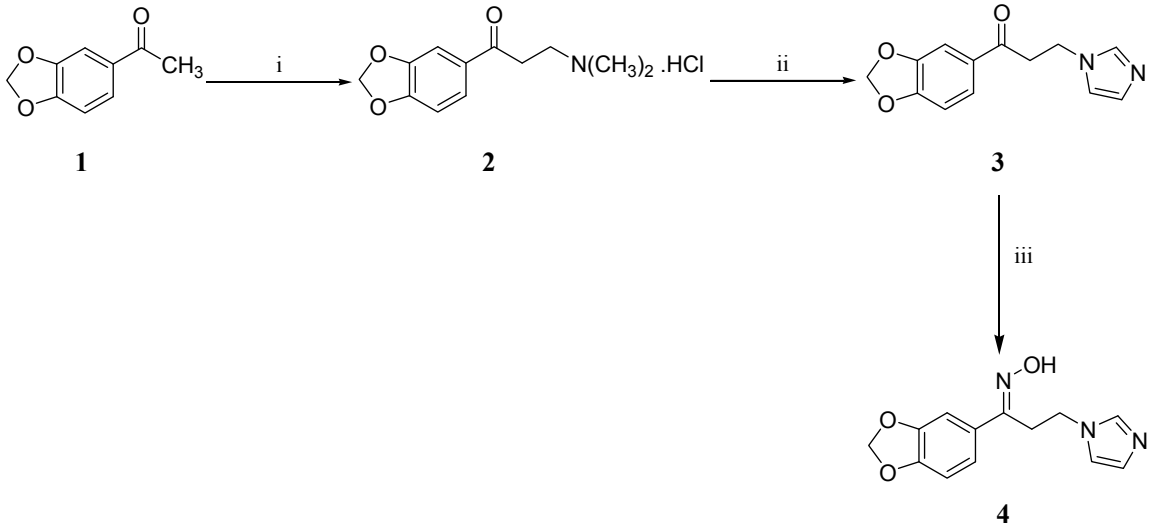
Azole-based compounds having either an imidazole or triazole pharmacophore moiety in their structure, constitute the mainstay of the antifungal chemotherapeutic agents used in the clinic [5,6]. Azoles competitively inhibit cytochrome P450-dependent lanosterol 14α-demethylase (CYP51) resulting in depletion of ergosterol in fungi making them unable to grow in a normal way [7,8]. A screening the literature revealed that most of the available imidazole-bearing antifungal agents have two carbon spacers between the imidazole moiety and an aromatic residue, while few antifungals have a three carbon spacer between the pharmacophore and the aromatic part [9–11].

On the other hand, the benzodioxole moiety is found in a sizable number of biologically active compounds with a wide range of activities [12–16]. The title molecule features both the 1,3-benzodioxole moiety and the imidazole nucleus connecting to each other through a three carbon bridge. Therefore, the current investigation deals with the synthesis, molecular characterization and single crystal X-ray structure of a new oxime derivative, namely *N*-[(1*E*)-1-(2*H*-1,3-benzodioxol-5-yl)-3-(1*H*-imidazol-1-yl)propylidene]hydroxylamine (**4**) to be utilized as a potential precursor for imidazole-bearing antifungal agents. The stereochemistry of the imine functionality in the title molecule **4** was certainly determined via the single crystal X-ray crystallography technique. In addition, density-functional theory (DFT) computations were also performed as a useful tool to investigate the electronic structure and molecular geometry of the title molecule **4**. Molecular docking studies were conducted in order to predict the biological activity of compound **4**.

2. Results and Discussion

2.1. Chemistry

Scheme 1 illustrates the synthetic pathway which was adopted to synthesize the target compound **4**. The synthesis commenced with a Mannich reaction under acidic conditions using the commercially available 1-(2*H*-1,3-benzodioxol-5-yl)ethanone (**1**). Subsequently, the formed Mannich base hydrochloride **2** was smoothly transformed in aqueous solution into the ketone **3** via a nucleophilic substitution reaction using imidazole. The target oxime **4** was ultimately obtained using the standard procedure for oxime formation with hydroxylamine hydrochloride in ethanol in the presence of potassium hydroxide [17].



Scheme 1. Synthesis of the target oxime **4**. *Reagents and conditions*: (i) $HN(CH_3)_2$.HCl, $(CH_2O)_n$, conc. HCl, ethanol, reflux, 2 h; (ii) Imidazole, water, reflux, 5 h; (iii) H_2NOH.HCl, KOH, ethanol, reflux, 18h.

2.2. Crystal Structure of the Title Compound **4**

The configuration of the target compound **4** was confirmed via X-ray crystallography. A suitable single colorless crystal of dimensions, 0.40 × 0.23 × 0.11 mm, was selected for X-ray diffraction analysis. The labeled displacement ellipsoid plot of this molecule is shown in Figure 1. Figure 2 depicts the packing of the molecules in the crystal structure.

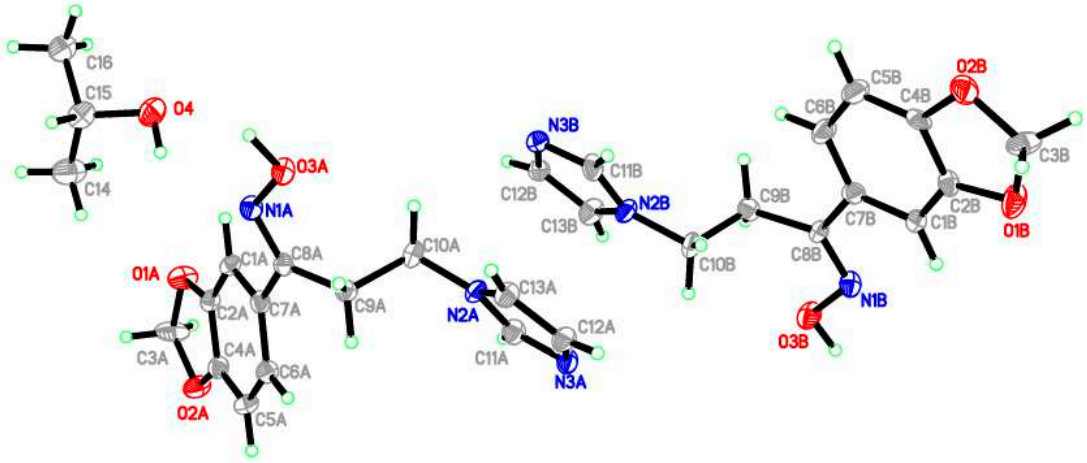


Figure 1. ORTEP diagram of the title compound drawn at 40% ellipsoids for non-hydrogen atoms showing two molecules and one isopropanol molecule as a solvent.

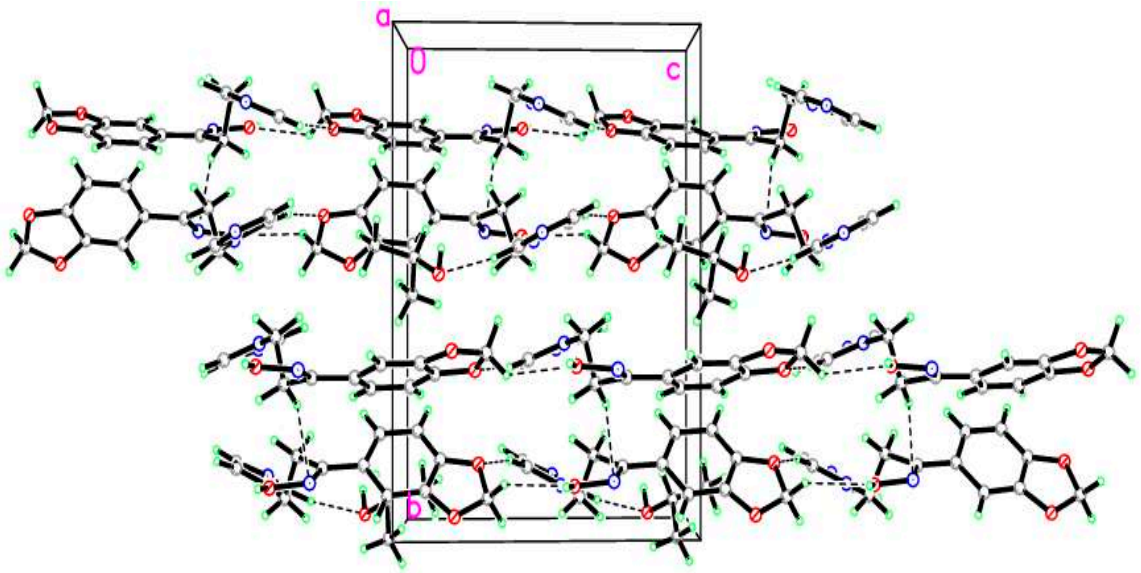


Figure 2. Crystal packing showing intermolecular hydrogen bonds as dashed lines along the *b* and *c* axes.

The single crystal X-ray molecular structure therefore conformed the assigned (*E*)-configuration of the imine group in the target compound. The crystal structure contains two independent molecules with one isopropanol molecule as a solvent in the asymmetric unit. The benzodioxole ring (C1/C2/O1/C3/O2/C4–C7) forms dihedral angles of 44.04(3)° and 20.04(2)° with the imidazole ring (N2/C11/N3/C12/C13) for molecules A and B, respectively. The crystal structure is stabilized by eight hydrogen bonds along the *b* and *c*-axis (Table 1).

Table 1. Hydrogen-bond geometry (Å, °) of the title molecule **4**.

D–H···*A*	*D*–H	H···*A*	*D*···*A*	*D*–H···*A*
O3A–H3OA···N3A [i]	1.00(5)	1.73(5)	2.722(5)	176(6)
O3B–H3OB···N3B [ii]	0.98(6)	1.70(6)	2.672(5)	175(8)
O4–H1O4···N1A	0.91(7)	2.38(7)	3.127(6)	139(6)
C3A–H3AB···O3A [iii]	0.9900	2.4900	3.128(6)	122.00
C3B–H3BB···O3B [iv]	0.9900	2.3600	3.080(6)	129.00
C11A–H11A···O4 [ii]	0.9500	2.2700	3.179(7)	159.00
C13A–H13A···O2A [iv]	0.9500	2.5600	3.459(6)	158.00
C13B–H13B···O2B [iii]	0.9500	2.5200	3.424(6)	160.00
C9B–H9BB···N1A [v]	0.9900	2.5800	3.502(6)	154.00

Symmetry codes: (i) $x-1, y, z$; (ii) $x+1, y, z$; (iii) $x, y, z-1$; (iv) $x, y, z+1$; (v) $-x+1, y+1/2, -z+1$.

2.3. Structural Geometry Analysis

Equilibrium structural geometry of the title molecule **4** has been evaluated by a potential energy surface (PES) scan study. The flexible dihedral angles of C_{11}–C_{12}–N_{13}–C_{14}, C_{11}–C_{10}–C_5–C_4 and C_{11}–C_{10}–N_{18}–O_{19} were scanned from 0° to 360° and their optimum energy was studied to identify stable conformations of the title compound **4**. The global minimum energy is –893.45 and –893.49 Hartree for the conformers of compound **4** in the gas and solution phases, respectively (various conformers of compound **4** are shown in Figure S1). From this PES analysis, we have identified the minimum energy conformer of this molecule which was chosen for the subsequent studies. The optimized structure of the studied compound **4** with atoms numbering is depicted in Figure 3. Optimized bond lengths, bond angles and dihedral angles have been presented in Table 2. The formation of intramolecular hydrogen bonding is exposed by the intramolecular contacts to $H_{22}\cdots N_{18}$ occur with H···O distance of 2.455 Å, which is shorter than the van der Waals separation between the O and H atoms (2.75 Å) [18]. Shortening of the C–N bond lengths N_{13}–C_{14}, N_{13}–C_{17}, N_{16}–C_{17} and N_{16}–C_{15} is typical for double bonds and it is due to resonance interactions. The linear fitting graphs (Figure S2) are drawn to study the correlation between the average experimental values and computed results. Statistical analysis revealed that the results of the computed solvation model are in a good agreement with the average experimental XRD values. Therefore, this method was considered to compute spectral vibrations, natural bond orbital and Frontier orbital energy analyses for the title molecule **4**.

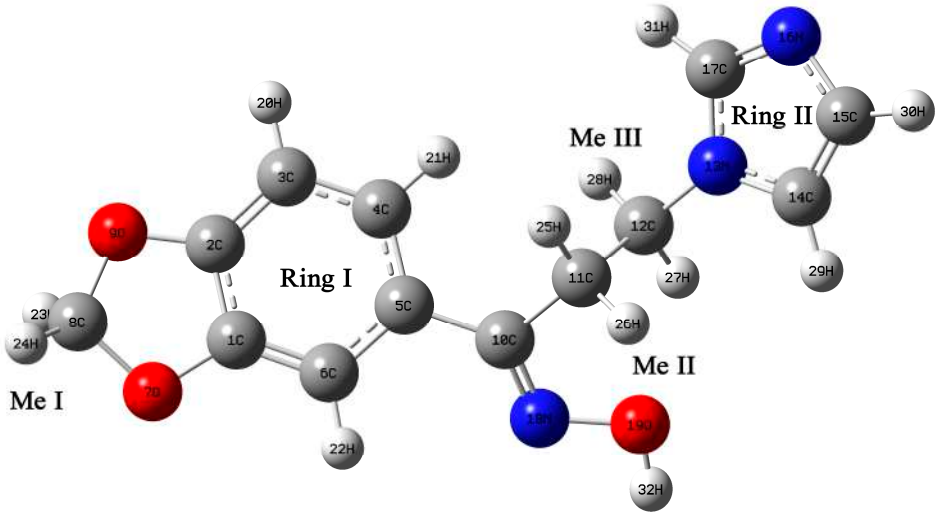


Figure 3. Optimized molecular structure of compound **4**.

Table 2. Optimized structural geometry parameters for compound **4**.

Bond Length (Å)				Bond Angle (°)				Dihedral Angle (°)			
Parameters	Calculated		Exp.	Parameters	Calculated		Exp.	Parameters	Calculated		Exp.
	Gas Phase	Solution Phase			Gas Phase	Solution Phase			Gas Phase	Solution Phase	
C1–C2	1.3947	1.3945	1.379	C1–C2–C3	121.40	121.44	121.60	C1–C2–C3–C4	–0.32	–0.29	1.20
C2–C3	1.3753	1.3764	1.362	C1–C2–O9	109.69	109.67	110.05	C1–C2–C3–H20	179.6	179.72	–179.12
C3–C4	1.4049	1.405	1.395	C1–C6–C5	117.55	117.55	117.05	C1–C2–O9–C8	10.37	10.84	–4.10
C4–C5	1.4001	1.4005	1.394	C1–C6–H22	121.74	121.53	121.62	C1–O7–C8–O9	16.91	17.41	–4.55
C5–C6	1.4181	1.4183	1.411	C1–O7–C8	105.45	105.50	105.41	C1–O7–C8–H23	135.54	135.89	115.78
C6–C1	1.3707	1.3719	1.370	C2–C1–C6	122.44	122.37	122.65	C2–C1–O7–C8	–10.64	–10.95	1.95
C1–O7	1.3743	1.374	1.376	C2–C1–O7	109.26	109.35	109.85	C2–C3–C4–C5	0.39	0.51	–1.00
C2–O9	1.3695	1.3695	1.382	C2–C3–C4	116.93	116.98	117.25	C2–C3–C4–H21	–179.8	–179.96	178.51
C3–H20	1.0821	1.0822	0.950	C2–O9–C8	105.31	105.44	105.57	C2–C1–C6–C5	0.21	0.09	1.80
C4–H21	1.0814	1.0815	0.950	C3–C2–O9	128.89	128.87	128.35	C2–C1–C6–H22	–179.59	179.94	–179.81
C5–C10	1.4846	1.4847	1.482	C2–C3–H20	121.55	121.72	121.41	C3–C4–C5–C6	–0.17	–0.44	1.05
C6–H22	1.0805	1.0808	0.950	C4–C3–H20	121.52	121.30	121.44	C3–C2–C1–O7	–178.62	–178.62	179.60
C8–O7	1.4317	1.4372	1.424	C3–C4–C5	122.28	122.18	121.95	C3–C4–C5–C10	178.73	178.73	177.75
C8–O9	1.4360	1.4401	1.418	C3–C4–H21	117.57	117.55	119.03	C3–C2–O9–C8	–170.62	–170.62	177.8
C8–H23	1.0892	1.0877	0.990	C5–C4–H21	120.15	120.27	119.03	C4–C5–C6–C1	0.13	0.13	2.30
C8–H24	1.0966	1.0943	0.990	C4–C5–C6	119.38	119.48	119.62	C4–C5–C6–H22	–179.72	–179.72	179.78
C10–C11	1.5127	1.5133	1.519	C4–C5–C10	121.01	120.74	121.35	C4–C5–C10–C11	16.37	16.37	19.05
C10–N18	1.2861	1.2868	1.288	C5–C10–C11	121.63	121.26	119.86	C4–C5–C10–N18	–163.31	–163.31	164.15
C11–C12	1.5435	1.5427	1.523	C5–C10–N18	116.24	116.28	117.56	C6–C1–C2–C3	0.002	0.004	–1.60
C11–H25	1.0897	1.0894	0.990	C5–C6–H22	120.71	120.91	121.63	C6–C1–C2–O9	178.67	178.67	178.55
C11–H26	1.0912	1.0915	0.990	C6–C5–C10	119.60	119.78	118.95	C6–C1–O7–C8	170.55	170.55	–178.00
C12–N13	1.4574	1.4620	1.459	C6–C1–O7	128.27	128.27	127.61	C6–C5–C4–H21	–179.7	–179.96	–179.51
C12–H27	1.0902	1.0894	0.990	O7–C8–O9	107.29	106.84	109.45	C6–C5–C10–C11	–164.46	–164.46	159.60
C12–H28	1.0924	1.0911	0.990	O7–C8–H23	109.53	109.56	109.83	C6–C5–C10–N18	15.85	15.85	17.25
N13–C14	1.3815	1.3802	1.370	O7–C8–H24	109.50	109.44	109.81	O7–C1–C2–O9	0.06	0.13	1.40
N13–C17	1.3678	1.3629	1.349	O9–C8–H23	109.38	109.46	109.80	O7–C1–C6–C5	178.42	178.54	179.65
C14–C15	1.3716	1.3713	1.360	O9–C8–H24	109.17	109.18	109.81	O7–C1–C6–H22	–1.73	–1.64	0.59
C14–H29	1.0778	1.0776	0.950	C10–C11–C12	111.71	111.99	111.31	O9–C2–C3–C4	–178.68	–178.61	178.55
C15–N16	1.3751	1.3795	1.377	C10–C11–H25	110.75	110.32	109.42	O9–C2–C3–H20	1.32	1.52	–1.53
C15–H30	1.0790	1.0792	0.950	C10–C11–H26	108.46	108.41	109.42	C10–C5–C6–C1	–179.05	–179.29	–178.45
N16–C17	1.3142	1.3197	1.323	C11–C10–N18	122.12	122.46	122.83	C10–C5–C4–H21	–0.79	–1.78	–1.11
C17–H31	1.0802	1.0798	0.950	C11–C12–N13	112.49	112.05	111.10	C10–C5–C6–H22	1.09	0.90	1.52
N18–O19	1.4067	1.4061	1.409	C12–C11–H25	109.89	109.89	109.42	C5–C4–C3–H20	–179.53	–179.49	178.63
O19–H32	0.9631	0.9647	0.985	C12–C11–H26	108.47	108.56	109.43	C12–N13–C14–C15	176.72	177.67	176.55

The used numbering of atoms is as shown in Figure 3.

2.4. Natural Bond Orbital Analysis

Natural bond orbital (NBO) analysis describes the (hyper)conjugative interactions between donor–acceptor orbitals in order to understand intramolecular charge–transfer phenomenon of the molecular system [19]. Selective donor–acceptor interactions of the oxime **4** are listed along with their occupancy and stabilization energy values in Table 3. The hyperconjugative interactions of $\pi(C_1–C_6)\rightarrow\pi^*(C_2–C_3)$, $\pi(C_1–C_6)\rightarrow\pi^*(C_4–C_5)$, $\pi(C_2–C_3)\rightarrow\pi^*(C_1–C_6)$, $\pi(C_2–C_3)\rightarrow\pi^*(C_4–C_5)$, $\pi(C_4–C_5)\rightarrow\pi^*(C_1–C_6)$, and $\pi(C_4–C_5)\rightarrow\pi^*(C_2–C_3)$ were 20.27, 17.86, 18.94, 19.07, 17.00 and 17.47 kcal/mol, respectively. This could be attributed to the charge delocalization leading to ring resonance effect. The lone pair conjugative interactions of $LP(2)O_7\rightarrow\pi^*(C_1–C_6)$, $LP(2)O_9\rightarrow\pi^*(C_2–C_3)$, $LP1(N_{13})\rightarrow\pi^*(C_{14}–C_{15})$, and $LP1(N_{13})\rightarrow\pi^*(N_{16}–C_{17})$ have stabilization energy of 25.80, 27.07, 30.67, and 46.28 kcal/mol, respectively. The large E(2) values revealed the occurrence of strong electron delocalization over the ring moieties. These interactions were observed as an increase in the electron density (ED) of the C–C antibonding orbital, which weakens the respective bonds. The C_{10}=N_{18} bond length (1.2861 Å) is significantly shorter than the other –CN bonds and the electron density (ED) of this antibonding orbital was decreased to 0.18707, which is an evidence for the rehybridization [20]. More conjugative and hyperconjugative interactions were formed in the lone-pair, C–C and C–C bond orbital overlap which confirms the intramolecular charge-transfer (ICT) causing the stabilization of the molecular structure of the title oxime **4**.

Table 3. Second-order perturbation theory analysis of Fock matrix in natural bond orbital basis for compound **4**.

Donor (*i*)	Occupancy(e)	Acceptor (*j*)	Occupancy(e)	E(2) [a] kcal/mol	E(*j*) – E(*i*) [b] (a.u)	F(*i*,*j*) [c] (a.u)
$\pi(C_1–C_6)$	1.70639	$\pi^*(C_2–C_3)$	0.36424	20.27	0.29	0.070
$\pi(C_1–C_6)$	1.70639	$\pi^*(C_4–C_5)$	0.37847	17.86	0.30	0.067
$\pi(C_2–C_3)$	1.69340	$\pi^*(C_1–C_6)$	0.33036	18.94	0.30	0.068
$\pi(C_2–C_3)$	1.69340	$\pi^*(C_4–C_5)$	0.37847	19.07	0.30	0.069
$\pi(C_4–C_5)$	1.69274	$\pi^*(C_1–C_6)$	0.33036	17.00	0.29	0.063
$\pi(C_4–C_5)$	1.69274	$\pi^*(C_2–C_3)$	0.36424	17.47	0.28	0.063
$\pi(C_4–C_5)$	1.69274	$\pi^*(C_{10}–N_{18})$	0.18707	17.62	0.28	0.064
$\pi(C_{14}–C_{15})$	1.85899	$\pi^*(N_{16}–C_{17})$	0.37926	14.88	0.28	0.061
$LP2(O_7)$	1.85977	$\pi^*(C_1–C_6)$	0.33036	25.80	0.36	0.090
$LP2(O_9)$	1.85270	$\pi^*(C_2–C_3)$	0.36424	27.07	0.35	0.093
$LP1(N_{13})$	1.55644	$\pi^*(C_{14}–C_{15})$	0.30606	30.67	0.29	0.087
$LP1(N_{13})$	1.55644	$\pi^*(N_{16}–C_{17})$	0.37926	46.28	0.28	0.103
$LP1(N_{18})$	1.95533	$\sigma^*(C_{10}–C_{11})$	0.03261	8.70	0.83	0.076
$LP1(O_{19})$	1.99160	$\sigma^*(C_{11}–H_{25})$	0.01285	0.67	1.11	0.024
$LP2(O_{19})$	1.90883	$\pi^*(C_{10}–N_{18})$	0.18707	15.97	0.35	0.068

The used numbering of atoms is as shown in Figure 3. [a]: E(2) means energy of stabilization interactions; [b]: Energy difference between donor-to-acceptor, *i* and *j* NBO orbitals; [c]: F(*i*,*j*) is the Fock matrix element between *i* and *j* NBO orbitals.

2.5. Vibrational Analysis

The title molecule **4** consists of 32 atoms and their characteristic vibrations are described by 90 normal modes. FT-Raman and FT-IR spectra of the title compound **4** are shown in Figures 4 and 5, respectively. Theoretical and experimental spectral data of the target oxime **4** are presented in Table 4, including calculated and fundamental wavenumbers, FT-IR- and FT-Raman intensities along with the tentative vibrational assignment. The calculated vibrational wavenumbers were corrected by scaled quantum mechanical force-field (SQMFF) method [21] by selective scaling factor approach [22]. Using this force-field method, the calculated wavenumbers are reproducing the experimental values with a mean deviation of 15 cm^{-1}. Internal valence coordinates and scaling factors information of the title compound **4** modes are given in Tables S1 and S2, respectively.

Table 4. Calculated vibrational wavenumbers, observed FT-IR and FT-Raman frequencies, FT-IR and FT-Raman intensities and their assignments with PED % for compound **4**.

Wavenumber			Intensity		
Expt.		Calc.	IR [a] (km·mol^{-1})	Raman [b] (m^2·sr^{-1})	Assignment with PED % (≥10%)
ν_{IR} (cm^{-1})	ν_{Raman} (cm^{-1})	ν_{Scal} (cm^{-1})			
		3830	131.118	7.45	ν (O_{19}–H_{32}) (100)
3144	3145	3128	1.497	8.37	$\nu_{ring\ II}$ (C–H) (99)
3121	3120	3118	2.054	7.851	$\nu_{ring\ II}$ (C–H) (99)
3114	3118	3103	4.324	10.20	$\nu_{ring\ II}$ (C–H) (99)
-	3073	3096	3.035	6.57	$\nu_{ring\ II}$ (C–H) (99)
3018	-	3056	1.286	5.39	$\nu_{ring\ I}$ (C–H) (99)
3007	3001	3026	2.149	10.90	$\nu_{ring\ I}$ (C–H) (99)
2993	-	3017	3.215	11.70	$\nu_{ring\ I}$ (C–H) (99)
-	2970	2977	9.230	2.62	ν_{as} (CH_2) Me III(93)
2945	2946	2944	29.934	17.60	ν_{as} (CH_2) Me I (75) + ν_s (CH_2) Me I (25)
-	-	2934	23.671	11.10	ν_s (CH_2) Me III (98)
-	-	2927	4.531	7.86	ν_{as} (CH_2) Me II (93)
-	2908	2889	6.873	10.60	ν_s (CH_2) Me II (98)
-	2845	2836	118.557	27.20	ν_s (CH_2) Me I (74) + ν_{as} (CH_2) Me I (26)
-	1629	1629	14.078	73.10	ν (C_{10}–N_{18}) (71)
1595	1606	1591	24.766	100.00	$\nu_{ring\ I}$ (CC) (53) + β (CH) Ring I (16)
-	-	1581	3.985	20.60	$\nu_{ring\ I}$ (CC) (58) + β (CH) Ring I (14)
-	-	1560	0.336	14.40	*Sci*(HC) Me I (89)
1503	1516	1504	44.673	2.85	β (CH) Ring II (41) + ν (C_{17}–N_{16}) (28) +ν (NC) (12)
-	-	1492	179.197	6.28	β (CH) Ring I (50) + $\nu_{ring\ I}$ (CC) (32)
1493	1494	1490	17.736	6.84	ν (C_{14}–C_{15}) (35) + β (CH) Ring II (29) +ν (NC) (11)
1450	-	1457	14.740	4.35	*Sci* (CH_2) Me II (37) + τ (CN) (31) + *Sci* (CH_2) Me III (16)
-	-	1444	3.326	21.40	ω (CH_2) Me I (88)
1439	1440	1442	25.303	19.50	*Sci* (CH_2) Me II + τ (CN) (25) + *Sci* (CH_2) Me III (14)
1428	-	1424	55.376	5.77	$\nu_{ring\ I}$ (CC) (44) + β (CH) Ring I (34)
1401	1403	1390	17.021	13.50	τ (CN) (47) + ω (CH_2) Me III (30)
1364	-	1369	2.376	5.68	ν (NC) (28) + τ (CN) (17) + ω (CH_2) Me III (12) + ρ (CH_2) Me III (12) + *twi* (CH_2) Me III (12)
1350	1346	1341	2.477	15.10	β (CH) Ring II (39) + ν (C_{17}–N_{16}) (31) + ν (NC) (15)
1313	1314	1324	38.626	10.90	β (CH) Ring I (40) + ν (CC) (37) + δ_a (Ring I) (10)
-	-	1301	90.153	46.50	$\nu_{ring\ I}$ (CC) (32) + β (CH) Ring I (15)
1280	1291	1293	9.747	28.50	β (CH) Ring II (55) + ν (C_{17}–N_{16}) (16)
-	1271	1276	18.733	10.70	ω (CH_2) Me II (62)
1255	1254	1251	4.921	3.83	*Twi* (CH_2) Me II (34) + τ (CN) (24) + ρ (CH_2) Me III (10) + *Twi* (CH_2) Me III (10)
-	-	1225	26.089	28.90	ω (CH_2) Me I (37)
1225	1232	1224	199.125	31.10	β (NOH) (23) + CO (13) + CC (12)
-	-	1222	78.688	30.70	ν (NC) (16) + CN (13) + β (CH) Ring II (13) + *Twi* (CH_2) Me I (11)
-	-	1208	103.083	19.30	β (NOH) (23) + $\nu_{ring\ I}$ (CC) (16) + ν (CO) (10) + β (CH) Ring I (10)
-	-	1202	120.699	19.90	$\nu_{ring\ I}$ (CC) (30) + ν (C_5–C_{10}) (10) + β (NOH) (10)
1173	1174	1151	4.028	2.22	$\nu_{ring\ I}$ (CC) (25) + β (CH) Ring I (25)
1147	1141	1136	6.792	2.61	ν (NC) (28) + *Twi* (CH_2) Me I (14) + $\nu_{ring\ I}$ (CC) (14) + β (CH) Ring I (12)
-	-	1124	5.682	2.44	ρ (CH_2) Me I (56) + τ (CO) (10) + $\nu_{ring\ I}$ (CC) (10)
1108	1107	1111	12.714	7.30	ν (NC) (32) + β (CH) Ring II (25) + ν (C_{14}–C_{15}) (11)
1085	1083	1097	54.779	15.00	δ (Ring I) (20) + ν (CO) (16) + ν (NC) (14)
-	1050	1079	51.301	13.80	β (CH) Ring II (43) + ν (NC) (32) + ν (C_{14}–C_{15})(15)
1035	1030	1032	12.857	19.20	τ (CN) (25) + ρ (CH_2) Me III (21) + *Twi* (CH_2) Me III (21)
1016	-	1019	121.778	4.74	ν (OC) (36) + τ (CN) (11)
957	956	1000	50.386	9.32	ν (CC) (26) + $\nu_{ring\ I}$ (CC) (14)
-	-	972	6.193	14.00	ν (CC)(66)
936	-	966	16.460	14.90	δ (Ring I) (34) + ν (NC) (27) + ν (CN) (13)
-	-	935	3.579	3.29	ω (CH) Ring I (86)
924	922	921	100.257	9.39	ν (N_{18}–O_{19}) (34) + τ (CN) (14) +ρ (CH_2) Me III (10) + *Twi* (CH_2) Me III (10)
895	893	896	54.208	6.21	ν (CO) (70) + δ (Ring I) (14)
878	-	883	61.051	8.07	ν (CO) (24) + ν (N_{18}–O_{19}) (16) + δ (Ring I) (13)
854	850	851	24.434	2.27	ω (CH) Ring I (77)
-	-	841	2.112	2.68	ω (CH) Ring II(87)
-	-	818	7.104	4.86	γ (Ring II) (89)
808	814	809	21.360	7.71	ω (CH) Ring I (84)
799	-	798	13.387	28.60	$\nu_{ring\ I}$ (CC) (33) + ν (CO) (18) + ν (CO) (13)
752	-	785	32.319	4.73	ω (CH) Ring II (77) + ORO (11)
743	-	756	2.956	6.19	τ (CN) (40) + ρ (CH_2) Me III (17) + *twi* (CH_2) Me III (17)

Table 4. *Cont.*

Wavenumber			Intensity		
Expt.		Calc.	IR [a] (km·mol^{-1})	Raman [b] (m^2·sr^{-1})	Assignment with PED % (≥10%)
ν_{IR} (cm^{-1})	ν_{Raman} (cm^{-1})	ν_{Scal} (cm^{-1})			
-	-	743	2.742	5.72	τ (CN) (26) + ρ (CH_2) Me III (11) + *twi* (CH_2) Me III (11)
-	-	733	9.478	12.10	τ (CN) (37) + ρ (CH_2) Me III (15) + *twi* (CH_2) Me III (15)
725	721	706	33.336	14.00	ω (CH) Ring II (82) + τ (CN) (14)
716	-	704	3.019	15.40	γ (Ring I) (18) + δ (Ring I) (11) + γ (Ring I) (11)
-	-	690	5.722	5.12	*puc* (Ring I) (61) + ω (CC) (13) + τ_a (Ring I) (10)
-	692	650	5.478	2.91	ω (CC) (15) + τ_a (Ring I) (12) + τ (Ring I) (10)
658	658	629	17.050	1.48	τ_a (Ring II) (69) + τ (CN) (17)
621	626	614	18.672	4.91	δ (Ring II) (17) + ν (C_{12}–N_{13}) (15) + ν (CC) (11)
578	573	592	11.347	7.42	τ_a (Ring II) (62) + ω (CC) (11)
556	-	582	14.299	9.94	δ (Ring I) (30)
492	490	530	5.947	2.11	τ (CN) (20) + ω (CC) (14) + *puc* (14)
-	-	447	5.385	7.04	γ (Ring I) (20) + OC (19) + δ (Ring I) (15)
433	449	440	19.054	7.96	β (CNO) (21) + δ (Ring I) (15) + ν (CC) (10)
425	-	424	86.609	9.89	τ (NO) (72)
417	-	405	13.261	4.70	τ_a (Ring I) (36) + *butt* (35) + τ (Ring I) (14)
-	387	361	1.486	7.82	τ (CN) (26) + β (CN) (20) + τ (CN) (10)
-	-	341	1.034	10.40	τ (CN) (30) + *Sci* (13) + OC (12)
-	330	333	0.753	9.09	τ (CN) (67) + β (CN) (11)
-	303	303	4.676	15.80	τ (CN) (38) + τ (CN) (15) + *butt* (11)
-	277	260	1.201	20.60	τ (CN) (69)
-	230	222	0.661	34.50	τ (CN) (51) + ρ (OC) (10)
-	-	215	0.930	29.90	τ_a (Ring II) + (24) + τ (Ring I) (24)
-	-	180	0.384	13.60	τ (CN) (73) + β (CC) (10)
-	-	138	0.183	22.60	τ (CN) (37) + *Sci* (20)
-	-	126	7.961	18.10	τ (Ring I) (40) + τ (CN)(18) + τ (CN) (18) + τ (CN) (14)
-	-	91	5.187	119.00	τ (CN) (27) + τ (Ring I) (17) + ω (CC) (12) + τ (CN)(10)
-	-	72	1.075	156.00	τ (CN) (99)
-	-	64	0.692	162.00	τ (CN) (78)
-	-	29	1.601	104.00	τ (CN) (98)
-	-	20	1.176	312.00	τ (CN) (99)
-	-	16	0.169	328.00	τ (CN) (86)

[a]: IR intensity; [b]: Raman intensity; Ring I: benzodioxole ring; Ring II: imidazole ring; ν: stretching; Me: methylene; ν_s: symmetric stretching; ν_{as}: asymmetric stretching; β: bending; τ: torsion; puc: puckering; ω: wagging; *twi*: twisting; ρ: rocking; *Sci*: scissoring; γ: out-of-plane bending; δ: in-plane bending; *butt*: butterfly mode; τ_a: out-of-plane torsion.

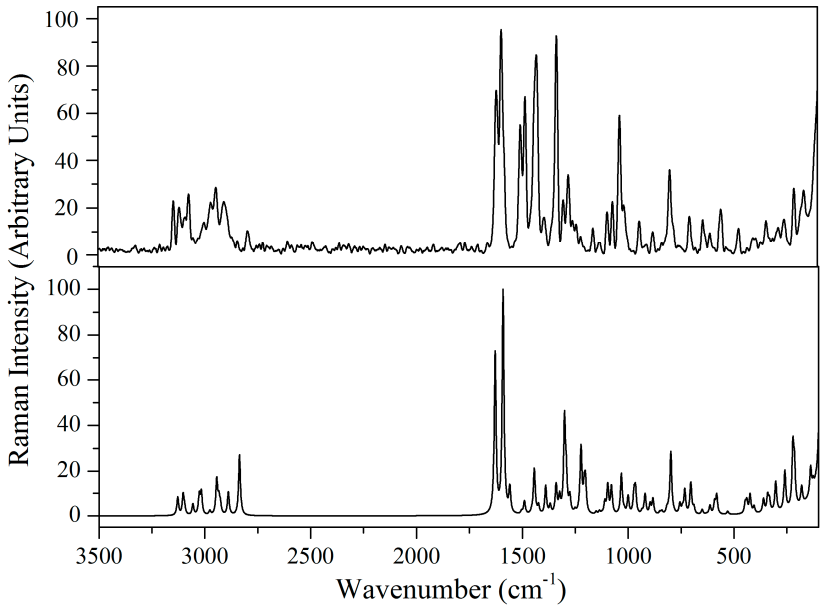


Figure 4. Experimental (**upper**) and simulated (**lower**) FT-Raman spectra of compound **4**.

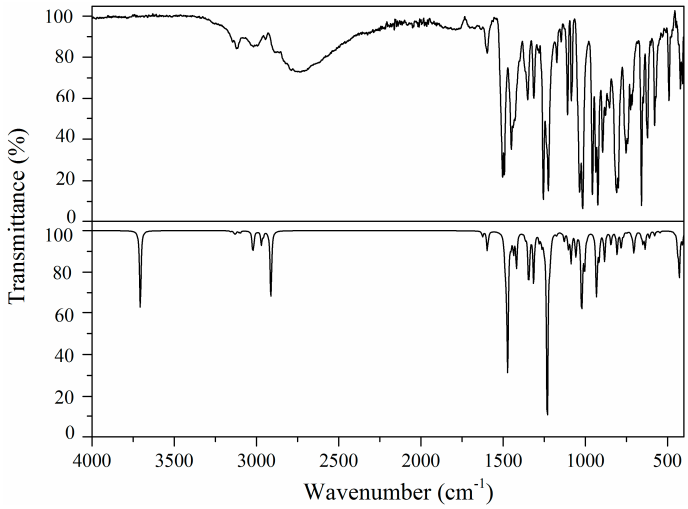


Figure 5. Experimental (**upper**) and simulated **(lower**) FT-IR spectra of compound **4**.

2.5.1. Imidazole Ring Vibrations

The calculated IR and Raman imidazole C–H stretching vibrations at 3118 and 3145 cm^{-1} are in close agreement with the experimental wavenumbers observed at 3144, 3125, 3120 cm^{-1} [23,24]. The FT-IR bands observed at 1503, 1350, 1280 and 1108 cm^{-1} and the FT-Raman ones at 1516, 1346, 1291, 1107 and 1050 cm^{-1} are definitely attributed to imidazole CH in-plane bend modes which are coupled with several other modes. The FT-IR bands at 752 and 725 cm^{-1} and the weak FT-Raman bands at 721 cm^{-1}, can be assigned to the out-of-plane C–H wagging modes, as supported by theliterature data [25]. The C_{14}=C_{15} stretching mode is the most characteristic vibration of the heterocyclic imidazole ring which was observed as medium intensity bands at 1493 (FT-IR) and at 1494 (FT-Raman) cm^{-1}. The FT-IR and FT-Raman vibrations of the imidazole ring out-of-plane torsion modes appeared at 658, 578 (FT-IR) and 573 (FT-Raman) cm^{-1}.

2.5.2. Methylene Group Vibrations

The neighboring rings π-system and nitrogen lone pair affects the spectral behavior of sp^3 hybridized methylene moiety. Methylene asymmetric and symmetric C–H stretching vibrations usually appear in the region 2960–2840 cm^{-1} [26]. The asymmetric (2970 and 2946 cm^{-1}) and symmetric (2908 and 2845 cm^{-1}) stretching contributing bands appeared as a medium intensity band in the FT-Raman spectrum of the title compound **4**. Lowering of symmetric stretching wavenumbers could be attributed to the hyperconjugative interaction between the nitrogen lone pair and σ*(C–H) bond. The rocking, wagging and twisting vibrational modes of compound **4** appeared in the region of 1400–900 cm^{-1} [27]. The CH_2 scissoring mode appeared as a characteristic band near 1450 and 1439 cm^{-1} in the FT-IR spectrum and at 1440 cm^{-1} in the FT-Raman spectrum of the title oxime **4**. The normal coordinate analysis (NCA) supports the FT-Raman bands at 1254 and 1271 cm^{-1} and the FT-IR bands at 1255 cm^{-1} for the unambiguous assignment of CH_2 twisting and wagging modes.

2.5.3. Benzodioxole Ring Vibrations

Aromatic C–H stretching mode appears in the region of 3000–3100 cm^{-1}. Weak FT-Raman bands identified at 3073 and 3001 cm^{-1} have been assigned to the C–H stretching mode. Usually the bands due to ring C–H in-plane and out-of-plane bending vibrations are observed in the region of 1000–1300 and 750–1000 cm^{-1}, respectively. In the title compound **4**, the C–H in-plane bending vibration has been observed as a medium intensity FT-IR band at 1313 cm^{-1} and as a weak band at 1314 cm^{-1} in the FT-Raman spectrum. The medium to weak intensity bands observed at 854 (FT-IR), 850 (FT-Raman), 814 (FT-Raman) and 808 (FT-IR) cm^{-1} have been assigned to C–H out-of-plane bending mode. Ring

C–C stretching modes have been identified in the FT-IR spectrum of the target compound **4** at 1595, 1428 and 1173 cm^{-1} while they appeared at 1606 and 1174 cm^{-1} in the FT-Raman spectrum. The ring asymmetric deformation and torsion modes have been identified at 716, 556, 492 and 417 cm^{-1} in the FT-IR and at 490 cm^{-1} in the FT-Raman spectra of the title molecule **4**.

2.6. Frontier Molecular Orbital Analysis

A detailed knowledge of molecular electron density distribution and electron motion are necessary to understand molecular recognition and chemical reactivity of the molecule. The LUMO and HOMO orbital energy analysis of the title compound **4** has been computed using DFT method in the solution phase (isopropanol). The electron charge cloud is located at the piperonal ring in highest occupied molecular orbital (HOMO) while it is located mainly at the phenyl ring in the lowest unoccupied molecular orbital (LUMO). The energy of the HOMO is −6.23 eV and LUMO is −1.60 eV giving rise to a HOMO-LUMO energy gap of 4.63 eV. The HOMO-LUMO energy gap value supports the intramolecular charge-transfer interactions within the title molecule. The HOMO and LUMO orbital diagram is shown in Figure 6.

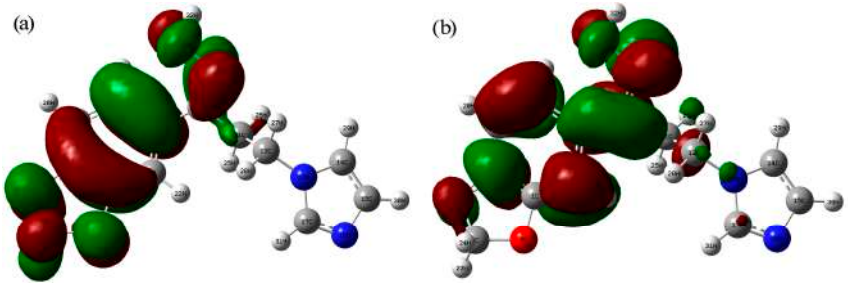


Figure 6. (**a**) HOMO (**b**) LUMO orbital of compound **4**.

2.7. NMR Chemical Shift Analysis

The carbon and hydrogen chemical shift values of the title oxime **4** were calculated based on Gauge-independent atomic orbital (GIAO) method at B3LYP/6-311++G(d,p) level of theory [28]. The computed values are presented in Table 5. The correlation graphs were plotted over the observed and predicted chemical shift values of the title molecule **4** and the linear fitting plots are shown in Figure S3.

Table 5. Calculated and experimental chemical shift values for compound **4**.

Carbon Atoms (^{13}C)			Hydrogen Atoms (^{1}H)		
Atoms	Value (ppm)		Atoms	Value (ppm)	
	Calc.	Exp.		Calc.	Exp.
C1	127.25	148.0	H20	5.81	6.84
C2	127.81	148.3	H21	7.01	7.06
C3	89.62	108.5	H22	5.89	7.13
C4	107.84	120.5	H23	5.40	6.04
C5	107.85	130.3	H24	5.20	6.04
C6	89.80	106.1	H25	1.92	3.14
C8	87.78	101.7	H26	2.23	3.14
C10	132.24	153.7	H27	3.40	4.17
C11	29.66	28.2	H28	3.64	4.17
C12	38.54	43.3	H29	6.05	6.89
C14	100.78	119.9	H30	5.94	7.19
C15	109.30	128.3	H31	6.38	7.66
C17	115.68	137.5			

The used numbering of atoms is as shown in Figure 3.

The phenyl carbons signals usually appear in the region of 120–140 ppm. The C1 and C2 in the title molecule **4** were observed at 148.0 and 148.3 ppm, respectively. This downfield chemical shift values revealed that, these carbon atoms bounded with the electronegative oxygen atoms. In general, imidazole ring protons signals occur in the region of 6–8 ppm. The ^{1}H-NMR spectrum of the target oxime **4** showed signals at 6.89, 7.19 and 7.66 ppm which correspond to the protons of the imidazole ring. The aromatic piperonal ring protons were observed at 6.84 (as doublet), 7.06 (as doublet) and 7.13 (as singlet) ppm. There is a good agreement between the calculated and observed chemical shift values of the title molecule **4** with a correlation coefficient (R^2) values = 0.994 and 0.953 for ^{13}C and ^{1}H, respectively.

2.8. Molecular Docking Study

Molecular docking is an important technique to predict the biological activity of chemical compounds [29]. The target compound **4** was energy minimized using DFT method with the help of Gaussian program [30]. The target protein (cytochrome P450-dependent (CYP51) lanosterol 14α-demethylase enzyme) for antifungal azoles has been identified based on a multilevel neighborhoods of atoms' (MNAs) algorithm model by the PASS online server [31]. This target protein (PDB code: 1EA1) was downloaded from the research collaboratory structural bioinformatics (RCSB) protein data bank [32]. The target compound **4** was docked using AutoDock Tools 1.5.4 (The Scripps Research Institute, La Jolla, CA, USA) interfaced with the AutoDock 4.2 program in the rigid docking methodology [33,34]. The binding free energy and inhibition constant of the proper conformation of the title compound **4** was predicted to be −5.06 kcal/mol and 195.75 μM, respectively. The hydrogen bond interaction of protein-ligand complex is shown in Figure 7. The amino acid residues LEU321 and PRO386 of the target protein are bounded with the title compound **4** by an intermolecular hydrogen bonding interaction. The docking study illustrated the affinity of compound **4** toward its target protein with a good binding energy value (–5.06 kcal/mol) and hence its suitability as a potential precursor to prepare new antifungal agents.

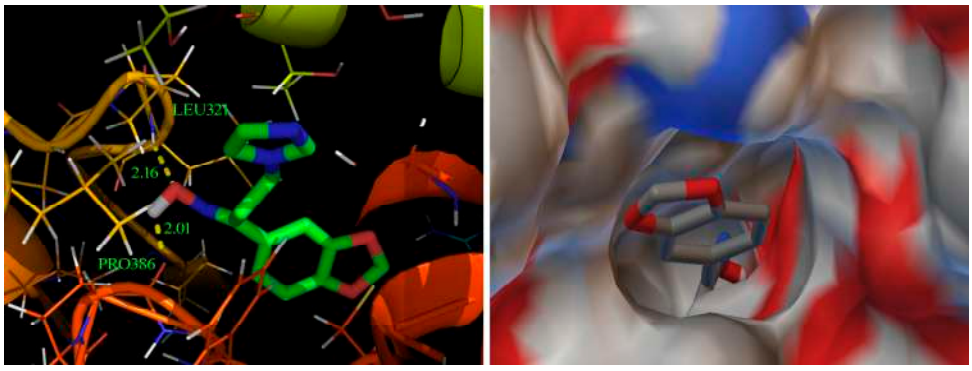


Figure 7. Binding pose of compound **4** with its target protein.

2.9. Antifungal Activity of the Title Compound **4**

Table 6 presents the preliminary antifungal activity of the tested oxime **4** as well as the reference standard drug, ketoconazole. Compound **4** exhibited a MIC value of 987.43 μmol/L against *C. albicans*, *C. tropicalis*, *C. parapsilosis* and *Aspergillus niger* in the broth microdilution assay. While inactive itself, taken together the body of evidence suggests that compound **4** could be used as a starting material to prepare new antifungal agents with better antifungal profile.

Table 6. Antifungal activity of compound **4** and ketoconazole against different *Candida* species and *Aspergillus niger*.

Compound No.	MIC (μmol/L)			
	C. albicans	*C. tropicalis*	*C.parapsilosis*	*Aspergillus niger*
4	987.43	987.43	987.43	987.43
Ketoconazole	7.53	15.05	15.05	15.05

3. Experimental

3.1. General

Melting points were measured using a Gallenkamp melting point device, and are uncorrected. Infrared (IR) spectra (as KBr disks) were recorded on FT-IR Spectrum BX device (Perkin Elmer, Ayer Rajah Crescent, Singapore). The NMR samples were dissolved in either $CDCl_3$ or DMSO-d_6 and the NMR spectra were recorded using a Bruker NMR spectrometer (Bruker, Reinstetten, Germany), at 500 MHz for ^{1}H and 125.76 MHz for ^{13}C at the Research Center, College of Pharmacy, King Saud University, Saudi Arabia. Chemical shifts are expressed in δ-values (ppm) relative to TMS as an internal standard. Mass spectra were recorded using a Quadrupole 6120 LC/MS equipped with an electrospray ionization (ESI) source (Agilent Technologies, Palo Alto, CA, USA). Silica gel TLC (thin layer chromatography) plates (silica gel precoated aluminium cards with 254 nm fluorescent indicator) from Merck (Darmstadt, Germany) were used for thin layer chromatography. Visualization was performed by illumination with a UV light source (254 nm).

3.2. Synthesis

3.2.1. Synthesis of 1-(2*H*-1,3-Benzodioxol-5-yl)-3-(1*H*-imidazol-1-yl)propan-1-one (**3**)

A catalytic amount of concentrated hydrochloric acid (0.5 mL) was added to a mixture containing paraformaldehyde (0.81 g, 9.0 mmol), dimethylamine hydrochloride (2.20 g, 27 mmol) and1-(2*H*-1,3-benzodioxol-5-yl)ethanone (**1**, 3.28 g, 20 mmol) in absolute ethanol (15 mL). The reaction mixture was refluxed for two hours, cooled and acetone (30 mL) was added to precipitate the Mannich base hydrochloride (**2**) which was collected by filtration and dried. Imidazole (1.36 g, 20 mmol) was added to a solution of compound **2** (2.58 g, 10 mmol) in water (10 mL) and the solution was refluxed for five hours, cooled and the precipitated solid was filtered off to afford compound **3**. Compound **3** was re-crystallized from ethanol to give 1.15 g (47%) of the pure pivotal ketone **3** as a white solid m.p. 150–152 °C. IR (KBr): ν (cm^{-1}) 3115, 2968, 1757 (C=O), 1637 (C=N), 1600, 1494, 1255, 750; ^{1}H-NMR ($CDCl_3$): δ (ppm) 3.37 (t, *J* = 6.5 Hz, 2H, –C*H*$_2$–CH$_2$–N), 4.42 (t, *J* = 6.5 Hz, 2H, –CH$_2$–C*H*$_2$–N), 6.05 (s, 2H, –O–C*H*$_2$–O–), 6.84 (d, *J* = 8.0 Hz, 1H, Ar–H), 6.99 (s, 1H, –N–C*H*=CH–N=), 7.04 (s, 1H, –N–CH=C*H*–N=), 7.39 (d, *J* = 1.5 Hz, 1H, Ar–H), 7.50 (dd, *J* = 1.5, 8.0 Hz, 1H, Ar–H), 7.64 (s, 1H, –N–C*H*=N–); ^{13}C-NMR ($CDCl_3$): δ (ppm) 39.6 (–*C*H$_2$–CH$_2$–N), 41.7 (–CH$_2$–*C*H$_2$–N), 102.0 (–O–CH$_2$–O–), 107.7 (Ar–CH), 108.0 (Ar–CH), 119.2 (–N–*C*H=CH–N=), 124.4, 129.1 (Ar–CH, –N–CH=*C*H–N=), 131.0, (Ar–C), 137.4 (–N–*C*H=N–), 148.4, 152.3 (Ar–C), 194.6 (C=O); MS *m*/*z* (ESI): 245.0 $[M + H]^+$.

3.2.2. Synthesis of (1*E*)-1-(2*H*-1,3-Benzodioxol-5-yl)-*N*-hydroxy-3-(1*H*-imidazol-1-yl)propan-1-imine (**4**)

Potassium hydroxide (1.12 g, 20 mmol) was added to a mixture containing hydroxylamine hydrochloride (1.39 g, 20 mmol), ketone **3** (2.44 g, 10 mmol) in ethanol (10 mL). The reaction mixture was refluxed under stirring for 18 hours, cooled to room temperature and the insoluble matter was collected by filtration. The filtrate was concentrated under reduced pressure and the residue was poured onto ice-cold water (15 mL). The obtained solid was filtered off and dried to yield 1.7 g (64%) of the target oxime **4** as a white solid m.p. 142–144 °C. Re-crystallization of the oxime **4** from isopropanol gave colorless single crystals which were suitable for X-ray analysis. ^{1}H-NMR (DMSO-d_6): δ(ppm) 3.14 (t, *J* = 7.0 Hz, 2H, –C*H*$_2$–CH$_2$–N), 4.17 (t, *J* = 7.0 Hz, 2H, –CH$_2$–C*H*$_2$–N), 6.04 (s, 2H, –O–C*H*$_2$–O–),

6.84 (d, *J* = 7.5 Hz, 1H, Ar–H), 6.89 (s, 1H, –N–C*H*=CH–N=), 7.06 (dd, *J* = 1.5, 8.0 Hz, 1H, Ar–H), 7.13 (d, *J* = 1.0 Hz, 1H, Ar–H), 7.19 (s, 1H, –N–CH=C*H*–N=), 7.66 (s, 1H, –N–C*H*=N–), 11.41 (s, 1H, OH); ^{13}C-NMR (DMSO–d_6): δ(ppm) 28.2 (–CH_2–CH_2–N), 43.3 (–CH_2–CH_2–N), 101.7 (–O–CH_2–O–), 106.1, 108.5 (Ar–CH), 119.9 (–N–CH=CH–N=), 120.5, 128.3 (Ar–CH, –N–CH=CH–N=), 130.3 (Ar–C), 137.5 (–N–CH=N–), 148.0, 148.3 (Ar–C), 153.7 (C=N–OH); MS *m*/*z* (ESI): 260.1 $[M + H]^+$.

3.3. Crystal Structure Determination

Slow evaporation of the alcoholic (isopropanol) solution of the title compound **4** furnished its colourless block single crystals. The X-ray diffraction measurement of the target oxime **4** was conducted on a SMART APEXII CCD diffractometer (Bruker, Karlsruhe, Germany) equipped with graphite monochromatic CuKådiation (λ = 1.54178 Å) at 296 (2) K. Cell refinement and data reduction were done by Bruker SAINT [35]. SHELXS-97 [36] was used to solve and refine the title structure. The final refinement of the crystal structure of the title oxime **4** was performed by full- matrix least-squares techniques with anisotropic thermal data for non hydrogen atoms on F^2. All the hydrogen atoms were placed in the calculated positions and constrained to ride on their parent atoms. Multi-scan absorption correction was applied by the use of SADABS software [35]. The crystallographic data and refinement information are summarized in Table 7. Crystallographic data of compound **4** have been deposited with the Cambridge Crystallographic Data Center (supplementary publication number CCDC-1508986). Copies of the data may be obtained free of charge from the Director, CCDC, 12 Union Road, Cambridge, CB2 1EZ, UK (deposit@ccdc.cam.ac.uk).

Table 7. The crystallographic data and refinement information.

Chemical Formula	**$2(C_{13}H_{13}N_3O_3)\cdot C_3H_8O$**
Molecular weight	578.62
Crystal system, space group	Monoclinic, $P2_1$
Temperature (K)	296
a, *b*, *c* (Å)	9.0963(3), 14.7244(6), 10.7035(4)
β(°)	94.298(3)
V (Å^3)	1429.57(9)
Z	2
Radiation type	Cu Kα
μ (mm^{-1})	0.81
Crystal size (mm)	0.40 × 0.23 × 0.11
Data collection	
Diffractometer	Bruker APEX-II CCD diffractometer
Absorption correction	Multi-scan, SADABS Bruker 2014
T_{min}, T_{max}	0.740, 0.916
No. of measured, independent and observed [I > 2σ(I)] reflections	6654, 3851, 2788
R_{int}	0.039
Refinement	
$R[F^2 > 2\sigma(F^2)]$ [a], $wR(F^2)$ [b], S	0.059, 0.144, 1.03
No. of reflections	3851
No. of parameters	393
No. of restraints	1
H-atom treatment	H atoms treated by a mixture of independent and constrained refinement
$\Delta\rho_{max}$, $\Delta\rho_{min}$ (e·Å^{-3})	0.26, −0.23

[a]: R is the residual factor for the reflections; [b]: wR is the weighted residual factor for all the reflections.

3.4. FT-IR and FT-Raman Measurements

The FT-Raman spectrum of the oxime **4** was recorded in the spectral range of 3500–50 cm^{-1} using a Bruker RFS-27 FT-Raman spectrophotometer (Bruker, Billerica, MA, USA). The 1064 nm line of Nd:YAG laser operating at 100 mW power was used for excitation. The FT-IR spectrum of the oxime **4**

was recorded with a spectral resolution of 2 cm^{-1} in the 4000–400 cm^{-1} range. Solid sample in KBr pellets was used in the FT-IR measurements.

3.5. Quantum Chemical Calculations

Optimized structural geometry and harmonic vibrational wavenumbers have been calculated at DFT/B3LYP/6-311++G(d,p) level of basis set in the gas phase. The polarizable continuum model (PCM) using the integral equation formalism (IEF) variant is the self-consistent reaction field (SCRF) to predict the structural parameters and vibrational wavenumbers of the title molecule **4** and isopropanol has defined as the solvent in implicit solvation model. This calculation has been performed in the presence of isopropanol by placing the title molecule **4** in a cavity within the solvent reaction field. Normal coordinate analysis (NCA) has been performed to obtain detailed explanation of the molecular motion relating to the normal modes using the MOLVIB program version 7.0 written by Sundius [37,38]. According to the scaled quantum mechanical force-field (SQMFF) procedure [21], selective scaling has been performed in the natural internal coordinate representation [22]. The simulated IR and Raman spectra of the title compound **4** have been plotted using pure Lorentizian band shapes with a bandwidth of full width height maximum of 10 cm^{-1}. Second order interactions between the filled orbital of one subsystem and vacant orbitals of another subsystem have been understood with the aid of natural bonding orbitals (NBO) analysis [19] using NBO 3.1 program [39] as implemented in the Gaussian '09 package [30] at the DFT/B3LYP level. Molecular docking analysis using AutoDock 4.2 program [33] predicted the antifungal activity of the title compound **4**.

3.6. Antifungal Activity

3.6.1. Materials

The reference standard antifungal drug, ketoconazole, was purchased from Sigma-Aldrich Co. (St. Louis, MO, USA). Liquid RPMI 1640 medium supplemented with L-glutamine was obtained from Gibco-BRL, Life Technologies (Paisley, Scotland). Sabouraud Dextrose Agar (SDA) was obtained from Merck Co. (Darmstadt, Germany). Dimethyl sulfoxide (100%) was used to dissolve ketoconazole, and/or the tested compound **4** to give an initial concentration of 2048 mg/L.

3.6.2. Organisms

The used fungal strains are *Candida albicans* (ATCC 90028), *Candida tropicalis* (ATCC 66029), *Candida parapsilosis* (ATCC 22019) and *Aspergillus niger* (ATCC 16404).

3.6.3. Preparation of Fungal Inocula

The inocula of the standard mold *Aspergillus niger* strain have been prepared by removing the sporulated *A. niger* from the Sabouraud Dextrose agar slant with a microbiological loop and the spores have been suspended in 10 mL of sterile water. The suspension has been filtered through sterile gauze to remove hyphae. The resulting suspension of conidia has been vigorously mixed using a vortex. The suspension has been adjusted to 1×10^5 CFU/mL using spectrophotometer. This fungal suspension has been diluted 1:5 with RPMI medium to obtain suspensions having 2× of the required final concentration. This conidial suspension had a final concentration of 1×10^4 CFU/mL when mixed with the tested solution of compound **4**. On the other hand, the inocula of the standard yeast strains of *C. albicans*, *C. tropicalis* and *C. parapsilosis* have been prepared by suspending five representative colonies, obtained from 24 to 48 h culture on Sabauraud Dextrose agar medium, in sterile distilled water. The final inoculum concentration must be between 0.5×10^5 and 2.5×10^5 CFU/mL.

3.6.4. Preparation of the Tested Compound Solution

Briefly, a twofold dilution series of the tested compound **4** has been prepared in a double strength RPMI 1640 culture medium. Ten serial dilutions were prepared to give concentrations ranged from 1024 mg/L to 2 mg/L.

3.6.5. Antifungal Susceptibility Studies

Minimum Inhibitory Concentrations (MICs) have been determined by broth microdilution testing as described previously by EUCAST [40]. The experiment was carried out in duplicate. Briefly, one mL of RPMI 1640 medium from each of the bottle containing the corresponding concentration of the tested compound **4** has been transferred into sterile 7 mL Sterilin tubes (Thermo Fisher Scientific, Waltham, MA, USA). The RPMI 1640 medium containing 1024 mg/L of the tested compound **4** has been dispensed to tube 1, the medium containing 512 mg/L has been dispensed to tube 2, the medium containing 256 mg/L has been dispensed to tube 3 and so on to tube 10 for the medium containing 2 mg/L of the tested compound **4**. One mL of the medium has been dispensed in tubes 11 (positive control) and 12 (negative control). One mL of the diluted inoculum suspension has transferred to each tube except tube 12 to bring the tested compound **4** dilutions to the required final test concentrations. The tubes were incubated at 35 °C for 72 h. The MIC of the tested compound **4** was determined visually by recording the degree of growth inhibition in each tube.

4. Conclusions

The synthesis and spectroscopic characterization of *N*-[(1*E*)-1-(2*H*-1,3-benzodioxol-5-yl)-3-(1*H*-imidazol-1-yl)propylidene]hydroxylamine (**4**) as new antifungal precursor has been reported. Computational studies on the target oxime **4** revealed that the theoretical wavenumbers are in a fair agreement with the observed wavenumbers except those associated with H-bonding. CH_2 symmetric stretching wavenumber is red-shifted due to the hyperconjugative interaction between the nitrogen lone pair and σ*(C–H) bond. Single crystal X-ray analysis of the target molecule **4** confirmed the (*E*)-configuration of its imine double bond. A molecular docking study predicted the binding mode of compound **4** into its target protein and hence its usefulness as a potential precursor for new imidazole-bearing antifungal agents featuring both benzodioxole and imidazole pharmacophore moieties.

Supplementary Materials: Supplementary materials are available online.

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Sample Availability: Samples of the synthesized compounds are available from the corresponding author.

ORIGINAL RESEARCH PAPER

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TOTAL DOMINATOR CHROMATIC NUMBER OF PATHS AND CYCLES THROUGH COMPUTER PROGRAMMING

Mathematics

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ABSTRACT

A total dominator coloring of a graph G=(V,E) without isolated vertices is a proper coloring together with each vertex in G properly dominates a color class. The total dominator chromatic number of G is a minimum number of color classes with additional condition that each vertex in G properly domi- nates a color class and is denoted by $\chi_{td}(G)$. In this paper we introduce C++ programmes that are able to efficiently determine on approximation to the total dominator chromatic number of Paths and Cycles.

2010 Mathematics subject classification code : 05C69, 68W25

KEYWORDS

Total dominator coloring, Total dominator chromatic number.

INTRODUCTION

In this paper we only consider Paths and Cycles. Further details in graph theory can be found in F.Harrary[4]

Let G=(V,E) be a graph with minimum degree atleast one. The Path and Cycle of order n are denoted by P_n and C_n respectively.

A proper coloring of G is an assignment of colors to the vertices of G, such that adjacent vertices have different colors. The smallest number of colors for which there exists a proper coloring of G is called a chromatic number of G, and is denoted by $\chi(G)$. A total dominator coloring (td-coloring) of G is a proper coloring of G with extra property that every vertex in G properly dominates color class. The total dominator chromatic number is denoted by $\chi_{td}(G)$ and is defined by the minimum number of colors needed in a total dominator coloring of G. This concept was introduced by A.Vijayalekshmi in [1]. This notion is also referred as a smarandachely k-dominator coloring of G,($k \geq 1$) and was introduced by A.Vijayalekshmi in [2].For an integer $k \geq 1$, a smarandachely k-dominator coloring of G is a proper coloring of G, such that every vertex in a graph G properly dominates a k color class. The smallest number of colors for which there exists a smarandachely k-dominator coloring of G is called the smarandachely k-dominator chromatic number of G and is denoted by $\chi^{s}_{td}(G)$.

In a proper coloring C of a graph G, a color class of C is a set consisting of all those vertices assigned the same color. Let C be a minimum td-coloring of G. We say that a color class is called a non-dominated color class (n-d color class)if it is not dominated by any vertex of G and these color classes are also called repeated color classes.

The total dominator chromatic number of Paths and Cycles were found in [3]. We have the following observation from [3]

Theorem A [3]

Let G be P_n or C_n. Then

$$\chi_{td}(P_n) = \chi_{td}(C_n) = \begin{cases} 2\left\lfloor \frac{n}{4} \right\rfloor + 2 \; if \; n \equiv 0(mod4) \\ 2\left\lfloor \frac{n}{4} \right\rfloor + 3 \; if \; n \equiv 1(mod4) \\ 2\left\lfloor \frac{n+2}{4} \right\rfloor + 2 \; Otherwise \end{cases}$$

Main Results

Section 1.1

In this section we have to find the total dominator chromatic number of paths by using C++ programme.

A path of 'n' vertices, denoted by P_n, is a connected graph where all but two vertices have degree 1. We label the vertices of P_n as v_i for ($1 \leq i \leq n$). Furthermore let (v_i, v_{i+1}) be an edge of P_n for $i<n$.

Here is the source code of C++ programme to find the total dominator chro- matic number of Paths. The C++ programme is successfully compiled and run on C++ platform.

Program as follows

```
#include “stdafx.h"
#include <Windows.h>
#include <conio.h>

#include <iostream> using namespace std; int main() {
int inpt;

cout << "Enter the Value" << endl;
cin >> inpt;
while (inpt >= 11)

{
int n = inpt; // matrix row
int m = inpt; // matrix column
// dynamic allocation

int** ary = new int*[n]; //logic matrix int** mat = new int*[n];
//adjacency matrix for (int i = 0; i < n; ++i)

{
ary[i] = new int[m];
mat[i] = new int[m];
}

// fill ary

for (int i = 0; i < n; ++I) for (int j = 0; j < m; ++j) ary[i][j] = i;
system("pause"); system("cls");
cout << "\n";

cout << "The Adjacency Matrix for P" << n << "\n" << "\n";
for (int i = 0; i < n; I++)
{
for (int j = 0; j < n; j++)
{
if (ary[j][i] == i + 1 | ary[j][i] == i - 1)
{
mat[i][j] = 1;
cout << mat[i][j] << " ";
}

else
{
mat[i][j] = 0;
cout << mat[i][j] << " ";
}
}
cout << "\n";
}
```

```
system("pause");
//-----END LOGIC TO FORM MATRIX------ int d;
cout<<"\n";

if(n%4==3)// CONDITION FOR GETTING SUB MATRIX
{
cout<<"Order of sub matrices for the above Matrix is : "<<(2*(n/4))
<<"x"<<(2*(n/4))<<"\n";

d=2*(n/4);
cout<<"\n";
}

else // CONDITION FOR GETTING SUB MATRIX

{
cout<<"Order of sub matrices for the above Matrix is : "<<(2*(n/4)
-1)
<<"x"<<(2*(n/4)-1)<<"\n";
d=2*(n/4)-1;
cout<<"\n";
}

cout<<"for sub matrices"<<" ";
system("pause");
system("cls");
cout<<"Sub Matrices"<<" "<<d<<"x"<<d;
cout<<"\n"<<"\n";
int r=0;// matrix row
int c=0;// matrix column int k;
int l;
if(n%4==0)

{
l=n/2+2;
}

else

{
l=n/2+3;
}

HANDLE hConsole=GetStdHandle(STD_OUTPUT_HANDLE);
for(k=0;k<l;k++)

{
cout<<"Sub Matrix"<<" "<<k+1;
cout<<"\n"<<"\n";
for(int i=0;i<n;I++)
{
for(int j=0;j<n;j++)
{
if(j>=k&&j<d&&i>=k&&i<d)
{
SetConsoleTextAttribute(hConsole, FOREGROUND_RED |
FOREGROUND_INTENSITY);
cout<<mat[i][j]<<" ";
}

else

{
SetConsoleTextAttribute(hConsole, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
//cout<<"."<<" ";
cout<<mat[i][j]<<" ";
}
}
cout<<"\n";
}

if(k==l-1)

{
SetConsoleTextAttribute(hConsole, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
cout<<"\n";
cout<<" No. of Sub Matrices are"<<" "<<l;
cout<<"\n";
cout<<"\n";
cout<<" Total Dominator Chromatic Number of "<<"P"<<n<<" "
<<"is"
<<" "<<l;
cout<<"\n";
cout<<"\n";
} system("pause"); system("cls"); d++;
}
return 0;
for(int i=0;i<n;++I)
delete[] ary[i]; delete[] ary; return 0;
}
return main();
}
```

Runtime Test

```
Enter the Value
13
Press any key to continue . . .
```

```
The Adjacency Matrix for P13

0 1 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```

```
Order of sub matrices for the above Matrix is : 5x5
for sub matrices Press any key to continue . . .
```

```
Sub Matrices 5x5

Sub Matrix 1

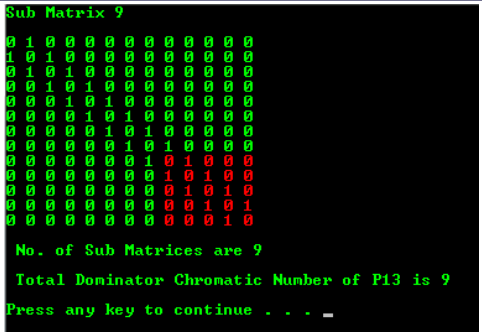
0 1 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```

```
Sub Matrix 2

0 1 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```

```
Sub Matrix 3

0 1 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```



Section 1.2

Program source code

In this section, we give the source code of the C++ program to find the td- chromatic number of a cycle. A cycle on n vertices denoted by C_n is a connected graph where each vertex has degree two. We label the vertices of c_n as v_i for $1 \le i \le n$ and let (v_i, v_{i+1}) be an edge of C_n for $1 \le i \le n - 1$. We let (v_n, v_1) be the remaining edge of C_n. The program is successfully compiled and tested under C++ platform. The program output is also shown below

Program as follows

```
#include “stdafx.h"
#include <Windows.h>
#include <conio.h>F

#include <iostream> using namespace std; int main() {
int inpt;

cout << "Enter the Value" << endl;
cin >> inpt;
while (inpt >= 11)

{
// dimensions
int n = inpt; // matrix row
int m = inpt; // matrix column
// dynamic allocation
int** ary = new int*[n]; //logic matrix

int** mat = new int*[n]; //adjacency matrix for (int i = 0; i < n; ++i)
{
ary[i] = new int[m];
mat[i] = new int[m];
}

// fill ary

for (int i = 0; i < n; ++I) for (int j = 0; j < m; ++j) ary[i][j] = i;
system("pause"); system("cls");
cout << "\n";
cout << "The Adjacency Matrix for C" << n << "\n" << "\n";
// -----LOGIC TO FORM MATRIX------ for (int i = 0; i < n; I++)
{

for (int j = 0; j < n; j++)

{
if (ary[j][i] == i + 1 | ary[j][i] == i - 1 | ary[j][i] == i + (n - 1)
| ary[j][i] == i - (n - 1))
{
mat[i][j] = 1;
cout << mat[i][j] << " ";
}

else

{
mat[i][j] = 0;
cout << mat[i][j] << " ";
}
}
```

```
cout << "\n";
}

system("pause");
// -----END LOGIC TO FORM MATRIX------ int d;
cout << "\n";

if (n % 4 == 3)// CONDITION FOR GETTING SUB MATRIX

{

cout << "Order of sub matrices for the above Matrix is : " << (2 * (n / 4))
<< "x" << (2 * (n / 4)) << "\n";
d = 2 * (n / 4);
cout << "\n";
}

else // CONDITION FOR GETTING SUB MATRIX

{
cout << "Order of sub matrices for the above Matrix is : " << (2 * (n / 4)
- 1)
<< "x" << (2 * (n / 4) - 1) << "\n";
d = 2 * (n / 4) - 1;
cout << "\n";
}

cout << "for sub matrices" << " ";
system("pause");
system("cls");
cout << "Sub Matrices" << " " << d << "x" << d;
cout << "\n" << "\n";

int r = 0;// matrix row
int c = 0;// matrix column int k;
int l;
// final value---------- if (n % 4 == 0)
{
l = n / 2 + 2;
}

else

{
l = n / 2 + 3;
}

HANDLE hConsole = GetStdHandle(STD_OUTPUT_HANDLE);
for (k = 0; k<l; k++)

{
cout << "Sub Matrix" << " " << k + 1;
cout << "\n" << "\n";
for (int i = 0; i < n; I++)
{
for (int j = 0; j < n; j++)
{
if (j >= k && j<d && i >= k && i <d)
{
SetConsoleTextAttribute(hConsole, FOREGROUND_RED |
FOREGROUND_INTENSITY);
cout << mat[i][j] << " ";
}

else
{
SetConsoleTextAttribute(hConsole, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
//cout << "." << " ";
cout << mat[i][j] << " ";
}
}
cout << "\n";
}
if (k == 1 - 1)
{
SetConsoleTextAttribute(hConsole, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
cout << "\n";
cout << " No. of Sub Matrices are" << " " << l;
cout << "\n";
cout << "\n";
cout << " Total Dominator Chromatic Number of " << "C" << n << " "
<< "is"
<< " " << l;
cout << "\n";
cout << "\n";
} system("pause"); system("cls"); d++;
}
return 0;
}
return main();
}
```

Runtime Test

```
Enter the Value
20
Press any key to continue . . .
```

```
The Adjacency Matrix for C20

0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1
1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```

```
Order of sub matrices for the above Matrix is : 9x9
for sub matrices Press any key to continue . . .
```

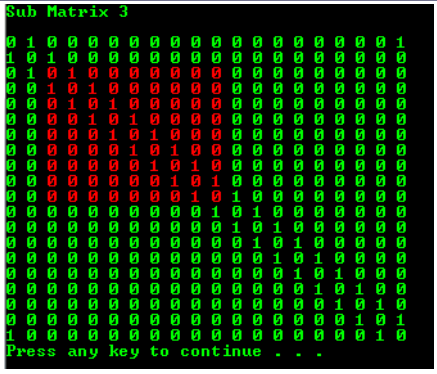
```
Sub Matrices 9x9

Sub Matrix 1

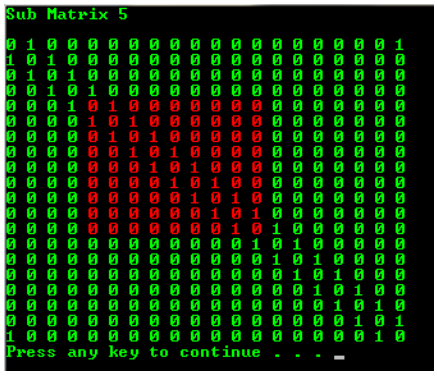
0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0
Press any key to continue . . .
```

```
Sub Matrix 2

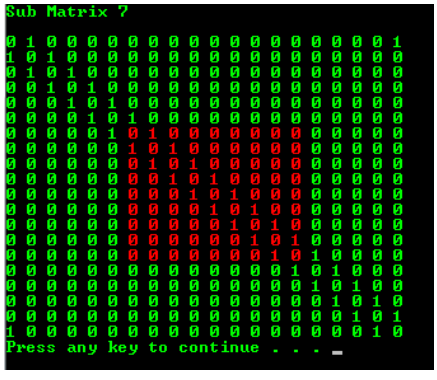
0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1
1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```


Sub Matrix 3
Press any key to continue . . .

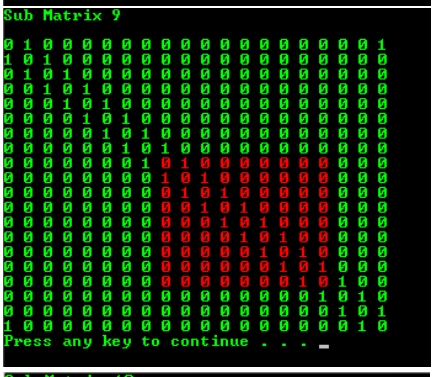

Sub Matrix 4
Press any key to continue . . .


Sub Matrix 5
Press any key to continue . . .


Sub Matrix 6
Press any key to continue . . .

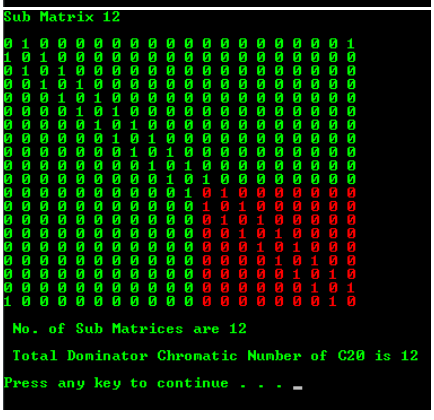

Sub Matrix 7
Press any key to continue . . .


Sub Matrix 8
Press any key to continue . . .


Sub Matrix 9
Press any key to continue . . .


Sub Matrix 10
Press any key to continue . . .


Sub Matrix 11
Press any key to continue . . .


Sub Matrix 12
No. of Sub Matrices are 12
Total Dominator Chromatic Number of C20 is 12
Press any key to continue . . .

CONCLUSION

In this paper, we investigated the hard counting problems, the total domi- nator chromatic number of paths and cycles. By introducing and equivalent rare-event estimation problem. We were able to apply the evolutionary C++ approach. We showed the C++ program provides a provable probabilistic performance lower bound guarantee which is easy to calculate on line. Our numerical output indicate that the proposed method is successful.

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TOTAL DOMINATOR CHROMATIC NUMBER OF PATHS AND CYCLES THROUGH COMPUTER PROGRAMMING

Mathematics

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ABSTRACT

A total dominator coloring of a graph G=(V,E) without isolated vertices is a proper coloring together with each vertex in G properly dominates a color class. The total dominator chromatic number of G is a minimum number of color classes with additional condition that each vertex in G properly domi- nates a color class and is denoted by $\chi_{td}(G)$. In this paper we introduce C++ programmes that are able to efficiently determine on approximation to the total dominator chromatic number of Paths and Cycles.

2010 Mathematics subject classification code : 05C69, 68W25

KEYWORDS

Total dominator coloring, Total dominator chromatic number.

INTRODUCTION

In this paper we only consider Paths and Cycles. Further details in graph theory can be found in F.Harrary[4]

Let G=(V,E) be a graph with minimum degree atleast one. The Path and Cycle of order n are denoted by P_n and C_n respectively.

A proper coloring of G is an assignment of colors to the vertices of G, such that adjacent vertices have different colors. The smallest number of colors for which there exists a proper coloring of G is called a chromatic number of G, and is denoted by $\chi(G)$. A total dominator coloring (td-coloring) of G is a proper coloring of G with extra property that every vertex in G properly dominates color class. The total dominator chromatic number is denoted by $\chi_{td}(G)$ and is defined by the minimum number of colors needed in a total dominator coloring of G. This concept was introduced by A.Vijayalekshmi in [1]. This notion is also referred as a smarandachely k-dominator coloring of G,($k \geq 1$) and was introduced by A.Vijayalekshmi in [2].For an integer $k \geq 1$, a smarandachely k-dominator coloring of G is a proper coloring of G, such that every vertex in a graph G properly dominates a k color class. The smallest number of colors for which there exists a smarandachely k-dominator coloring of G is called the smarandachely k-dominator chromatic number of G and is denoted by $\chi^{s}_{td}(G)$.

In a proper coloring C of a graph G, a color class of C is a set consisting of all those vertices assigned the same color. Let C be a minimum td-coloring of G. We say that a color class is called a non-dominated color class (n-d color class)if it is not dominated by any vertex of G and these color classes are also called repeated color classes.

The total dominator chromatic number of Paths and Cycles were found in [3]. We have the following observation from [3]

Theorem A [3]

Let G be P_n or C_n. Then

$$\chi_{td}(P_n) = \chi_{td}(C_n) = \begin{cases} 2\left\lfloor \frac{n}{4} \right\rfloor + 2 \; if \; n \equiv 0(mod4) \\ 2\left\lfloor \frac{n}{4} \right\rfloor + 3 \; if \; n \equiv 1(mod4) \\ 2\left\lfloor \frac{n+2}{4} \right\rfloor + 2 \; Otherwise \end{cases}$$

Main Results

Section 1.1

In this section we have to find the total dominator chromatic number of paths by using C++ programme.

A path of 'n' vertices, denoted by P_n, is a connected graph where all but two vertices have degree 1. We label the vertices of P_n as v_i for ($1 \leq i \leq n$). Furthermore let (v_i, v_{i+1}) be an edge of P_n for $i<n$.

Here is the source code of C++ programme to find the total dominator chro- matic number of Paths. The C++ programme is successfully compiled and run on C++ platform.

Program as follows

```
#include “stdafx.h"
#include <Windows.h>
#include <conio.h>

#include <iostream> using namespace std; int main() {
int inpt;

cout << "Enter the Value" << endl;
cin >> inpt;
while (inpt >= 11)

{
int n = inpt; // matrix row
int m = inpt; // matrix column
// dynamic allocation

int** ary = new int*[n]; //logic matrix int** mat = new int*[n];
//adjacency matrix for (int i = 0; i < n; ++i)

{
ary[i] = new int[m];
mat[i] = new int[m];
}

// fill ary

for (int i = 0; i < n; ++I) for (int j = 0; j < m; ++j) ary[i][j] = i;
system("pause"); system("cls");
cout << "\n";

cout << "The Adjacency Matrix for P" << n << "\n" << "\n";
for (int i = 0; i < n; I++)
{
for (int j = 0; j < n; j++)
{
if (ary[j][i] == i + 1 | ary[j][i] == i - 1)
{
mat[i][j] = 1;
cout << mat[i][j] << " ";
}

else
{
mat[i][j] = 0;
cout << mat[i][j] << " ";
}
}
cout << "\n";
}
```

```
system("pause");
//-----END LOGIC TO FORM MATRIX------ int d;
cout<<"\n";

if(n%4==3)// CONDITION FOR GETTING SUB MATRIX
{
cout<<"Order of sub matrices for the above Matrix is : "<<(2*(n/4))
<<"x"<<(2*(n/4))<<"\n";

d=2*(n/4);
cout<<"\n";
}

else // CONDITION FOR GETTING SUB MATRIX

{
cout<<"Order of sub matrices for the above Matrix is : "<<(2*(n/4)
-1)
<<"x"<<(2*(n/4)-1)<<"\n";
d=2*(n/4)-1;
cout<<"\n";
}

cout<<"for sub matrices"<<" ";
system("pause");
system("cls");
cout<<"Sub Matrices"<<" "<<d<<"x"<<d;
cout<<"\n"<<"\n";
int r=0;// matrix row
int c=0;// matrix column int k;
int l;
if(n%4==0)

{
l=n/2+2;
}

else

{
l=n/2+3;
}

HANDLE hConsole=GetStdHandle(STD_OUTPUT_HANDLE);
for(k=0;k<l;k++)

{
cout<<"Sub Matrix"<<" "<<k+1;
cout<<"\n"<<"\n";
for(int i=0;i<n;I++)
{
for(int j=0;j<n;j++)
{
if(j>=k&&j<d&&i>=k&&i<d)
{
SetConsoleTextAttribute(hConsole, FOREGROUND_RED |
FOREGROUND_INTENSITY);
cout<<mat[i][j]<<" ";
}

else

{
SetConsoleTextAttribute(hConsole, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
//cout<<"."<<" ";
cout<<mat[i][j]<<" ";
}
}
cout<<"\n";
}

if(k==l-1)

{
SetConsoleTextAttribute(hConsole, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
cout<<"\n";
cout<<" No. of Sub Matrices are"<<" "<<l;
cout<<"\n";
cout<<"\n";
cout<<" Total Dominator Chromatic Number of "<<"P"<<n<<" "
<<"is"
<<" "<<l;
cout<<"\n";
cout<<"\n";
} system("pause"); system("cls"); d++;
}
return 0;
for(int i=0;i<n;++I)
delete[] ary[i]; delete[] ary; return 0;
}
return main();
}
```

Runtime Test

```
Enter the Value
13
Press any key to continue . . .
```

```
The Adjacency Matrix for P13

0 1 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```

```
Order of sub matrices for the above Matrix is : 5x5
for sub matrices Press any key to continue . . .
```

```
Sub Matrices 5x5

Sub Matrix 1

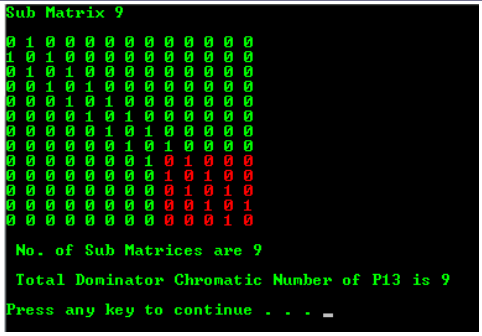
0 1 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```

```
Sub Matrix 2

0 1 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```

```
Sub Matrix 3

0 1 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```



Section 1.2

Program source code

In this section, we give the source code of the C++ program to find the td- chromatic number of a cycle. A cycle on n vertices denoted by C_n is a connected graph where each vertex has degree two. We label the vertices of c_n as v_i for $1 \le i \le n$ and let (v_i, v_{i+1}) be an edge of C_n for $1 \le i \le n - 1$. We let (v_n, v_1) be the remaining edge of C_n. The program is successfully compiled and tested under C++ platform. The program output is also shown below

Program as follows

```
#include “stdafx.h"
#include <Windows.h>
#include <conio.h>F

#include <iostream> using namespace std; int main() {
int inpt;

cout << "Enter the Value" << endl;
cin >> inpt;
while (inpt >= 11)

{
// dimensions
int n = inpt; // matrix row
int m = inpt; // matrix column
// dynamic allocation
int** ary = new int*[n]; //logic matrix

int** mat = new int*[n]; //adjacency matrix for (int i = 0; i < n; ++i)
{
ary[i] = new int[m];
mat[i] = new int[m];
}

// fill ary

for (int i = 0; i < n; ++I) for (int j = 0; j < m; ++j) ary[i][j] = i;
system("pause"); system("cls");
cout << "\n";
cout << "The Adjacency Matrix for C" << n << "\n" << "\n";
// -----LOGIC TO FORM MATRIX------ for (int i = 0; i < n; I++)
{

for (int j = 0; j < n; j++)

{
if (ary[j][i] == i + 1 | ary[j][i] == i - 1 | ary[j][i] == i + (n - 1)
| ary[j][i] == i - (n - 1))
{
mat[i][j] = 1;
cout << mat[i][j] << " ";
}

else

{
mat[i][j] = 0;
cout << mat[i][j] << " ";
}
}
```

```
cout << "\n";
}

system("pause");
// -----END LOGIC TO FORM MATRIX------ int d;
cout << "\n";

if (n % 4 == 3)// CONDITION FOR GETTING SUB MATRIX

{

cout << "Order of sub matrices for the above Matrix is : " << (2 * (n / 4))
<< "x" << (2 * (n / 4)) << "\n";
d = 2 * (n / 4);
cout << "\n";
}

else // CONDITION FOR GETTING SUB MATRIX

{
cout << "Order of sub matrices for the above Matrix is : " << (2 * (n / 4)
- 1)
<< "x" << (2 * (n / 4) - 1) << "\n";
d = 2 * (n / 4) - 1;
cout << "\n";
}

cout << "for sub matrices" << " ";
system("pause");
system("cls");
cout << "Sub Matrices" << " " << d << "x" << d;
cout << "\n" << "\n";

int r = 0;// matrix row
int c = 0;// matrix column int k;
int l;
// final value---------- if (n % 4 == 0)
{
l = n / 2 + 2;
}

else

{
l = n / 2 + 3;
}

HANDLE hConsole = GetStdHandle(STD_OUTPUT_HANDLE);
for (k = 0; k<l; k++)

{
cout << "Sub Matrix" << " " << k + 1;
cout << "\n" << "\n";
for (int i = 0; i < n; I++)
{
for (int j = 0; j < n; j++)
{
if (j >= k && j<d && i >= k && i <d)
{
SetConsoleTextAttribute(hConsole, FOREGROUND_RED |
FOREGROUND_INTENSITY);
cout << mat[i][j] << " ";
}

else
{
SetConsoleTextAttribute(hConsole, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
//cout << "." << " ";
cout << mat[i][j] << " ";
}
}
cout << "\n";
}
if (k == 1 - 1)
{
SetConsoleTextAttribute(hConsole, FOREGROUND_GREEN |
FOREGROUND_INTENSITY);
cout << "\n";
cout << " No. of Sub Matrices are" << " " << l;
cout << "\n";
cout << "\n";
cout << " Total Dominator Chromatic Number of " << "C" << n << " "
<< "is"
<< " " << l;
cout << "\n";
cout << "\n";
} system("pause"); system("cls"); d++;
}
return 0;
}
return main();
}
```

Runtime Test

```
Enter the Value
20
Press any key to continue . . .
```

```
The Adjacency Matrix for C20

0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1
1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0
Press any key to continue . . .
```

```
Order of sub matrices for the above Matrix is : 9x9
for sub matrices Press any key to continue . . .
```

```
Sub Matrices 9x9

Sub Matrix 1

0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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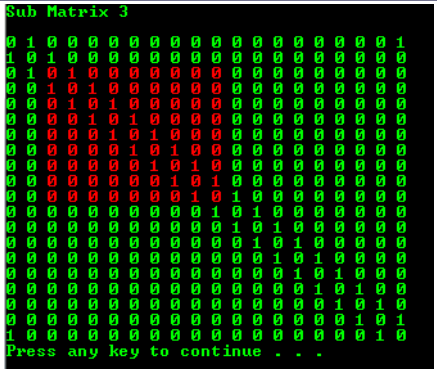
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Sub Matrix 4
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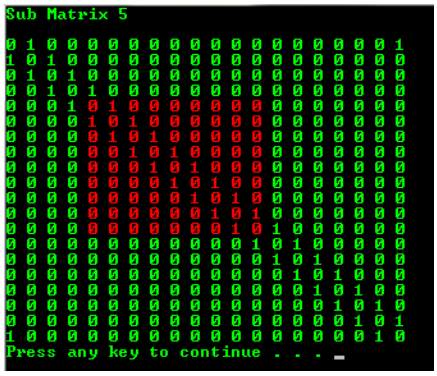
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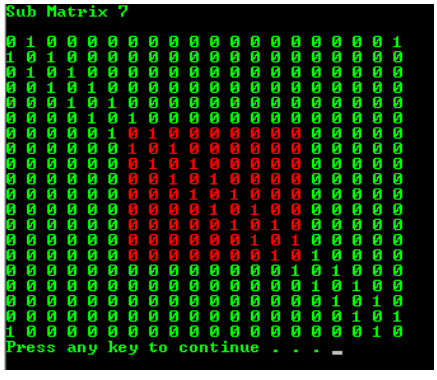
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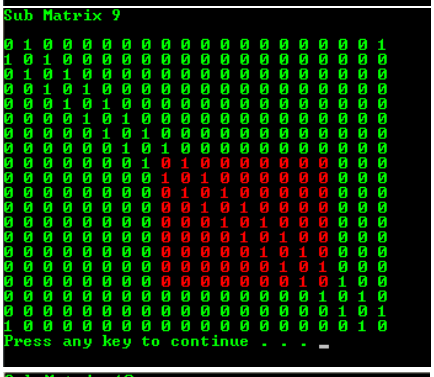
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Sub Matrix 11
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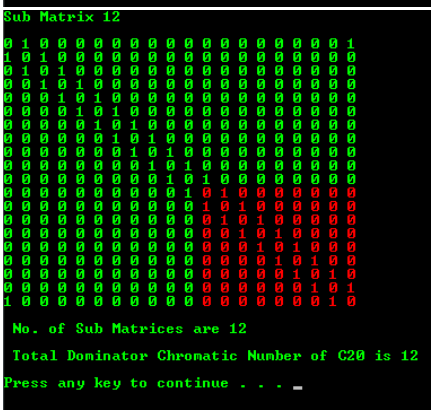
Sub Matrix 12
No. of Sub Matrices are 12
Total Dominator Chromatic Number of C20 is 12
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CONCLUSION

In this paper, we investigated the hard counting problems, the total domi- nator chromatic number of paths and cycles. By introducing and equivalent rare-event estimation problem. We were able to apply the evolutionary C++ approach. We showed the C++ program provides a provable probabilistic performance lower bound guarantee which is easy to calculate on line. Our numerical output indicate that the proposed method is successful.

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A STUDY ON THE AWARENESS OF CRYPTOCURRENCY IN CHENNAI CITY

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ABSTRACT

Money is something which keeps a great value in life of human being and its history dates back to ancient time when Gold, Silver and other metal coins were used for buying goods and other essential items, known as Barter system. After that Monetary system came into picture and later different currencies came into existence which were adopted by different countries in the world.This wasn't the end of monetary evolution. Cryptocurrency is the latest development is the monetary system. Cryptocurrency is neither commodity money nor fiat money – it is a virtual currency. The paramount needs to understand the details about cryptocurrency not only as a technology but also as an investment vehicle or a commodity has struck popularity even before it reached the top of its fame after the 2008 Financial Crisis. However, the success of cryptocurrency will largely depend on the extent to which society is willing to adopt it. The present study is carried out to understand the consumers awareness and perception towards cryptocurrencies. The data is collected from among 110 respondents in Chennai city.

Keywords: *Monetary system, financial crisis, cryptocurrencies, technology*

INTRODUCTION

In the history of humans, they have used commodity as currency in Barter system. Gradually, Barter System got replaced by Monetary System and later on different currencies came into existence which were adopted by different countries of the world. The metal coins which were predominantly used for exchange were overshadowed by paper money as it was easy to carry from one place to another and presence of big denominations in printed paper form helped big businesses to carry out big transactions. Gradually, the use of cash transactions started fading away due to invention of Plastic money. Later on, the development of computers and invention of Internet gave birth to Internet banking and due to further advancement of mobile phone technology, we can easily avail the facilities like mobile banking or mobile payment gateways where all transactions will be done just through one click in our mobile. . This wasn't the end of monetary evolution. Cryptocurrency is the latest development is the monetary system. Cryptocurrency is a digital currency which is created for the purpose of transactions as a normal currency. Cryptocurrencies are existing in all over world but still its status has

not been identified as whether it will ever attain the actual currency status or it will remain as a part of investment portfolio. It uses Cryptography and Blockchain technology to secure its exchanges and limit the production of a particular type of cryptocurrency and keep track of each and every transaction in whole network.

OBJECTIVES OF THE STUDY

- To study about the consumer awareness of cryptocurrency
- To determine the willingness of people to choose Cryptocurrency as an investment tool
- To study the various factors, which are important in adoption of cryptocurrency

NEED FOR THE STUDY

Cryptocurrency is a new age technology based digital currency and its popularity is increasing among people gradually but the Government and regulatory authorities are still doubtful about its use and there are many legal and security issues linked with it. Cryptocurrencies are mainly being used as investment tool and it is highly volatile in nature. It's almost a decade that Cryptocurrencies are existing all over world but still its status has not been identified as whether it will ever attain the actual currency status or it will remain as a part of investment portfolio. People are also not much aware about the worth of cryptocurrency and mostly they perceive it as illegal means. Thus it is important to study the awareness of cryptocurrencies among people.

LITERATURE REVIEW

Bhattacharjee and Harmeet Kaur (2015), concluded that the results attained by Bitcoin so far may give rise to new hopes to both consumers and market who seek more freedom in terms of volume and payment methods Tara Mandjee (2015), concluded that Bitcoin is now young and experimental, however in coming times it will make a long-lasting impression. Trevor I. Kiviat (2015), held that Bitcoin has both upside and downside, however blockchain technology may be adapted and that policy makers should make regulations with caution and precession.

B Eshwari, Ahamed Adeeba (2018), found in their study, which is empirical, on "A Study on Perception of Bitcoin and Their Awareness and Impact among investors in Asset Management Company With Reference To Bangalore City" that investors are aware about Bitcoin of Asset Management Company. All the investors' perceptions towards Bitcoin are more focusing on better returns which will be the reason to overcome other investment avenues in future and higher bracket investors are more focusing in investing on Bitcoin rather compared lesser bracket group. Also all the investors prefer Bitcoin to be regulated by regulatory body in India.

Mittal Alka (2017), analyzed in the study on "An Analytical Study Of Present Position Of Bitcoins", the Indian Tax and legal considerations regarding Bit coins, the problems and risks related with Bitcoins such as Cyber Attacks and Hacking, Price Fluctuation and Inflation, Fraud, Uncertainties in the Government Policies, and risks related with Bitcoins such as Money Laundering, Drug Trafficking, Tax Avoidance and Evasion and Terrorist Financing.

Tamradaman Akshaya and Nagpure Sangeeta (2017), discussed about the problems in their study on "Bitcoin in India" , which can be foresee is the pace of change in regulations; change in regulation usually takes a route of develop, propose and adopt which generally takes a period. Regulations or regulatory changes typically evolve at a slower pace than innovation thereby killing it by declaring it illegitimate. Also as its not been governed by a central authority Bitcoin tends to fluctuate widely and to be used globally its volatility needs to settle down.

RESEARCH METHODOLOGY

The study was carried out to get knowledge of the customers awareness and perception towards cryptocurrencies. The data was collected using primary data and secondary data. Primary Data is collected through a well-structured questionnaire from 110 respondents of Chennai city using

convenient sampling method. Data is presented in tables Secondary data was collected from published articles such as journals, books, internet websites.

DATA ANALYSIS AND INTERPRETATION

Table 1: Socio Economic profile

Category	Number of respondents	Percentage %
Gender wise		
Male	78	71
Female	32	29
Age wise (in years)		
18-25	17	15
26-35	44	40
36-50	37	34
More than 50	12	11
Education level		
Primary	7	6
sslc	28	26
plus 2	32	29
UG/ PG	43	39
Occupation level		
Students	18	16
Government employees	27	24
Private employees	49	45
Others	16	15
Income group		
Less than 1 lakh	18	16
1lakh-3 lakh	29	26
300001 – 5 lakh	38	35
More than 5 lakh	25	23
Total	110	100

Source: Primary data

Table 1 shows that out of 110 respondents, 71% of them belongs to male category and 29% to female category. The demographic profile shows that majority of respondents belongs to 26-35 age group and 39% of them are having UG/PG education. Majority of respondents, 45% are private employees and 35% of customers are having 300001-5 lakh as their annual income.

Table 2:Response related to usage of cryptocurrency

Experience of cryptocurrency		
	Number of respondents	**Percentage %**
No experience	46	42
Small amount of experience	27	25
General amount of experience	21	19
Great deal of experience	16	14
Future use		
Yes	76	69
No	34	31
If No, Why		

Exchange risk	9	26
Theft and hacking	8	24
No expertise	13	38
No central authority	4	12
If Yes, Why		
Low cost	17	22
User anonymity	12	16
No third party	19	25
No tax	28	37

Source: Primary data

According to the survey 42% of the respondents have no experience of using cryptocurrency, 25% said they have small amount of experience, 19% of respondents say that they great deal of experience. This shows that though people are aware about cryptocurrency but they don't use it as of now.

We can also interpret that though respondents are aware of cryptocurrency but the experience of using is less but most of them showed interest in using it near future which indicates that use of cryptocurrency will increase. Result shows that 69% of respondents are open to use cryptocurrency in future whereas 31% of respondents says that they don't want to use it. In further investigation it was found that most of the respondents who said they will use cryptocurrency in near future said no taxes on transaction as a most important factor, followed by no third party intervention as second most important factor for choosing cryptocurrency and user anonymity was the least opted choice by the respondents as they don't want to hide their identity.

Table 3: Preference of respondents on cryptocurrency

Preference	**Number of respondents**	**Percentage %**
Currency	21	19
Investment tool	56	51
No preference	33	30
Total	110	100

Source: Primary data

Table 3 shows that majority of respondents, 51% prefer to use cryptocurrency as an investment tool. Only 21% of respondents prefer to use it as currency and 33% choose not give any preference for cryptocurrency usage.

Table 4: Factors affecting usage of cryptocurrency

	R1	**R2**	**R3**	**R4**	**R5**	**Total Score**	**Overall Rank**
Improved govt legislations	48	32	19	11	10	457	1
Education about cryptocurrencies	36	38	22	8	6	420	2
More stable cryptocurrencies price	18	17	26	29	20	314	5
Major banks accepting proceeds of cryptocurrencies	12	16	29	21	32	255	6
Faster transaction process	42	29	21	11	7	418	3

Better tools for e-commerce merchant	25	29	19	18	19	353	4

Source: Primary data

Table 4 shows the factors affecting the usage of cryptocurrency among respondents. Most respondents prefer to use various cryptocurrencies due to improved government legislation. Second rank goes to education about cryptocurrencies among respondents, as more advertisements and awareness classes are taking place. Third rank goes to faster transaction process and the least rank 6 goes to banks willingness to accept cryptocurrencies.

FINDINGS

From the study it was found out that 42% of respondents have no experience on usage of cryptocurrency and 16% have great deal of experience in its usage. 76% of respondents are ready to use cryptocurrencies in future due to no tax burden, no third party interruption, low cost and user anonymity. 34% of respondents are not ready to use in future due to exchange rate risk, theft and hacking, lack of proper awareness.

SUGGESTIONS

1. As cryptocurrency is a part of decentralized system and it is available across the globe,proper regulation is required.
2. Proper awareness programmes are required to make cryptocurrencies more familiar among people.

LIMITATIONS OF THE STUDY

1. The study is confined to 110 respondents
2. Data is collected from limited geographical area
3. The customers attitude may change in future

CONCLUSION

From the study carried out we can clearly see that cryptocurrency is still in an evolution phase and it has not gained much of the user base. Also very less population of India aged between 26-35 is aware about cryptocurrency and even if they are aware of cryptocurrency they hardly use it. People said the reason they are reluctant to use cryptocurrency is that Exchange rate is very volatile. Cryptocurrency is a peer-peer currency, thus doesn't require any intermediaries to complete the transaction which reduces the cost per transaction, and also not tax burden, these are the major reasons given by respondents for using the cryptocurrency. The improved government legislation, educating people about cryptocurrencies are some of the factors affecting the respondents future adoption of virtual currency.

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CUSTOMER PERCEPTION TOWARDS DIFFERENT DIGITAL CHANNELS OF BANKING WITH SPECIAL REFERENCE TO KANNIYAKUMARI DISTRICT

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ABSTRACT

Digital Banking is the activity of providing various banking transactions to the customers through digital channels. Through opting digital channels for communicating transactions banks can reduce their cost of operation as well as their time for operation. This also helps the customers to save their effort, time and cost. Digital banking enables a bank's customers to access banking products and services via an electronic/online platform. So, digital channels are treated as an important medium for day to day banking operations. Digital channels refer to Automated Teller Machines(ATMs), Cash Deposit Machines (CDMs), Payment Cards, Mobile Applications, SMS Services, Online Applications, Contact Centre, Interactive Voice Response (IVR), etc. The customers can access both online and offline services at this time. But the online services through digital channels are more convenient and user friendly. The main aim of this study is to find out the level of customer satisfaction towards the digital services of banks. The other objectives are to familiarize the digital channels and services, to measure the accuracy of transactions, to know the merits and demerits of digital banking services, and to compare the benefits of digital banking services over traditional banking.

***Key words**: Digital banking, Digital channels, Banking transactions.*

INTRODUCTION

In India banking sector is the major service sector. Banking sector act as a backbone in Indian financial system. In earlier days banking operations done only through direct banking operations. The banking industry has undergone incredible changes over the last 20 years through technology. With the introduction of new technologies in the banking sector, the practice of direct banking has changed and banking transactions have become fully digitalized. All records are maintained in digital form with digital banking. With this digitalization, banking services can be easily accessed from home by customers. Older people do not have to wait long in line. Big merchants have also become accustomed to completing their transactions on their mobile phones without delay. This also saves customers time.

Due to this digitalization, the customer base in the banks is less. Because of this, operational cost of banks have been reduced compared to traditional banking. The confidentiality of customer transactions is also protected in digital banking. A lot of digital channels have also been introduced for customers to use digital banking services. Automated Teller Machines(ATMs), Cash Deposit Machines (CDMs), Internet banking, Mobile banking, Unified Payments Interface(UPI), E-Wallet, Aadhar Enabled Payment System (AEPS), usage of Core Banking Solution(CBS), Debit and Credit cards are some of the examples of digital channels. Through digital channel customers can easily transfer funds from one account to another account. It enables payment of utility bills, online payment for online shopping also. It strengthens privacy and security for customers. Through Core Banking Solutions(CBS), customers can make transactions in their bank account through any branch of that bank.

Digital channels would create better ways for banks to strengthen their relationship with customers and create opportunities to sell additional products through a single platform.

OBJECTIVES OF THE STUDY

- To study on level of customer awareness about digital channels.
- To measure the level of satisfaction customers experience through digital channels.
- To identify the various problems and issues faced by the customers while using digital products.
- To identify the various factors which affect the customer perception towards different digital channels.

SCOPE OF THE STUDY

The main aim of the study is to analyze customer perception towards different digital channels of banking with special reference to Kanniyakumari District. In Kanniyakumari District literacy rate is 91.75%, which is the first district in Tamil Nadu in terms of literacy rate. So most of the people are educated and aware of new generation banking products. The aim is to understand the level of customer satisfaction towards digital channels and the issues faced by them while using the products. We will also collect feedback from the people for further development and improvement of the banking services.

METHODOLOGY

In this study both primary and secondary data have been collected. Primary data have been collected through interview schedule and a well-structured questionnaire. Simple random sampling method is used for the study and a sample size of 200 respondents is taken from Kanniyakumari District. Secondary data have been collected from articles, journals, websites and newspapers.

REVIEW OF LITERATURE

Meena and Rathiha (2021) identified key features of internet banking by analyzing the response of internet banking customers in their study. Although there are many benefits to internet banking, most people use this service only to review their bank records. They use online banking service once a month. The reason for this infrequent use is the lack of personal contact with customers and bank employees when customers use the service. Banks need to be constantly improved and give proper awareness to the customers to use this service without fear and hesitation.

Anisha and Jeba Melvin (2018) stated that internet banking is used by most of the people to save their time. Internet banking provides banking services to customers from anywhere with an internet connection. They feel some privacy and security in this service due to new technology advancement. According to the authors, the main factor influencing the customers to use internet banking is age. People between the age group of 31years to 40years use these services to make their daily financial transactions.

Inder Pal Singh and Payal Bassi (2017) in their paper found that public and private sector banks offer various internet services to their customers to cater to their needs. In their paper they have discussed about various internet services provided by the banks. It has been decided that to use internet services properly bank should provide attractive and easy to use interface. To easily avail the internet services provided by the banks, proper security concerns should be provided by the banks to the customers.

DATA ANALYSIS AND INTERPRETATION

The data collected using interview schedule and questionnaire has been presented in the forms of tables and charts for understanding.

Gender wise classification

Table 1.1

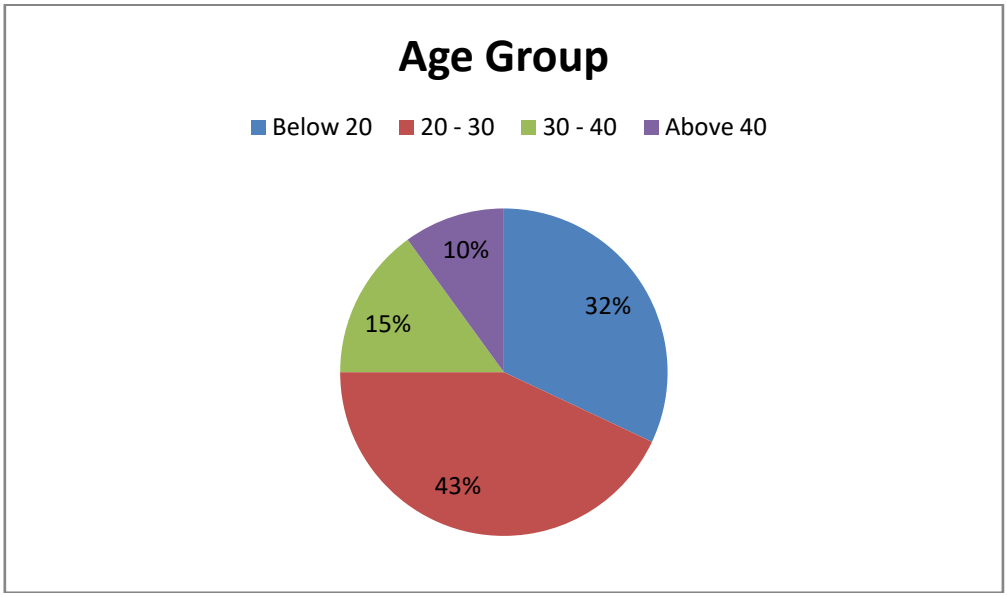
Gender	Respondents	Percentage (%)
Male	114	57
Female	86	43
Total	**200**	**100**

Source : Primary data

Table 1.1 shows that most of the respondents are Male. It indicates 57% of the respondents are male and remaining 43% are female. From these data it can be seen that male customers are actively using digital products as compared to female customers.

Age wise classification

From this figure 1.1 it is clear that 43% of the respondents are under the age group of 20years to 30years and 32% of the respondents are in the group of below 20years. In the group of 30 years to 40 years 15% of respondents are available. Only less amount that is 10% of the respondents are under the group of above 40 years. From this we can conclude that most of the respondents are youngsters and they are aware of these digital products. Rather than using traditional banking, they opt for these digital products for their financial transactions.



Source : Primary data

Figure 1.1

Economical background wise classification

Table 1.2

Category	Respondents	Percentage (%)
Self employed	34	17
Businessman	112	56
Govt employees	54	27
Total	**200**	**100**

Source : Primary data

Table 1.2 indicates that most of the respondents i.e. 56% of the respondents are business people. They use digital services for their business transactions. Because it is a fast and time saving way to do transactions. 27% of the respondents are under the group of govt employees and the remaining 17% are self employed.

Customer Satisfaction level

Table 1.3

Services	Highly Satisfied	Satisfied	Moderate	Dissatisfied	Highly Dissatisfied	Total
ATM	20	81	57	24	18	200
Mobile Banking	20	83	44	28	25	200
Internet Banking	12	72	48	38	30	200
UPI	62	93	28	11	6	200
Customer service	23	77	38	30	32	200
Security level	52	102	25	15	6	200
Time saving	82	87	26	3	2	200

Source : Primary data

Table 1.2 shows the level of satisfaction of the respondents. From this we can understand that 10% of the respondents are highly satisfied with the ATM services and 40.5% are satisfied. Only 9% are highly dissatisfied with ATM services. Most of the respondents are satisfied with mobile banking, internet banking, UPI services. 38.5% of respondents are satisfied with customer service. 51% of respondents are satisfied with the level of security provided in digital services and 43.5% are satisfied with the time saving feature, only 1% are highly dissatisfied with this.

Problems faced by customers

Table 1.4 shows that 77.5% of respondents easily adapt themselves to new technology. Considering the availability of banking services all times, 74% of respondents encounter problems with this service. In terms of safety and security, 85.5% of respondents are ok with that. Most of the respondents face problems with banks' awareness, network issues and timely response to complaints.

Table 1.4

Factors	Yes	No	Total
Easy Adaptation to Innovative Technology	155	45	200
Availability of 24/7 Banking Service	52	148	200
Safety & Security	171	29	200
Instructions and Awareness from Banks	98	102	200
Network issues	49	151	200
Timely Response for Complaints	72	128	200

Source : Primary data

FINDINGS

According to our study, male customers use digital channels more than female customers. Most Young customers in the age group of 20years to 30years use these services. Most (56%) of the respondents are business people use these services to do their business transactions. Considering the various services offered by banks, most people are satisfied with the services. They mainly use these services to save their time. Some customers face problems related to network issues and resolving grievances.

SUGGESTIONS

Banks need to provide systematic awareness and training programs for customers to use new and up-to-date digital products. Because not everyone is aware of new products. Banks need o provide customers with a safe and secure feeling when using the digital services. Banks should always ensure that ATMs are functioning properly. This will reduce the waiting time of customers at ATMs and also reduce customer complaints. Banks should handle proper and easy means for customers to lodge their complaints. Quick and expeditious response from the bank to customer complaints regarding digital transactions will increase the number of customers using the services.

CONCLUSION

This study attempted to identify the customer perception towards digital channels. From this study it is clear that younger generation is ready to use the new digital services. This is because they do not want to spend their time at bank branches by waiting in line for a long time for their financial needs. So they easily prefer this services. But sometimes when using these services they face some problems like network issues, security issues and some other issues. Banks take more time to resolve these issues and customer complaints. So they are reluctant to use these services. Banks should take immediate action to resolve these complaints to maintain this customer base. In the mean time, create proper awareness among customers to use these services in a safe and secure manner.

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CONSUMER SATISFACTION TOWARDS ONLINE SHOPPING WITH SPECIAL REFERENCE TO THIRUVANANTHAPURAM CITY

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ABSTRACT

Nowadays internet shopping is a phenomena that is growing rapidly. There is an exponential growth of the main players in this industry indicates there is still a large reservoir of market potential for e-commerce. The convenience of online shopping showed an emerging trend among consumers. The prevalence of online shopping has raised the interest of the retailers to focus on this area. Therefore, the study was to determine the factors influencing the satisfactory level, perceived usefulness and online shopping behaviour while mediated by purchase intention. Currently online shopping becomes one of the popular approaches for business and customers perform trade over the internet. Business tries to create new ways to promote their product via online. The present study is descriptive and analytical in nature. The study covers respondents from Thiruvanathapuram city. Convenient sampling method is used for the study and sample size is 60. Both primary and secondary data are used for study. Primary data are collected through direct questionnaire and secondary data are collected from books, journals and websites. The main objective of the study is to find out the factors influencing the satisfaction of consumers to shop online. The study also tries to find out the difficulties faced by the customers while purchasing through online.

Keywords: *Online Shopping, internet, Consumer, industry and Market.*

INTRODUCTION

Online shopping is a form of electronic commerce which allow consumers to directly buy goods or services from a seller over the internet using a web browser or a mobile app. Online Shopping are playing an important role in the overall relationship between market and their consumers. Consumers find the product by visiting the website of the retailers directly or searching among alternative vendors using shopping search engine, which displays the same product availability and pricing at different e-retailers. It provides a very comfortable service for its customers. The purchase behavior of customers are mainly based on the cyber space appearance such as pictures, images, quality information and video clips of the products, not on the actual experience. With online shopping we are no longer required to visit mall to make a purchase. By just sitting at the comforts of our homes, we can buy the requires

products and also pay online.

Online shopping is fast, convenient with your goods reaching you at doorsteps. The key drivers for the boost of online shopping sector are increasing broad band internet penetration, rising standard of living with high disposable income, availability of much wider product range compared to what is available in the market. The wide use of internet and rapid growth of technology have created a new market for both the customers and business. Nowadays internet is not just another medium to get in touch with consumers, but it is an important channel to find potential customers as well as channel to continue relationship with existing customers. Customer satisfaction is used to measure how much customer is happy with any product, its quality and overall experience.it reflects if customer is happy to engage with any business or not. It is also an important aspect to measure success of a business. The objective of this research is to overview the customer response towards online shopping .This research highlights the effects of customer satisfaction on online shopping. It also provides a comprehensive overview of how online shopping can be made a better experience by putting forth the underlying correlation of customer satisfaction in boosting the number of people who shop online.

REVIEW OF LITERATURE

Nahil Abdallah, Hassan Alyafai and Amin Ibrahim (2021), in their study revealed that to reach greatest number of clients, the purchasing procedure must also be user friendly because most customers prefer online shopping to conventional shopping, large and effective ads accessibility, product quality should be made to stimulate clients' interest. The study concludes that pricing and commodity quality should complement one another to create consumer satisfaction.

Dr A. Muthupriya (2019), has conducted a study entitled "A study on consumer satisfaction towards online shopping in Shivaganga District" states that online shopping has truly revolutionized and influenced our society as a whole. Use of technology has opened new doors and opportunities for online shopping variety, quick service and reduced price were three significant ways through which online shopping influenced people from all over the world and suggest that through privacy, security policies and websites designers are doing their best to end the unethical practices.

Bhatt A (2014), has studied the attitudes of consumer towards e-shopping based on consumers behavior, beliefs, preferences and opinions also studied the pattern of online shopping gaining more popularity among people, especially in the younger generation.

Rashed Al Karim (2013), has conducted a study entitled "study customer satisfaction in online shopping: a study in to the reasons for motivations and inhibitions "states that there are various factors that depend consumers purchasing decisions. From the study it was found that online payment system, privacy or searching issues, delaying of delivery and lack of customer service are the main inhibitions that faced by the respondents. The study reveals that security and privacy issues will create loss of trust and reputation and also affect the customer confidence.

STATEMENT OF THE PROBLEM

A big revolution is taking place in the digital world. Online shopping has gained a lot of importance in the present marketing conditions. But along with its growth the number of fraudulent practices and cheating also increased. Such fraudulent activities created fear in the minds of customers and adversely affect the attitudes of consumers towards online purchase. To enhance that attract online customer is very important so that it is very crucial for all online retailers to identify and know about the factors influence customers to shop online.

SCOPE OF THE STUDY

The scope of the study is wide and valuable. The study deals with the customer satisfaction towards online shopping stores. The study will help the marketers to know about the level of satisfaction of consumers and with the help of the result they can frame marketing strategies to fulfill the unsatisfied wants of consumes.

OBJECTIVES OF THE STUDY

- To provide awareness regarding the concept of consumer satisfaction and online purchase.
- To analyse the satisfaction level of consumers towards online purchase in Thiruvananthapuram City.
- To identify the difficulties faced by the customers while online shopping in Thiruvananthapuram City.

RESEARCH METHODOLOGY

Research design is a detailed blue print used to guide the research study towards its objectives. The study is descriptive and analytical in nature. Both primary and secondary data are used for the study. Primary data are collected through a well-structured questionnaire. Convenient sampling method is used for the study and sample size of 60 respondents is taken for the study from Thiruvananthapuram city. Secondary data are collected from various websites, books, journals and newspapers.

HYPOTHESIS

H_0 – There is no significant relationship between age and frequency of purchase of respondents regarding the online shopping.

H_1 –There is significant relationship between age and frequency of purchase of respondents regarding the online shopping.

DATA ANALYSIS AND INTERPRETATION

The data collected has been presented in the form of various tables and graphs. For the purpose of analysis and interpretation various statistical tools like chi-square test, simple percentage and graphs are applied.

Table No. 1.1 Gender wise classification

Gender	Respondents(f)	Percentage (%)
Male	9	15
Female	51	85
Total	**60**	**100**

Source: Primary Data

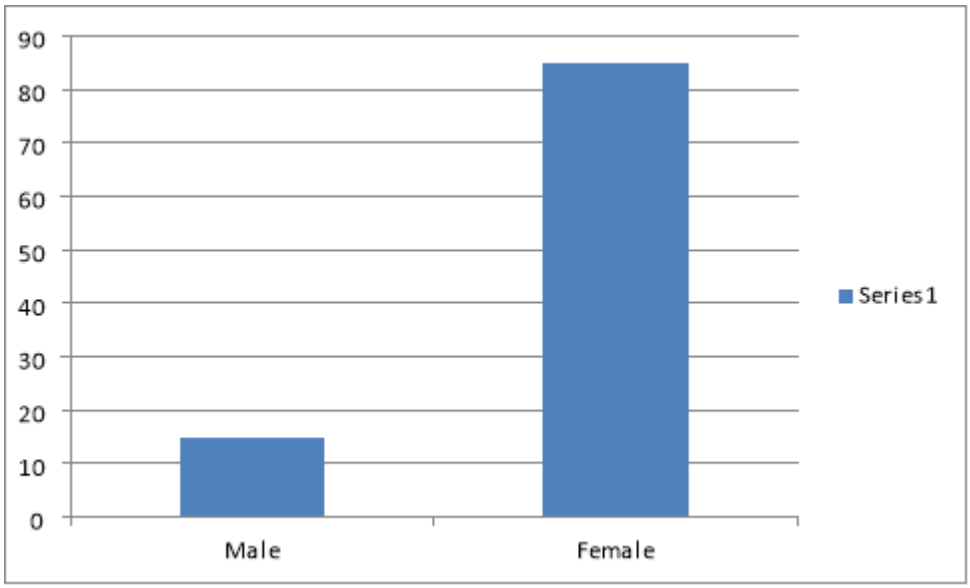

Figure No. 1.1, Bar chart showing the gender wise classification of respondents

Inference: The figure 1.1 shows those major portions (85%) of respondents are female. While male consists of only (15%). Thus it can be concluded that majority of respondents are female.

Table No. 1.2 Age group of respondents

Age	Respondents (f)	Percentage (%)
Below 20	3	5
20-30	21	35
30-40	30	50
Above 40	6	10
Total	**60**	**100**

Source: Primary Data

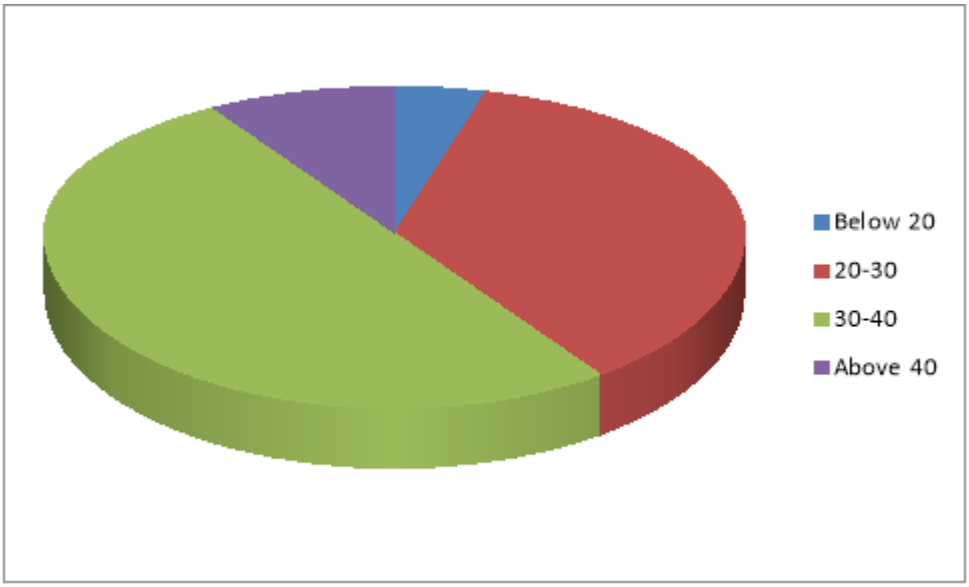

Figure No. 1.2, Pie chart showing the age group of respondents

Inference: From the figure 1.2 it is clear that 50 percent of respondents are under the age group of 30-40. Only 5 percent are under the age group of below 20. 35 percent of respondents come under the age group of 20-30 and 10 percent of respondents come under the age group of above 40. So it can be concluded that most number of respondents are from 30-40.

Table No 1.3 Frequency of Purchase

Frequency	Respondents (f)	Percentage (%)
Daily	6	10
weekly	9	15
Monthly	36	60
Yearly	9	15
Total	**60**	**100**

Source: Primary Data

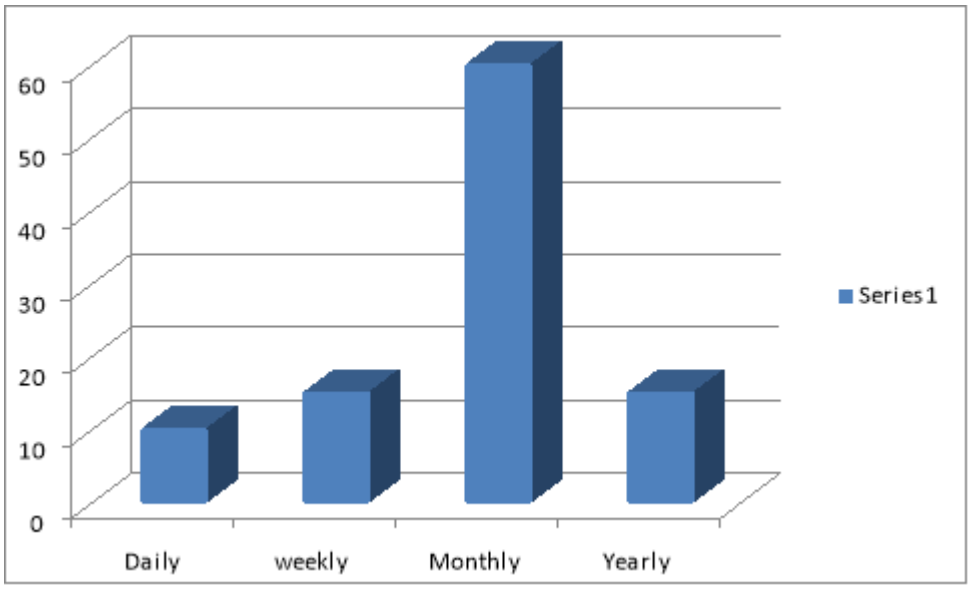

Figure No. 1.3, Bar chart showing the frequency of purchase of respondents

Inference: From the above figure it can be showed that the purchase behavior of majority of respondents (60%) is monthly. Only 10 percent are purchase daily, 15 percent of respondents are purchase weekly and yearly basis.

Table No .1.4 Problems faced in Online Shopping

Problems	**Respondents (f)**	**Percentage (%)**
Product arrival	3	5
Product arrive in damage	3	5
Wrong product	3	5
Not quality goods and service	12	20
No problem	39	65
Total	**60**	**100**

Source: Primary Data

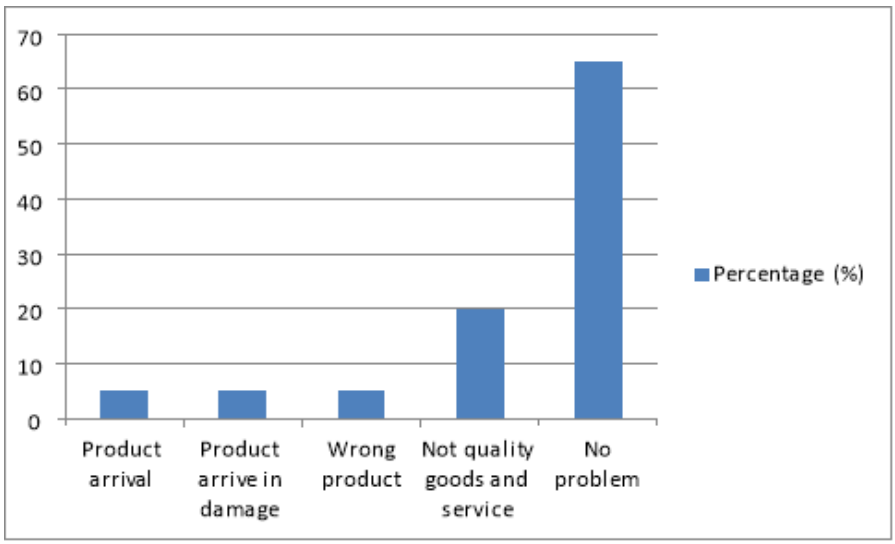

Figure No. 1.4, Line chart showing the problems faced by the respondents

Inference: From the figure 1.4, it is clear that majority (65%) of respondents are satisfied in online shopping. 20 percent responds that no quality goods and service available in online shopping.

Relationship between age and frequency of purchase

H_0 – There is no significant relationship between age and frequency of purchase of respondents regarding the online shopping.

H_1 –There is significant relationship between age and frequency of purchase of respondents regarding the online shopping.

Table No. 1.5 Age and frequency of Purchase

Age / Frequency	Daily	Weekly	Monthly	Yearly	Total
Below20	1(0.3)	1(0.45)	1(1.8)	0(0.45)	3
20-30	2(2.1)	5(3.15)	12(12.6)	2(3.15)	21
30-40	2(3)	2(4.5)	20(18)	6(4.5)	30
Above 40	1(0.6)	1(0.9)	3(3.6)	1(0.9)	6
Total	6	9	36	9	60

Source: Primary Data

Figures in brackets shows expected frequencies.

Degree of freedom- (4-1) (4-1) = 3x3 = 9

Level of significance is 5%

Chi-Square value is 89.64 and Table value is 16.92

Inference: The result from the chi-square test indicates that age of respondents is significantly related with frequency of purchase. The chi-square value (89.64) is more than the table value (16.92) at 5% level of significance, therefore the null hypothesis is rejected and it can be concluded that there is a significant relionship between age and frequency of purchase.

FINDINGS

- Analysis of personal characteristics of respondents reveals that majority (85%) of the respondents is female, majority of respondents belong to the age group of 30-40 and majority of (60%) of respondents are post graduate.
- From the study it can be understood that majority of respondents made their purchase monthly basis.
- The study found that online advertisement is act as a major source of awareness.
- Majority (40%) of respondents consider product rating before online shopping.
- The study revealed that there is significant relationship between age and frequency of purchase.
- Majority of respondents satisfied with choice of availability of product.

SUGGESTIONS

- Proper safety measures should be adopted to prevent online fraudulent activities.
- More promotional activities are needed to catch prospective customers in the area of online shopping.
- Better to implement add free applications to ensure effective online shopping.
- Find and remove unauthorized sellers from the shopping site to ensure the quality of products.

CONCLUSION

Online shopping is most popular and effective method of shopping in nowadays. Customer satisfaction is a measurement that determines how customers are happy with the product, service, quality and capabilities. The proposed study tries to find out the customer satisfaction towards online shopping with special reference to Thiruvananthapuram city. The study found that most of the customer satisfied with online shopping and also found that there is a positive relationship between age and

frequency of purchase. Day by day the needs, wants, tastes and preferences of customers are changing and there is need to take proper and effective ways to understand the needs of customers listen their feedback and maintain effective communication. This will help the sellers to improve satisfaction level of customers in better way. It is very important to constantly satisfy the customers by providing quality services and product with reasonable price because customers are the backbone of online shopping and they are considered as the king in the market.

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A STUDY ON CONSUMER SATISFACTION TOWARDS ORGANIZEDRETAIL OUTLETS IN THIRUVANANTHAPURAM CITY

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ABSTRACT
A retail outlet or store is a retail sales establishment which has a genuine retail activity and which therefore has a sales area. Modern retailing has entered into the market in India as is observed in the form of bustling shopping centres, multi stored malls and the huge complexesthat offer shopping, entertainment and food all under one roof. A large young. The growth pattern in organized retailing and in the consumption made by the Indian population will follow a rising graph helping the newer business to enter retail industry in India.. However, there is a need for promotion of organized retail outlet in our country. The present study is descriptive and analytical in nature. The study covers respondents from Thiruvananthapuram district. Simple random sampling method is used for the study and the ample size is 200. Both primary and secondary data is used for study: primary data are collected through direct questionnaire and books, journals and websites are used to collect secondary data. The main objective of the study is to find out the level of satisfaction of customer on various marketing mix in organized outlet. The study also tries to find out the factors influencing the buying decision of customers in organized retail outlets.

Keywords: Retail, Customer, Industry, GDP, Service Sector.

INTRODUCTION
Indian retail industry has emerged as one of the most dynamic and fast-paced industriesdue to the entry of several new players. Retailing in India came with evolutionary patternfrom local stores to super market. Initially it was unorganized and after that it is carried forward and now it is growing organized sector such as super market, hyper market, malls etc. Organized retailing comprises mainly of modern retailing with busy shopping mall, multistored malls and huge complexes that offer large variety of products in terms of quality, valuefor money and makes shopping a memorable experience. Retail industry has a tremendous contribution in boosting the Indian economy by increasing employment, enhancing exportand giving small scale industries the opportunity to sell their products at competitive price. Retail is the sale of goods and services to retailers. Retail outlets act as an interface between producer and consumer improves the flow of goods and services and raises the efficiency of distribution of economy. For a strong and stable economy, a well-organized and efficient retail sector is must. India is one of the fastest growing retail market in the world the main characteristics of retailing are:It offers direct interaction with customersIt offers employment opportunities to all age groups irrespective of age, gender andreligion.Customer service plays a vital role in the success of retail business.

Interestingly for many years retailers have been conducting surveys to their customers to measure their level of satisfaction and their opinion of various details of their store experience, service and merchandise provided at various retail outlet but they are not able to retain all their customers by providing solutions to them. Customer satisfaction is one of the main objectives every business. Customer satisfaction is defined as a measurement thatdetermines how happy customers are with a company's product, service and capabilities. Business identifies that retaining existing customers is

more profitable than having to win the new ones to replace those cost. Customer satisfaction is the key factor in knowing the successof any retail store; therefore it is very important to measure it. It can be measured using survey techniques and questionnaires. Getting high level satisfaction is very important because satisfied customers are more likely to be loyal.

REVIEW OF LITERATURE

Akshay Kumar, G Bhat and Rajendra Prasad (2020), concluded that customers are satisfied with some services like complaints and return handling, packaging, refreshment facilities, shopping carts as well as pricing of these services. They suggest that the company must give special attention to current billing system, maintain adequate staffs, availability of products and advertisement.

S.Karmugil and Dr R. Kannapa (2015), their study was carried out among 375 respondentsfrom selected organized retail stores. The collected data were analyzed by using statistical tools like cross table analysis and one way ANOVA f test to find out that there is no association between selected retail stores respondent and their overall customer satisfaction. The study also concluded that retail store s try to provide lot of innovative services to their customers for improving customer satisfaction.

R.Gomathi, S.Kishore and R.Deepika (2013), their study revealed that the customers are satisfied with the contribution made by departmental store and they are interested in recommending it to other customers.

Malik (2012), found that the organized retailers need to enhance customer satisfaction in terms of ensuring product quality, store convenience, after sales service, availability of new product with attractive promotional schemes.

STATEMENT OF THE PROBLEM

The retailing industry in India is the largest industry accounting for over 10 percent of country's GDP and around 8 percent of the employment. The retail market has been vital to the world economy and undergone the ever intensified competition under recent crisis and economic turn down period. For modern life, the existence of traditional markets has been gradually replaced by their descendant supermarket and people depend on supermarkets for the basic needs. Due to the tremendous growth of retail industry, it is vital for retailers to understand the degree of importance of listening to the inner voice of customers' needs in order to create and increase the level of satisfaction. The study economizes the issues relatingto the satisfaction of consumers in Thiruvananthapuram city which will help the various organized retail outlets for identifying the needs of customer and improve the image of organized retailers.

SCOPE OF THE STUDY

The scope of the study is wide and valuable. The study deals with the customer satisfaction towards organized retail outlet which is very essential for retailing. The study covers the entire area of Thiruvananthapuram city and will be beneficial to various retailers and customers. The study will help the retailers to know about the satisfactory level of consumers and with help of the results they can frame various marketing strategies to fulfill the unsatisfied wants of consumers.

OBJECTIVES OF THE STUDY

To provide an awareness regarding the concept of consumer satisfaction.
To identify the factors influencing the buying decision of customers in organizedretail outlets in Thiruvananthapuram city.To find out the level of satisfaction of customers on various marketing mix inorganized outlets in Thiruvananthapuram city.

RESEARCH METHODOLOGY

Research design is a detailed blueprint used to guide the research study towards its objectives. The study is descriptive and analytical in nature. Both primary and secondary dataare used for the study. Primary data were collected through a well-structured questionnaire. Simple random sampling method is used for the study and a sample size of 200 respondentsis taken from Thiruvananthapuram city. Secondary data are collected from various websites, books, journals and newspapers. Various statistical tools like chi-square test, rank correlation,percentage, graphs and charts are used to analyze and interpret the data.

HYPOTHESIS

Ho – There is no significance relationship between product characteristics and levelof customer satisfaction

H1 - There is a significance relationship between product characteristics and levelof customer satisfaction

Ho – There is no significance relationship between price and level of customersatisfaction

H1 - There is a significance relationship between price and level of customersatisfaction

Ho – There is no significance relationship between place and level of customersatisfaction

H1 - There is a significance relationship between place and level of customersatisfaction

Ho – There is no significance relationship between promotional schemes and levelof customer satisfaction

H1 - There is a significance relationship between promotional schemes and level of customer satisfaction

DATA ANALYSIS AND INTERPRETATION

The data collected has been presented in the form of various tables and graphs. For the purpose of analysis and interpretation various statistical tools like chi-square test, rank correlation and simple percentage are applied.

Table No. 1.1 **Gender wise classification of respondents**

Gender	**Respondents (f)**	**Percentage (%)**
Male	80	40
Female	120	60
Total	**200**	**100**

Source: Primary Data

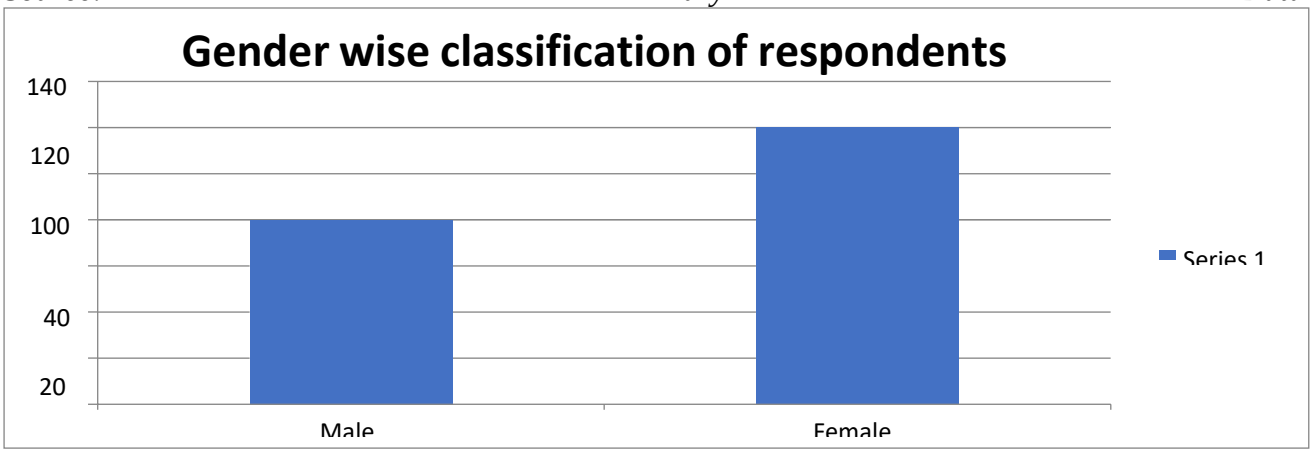

Figure: 1.1, Bar chart showing the gender wise classification of respondents

Inference: The table 1.1 shows that major portions (60%) of respondents are female. Whilemale

consists of only 40%.Thus it can be concluded that majority of respondents are female.
Table No. 1.2 **Age group of respondents**

Age	**Respondents(f)**	**Percentage (%)**
Below 20	41	20.5
20-30	82	41
30-40	44	22
Above 40	33	16.5
Total	**200**	**100**

Source: Primary Data

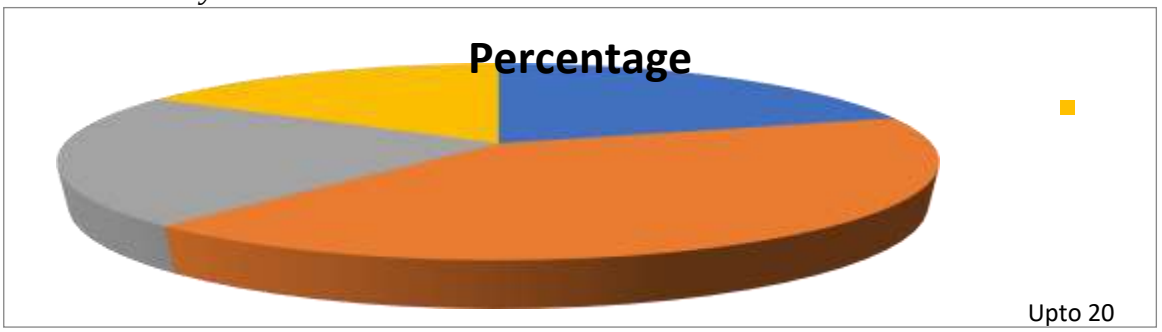

Figure: 1.2, Pie chart showing the age group of respondents
Inference: From the table 1.2, it is clear that 41 percent of respondents are under the age group of 20-30. Only 16.5 percent are under the age group of above 40. 22 percent of respondents comes under the age group of 30-40 and 20.5 percent of respondents comes under the age group of up to 20. So it can be concluded that most number of respondents are from 20-30.
Test to explore the relationship between various marketing mix and level customersatisfaction
Relationship between product characteristics and level of satisfaction.
Ho – There is no significance relationship between product characteristics and level of customer satisfaction
H1 - There is a significance relationship between product characteristics and levelof customer satisfaction
Table No.1.3**Product characteristics and level of satisfaction**

Sl.No.	**Product Characteristics**	**HS**	**S**	**N**	**D**	**HD**	**Total Score**	**Rank**
1	Quality ofProduct	100	70	10	11	9	841	I
2	Good Value for money	62	95	22	13	8	790	III
3	Unique Trinity Goods	50	99	26	16	9	765	IV
4	Variety ofGoods	68	100	12	17	03	813	II

Source: Primary Data

Degree of freedom- (4-1) (5-1) = 3*4 =12
Level of significance 5%, Chi-Square value is 51.83 and Table value is 21.01

Inference: The result from the chi-square test indicates that the product characteristics are significantly related with the customer. As the chi-square value is more than the table value at 5% level of significance and the hypothesis is rejected and concluded that **there is a significance relationship between product characteristics and level of customersatisfaction**
Relationship between price and level of satisfaction.

Ho – There is no significance relationship between price and level of customersatisfaction
H1 - There is a significance relationship between price and level of customersatisfaction

Table No.1.4 **Price and level of satisfaction**

Sl.No.	Price	HS	S	N	D	HD	Total Score	Rank
1	Reasonable	40	78	48	24	10	714	I
2	AffodatteMoney	39	88	38	22	13	674	II

Source: Primary Data

Degree of freedom- (2-1) (5-1) = 1*4 =4
Level of significance 5%, Chi-Square value is 2.26 and Table value is 9.49

Inference: The chi-square test indicates that price is not significantly with customer satisfaction. As the chi-square value is less than table value (9.49) at 5% level of significance,the null hypothesis is accepted and concluded that **there is no significance relationship between price and level of customer satisfaction.**
Relationship between place and level of satisfaction.
Ho – There is no significance relationship between place and level of customersatisfaction
H1 - There is a significance relationship between place and level of customersatisfaction

Table No.1.5
Physical Aspects and level of satisfaction

Sl.No.	Physical Aspects	HS	S	N	D	HD	Total Score	Rank
1	Convenient Location	72	100	14	10	4	826	I
2	ParkingSpace	43	70	49	25	13	705	III
3	Outlet Atmosphere	38	99	45	12	6	751	II
4	Lighting and Arrangement	31	82	39	20	28	668	IV

Source: Primary Data

Degree of freedom- (4-1) (5-1) = 3*4 =12
Level of significance 5%, Chi-Square value is 85.02 and Table value is 21.0

Inference: The result from chi-square test shows that the physical aspects have significant relation with level of satisfaction. The chi-square value is higher than table value, the null hypothesis is rejected and it can be concluded **that there is a significance relationship between place and level of customer satisfaction.**

1.7.1.3 Relationship between promotional schemes and level of satisfaction.

Ho – There is no significance relationship between promotional schemes and level ofcustomer satisfaction

H1 - There is a significance relationship between promotional schemes and level of customer satisfaction

Table No.1.6 **Promotional Schemes and level of satisfaction**

Sl.No.	**Promotional Schemes**	**HS**	**S**	**N**	**D**	**HD**	**Total Score**	**Rank**
1	Monetary and quality benefit offers	56	70	37	32	5	740	III
2	Free Gifts	60	53	32	27	28	690	IV
3	Discount	73	72	25	17	13	776	I
4	Coupon	68	60	41	20	11	754	II

Source: Primary Data

Degree of freedom- (4-1) (5-1) = 3*4 =12
Level of significance 5%, Chi-Square value is 37.42 and Table value is 21.0

Inference: The result from the chi-square test indicates that promotional schemes aresignificantly related with customer. The chi-square value is more than the table value at 5% level of significance, the hypothesis is rejected and it can be concluded that **there is a significance relationship between promotional schemes and level of customer satisfaction.**

FINDINGS

The analysis of personal characteristics of the respondents reveals that majority (41%) of the respondents belong to the age group of 20-30, majority of the respondents are female and 33 percent of respondents are graduates and majority of respondents are married.

Throughout the study it can be understood that majority of the respondents made theirpurchase only once a month from the organized retail outlets.The study found that advertisement is act as a major source of awareness.The study proved that there is a significance relationship between product characteristics and level of customer satisfaction.The study revealed that there is no significance relationship between price and level of customer satisfaction.The study found that there is a significance relationship between the physical aspectsand level of customer satisfaction.The study showed that there is a significance relationship between promotionalschemes and level of customer satisfaction.

CONCLUSION

Retail industry has a tremendous contribution in boosting the Indian economy by increasing employment, enhancing export and giving small scale industries the opportunity to sell their products at competitive price. Customer satisfaction is defined as a measurement that determines how happy customers are with a company's product, service and capabilities. The proposed study tries to find out the customer satisfaction towards organized retail outlets in Thiruvananthapuram city. The study found

that there is a positive relationship between the variables such as product, physical aspects and promotional aspects. Proper and effective implementation of marketing strategies helps the retail industries to attract more number of potential customers. By way of increasing the product quality, fixing market segmentation and various promotional activities enhance the retail industry to make more number ofcustomers. The study also showed that there is no significant relationship between the price and level of customer satisfaction. Consumers are the King in the market; consumers taste and preferences are changing day by day and the marketers and retail outlets are ready with new strategies to catch new customers to survive in the market.

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ORGANIC FOOD PRODUCTS – OPPORTUNITIES AND CHALLENGES

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ABSTRACT

Nowadays, most environmental challenges that humanity is facing relate to unsustainable consumption patterns and lifestyles. Sustainability is seen in this context as a consumption pattern that meets the needs of present generations without compromising the needs of future generations. This is also related to basic needs such as food. The present food chain is mainly based on food scarcity, GMOs, use of pesticides and antibiotics, and industrialization of the agriculture system. Growing consumer demand for organic food is based on most of these facts. Organic production combines best environmental practices, preservation of natural resources animal welfare standards while ensuring no use of genetic engineering, pesticides, additives, or fertilizers; each stage of organic food production being controlled and certified. On the other hand, there are some unique challenges to the cost and logistics of moving locally or regionally produced organic foods on the market.

Keywords: Organic, Consumer, Pesticides, challenges.

I. INTRODUCTION

The world is taking up a healthier turn for good as people seem to accept the inclusion of organic food as a part of their daily life. And why not, one should always consume the safest produce. Yet the rate of adoption has been slow in the Indian market. The organic products market seems to be a niche market for many of the farmers or manufactures. But this is what our ancestors were eating and leading a healthy life. Now, there is a need to encourage farmers regarding practicing organic farming at a large scale by the government. The government should certify the produce of farmers by organic certification with minimal fees so that the farmers can get a good amount for their organic produce. Today's consumer is however well aware of the fact that now there is the foremost need to switch over their food habits from non-organic food products to organic food products.

OBJECTIVES

- To exit the awareness of consumers towards organic food products
- To explore the challenges and opportunities faced by consumers towar products.

STATEMENT OF PROBLEM

Nowadays consumers are becoming more educated about their environmental re have more willingness to choose a organic food product over a conventional one marketers are not only working to achieve a fat bottom line but they are also w ensuring the sustainability of the bottom line. So thepresent study is undertaken Organic Food Products – opportunities and challenges.

RESEARCH METHODOLOGIES

A research methodology is a systematic way to solve a problem. It is a science of research has been carried out. The procedures by which researches go about describing, explaining and predicting phenomena are called research methodolog employs both analytical and descriptive type of methodology. The major part of this on primary data. This study focuses on challenges and opportunities as price, avail benefits, nutritional values, food-safety concerns, animal welfare concerns, and impact concerns.

REVIEW OF LITERATURE

Mehra and Ratna(2017), found that six significant factors were found to influenc towards organic food, health, consciousness, and product information, value accessibility and trust. Result of the study showed that women and younger consum positive attitude towards organic food and perceived consumption of organic food to food option. They were keen on getting product information and compared labels wh nutritious food. Women perceived consumption of organic food to be a healthier option

Sharma and Bali in (2018), concluded that consumers are very much aware that orga good for health, these products are free from chemical which resulting in on side effect cause harm to the consumers. The consumers living in urban Areas are more aware at food helps to reduce stress level and maintain an energetic lifestyle. Another factor this that respondents are willing to pay even higher prices because of it is beneficial for heal

Chiciudean moser (2015), organic agriculture mitigates human ecological concer greenhouse gas discharges, biodiversity decline and soil destruction, and also calls atten health.

ANALYSIS AND INTERPRETATION

Table 1 Demographic profile of the Respondents

Variables	Particulars	No. of respondents	Percentage
Gender	Male	44	44
	Female	56	56
	Total	100	100
Age	Below 20	39	39
	20-30	55	55
	30-40	5	5
	Above 60	1	1

	Total	100	100
Occupation	Employed	9	9
	Unemployed	1	1
	Students	88	88
	Others	2	2
	Total	100	100
Nature of family	Nuclear	72	72
	Joint	28	28
	Total	100	100
Size of the family members	2 members	8	8
	2-4 members	50	50
	4-6 members	31	31
	above	11	11
	Total	100	100

Sources: primary data

Observed data 44 percentage of the respondents are male and remaining 56 percentage are female. It is noted that 39 percentage of the respondents belongs to the age group of below 20 years, 55 percentage of the respondents belong to the age group of 20-30 years, 5 percentage of the respondents belong to the age group of 30-40 years and 1 percentage of the respondents belong to the age group of above 50 years. It is inferred that the 9 percentage of the respondents are employed, 1percentage of the respondents are unemployed, 88 percentage of the respondents are students, 2 percentage of the respondents are others. If clear that, 72 percentage of respondent's nature of family is nuclear family, 28 72 percentage of respondent's nature of family is joint family, If understood that 8 percentage of the respondents family members have 2 members, 50 percentage of respondents family members have 2-4 members, 31 percentage of the respondents family members have 4-6 members, 11 percentage of the respondents family members have above 6 members in their family.

Table 2 Challenges of Organic Product

S.No	Awareness	Very High	High	Medium	Low	Very Low
1	Lack of awareness about organic food	52(38.5%)	56(41.5%)	9(6.7%)	9(6.7%)	9(6.7%)
2	Consumer preference for low price product	51(37.8%)	56(41.5%)	6(4.4%)	9(6.7%)	13(9.6%)
3	Convince the farmer	4(3%)	58(43%)	63(46.7%)	6(4.4%)	4(3%)
4	Pay extra percentage to the retailer	16(11.69%)	72(53.3%)	35(25.9%)	8(5.9%)	4(3%)
5	Expensive storage method	31(23%)	71(52.6%)	14(10.4%)	15(11.1%)	4(3%)

Source:primary data

The above table inferred that majority of 42.5% consumers buy Lack of awareness about organic food mostly and 38.5% consumers always buy Lack of awareness about organic food. 41.5% consumers mostly buy Consumer preference for low price product and 37.8% consumers always buy Consumer preference for low price product. 46.7% consumers sometimes buy Convince the

farmer and 43% consumers mostly do so. 53.3% consumers mostly buy Pay extra percen
retailer and 25.9% consumers sometimes do so. 52.6% consumers mostly buy organic
storage method and rest 23% respondents always do so.

FINDINGS

- 56 percent of the respondents are female
- 45 percent of the respondents are age group of 20-30 years
- 84 percent of the respondents are unmarried.
- 37 percent of the respondents are master degree.
- 88 percent of the respondents are students
- 50 percent of the respondents are from joint family
- 50 percent of the respondents have 2-4 family members
- 57 percent of the respondents are earning monthly income below Rs.25000
- 70 percent of the respondents are amount spent on green product up to 0-2000 per m
- 32 percent of the respondents are mode of updating about green product from friends.
- 32 percent of the respondents are buying of green product in frequently air pollution.

The above table inferred that majority of 42.5% consumers buy Lack of awareness about food mostly and 38.5% consumers always buy Lack of awareness about organic food consumers mostly buy Consumer preference for low price product and 37.8% consumers buy Consumer preference for low price product. 46.7% consumers sometimes buy Conv farmer and 43% consumers mostly do so. 53.3% consumers mostly buy Pay extra percentag retailer and 25.9% consumers sometimes do so. 52.6% consumers mostly buy organic Ex storage method and rest 23% respondents always do so.

CONCLUSION

World's total organic produce, despite having the largest organic farmland. Its growth h sluggish, with people holding preconceived notions about the segment. Here are a few hin that this segment is facing, the founders felt that there is high cost involved in produc organic food. Availability of branded bio fertilizers and pesticide is less in the market com the chemical fertilizers. This leads to the significant issues in communicating and marke ingredients used in producing the organic products. The number of customers interested to c organic products is relatively less than the inorganic products. Though they prefer organic p the frequency of buying organic products are relatively less. Most of the consumers prefer products are occasional buyers. The employers felt that as the consumer segment is very advertisement in mass media would be very expensive and it may further increase the sellin

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CONSUMER PERCEPTION OF GREEN MARKETING WITH SPECIAL REFERENCE TO ORGANIC FOOD PRODUCTS

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ABSTRACT

Organic food products are seen as being more nutritious, more advantageous, more secure, and natural. They contain less chemical deposits and taste superior to anything ordinary nourishment consequently; customers are willing to pay premium cost for organic food. Therefore, while organic agriculture may relate to a set of different improved practices, the term organic in and of itself is not a guarantee of food safety. Organic product related certification and other regulatory factor, and their attitude. The research concludes that consumers are very much aware of organic food products.

Keywords: *organic, chemical, agriculture.*

INTRODUCTION

Today's consumers are moving towards consumption of organic food in place of conventional food, to avoided adverse health effects of chemical preservatives present is non – organic food. India has emerged as one of the largest markets in the world for organic food. Organic food players are progressively offering their items through online sites and retail locations. Many people have an opinion on whether organic food is healthier compared to conventional food. It may be surprising to know that only a very small number of scientific studies have addressed this question directly. The reason is that it is far easier to measure the vitamin content of organic and conventional fruit, than no measure if either one is healthier. The nowadays consumers are more and more interested in knowing the source of the food they are consuming. Some key trends in global organic food consumerism include sustainable development, ethical action, human and animal welfare, environmental protection, and transparency of production.

OBJECTIVES

- To find out the demographic profile of the sample respondents.
- To understand the factors stimulating the perception and awareness on green marketing organic food products.

...OF THE STUDY

...with rising concern of health issues and food safety, many consumers have turned their site to ...products. The increased consumers' interest in organic food has been attributed among others to ...growing demand for food free from pesticides and chemical residues. Organic food promotes a ...of human, other living organisms and the nature. It also promotes no artificial preservatives and ...maintain the originality of food. This prevents excess use harmful ingredients and thereby ensures ...This study attempted to gain knowledge about consumer attitude towards organic food product ...ption and to see whether there is any potential this might have for changing their behaviour. The ...for carrying out this study is that consideration for the environment could come only from ...informed citizens who are aware of, and fully committed to their rights to a quality health and ...ment.

...EMENT OF THE PROBLEM

The organic food market is emerging stage has experienced steadfast growth in the few years. ...current growth in the organic market is driven by health factor and safe consumption. Health issues ...becoming consumer's priorities to purchase the organic food products. These are the main driving ...while purchasing the organic food products. So the present study is undertaken on the title of ...consumer perception of green marketing with special reference to organic food Products

...THODOLOGY

The present study is an empirical in nature, based on both primary and secondary data. Primary ...were collected from 135 sample respondents with the help of well-Structured interview schedule. ...dary data were collected from the journal, books, magazines and internets.

...EW OF LITERATURE

Bo Chen and Sayed Saghaian (2017), study examine about consumer preference for organic ...can affect choice of retailing format. Whereas they shop less in warehouse club and convenience ...this has strong managerial implication for retailer.

Siti hasanah Hassan, Loi Wai Yee et al. (2015),indicated various factors that influence the ...to buy organic food products and they are environmentalconcerns, health factors and value but ...knowledge towards organic food is not significant influence in buying organic foods.

Mohamed Bilal Basha & K. Ramesh (2014), in their study indicates that health concern is the ...motivation of organic food consumers chosen for the study and also examined the impact of ...graphic variables on the buying intention of consumers of organic food products.

Table -1 Analysis and Interpretation

S.No	Gender	No. of respondents	Percent
1	Male	56	41.5
2	Female	79	58.5
	Total	135	100.0
S.No	**Age**	**No. of respondents**	**Percent**
1	20-30	69	51.1
2	31 and above	66	48.9
	Total	135	100.0
S.No	**Marital status**	**No. of respondents**	**Percent**
1	Married	82	60.7
2	Unmarried	53	39.3
	Total	135	100.0

Source: Primary data

The above table shows that58.5% of the consumers are female and 41.5% of the consumers are male. Majority comparisons51.1% consumers are under the age group of 20-30 years.Around consumers belong to 31 and above.60.7% of the consumers are married and 39.3% of the consumers are unmarried.

Table-2 Multiple Responses of Consumers on Stimulating Factors towards the Purchase of Organic Food Products

Stimulating Factors	Responses		%of cases	Rank
	N	Percent		
Better taste	109	11.6%	80.7%	
Fresh of food	130	13.8%	96.3%	IV
Good for my health	135	14.4%	100.0%	II
Good for my children	94	10.0%	69.6%	I
Do not contain pesticides / Lower residues	25	2.7%	18.5%	V
It's something new just try them	19	2.0%	14.1%	VII
Good for the environment	118	12.6%	87.4%	VIII
It's trendy / Fashionable to buy	66	7.0%	48.9%	III
Family preferences	109	11.6%	80.7%	VI
Live long	135	14.4%	100.0%	IV
Total	940	100.0%	696.3%	I

Source: *primary data*

The above table explains the composition of multiple responses of the consumers in Kanyakumari district with regard to the various stimulating factors which induce consumers to purchase organic products. Based on the cumulative score of all the ten factors, two factors name good for health of livelong stand first in the ranking and hence these factors seem to be the most important stimulating consumers for the purchase of organic products. Stimulating consumers purchase factors namely fresh of good ranks second and good for the environment ranked third, better taste and family preference ranked fourth, and good for my children, it's trendy and fashionable to buy, do not contain pesticides and lower residues and it's something new just to try them are ranked fifth,sixth,seventh and eighth respectively. It can be concluded that certain non-organic products are getting established in the market which attract the people and create awareness of organic products among the consumers. The researcher concludes that the good for health and livelong organic products is comparatively higher than the no organic products, which naturally instigate the consumers to believe in the neutrality and nutritional aspect of the products. Moreover, it also motivates them towards both purchase and usage of these products in the study area.

FINDINGS

- A majority of 58.5 percent consumers were female category.
- A highest of 51.1 percent consumers belongs to the age category of 20-30 years.
- A majority of 60percent consumers were married.
- People are becoming aware conscious and prefer sustainable life, so people avoid chemical based products. Therefore, chance and scope for organic food products will be more leading peace to life and long life.

CONCLUSION

- We can now grow our crops, following the natural law and adopt natural organic and biological farming systems. We can grow healthful crops. At lower cost.
- Organic food has lower pesticide residue and nitrate levels than convention foods.
- Clear promoters of healthy eating in the home.
- Organic products are the best from nature, and the best for nature.

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CONTENTS

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A STUDY ON NON AWARENESS OF ORGANIC FOOD PRODUCTS

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ABSTRACT

Hotels and Restaurants is a field with in the service industry, which render service to the common public like Lodging, Food, Drink, Travel and Tourisium. In Kanyakumari District Tourisium is one of the major sources of Business which is highly linked with Hotels and Restaurants. The owners suppose to introduce many innovative strategies and need constant improvements in recent years to sustain their Business. The present study evaluates sustainable innovation practices followed by owners of Hotels and Restaurants in Kanyakumari District. The customers of Hotels and Restaurants are flouting and changing every day so the importance of innovative ideas is very high to attract the customers. The sustainable innovation like eco friendliness, paperless Hotel, Seasonal transformation ,Organic Theme , Farm Fresh material for usage, Transparency in cooking area, Distance barrier by Delivering , Energy Conservation, Preference to customer feedback and Loyal Customers, Social Media promotion, Association with big organizations, Advertisement, Importance to uniqueness, changes in fashion, Maintaining Brand Image. In this study, an attempt is made to analyze these Factors. The important objective of the study is to analyze the sustainable innovation of Hotels and Restaurants in Kanyakumari District. The study covered both primary and secondary data. For the present study 40 Hotels and Restaurants owners are selected by adopting convenient sampling method. Percentage and Garrett ranking technique is used to analyze the data.

Keywords : *Sustainable Innovation, Hotels and Restaurants , Entrepreneurs*

Introduction

"The one land that all men desire to see and having seen once, by even a glimpse, would not give the glimpse for all the shows of all the rest of the globe combined".-Mark Twain on India

No other country has so much to offer to a tourist than India. Each of the 29 States of India contains more historic and religion monuments for the tourist. By its location Kanyakumari occupies and unique among the tourist center of India. From the very earliest historical period, travel was a fascination and Tourism industry is the largest foreign exchange earner for the country..

Kanyakumari was once referred to as the "Alexandria of the East". It was also famous centre for commerce and Trade. When you take tourist (or) Tourism Hotels and Restaurants play a vital role .The satisfaction and retention of tourist is depend up on the performance of the Hotels were they staying and the food serving to them during their trip. It is an essential factor that the owners of Hotels and Restaurants in kanyakumari were highly responsible for implement many Sustainable innovative ideas and practices to retain the visitors who visiting kanyakumari frequently for Devotional purpose are as tourist to enjoy the unique experience of watching the sunset and Moonrise simultaneously once full moon evening.

The Present study evaluates the Sustainable innovative practices followed by owners of Hotels and Restaurants in Kanyakumari. The Owners following so many tat tick such as eco friendliness, paperless Hotel, Seasonal transformation ,Organic Theme , Farm Fresh material for usage, Transparency in cooking area, Distance barrier by Delivering , Energy Conservation, Preference to customer feedback and Loyal Customers, Social Media promotion, Importance to uniqueness, changes in fashion, Maintaining Brand Image. In this study, an attempt is made to analyze these Factors

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Statement of Problem

Not surprisingly, the view of sunrise and sunset, confluence of three seas, 133-foot Thiruvalluvar statue in the mid-sea, Vivekananda rock memorial and meditation dome surrounded by sea, Gandhi and Kamarajar memorial hall in the southern tip of the country has been well recognized by the tourists. After COVID19 Tourists were withdrawing year after year this would have an adverse effect on the economy, The Hotels and restaurants really facing lot of challenges to sustain their business.

Review of Literature

'Active tourism' will help attract crowd: survey Nagercoil, January 17, 2012, The Hindu

The concept of 'Active Tourism,' a new travel philosophy that combines adventure, ecotourism and cultural aspects of a discovery tour would definitely attract large number of foreign tourists and also increase the economy, according to a survey conducted by a group of students from a private engineering college. is a suggestion, said J. Dhilip Head, Department of Management Studies of Vins Christian College of Engineering.

Objectives

The important objective of the study is to analyze the sustainable innovation of Hotels and Restaurants in Kanyakumari

Methodology

Area of study

The area of the study refers to Kanyakumari .

Sources of data

The study is confined with both primary and secondary data. The primary data is collected through a well structured interview schedule. The secondary data have been mainly collected from the books, journals, magazines, and also from the internet.

Sampling Design

In order to study the problems faced by Hotels and Restaurants owners 40 Hotels and Restaurants units are randomly selected from Kanyakumari .

Statistical Tool Used

The collected data were analyzed with the help of various statistical measures such as ***Percentage and Garrett ranking technique.***

The formula used for Garrett ranking method is

$$\text{Percent position} = \frac{100(R_{ij} - 0.5)}{N_{ij}}$$

Analysis of Data

Age – wise classification of the owners

The unit owners selected for the study were classified according to their age presented in the following table

Age – wise classification of owners

Sl. No.	Age	No. of Respondents	Percentage
1.	Up to 35 years	6	15
2.	35 – 50	19	47.5
3.	Above 50	15	37.5
Total		**40**	**100.00**

Source: Primary data

The above table shows that 6(15 percent) of the respondents belongs to the age group of up to 35 years, 19(47.5 percent)of the sample owners belongs to the age group of 35 to 50 years and remaining 15(37.5 percent) of the respondents belongs to the age group of above 50 years.

Educational qualification of the owners

Educational qualification of individual is an important factor which decides the occupation nature and social status. Hence the respondents selected for the study were classified according to their education qualification as presented in the following table.

Educational qualification of the owners

Sl. No.	Educational qualification	No. of respondents	Percentage
1.	UG	21	52.5
2.	PG	8	20
3.	Others	11	27.5
Total		**40**	**100.00**

Source: Primary data

It is inferred from the above table, out of 40 respondents 21(52.5 percent) of them are under graduates, 8(20 percent) of the owners are post graduates and the remaining 11(27.5 percent) of them are having other qualifications such as professional degree, technical degree and school education.

Capital Invested by the owners

Capital is the life blood of any business. There is a close link between the capital investment and the profit earned. The following table reveals the frequency distribution of capital invested by various Hotels and Restaurants owners.

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Capital Invested by the owners

Sl. No.	Capital investment (in Rs.)	No. of respondents	Percentage
1.	Up to 10,00,000	5	12.50
2.	Rs.15,00,000 to Rs.20,00,000	14	35.00
3.	Rs.25,00,000 to Rs.50,00,000	11	27.50
4.	One Crore	10	25.00
	Total	**40**	**100.00**

Source: Primary data

The above table infers that 5(12.5 percent) of the owners' invested up to 10 lakhs, 14(35 percent) of the owners invested Rs.15 to 20 lakhs, 11(27.5 percent) of the respondents investedRs.25 to 50 lakhs, and the remaining 10(25 percent) of the units invested above one crore in their business.

Nativity of Tourist

When it comes tourist, from where they are travelling is important because the taste and preference of the tourist is depend on the location from where they are coming. Hence the respondents selected for the study were classified according to their Geographical category presented in the following table.

Sl. No.	Category	No. of respondents	Percentage
1.	Indian	32	80
2.	Others	8	20
	Total	**40**	**100.00**

Source: Primary data

It is observed that of the respondents 80% are Indian tourists and of the respondents 20% are foreign tourist. It reveals that majority of the respondents are Indian tourist.

Innovative Ideas Followed by the respondents in their business

What is sustainability in the hotel industry?

There are four factors consider as sustainability by the Hotels and Restaurant Owners. By adopting Garrett ranking method it is ranked and the shown in the table.

Sl. No.	Storage Problems	Garrett mean score	Rank
1.	Save Water	49.61	IV
2.	Support the local Community	51.77	III
3.	Automate Energy	52.01	II
4.	Reduce their plastic consumption	52.86	I

Source: Computed Data

It is revealed from the above table that **Reduce** their plastic consumption (52.86) high and hold first rank. Energy conservation holds second and third is for the support of local community.

Eco friendliness

The following table indicates the effective ways adopted by the hotel owners to make their Hotels and Restaurants Plastic Free.

Sl. No.	Problems	Garrett mean score	Rank
1.	Don't provide straws or disposable cups and cutlery unless absolutely necessary.	71.5	I
2.	Pitchers of filtered tap water	41.57	V
3.	Keycards and Smart Lock	40.97	VI
4.	Recycling bins around	44.22	IV
5.	Get rid of single-use plastic water bottles	61.3	II
6.	Sustainable packaging in Hotels	57.07	III

Source: Computed Data

It is inferred from the above table that Avoid using of Disposable ranks first, Get rid of single-use plastic ranks second, Sustainable packaging in Hotels ranks third, Recycling bins around ranks fourth, Pitchers of filtered tap water ranks fifth and Keycards and Smart Lock last in the Eco friendliness adopted by owners in the study area.

Support the local community & Seasonal Transformation

The following Table indicates the seasonal Transformation and support the local community of Hotels and Restaurants.

Sl. No.	Problems	Garrett Mean Score	Ranks
1.	Going green and Organics	57.28	II
2.	Change in style depend on the climate	57.01	III
3.	Cut food waste, Donate leftovers	56.89	IV
4.	Supporting local farmers, producers	59.31	I

Source: Computed Data

The above table reveals that most of the owners mention "Supporting local farmers, producers, as community support and Going green and Organics second rank with mean score 57.28. Change in style depend on the climate holds third and fourth Cut food waste Donate leftovers.

Innovative strategy adopted by restaurant owners to sustain in the market

Sl. No.	Problems	Garrett mean score	Rank
1.	Delivery to Hotel rooms	71.5	I
2.	Using Organic farm fresh materials	41.57	IV
3.	Social Media Promotion	40.97	VI
4.	Serving Traditional Menu	41.22	V
5.	Transparent Kitchen	57.07	III
6.	Build Brand Image (or) Goodwill	64.3	II

Source: Computed Data

The above analysis indicates effective strategy to sustain their market is delivering food to door steps obtain first rank and brand image secured second place, transparency in cooking took third place and fourth is for using organic materials, fifth is for traditional food and social media promotion is sixth rank.

Findings of the Study

The following are the important findings of the study.

- It is found that 19(47.5 percent) of the sample owners belongs to the age group of 35 to 50 years.
- The researcher found that 21(5
the Hotels and Restaurants
graduates.
- It is found that most of the
visiting the Hotels and Rest
in India limit.
- Regarding the understanding of
in the hotel industry, most of the
Restaurants owners reveal
consumption hold first rank
conservation holds second and
support of local community
- The researcher found that Avoid
Disposable ranks first, Get rid of
plastic ranks second, Sustainable
in Hotels ranks third, Recycling
ranks fourth, Pitchers of filtered
ranks fifth and Keycards and Smart
in the Eco friendliness adopted by
the study area.
- It is found that "Supporting local
producers, as community support
green and Organics second rank. Change
style depends on the climate holds
fourth rank is for Cut food waste
leftovers.
- The researcher found that delivering
door step with good brand name
effective innovative strategy to sustain
market.

Suggestions

Based on the findings of the study following suggestions are made

- Most of the visitors from India and
advantage for the Hotels and Restaurants
attract them with their taste and prefer
- Going for trending ideas like open
and using of farm fresh and organic
help the Hotels and Restaurants to
their market
- Impoverished idea day by day for deliv
of good can also taken in to consideration

Conclusion

The present study briefly analyzed sustainable innovation of Hotels and Restaurants owners in the study area. The trend of tourism faced vast difference after covid-19 and lockdown challenges faced by the owners during pandemic situation and the situation not yet set back to normal. Innovation and sustainability is part and parcel of the Hotels and Restaurants business continuous effort should maintain to attract

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that the Govern
encourage tour
will helps the
lead their busi

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1. Fazili
Tourism
southern

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that the Government may take necessary effort to encourage tourism by liberal the restrictions and will helps the Hotels and Restaurants owners to lead their business successful in the study area.

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Consumer Awareness towards Green Products

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Abstract

Consumer's awareness about green products is important in guiding the green consumer purchasing behaviour. The main objective of this study is to know the consumer awareness about green products. As the world's economy is hurriedly developing, the global environment is increasingly weakening. Protecting environment and creating a safe living environment has become one of the most important concerns of consumers. Green marketing generally aims to encourage environmentally friendly products and a safe enviro nment where people can stay. Every year the populations of people who are rotating towards green brands or environmental friendly products are increasing thus magnifying the phenomenon.

Key Words: Green Product, Environment, Green Marketing, Consumer Awareness.

INTRODUCTION

The green movement has been expanding rapidly in the world. With regards to this consumers are taking responsibility and doing the right things. Consumer awareness and motivation continue to drive change in the marketplace, notably through the introduction of more green products. Compared to consumers in the developed countries, the Indian consumer has much less awareness of global warming issues. Successful marketing has always been about recognizing trends and positioning products, services and brand in a manner that supports buyer intentions. Today, "Green" marketing has moved from a trend to a way of doing business and businesses that sell should recognize the value of going green and incorporating this message into their marketin g program and communicating the green concept to their consumers.

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Green is slowly and steadily becoming the symbolic colour of eco -consciousness in India. The growing consumer awareness about the origin of green products and the concern over impending global environmental crisis there are increasing the opportunities to marketers to convince consumers. Firms have increasingly introduced GPIs (Green Product Innovations) into their product developments over recent decades. Studies on the consumption of environmentally sustainable products have demonstrated that perceived product performance is a significant barrier to their selection.

Objectives

- To find out the demographic profile of the respondents.
- To measure the awareness among the general public about green products.
- To give suggestions for better usage of gree n products.

Scope of the study

The present a study on consumer awareness of green products and it impact on green buying behaviour is made with the intention to lessen the usage of non-green packaging to reduce pollution. This study analyses the awareness of green packaging among the peopleand to identify the challenges of green packaging. The inference of the study will be useful for the people in general.

Statement of the problem

Now-a-days consumers are becoming more educated abo ut their environmental responsibility and have more willingness to choose a green product over a conventional one. Now a day's marketers are not only working to achieve a fat bottom line but they are also working towards ensuring the sustainability of the bottom line. This led to the development of new avenue of marketing called "green marketing". Among the 4p,s of green marketing, green packaging assumes great significance. All manufactured products, including their packaging have impacts on the environmen t that are not sustainable in the long run. Therefore marketers realized that packaging performs an important role in the communications and would be one of the most important factors influencing consumer purchase decision. The combination of green and pac kaging would be a new choice for consumers. Hence it is the need for the present situation to save the environment as it is affected very much by way of packaging materials. Green packaging is one of the factors which contribute to save the environment. So the present study is undertaken on the title of A study on consumer awareness of green product and it impact on green buying behaviour.

Methodology

The present study is an empirical in nature, based on both primary and secondary data. Primary data wer e collected from 100 sample respondents with the help of well structured interview schedule. Secondary data were collected from the journal, books, magazines and internets

Review of Literature

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Mitul Delia. (2012) in her study "Consumer behaviour towards the new packaging of FMCG (fast moving consumer goods) products", conferred that the importance of packaging design as a vehicle for communication and branding is growing in competitive markets for packaged FMCG(fast moving consumer goods) products. Product also deliver brand identification and label information like usage instructions, contents, and list of ingredients or raw materials, warnings for use and directives for care of product.

Mohammad Zakersalehi and Amin Zakersalehi.(2012) in their study "Consumer's attitude and purchasing intention toward green product foods; A Malaysian perspective", helps marketers and providers to understand how to improve their green products, what type of green packaging they need and how to attract consumers to buy their products. Product as the final tool to reach the consumers has a salient role to transfer the message of green foods. Although the concept of green product of foods is relatively new to Malaysian manufacturers but the consumption of green product foods is getting popular in Malaysia and the market is emerging dramatically similar to developed countries' trends.

Dr.Ravi. P. and Dhanalakshmi, A. (2014), in their study "A study on consumer behaviour towards green produ ct in a waste minimization perspective" conferred that green marketing is not only about green consumption but also about waste minimization. The paper studied the consumption behaviour towards product. It is inferred from the analysis that consumers prefer FMCG (fast moving consumer goods) products for their brand credibility and quality and not for their green marketing practices.

Analysis and Interpretation

Table 1

Demographic profile of the Respondents

Variables	Particulars	No. of respondents	Percentage
Gender	Male	44	44
	Female	56	56
	Total	100	100
Age	Below 20	39	39
	20-30	55	55
	30-40	5	5
	Above 60	1	1
	Total	100	100
Occupation	Employed	9	9
	Unemployed	1	1

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Descriptive Statistics

Sources	**N**	**Mean**	**Std. Deviation**	**Minimum**	**Maximum**
TV	100	2.7778	1.96769	1	7
Magazines	100	4.0000	1.64083	1	7
internet Ads	100	3.4815	1.71803	1	7
Friends/Relatives	100	4.5556	1.92820	1	7
Newspaper	100	4.1481	2.23097	1	7
Seminars/Conferences	100	5.7407	1.40309	1	7
Super market staff	100	3.2963	1.75005	1	7

ABOUT CREATING AWARENESS OF GREEN PRODUCT

Sources	Mean score	Rank
TV	2.7778	VII
Magazines	4.0000	IV
internet Ads	3.4815	V
Friends/Relatives	4.5556	II
Newspaper	4.1481	III
Seminars/Conferences	5.7407	I
Super market staff	3.2963	VI

The above table 2 clearly shows that the respondents were mainly influenced for the reason of green packaged product.

INTREPRETATION:

The table 2 reported that "Seminars/Conferences" was ranked first among the reason with the highest mean score 5.7407. Also reported that "Friends/Relatives" was ranked second among the reason with a mean score 4.5556. Also reported that "Newspaper" was ranked third among the reason with the mean score of 4.1481. Also reported that "Magazines" was ranked fourth among the reason with the mean score of 4.000. Also reported that "Internet Ads" was ranked fifth among the reason with the mean score of 3.4815. Also reported that "Super market staff" was ranked sixth among the reason with the mean score of 3.2963. Also reported that "TV" was ranked seventh among the reason with the mean score of 2.778.

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Findings

- 56 percent of the respondents are female.
- 45 percent of the res pondents are age group of 20-30 years.
- 84 percent of the respondents are unmarried.
- 37 percent of the respondents are master degree.
- 88 percent of the respondents are student s.
- 88 percent of the respondents are from joint family.
- 50 percent of the respondents have 2-4 family members.
- 57 percent of the respondents are e arning monthly income below Rs. 25000.
- 70 percent of the respondents are amount spent on green product up to 0 -2000 per month.
- 32 percent of the respondents are mode of updating about g reen product from family friends.
- 32 percent of the respondents are buying of green product in frequently air pollution.
- Media awareness of green product: Friedman's rank test was used to analyse, the creating awareness of green product green product, TV, Magazines, Internet adds, Friends/Relatives, Newspaper, Seminars/Conferences, Super market staff were identified. The creating awareness highest mean value is considered as the most important awareness for getting the green product. The respondents of awar eness of green product s rank "Seminars/Conference "as the first ranked for awareness for getting the green package product about their customers with higher mean score value of 5.7407,4.5556 and 4.1841 respectively.

Suggestion

- The reason behind using non g reen product is due to more availability, convenient and price. They are willing to restrict using non green product. Therefore it is a good opportunity for the companies to start producing green product and restrict non green product.
- Green product are not much attractive they, have minimalist design and inadequate promotional measure. Therefore the manufacturers, distributors and retailers take adequate measures to improve the quality, design and make the customers to buy green product.

CONCLUSION

Environment can damage the way of life of human being. They have the responsibility to protect nature and environment. Usage of green product will help them to change their life style into a green one. But the awareness level on the usage of green products among the people is very limited. There is a need to educate the people on the usage of green products and on identifying the green attributes of products they use. This would help to protect the environment for the future generation.

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Understanding the Change Management in the Information Technology (IT) Services Industry

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Understanding the Change Management in the Information Technology (IT) Services Industry

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Change is continuous and often uninvited. Every organisation in the world is affected by change. Organisational change will not happen instantly, it is a process. This study is conducted to understand the change management in the Information Technology (IT) services industry. The research instrument used in this study to collect data was the questionnaire. The questionnaire was based on the six dimensions of the managing change model. The findings indicate that major reasons for IT services employee's short tenure are relocation, family reason, salary, and better career prospect. Resistance to change is very common during the change process. The foremost reasons for resistance to change are new learning, more work, and fear of failure. Resistance can be reduced by involving employees in the change process. Understanding organisational change leads to active participation of employees towards positive change effort.

Keywords: Change Management, Information Technology (IT) Services Industry

Introduction

The Indian Information Technology (IT) industry has become one of the vibrant sectors of Indian economy. According to the Government of India (GoI), India is the base for most of the Fortune 500 and Global 2000 companies. National Association of Software and Services Companies (NASSCOM) report states that IT industry is the largest private sector in India with 37 lakhs employees. In the financial year 2014-15, IT software and services added about 2,31,000 jobs (consisting of 34 per cent women employees). According to the Software Technology Parks of India (STPI) annual report, the indirect employment in the IT industry accounts to nearly one crore.

In terms of the national Gross Domestic Product (GDP), the IT sector revenue has grown from 1.2 per cent in the financial year 1997-98 to nearly 9.3 per cent in the financial year 2015-16 (GoI). In the financial year 2016, the revenue generated by the Indian IT services sector is Rs. 7,500 crores (NASSCOM). In order to sustain in this competitive world, organisations have to adapt to the business environment and change continuously.

Change is an alteration in existing state of an organisation in terms of people, structure, or technology. It is not only adequate to react to change but anticipate the impact of change and managing change effectively really matters for the success of an organisation. Organisational change may be defined as the implementation of an idea or behaviour which is new to the organisation (Daft, 1982).

Change is inevitable, similarly, resistance to change also inevitable (Baker, 1989). The resistance to change may be due to the individual, organisational, or both. The resistances need to be tackled in order to implement the change process effectively. To successfully manage organisational change, the managers must know what to change, why to change, when to change, and how to change (Gupta, 1998). Study of organisational change and management of change have emerged as most common topics of management (Sturdy and Grey, 2003).

Review of Literature

The study of Judge, Thoresen, Pucik, and Welbourne (1999) states that the success of change efforts lies in the ability and motivation of individuals within the organisation. While choosing managers for change management process, the organisation might want to consider managers who have a positive self-concept and are risk tolerant.

*Corresponding author

According to Rousseau and Tijoriwala (1999), the social influence of co-workers plays a vital role in interpreting the change. Reasons for the change efforts are likely to play a greater role in motivating change in its early phases.

Shanley (2007) stated a set of seven change management competencies (analytical, insightful, influential, emotional, interpersonal, political, and administrative) that are required for change agents. Many change efforts fail because of poor leadership and weak management.

According to Sackmann, Eggenhofer-Rehart, and Friesl (2009), the change activities need to stay in the focus of those who are concerned with the implementation. The appropriate use of management by objectives and a performance oriented reward system seem to be adequate instruments for reviewing and evaluating the progress of implementation.

Based on the observation of Ghitulescu (2012) during the times of organisational change, employees must proactively implement new ideas to make the change efforts successful. Active participation through adaptivity and proactivity contributes to increased feelings of efficacy that underlie employees' readiness for change and their motives to support the change.

Hakonsson, Klaas, and Corroll (2013) stated that the leaders should see themselves more as designers of structures that support continuous change. Change in the short run will lead to a performance decline, managers should not give up after the initial lack of success; instead, they should continue and maintain a long-term focus.

From the literature cited it is evident that managing the people side of change is considered as an important dimension while dealing with organisational change. Organisational change efforts frequently end up with some form of human resistance (Kotter & Schlesinger, 1979).

A change model is a representation of steps involved in a change process, these models provide guidelines for the managers, consultants, and Organisation Development (OD) practitioners to lead the change efforts (Rothwell and Sullivan, 2005).

Managing Change Model

Managing Change Questionnaire (MCQ) was developed by W. Warner Burke Associates, Inc., organisation consultants. It was developed to understand how people respond to change. The MCQ provide useful information to participants regarding the understanding of certain aspects of organisational change (Church, Waclawski, and Burke, 1996).

Figure 1: Managing Change Model

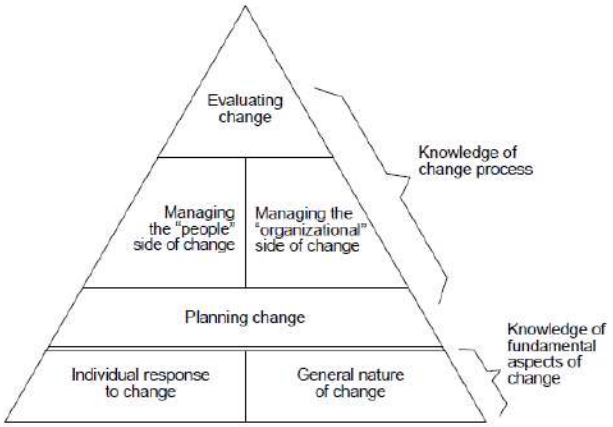


Figure 1. Managing Change Model. Adapted from "OD Practitioners as Facilitators of Change", by Allan H. Church, Janine Waclawski, and W. Warner Burke, 1996, *Group & Organization Management,* 21, p 33. Adapted with permission.

The managing change model was based on six dimensions: individual response to change, general nature of change, planning change, managing the 'people' side of change, managing the 'organisational' side of change, and evaluating the change effort. Following are the contents addressed in each dimension.

Individual Response to Change: People resist change due to loss of routine, and the loss of personal choice.

General Nature of Change: A definite pattern is followed while implementing the organisational change.

Planning Change: Covers the activities occur during the change process and prior to implementation.

Managing the People Side: Emphasise the need to communicate the participants regarding the change effort.

Managing the Organisational Side: Managing the reward system, the organisational structure, and the barriers to facilitate the change process.

Evaluating Change: Providing feedback to people regarding the progress of change made, recognition of people involved in the change process.

Studies on Change Management

Prior studies on change management using MCQ and their findings are summarised below.

According to Church, Waclawski, and Burke (1996), OD practitioners achieved higher scores when compared with managers and executives on the MCQ subscale regarding managing the people side of change. OD consultants are quite aware of the complexities involved in facilitating change. OD practitioners seemed to be more skilled in understanding people issues such as: communicating across levels of organisation, power of groups, role of rewards in supporting change efforts, and working with complaints.

Siegal, et al., (1996) suggests that the management development programmes designed to implement change process must mainly focus on the following important areas: individual response to change, general nature of change, and managing the 'people' side of change. The managers are skilled in managing the organisational aspects of change process but not the people side.

Pare and Jutras (2004) identified that the IT specialists are more knowledgeable about the process of change, more particularly managing the human and organisational side of change. Senior IT managers and systems analysts have a better understanding of the issues pertaining to organisational change process than the programmers and technicians.

In overview, the studies based on MCQ formed a common conclusion. First, it is important for the employees to have the knowledge about the change management. Second, managing the people side of change seems to be key dimension while dealing with the change process.

The present study focuses on the understanding of the IT services employees regarding the change management in their organisation.

Objectives

The specific objectives of this paper are as follows:

(1) To validate the dimensions of the managing change model in the Indian context, and to check the reliability of the questionnaire.
(2) To know the knowledge level of IT services industry employees towards understanding the organisational change.
(3) To identify the major reasons for resistance to change in the IT services industry.

Methodology

The research instrument used in this study to collect data was the questionnaire. In non-probability sampling designs, judgment sampling method was used in this study. A total of 200 questionnaires were issued to a sample of IT services employees from the NASSCOM membership companies located in Chennai. Total IT services companies registered with NASSCOM was 186 out of which, top five companies among NASSCOM industry rankings of top 20 players in IT services were considered. In total, 123 IT employees returned the questionnaires, yielding a response rate of 61.5 per cent. After eliminating the incomplete responses, 82 questionnaires were finalised for the analysis. Statistical techniques such as Fisher's Exact, correspondence analysis, mean, and average ranking (using reverse weights) were used to analyse the data collected.

The questionnaire was based on the six dimensions of the managing change model. Apart from these dimensions, based on the literature survey few other factors such as reasons for resistance to change, methods used to deal the resistance to change also included in the questionnaire. Respondents were also asked to rank the strongest resistance they have experienced during the change process and the effective method which was followed by their organisation while dealing with the resistance to change.

Analysis

Reliability of the Questionnaire

While checking the reliability of the instrument, all the six dimensions of the managing change model and the change methods used in the organisation during the change process yielded a high Cronbach's alpha value which is almost close to one. The scale reliability was $\alpha = 0.87$ with 95% confidence interval. The high reliability indicates the stability and consistency of the research instrument. Though the research instrument was developed using the dimensions of managing change model, the universality of the change management practices and the IT services industry culture provides huge support in using the research instrument in the Indian context.

Knowledge Level of IT Services Employees towards Understanding the Organisational Change

The second objective of the study was to examine the knowledge level of IT services employees towards understanding the change. To examine the knowledge level, three approaches were used in this study: (a) demographic characteristics of the respondents; (b) association between age and tenure of IT services employees; and (c) understanding of IT services employees towards change management. The details of these approaches are described below.

(a) Demographic Characteristics of the Respondents

57.3 per cent of the respondents were male and 42.7 per cent of the respondents were female. Regarding the age of the respondents, 54.9 per cent belongs to the age group 21-25 years, 37.8 per cent belongs to 26-30 years, and 7.3 per cent belongs to 31-35 years old. This suggests that the IT services industry mainly constitute a good number of younger people who had recently entered the field after completing their studies. Unlike other industries, only a minimum number of people 7.3 per cent who are above 31 years old and more are working in the IT services industry.

In terms of educational background, as measured by highest degree obtained, 9.8 per cent of respondents had received their bachelors degree in computer applications or computer science. 69.5 per cent of the respondents had received their bachelors in engineering or technology. 6.1 per cent had their masters in computer applications or computer science, 2.4 per cent had their masters in engineering or technology, and 12.2 per cent had their masters in business management. It is been inferred that the IT services industry is dominated by the young graduates at the bachelors level in engineering or technology, followed by the masters level in business management. The higher educational level of the employees leads to a better knowledge about the organisational change.

With respect to tenure in their organisation, 24.4 per cent respondents had less than one year of experience, 39 per cent had experience of 1-3 years 17.1 per cent had experience of 4-5 years, and 19.5 per cent had experience of more than five years. This is also again supported by the previous finding that majority of the employees from the IT services industry are fresher. 56.1 per cent had no previous work experience, and 43.9 per cent had previous work experience.

(b) Association between Age and Tenure of IT Services Employees

Table 1: Association between Age and Tenure of IT Services Employees

Age	Tenure				Total
	Less than 1 year	1-3 years	4-5 years	6 years and more	
21-25 years	17	24	3	1	45
26-30 years	2	8	11	10	31
31-35 years	1	0	0	5	6
Total	20	32	14	16	82

The cross tabulation between age and tenure of the IT services employees Table 1 shows that the tenure of the employees associated with their age. Employees in the age group of 21-25 years are having 1-3 years of experience. Whereas employees in the age group of 31-35 years are having 6 and more years of experience.

> HYPOTHESIS 1: *There is an association between age and tenure of the IT services employees.*

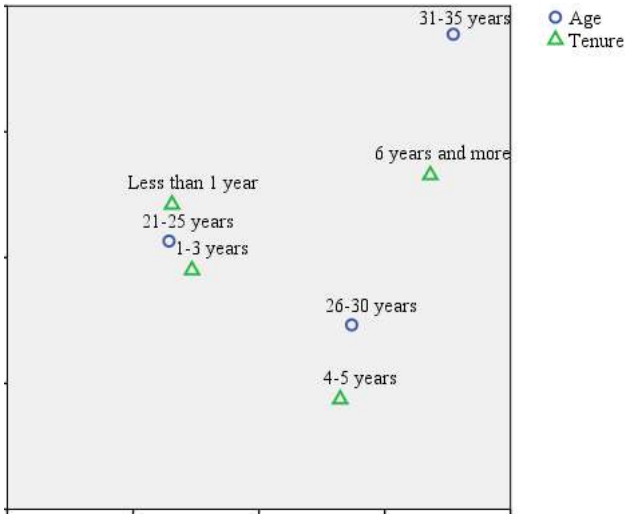
Table 2: Fisher's Exact Value for Age and Tenure of IT Services Employees

Fisher's Exact Test	Value	Exact Sig. (2-sided)
Fisher's Exact	41.995	.000

Table 2 indicate that the Fisher's Exact value is 41.995 and significant value is 0.000. The Fisher's Exact test indicates that there is a significant association between age and tenure of the IT employees.

Correspondence analysis was performed in order to compare the association between age and tenure at a category level.

Figure 2: Correspondence Analysis



From Figure 2 it is inferred that the IT employees in the age group 21-25 years are associated with less than one year, and one to three years of experience. The IT employees in the age group 26-30 years are associated with four to five years of experience, while those in the age group of 31-35 years are associated with six and more years of experience.

(c) Understanding of IT Services Employees Towards Change Management

In order to identify the knowledge level of IT services employees towards understanding the change, 8 statements were given in the form of Likert's scale. Mean for all the ratings was calculated and listed in Table 3.

Table 3: Understanding the Change

Knowledge Level of IT Services Employees	Mean
Training the employees helps them to feel positive about change	1.80
Understanding change is important for the successful change effort	1.82
Change leads to implementation of technology	1.85
Change helps in individual growth of the employee	1.99
Change helps in overall development of the organisation	2.00
Resistance to change is common in the organisation	2.02
Change enhances the performance of the employees	2.12
Resistance does not imply that the employees are against change	2.17

The result shows that the employees of the IT services industry are having a fair knowledge about the changes happening in their organisation. This is evident from the mean value which lies for all the statements between one and three i.e. between strongly agree and neutral.

Reasons for Resistance to Change

For an effective management of change, the organisation must identify the reasons for the resistance to change and attempt to overcome the resistances.

Table 4: Reasons for Resistance to Change

Reasons for Resistance	Mean	Rank
New Learning	7.3	I
More Work	6.5	II
Fear of Failure	6.4	III
Organisational Politics	6.0	IV
Need for Security	5.6	V
Poor Timing	5.3	VI
Loss of Status	4.7	VII
Lack of Resources	4.7	VII
Lack of Reward	4.4	VIII
Lack of Involvement	4.1	IX

To find out the reasons for resistance to change, the respondents were asked to rank the reasons for resistance to change in their organisation during the change process, by assigning 1 to the strongest resistance, 2 to the next strongest resistance, and so on. The factors included were new learning, need for security, more work, organisational politics, fear of failure, poor timing, loss of status, lack of resources, lack of involvement, and lack of reward. The responses were analysed by using average ranking (using reverse weights).

As for as the reason for resistance to change is concerned, the average score for new learning is 7.3 in the 1 to 10 point scale followed by more work and fear of failure with the average score of 6.5 and 6.4 respectively.

Lack of resources, lack of reward, and lack of involvement were scored as 4.7, 4.4, and 4.1 respectively. Employees in the IT services industry are not considering these factors as the reasons for resistance to change in their organisation.

Discussion

This study is carried out to understand the knowledge level of IT services employees regarding the change management. Various analyses were performed to examine the objectives of the study.

First, the applicability of the research instrument in the Indian context. After a thorough search for literature in the area of change management from the databases like EBSCO, Emeraldinsight, ProQuest, Sage, ScienceDirect, Springer, Taylor and Francis, and Wiley, it was found that very few studies were done in the field of change management in India. Out of which none of the studies used the managing change framework. The researcher obtained permission to adapt the managing change model from Prof. W. Warner Burke, Teachers College, Columbia University, New York. The questionnaire was developed based on the six dimensions of the managing change model. This study validated the questionnaire in the Indian context since it was originally developed in New York. The high Cronbach's alpha value of 0.87 for all the dimensions shows the stability and consistency of this questionnaire. Hence, this questionnaire can be used as a research instrument to conduct studies related to change management in India.

Second, knowledge level of IT services employees towards understanding the organisational change. To examine the knowledge level, demographic characteristics of the respondents were analysed. The results revealed that, unlike any other industries in India, the IT services industry constitute a major portion of young employees in the age group of 21-30 years old. Interestingly, the tenure of the employees is also very short when compared to other industries. In order to establish the association between the age and tenure of the employees, hypothesis 1 was developed and tested using Fisher's Exact. Hypothesis 1 was supported as there is an association between age and tenure of the employees. Further, to compare the association at the category level, correspondence analysis was performed. The results further revealed that the employees in the age group of 21-25 years are possessing less than one year to maximum three years of experience. The reasons for the short tenure are better career prospect, relocation, family reason, and salary.

A better career prospect is a good opportunity an employee gets from another company. Since India is a preferred location for the Fortune 500 and Global 2000 companies, the IT services employees have a lot of options and opportunities. Dissatisfaction of an employee in the current career path leads to search of a new employer. Majority of the IT services employees working in Chennai are not the natives of Chennai. After gaining a few years of experience in the industry, they decide to relocate from Chennai to another city in order to stay close to their parents, spouse, or children. The IT services industry consist of 34 per cent women workers. Many of the women workers quit the job when they expect a child after marriage. They quit the job to take care of the child for a few years and because of family reasons. The IT services industry offer a very attractive pay when compared to any other industry in India. The younger employees are more interested in changing jobs in order to secure a higher salary.

The IT services employees have a good knowledge about the organisational changes in their organisation. Well-designed training programmes, demonstration from the subject matter experts, and the technological advancements in the industry helps the employees to adapt organisational changes easily. Moreover, young employees are willing to

work in the challenging and dynamic work environment. For all these reasons the IT services employees possess a better understanding of their organisational change.

Third, another contribution of this study is the identification of reasons for resistance to change in the IT services industry. Major reasons for resistance to change are new learning, more work, fear of failure, and organisational politics. The resistance to change arises mainly due to lack of information about the change process. It is important to communicate every change effort in order to overcome the resistances. The communication could be done through the presentation, reports, or demonstration. Educating the people regarding the change helps to reduce the resistances to a great extent. Involving employees and allowing them to participate in the change process, helps to build commitment of the employees during the change process. Attending the complaints and problems of the employees helps to gain the confidence of the employees. Providing training to the employees about the new ways helps to overcome performance pressures. Finally, offering incentives to the employees after the change initiative gains maximum support from the employees.

Conclusion

This study has documented the usage of managing change model and its six dimensions in Indian context along with the verification of reliability of the research instrument. The knowledge level of IT employees towards understanding the change and the major reasons for the resistance to change in the IT services industry also unveiled from this study. The findings suggest that the employees of the IT services industry possess a fair knowledge about their organisational changes.

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On Sequential Graphs

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Abstract

A labeling or valuation of a graph G is an assignment f of labels to the vertices of G that indices for each edge xy a label depending on the vertex labels f(x) and f(y). In this paper we study some classes of graphs which admit sequential labeling.

Keywords: Labeling, Sequential graph, Braid graph, Total graph, Cyclic graph.

1. INTRODUCTION

Unless mentioned a graph in this paper shall mean a simple finite graph without isolated vertices. For all terminology and notations in Graph Theory, we follow Harary [3] and for all terminology regarding Sequential labeling we follow Grace [2].

Let G be a (p, q) graph. Let V(G), E(G) denote respectively the vertex set and edge set of G. Consider an injective function g : V(G) $\rightarrow$ X where X = {0, 1, 2,..., q} if G is a tree and X = {0,1, 2,..., q 1} otherwise. Define the function g*: E (G) $\rightarrow$ N, by g*(uv) = g(u) + g(v) for all edges uv, where N is the set of all natural numbers. If g*(E (G)) is a sequence of distinct two integers say {k, k + d, k + 2d,..., k + (q - 1)d} for some k and d, then the function g is said to be (k, d) - Sequential labeling and the graph which admits such a labeling is called as a Sequential graph.

If d = 1, G is a called k- sequential graph

Definition1.1: A chord of a cycle C_n is called a P_k - chord if it divides the cycle into two cycles C_k and C_{n-k+2}.

Theorem1.2: Let G be a graph obtained from C_{2t+1} with a P_4 - chord. Then G is a (t+2, 1), $t \geq 1$ Sequential graph.

Proof: Let $C_{2t+1} = (u_1u_2,\ldots, u_{2t+1}u_1)$ and let $u_2\, u_{2t}$ be a P_4-chord of C_{2t+1}.
The graph G consists of 2t + 1 vertices and 2t + 2 edges.

Define $f : V(G) \rightarrow \{0, 1, 2,\ldots, 2t + 1\}$ as follows:

$f(u_{2i-1}) = i, \quad 1 \leq i \leq t + 1$

$f(u_{2i}) = (t + 1) + i, \quad 1 \leq i \leq t$

Also $f(u_i) < f(u_j)$ for all $i \neq j$
Clearly vertex labels are distinct.

Then the induced edge labels are given by $f^*(u_iv_i) = f(u_i) + f(v_i)$ and are as follows:

$f^*(u_iu_{i+1}) = t + i + 2, \quad 1 \leq i \leq 2t$

$f^*(u_1u_{2t+1}) = t + 2$

$f^*(u_2u_{2t}) = 3t + 3$

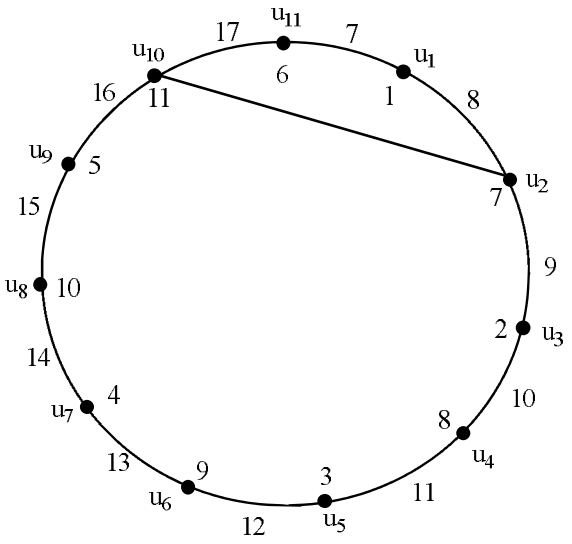
Thus the set of labels of the edges of the cycle $= \{t + 2, t + 3,\ldots, 3t + 1, 3t + 2\}$ and the label of the chord is 3t + 3.

Clearly edge values are distinct and is of the form $\{t + 2, t + 3,\ldots, 3t + 2, 3t + 3\}$.

Thus the induced edge labels are given by $f^*(E(G)) = \{k, k + d, k + 2d,\ldots, k + (q - 1)d\}$
where k = t + 2 and d = 1.

Therefore G is a k-Sequential graph.

Illustration 1.3: (7, 1) - Sequential labeling of C_{11} with P_4-chord is given below.



Theorem 1.4: The graph $K_{1,n} + K_{1,m}$ is a (2t + 1,1) - Sequential graph for all m, n and for any non-negative integer t.

Proof: Let V ($K_{1,n}$) = {$u_0, u_1, \ldots, u_n$} where deg u_0 = n and V($K_{1,m}$) = {$v_0, v_1, \ldots, v_m$} where deg v_0 = m. Join each vertices of $K_{1,n}$ to every vertices of $K_{1,m}$, then we get the graph $K_{1,n} + K_{1,m}$.
Let G = $K_{1,n} + K_{1,m}$

The edge set of G is E(G) = $\{u_0u_i; 1 \le i \le n\} \cup \{v_0v_i ; 1 \le i \le m\} \cup \{u_iv_j ; 1 \le i \le n, 1 \le j \le m\}$

Note that G has n + m + 2 vertices and n + m + (n + 1) (m + 1) edges.

Let t be a non-negative integer. Define f : V(G) $\rightarrow \{0, 1, 2, \ldots, (n + m + (n + 1)(m + 1)) - 1\}$ as follows:

$f(u_i) = i + t, \quad 0 \le i \le n$

$f(v_0) = n + t + 1$

$f(v_i) = i(n + 2) + n + t, \quad 1 \le i \le m$

Then the induced edge labels are given by $f^*(u_iv_i) = f(u_i) + f(v_i)$ and are as follows:

$f^*(u_0u_i) = 2t + i, 1 \le i \le n$

$f^*(v_0v_i) = 2t + i (n + 2) + 2n + 1, 1 \le i \le n$

$f^*(v_0u_i) = 2t + (n + 1) + i, 1 \le i \le n$

$f^*(v_ju_i) = 2t + (j + 1)(n + 1) + i + (j - 1), \quad 0 \le i \le n, 1 \le j \le m$

Thus the set of labels of the edges of $K_{1,n}$ = {2t + 1, 2t + 2, 2t + 3,..., 2t + n}

The set of labels of the edges v_0u_i, $0 \le i \le n$ = {2t + n + 1, 2t + n + 2,..., 2t + 2n + 1}

The set of labels of the edges v_0v_i and v_1u_i, $0 \le i \le n$

= {2t + 2(n + 1)}$\cup$ {2t + 2(n + 1) +1, 2t + 2(n + 1) + 2,…, 2t +2 (n + 1) + n}

The set of labels of the edges v_0v_2 and v_2u_i, $0 \le i \le n$

= {2 (n + 1) + n + 1}$\cup$ {2t + 3(n + 1) + 2, 2t + 3 (n + 1) + 3,..., 2t + 3(n + 1) + n}

The set of labels of the edges v_0v_m and v_mu_i, $0 \le i \le n$

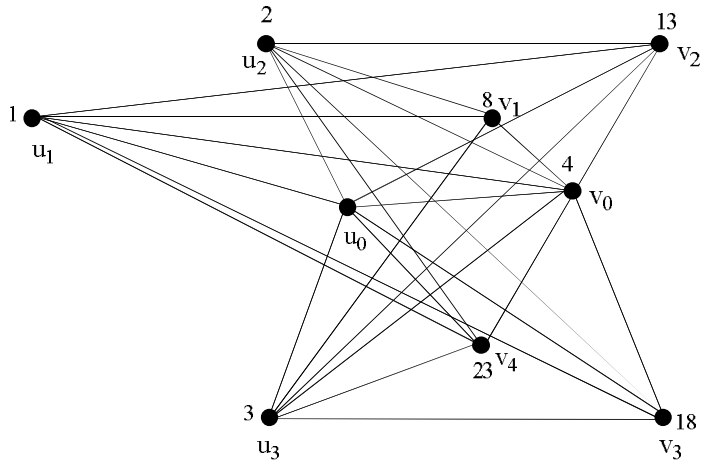
= {2t + (m + 2) (n + 1) + m- 2}$\cup$ {2t + (m + 2)(n + 1) + m -1,
2t + (m + 2) (n + 1) + m,…, 2t + (m + 1)(n + 1) + m + n}

Thus the edges values of the graph G is distinct and is of the form
2t + 1, 2t +2, 2t + 3,…, 2t + n, 2t + n + 1, 2t + n + 2,…, 2t + 2 n + 1,…, 2t + 2 (n + 1) + n,…, 2t + 3(n + 1) + n,…, 2t + (m + 2)(n + 1) + m □ 2,…, 2t + (m + 1) (n + 1) + m + n.

Thus the induced edge labels are given by $f^*(E(G)) = \{k, k + 1, \ldots, k + (q - 1)\}$ where k = 2t + 1 and d = 1

Therefore f is a Sequential labeling. Thus G is a k-Sequential graph.

Illustration: 1.5: $K_{1,3} + K_{1,4}$ is a sequential graph.



Theorem1.6: The graph $P_2 + mK_1$ is a (2t + 1, 1) - Sequential graph for all m and for any non-negative integer t.

Proof: Consider a path P_2 with two vertices v_1, v_2. Let y_1, y_2,..., y_m be the m isolated vertices. Join v_1, v_2 with y_i, $1 \le i \le m$. The graph obtained is $P_2 + mK_1$

Let $G = P_2 + mK_1$. The vertex set of G is $V(G) = \{v_1, v_2, y_1, y_2,..., y_n\}$
$E(G) = \{(v_1, v_2)\} \cup \{(v_1, y_i),\ 1 \le i \le m\} \cup \{(v_2, y_i), 1 \le i \le m\}$

Then $|V(G)| = 2 + m$ and $|E(G)| = 2m + 1$

Let t be an integer such that $t \ge 0$.

Define labeling $f : V(G) \to \{0, 1, 2,..., 2m\}$ as follows:

$f(v_1) = t$
$f(v_2) = t + 1$
$f(y_i) = t + 2i, \quad 1 \le i \le m$

Then the induced edge labels are given by $f^*(u_iv_i) = f(u_i) + f(v_i)$ and are as follows:

$f^*(v_1v_2) = 2t + 1$
$f^*(v_1y_i) = 2t + 2i, \quad 1 \le i \le m$
$f^*(v_2y_i) = 2t + 2i + 1, \quad 1 \le i \le m$

Thus the label of the edge v_1v_2 is 2t + 1.

The set of labels of the edges v_1y_i, $1 \le i \le m$ are $\{2t + 2, 2t + 4, 2t + 6,..., 2t + 2m\}$

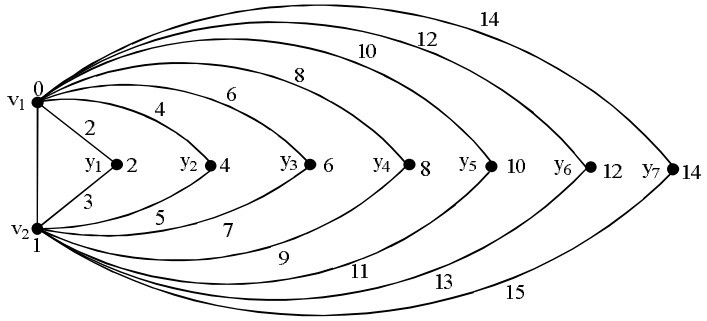
The set of labels of edges v_2y_i, $1 \le i \le m$ are $\{2t + 3, 2t + 5,..., 2t + 2m - 1, 2t + 2m + 1\}$

Therefore the values of the edges form the set $\{2t + 1, 2t + 2, 2t + 3,..., 2t + 2m, 2t + 2m + 1\}$

Thus the induced edge labels are given by $f^*(E(G)) = \{k, k + d, k + 2d,..., k + (q - 1)\}$
where $k = 2t + 1$ and $d = 1$.

Thus f is a Sequential labeling of G. Hence $P_2 + m K_1$ is a k-Sequential graph.

Illustration 1.7: (1, 1) - Sequential labeling of $P_2 + 7K_1$ is given below.



Theorem 1.8: The total graph of the path $G = T(P_n)$ is a $(2t + 1, 1)$ - Sequential graph for all n and for any non-negative integer t.

Proof: The vertex set of G is $V(G) = \{u_i, 1 \le i \le n, v_i, 1 \le i \le n - 1\}$
The edge set of G is $E(G) = \{u_iu_{i+1}, 1 \le i \le n - 1\} \cup \{v_iv_{i+1}, 1 \le i \le n - 2\}$
$\cup \{v_iu_{i+1}, 1 \le i \le n - 1\} \cup \{u_iv_i ; 1 \le i \le n - 1\}$

Then $|V(G)| = 2n - 1$ and $E(G) = 4n - 5$

Let t be a n integer such that $t \ge 0$. Define $f : V(G) \to \{0, 1, 2, \ldots, 4n - 6\}$ as follows:

$f(u_i) = 2i + t - 2, \quad 1 \le i \le n$
$f(v_i) = 2i + t - 1, \quad 1 \le i \le n - 1$

Then the induced edge labels are given by $f^*(u_iv_i) = f(u_i) + f(v_i)$ and are as follows :

$f^*(v_iv_{i+1}) = 2t + 4i, \quad 1 \le i \le n - 2$
$f^*(u_iu_{i+1}) = 2t + 4i - 2, \quad 1 \le i \le n - 1$
$f^*(u_iv_i) = 2t + 4i - 3, \quad 1 \le i \le n - 1$
$f^*(v_iu_{i+1}) = 2t + 4i - 1, \quad 1 \le i \le n - 1$

The set of labels of the edges $v_iv_{i+1}, 1 \le i \le n - 2$
$= \{2t + 4, 2t + 8, 2t + 12, \ldots, 2t + 4n - 12, 2t + 4n - 8\}$

The set of labels of the edge $u_iu_{i+1}, 1 \le i \le n - 2$
$= \{2t + 2, 2t + 6, 2t + 10, \ldots, 2t + 4n - 10, 2t + 4n - 6\}$

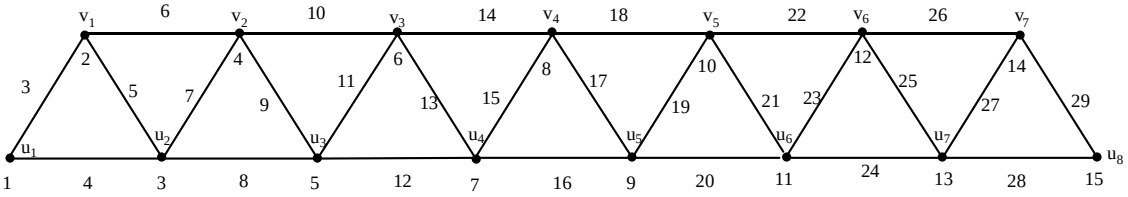
The set of labels of the edges $u_iv_i, 1 \le i \le n - 1, v_iu_{i+1}, 1 \le i \le n - 1$
$= \{2t + 1, 2t + 3, 2t + 5, \ldots, 2t + 4n - 7, 2t + 4n - 5\}$

Thus the values of the edges form the set
$= \{2t + 1, 2t + 3, 2t + 5, \ldots, 2t + 4n - 7, 2t + 4n - 6, 2t + 4n - 5\}$
Thus the induced edge labels are given by $f^*(E(G)) = \{k, k + d, k + 2d, \ldots, k + (q - 1)d\}$ where $k = 2t + 1$ & $d = 1$

Hence the above defined labeling pattern f admits Sequential labeling.

Therefore, $T(P_n)$ is a k-Sequential graph.

Illustration: 1.9: (3,1) is a Sequential labeling of $T(P_8)$



Theorem 1.10: The graph $G = T(P_n) \odot K_m^c$ is a (2t + 1,1) - Sequential graph for all m, n and for any non-negative integer t.

Proof: The vertex set of G is

$V(G) = \{u_i ; 1 \le i \le n\} \cup \{v_i ; 1 \le i \le n-1\} \cup \{u_{ij} ; 1 \le i \le n, 1 \le j \le m\}$
$\cup \{v_{ij} ; 1 \le i \le n-1, 1 \le j \le m\}$

The edge set of G is

$E(G) = \{(u_iu_{i+1}) ; 1 \le i \le n-1\} \cup \{(v_iv_{i+1}) ; 1 \le i \le n-2\} \cup \{(u_iv_i) ; 1 \le i \le n-1\} \cup \{(v_iu_{i+1}) ;$
$1 \le i \le n-1\} \cup \{(u_iu_{ij}) ; 1 \le i \le n, 1 \le j \le m\} \cup \{(v_iv_{ij}); 1 \le i \le n-1, 1 \le j \le m\}$

Then $|V(G)| = 2n(m + 1) - m - 1$

$|E(G)| = 2n(m + 2) - m - 5 = q$ (say)

Let t be an integer such that $t \ge 0$.

Define a labeling $f : V(G) \to \{0, 1, 2, \ldots, 2n(m + 2) - m - 6\}$ as follows:

$f(v_i) = 2i + t - 1, \ 1 \le i \le n-1$

$f(u_i) = 2i + t - 2, \ 1 \le i \le n$

$f(v_{ij}) = (n-1)(4 + j - 1) - i + t, \ 1 \le i \le n-1, 1 \le j \le m$

$f(u_{ij}) = (n-1)(4 + m) + n(j - 1) + t - i + 1, \quad 1 \le i \le n, 1 \le j \le m$

The vertex labels are distinct.

Then the induced edge labels are given by $f^*(u_iv_i) = f(u_i) + f(v_i)$ and are as follows:

$f^*(v_iv_{i+1}) = 2t + 4i, \ 1 \le i \le n-2$

$f^*(u_iu_{i+1}) = 2t + 4i - 2, \quad 1 \le i \le n-1$

$f^*(u_iv_i) = 2t + 4i - 3, \quad 1 \le i \le n-1$

$f^*(v_iu_{i+1}) = 2t + 4i - 1, \quad 1 \le i \le n-1$

$f^*(v_iv_{ij}) = 2t + i + (n-1)(4 + j - 1) - 1, \ 1 \le i \le n-1, 1 \le j \le m$

$f^*(u_iu_{ij}) = 2t + i + (n-1)(4 + m) + n(j - 1) - 1, \ 1 \le i \le n, 1 \le j \le m$

Thus the set of labels of the edges v_iv_{i+1}, $1 \le i \le n-2$

$= \{2t + 4, 2t + 8, 2t + 12, \ldots, 2t + 4n - 12, 2t + 4n - 8\}$

The set of labels of the edges u_iu_{i+1}, $1 \le i \le n-1$

$= \{2t + 2, 2t + 6, 2t + 12, \ldots, 2t + 4n - 10, 2t + 4n - 6\}$

The set of labels of the edges u_iv_i, v_iu_{i+1}, $1 \le i \le n-1$

$= \{2t + 1, 2t + 3, 2t + 5, \ldots, 2t + 4n - 7, 2t + 4n - 5\}$

The set of labels of the edges $v_1v_{1j}, v_2v_{2j}, \ldots, v_{n-1}v_{n-1j}, u_1u_{1j}, u_2u_{2j}, \ldots, u_nu_{nj}$, $1 \le j \le m$

$= \{2t + 4n - 4, 2t + 4n - 3, 2t + 4n - 2, \ldots, 2t + 2n(m + 2) - m - 6, 2t + 2n(m + 2) - m - 5\}$

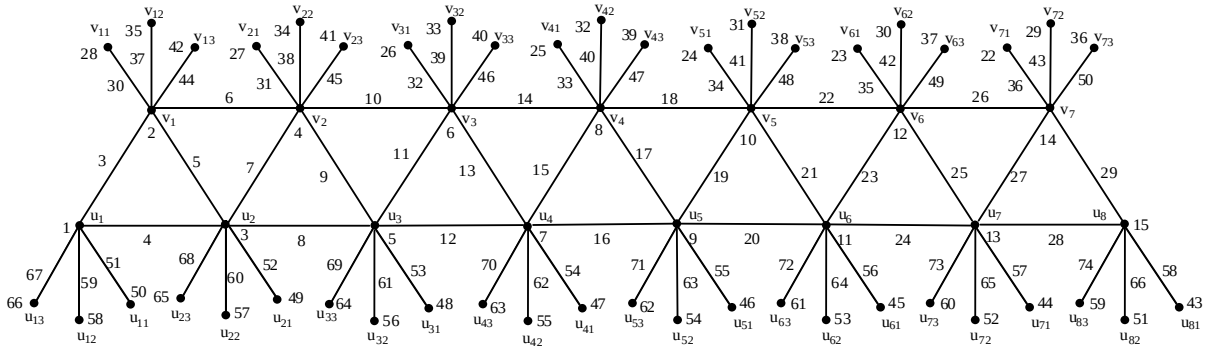
Therefore the set of labels of the edges of G is $\{2t + 1, 2t + 2, 2t + 3, \ldots, 2t + 4n - 6,$
$2t + 4n - 5, \ldots, 2t + 2n(m + 2) - m - 6, 2t + 2n(m + 2) - m - 5\}$

Thus the induced edge labels are given by $f^*(E(G)) = \{k, k + d, k + 2d, \ldots, k + (q - 1)d\}$ where $k = 2t + 1$ and $d = 1$

Thus the above defined labeling pattern f admits Sequential labeling for G.

Therefore $T(P_n) \odot K_m^c$ is a k-Sequential graph.

Illustration 1.11: (3,1) - Sequential labeling of $T(P_8) \odot K_3^c$



Theorem 1.12: The braid graph B(n) is a (2t + 1, 1) - Sequential graph for all $n \geq 3$ and for any non-negative integer t.

Proof: The vertex set of B(n) is $V(B(n)) = \{x_1, x_2, \ldots, x_n, y_1, y_2, \ldots, y_n\}$
The edge set of B(n) is

$E(B(n)) = \{x_i x_{i+1} ; i = 1,2,3,\ldots, n - 1\} \cup \{y_i y_{i+1} ; i = 1, 2,\ldots, n - 1\} \cup \{x_i y_{i+1} ;$
$i = 1, 2,\ldots, n - 1\} \cup \{y_i x_{i+2} ; i = 1, 2,\ldots, n - 2\}$

Then $|V(B(n))| = 2n$ and $|E(B(n))| = 4n - 5$

Let t be an integer such that $t \geq 0$. Define labeling $f : V(B(n)) \rightarrow \{0, 1, 2,\ldots, 4n - 4\}$ as follows:

$f(x_i) = 2i + t - 2, \quad i = 1, 2,\ldots, n$
$f(y_i) = 2i + t - 1, \quad i = 1, 2,\ldots, n$

Then the induced edge labels are given by $f^*(u_i v_i) = f(u_i) + f(v_i)$ and are as follows:

$f^*(x_i x_{i+1}) = 2t + 4i - 2, \; 1 \leq i \leq n - 1$
$f^*(y_i y_{i+1}) = 2t + 4i, \; 1 \leq i \leq n - 1$
$f^*(x_i y_{i+1}) = 2t + 4i - 1, \; 1 \leq i \leq n - 1$
$f^*(y_i x_{i+2}) = 2t + 4i + 1, \; 1 \leq i \leq n - 2$

The set of labels of edges $x_i x_{i+1}$, $1 \leq i \leq n - 1$
$= \{2t + 2, 2t + 6,\ldots, 2t + 4n - 10, 2t + 4n - 6\}$

The set of labels of the edges $y_i y_{i+1}$, $1 \leq i \leq n - 1$
$= \{2t + 4, 2t + 8,\ldots, 2t + 4n - 8, 2t + 4n - 4\}$

The set of labels of the edges $x_i y_{i+1}$, $i = 1,2,\ldots, n - 1$ and $y_i x_{i+2}$, $i = 1, 2,\ldots, n - 2$
$= \{2t + 3, 2t + 5,\ldots, 2t + 4n - 7, 2t + 4n - 5\}$

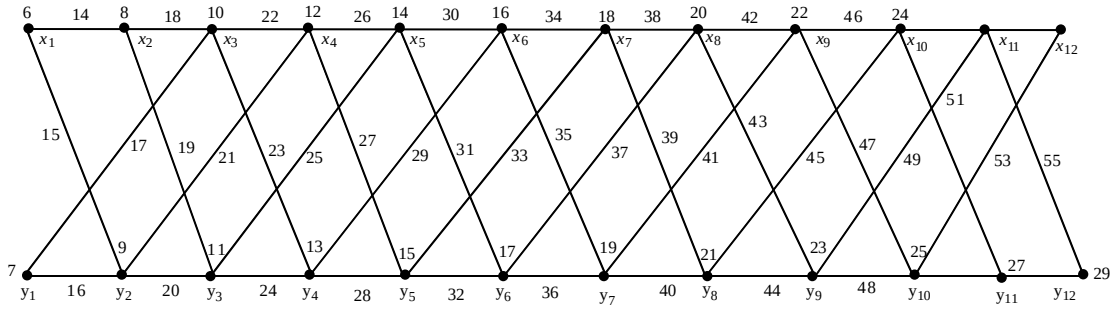
Hence the values of the edges form the set $\{2t + 2, 2t + 3,\ldots, 2t + 4n - 5, 2t + 4n - 4\}$

Thus the induced edge labels are given by $f^*(E(G(B(n)))) = \{k, k + d, k + 2d,..., k + (q - 1)d\}$
where $k = 2t + 2$ and $d = 1$

So that f is a Sequential labeling of B(n).

Hence B(n) is a k-Sequential graph.

Illustration 1.13: (14, 1) - Sequential labeling of B(12)



Theorem1.14: The graph $G^* = B(n) \odot K_m^c$ is a (2t + 1, 1) - Sequential labeling for all m, $n \geq 3$ and for any non-negative integer t.

Proof: Let $x_{i1}y_i$, $1 \leq i \leq n$ be the vertices of B(n).
Join x_i and y_i, $1 \leq i \leq n$ to new vertices x_{ij} and y_{ij}, $1 \leq j \leq m$ respectively.

The resultant graph is $G^* = B(n) \odot K_m^c$

$E(G^*) = \{x_ix_{i+1} ; 1 \leq i \leq n - 1\} \cup \{y_iy_{i+1} ; 1 \leq i \leq n - 1\} \cup \{x_iy_{i+1} ; 1 \leq i \leq n - 1\}$
$\cup \{y_ix_{i+2} ; 1 \leq i \leq n - 2\} \cup \{x_ix_{ij} ; 1 \leq i \leq n, 1 \leq j \leq m\} \cup \{y_iy_{ij} ; 1 \leq i \leq n, 1 \leq j \leq m\}$

G^* has $2n(m + 1)$ vertices and $4n + 2nm - 5$ edges.

Let t be a non-negative integer. Define a labeling $f : V(G^*) \to \{0, 1, 2, ..., 4n + 2n\,m - 6\}$ as follows:

$f(x_i) = 2i + t - 2$, $1 \leq i \leq n$
$f(y_i) = 2i + t - 1$, $1 \leq i \leq n$
$f(x_{ij}) = 4(n - 1) + mn - (i - 1) + (j - 1)n + t + 1$, $1 \leq i \leq n, 1 \leq j \leq m$.
$f(y_{ij}) = 4(n - 1) - (i - 1) + (j - 1)n + t$, $1 \leq i \leq n, 1 \leq j \leq m$.

Then the induced edge labels are given by $f^*(u_iv_i) = f(u_i) + f(v_i)$ and are as follows:

$f^*(y_iy_{i+1}) = 2t + 4i$, $1 \leq i \leq n - 1$
$f^*(x_ix_{i+1}) = 2t + 4i - 2$, $1 \leq i \leq n - 1$
$f^*(x_iy_{i+1}) = 2t + 4i - 1$, $1 \leq i \leq n - 1$
$f^*(y_ix_{i+2}) = 2t + 4i + 1$, $1 \leq i \leq n - 2$
$f^*(x_ix_{ij}) = 2t + i + n(m + j + 3) - 4$, $1 \leq i \leq n - 1$, $1 \leq j \leq m$
$f^*(y_iy_{ij}) = 2t + i + n(j + 3) - 4$, $1 \leq i \leq n$, $1 \leq j \leq m$

Thus the set of labels of edges x_ix_{i+1}, $1 \leq i \leq n - 1$
$= \{2t + 2, 2t + 6, 2t + 10, \ldots, 2t + 4n - 10, 2t + 4n - 6\}$

The set of labels of edges y_iy_{i+1}, $1 \leq i \leq n - 1$
$= \{2t + 4, 2t + 8, 2t + 12, \ldots, 2t + 4n - 8, 2t + 4n - 4\}$

The set of labels of edges x_iy_{i+1}, and y_ix_{i+2}, $1 \leq i \leq n - 1$

$= \{2t + 3, 2t + 5, 2t + 7, \ldots, 2t + 4n - 7, 2t + 4n - 5\}$

The set of labels of edges $x_i x_{ij}$, $y_i y_{ij}$, $1 \le i \le n, 1 \le j \le m$

$= \{2t + 4n - 3, 2t + 4n - 2, 2t + 4n - 1, \ldots, 2t + 4n + 2n\,m - 5, 2t + 4n + 2\,nm - 4\}$

Therefore the set of labels of the edges of G^*

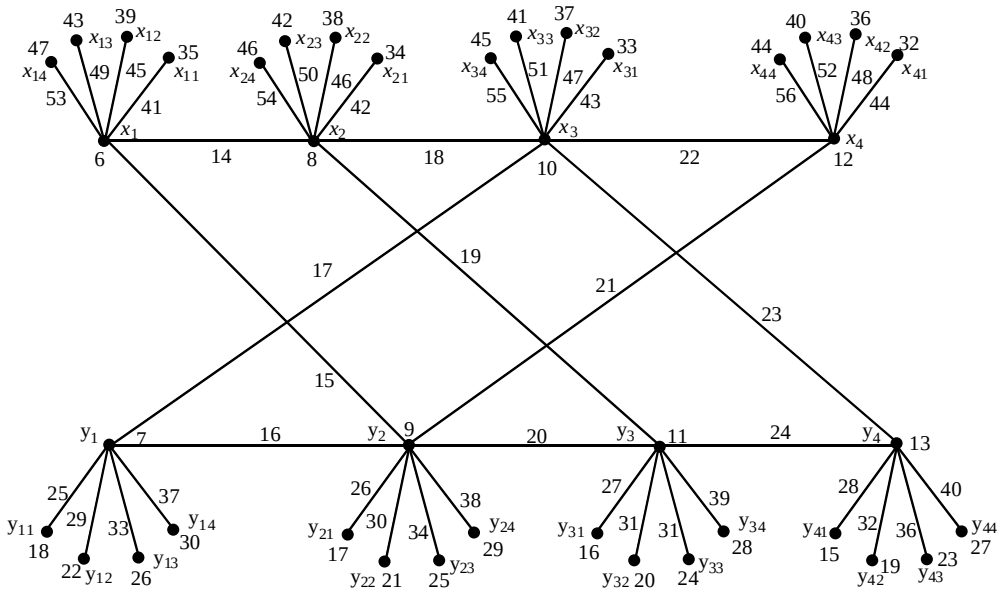
$= \{2t + 2, 2t + 3, 2t + 4, \ldots, 2t + 4n - 5, 2t + 4n - 4, 2t + 4n - 3, 2t + 4n - 2,$
$2t + 4n - 1, \ldots, 2t + 4n + 2n\,m - 5, 2t + 4n + 2n\,m - 4\}$

Thus the induced edge labels are given by $f^*(E(G^*) = \{k, k + d, k + 2d, \ldots, k + (q - 1)d\}$
where $k = 2t + 2$ and $d = 1$

Therefore the vertex function f defined above is a Sequential labeling for G^*.

Thus $G^*$is a k-Sequential graph.

Illustration 1.15: (14, 1) - Sequential labeling of B(4) $\odot$ K_4^c



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Unconscious Rendering in Alice Munro's *Too Much Happiness* and *Dear Life*

Abstract:

This paper brings to light the psychological defects and the reason behind the problems in Alice Munro's select short stories of *Too Much Happiness* and *Dear Life*. Alice Munro has kept her second life as an artist secret and this idea of her hidden identity appears in many of her stories in different forms. In most of her works, the protagonists are often married women with children who do not let themselves be oppressed by their husbands, but instead choose to live their own lives. The feeling of hostility, their old memories, the lack of confidence in their life, and the feeling of missing someone deep from their heart are the things that do not allow them to live a happy life. The characters from these two collections have undergone a lot of sufferings since from their childhood which is reflected in their upcoming life whether it is good or bad. Their personality and behaviour is based upon the old memories which they have stored in their sub-conscious mind.

Keywords: Childhood, Hostility, Identity, Psychology, Suffering.

Alice Munro is one of the best known short story writers in the world and she has played a significant role in making short-story writing respectable in Canada. She is born as Alice Ann Laidlaw on July 10, 1931. Alice Munro was brought up in the reticent Scots-Irish community of Wingham, Ontario, which is situated in the area around Huron County. This region was later came to be known as Alice Munro country because most of her stories are set in this remote region. Many of Munro's stories are set in Huron County, Ontario. Her strong regional focus is one of the features of her fiction. Another feature is the omniscient narrator who serves to make sense of the world.

The laws of the "unconscious" are repetition and desire. The "unconscious" is also a kind of memory. The "Unconscious" is a kind of knowledge. Clearly to say that, it is an "unknown knowledge". Lacan tells that what is repressed is the unconscious, the unconscious is not simply the sum of the repressed: "The repressed does not cover everything that is unconscious. The unconscious has the wider compass: the repressed is part of the unconscious" (Hewitson 21).

Lacan says that "desire is the essence of man" (no subject 2017). Desire is altogether the heart of human existence and the central concern of psychoanalysis. However, when Lacan talks about desire, it is not any other kind of desire, but it is always an unconscious desire. The aim of psychoanalytic treatment is to analyze and to recognize the truth about desire. It is only possible to recognize one's desire when it is articulated in speech. Speech is not able to articulate the whole truth about desire; whenever speech attempts to articulate desire, there is always a leftover.

One of Lacan's most important criticisms of the psychoanalytic theories is that they tend to confuse the concept of desire with the related concepts of demand and need. Human beings, born helpless are in need of someone to help them. One can fulfill the need, but human demand of unconditional love which cannot be fulfilled. Desire can never be satisfied; it is constant in its pressure and is eternal. The feature of desire is hysteria. Desire emerges originally from other that is in the unconscious. Lacan's phrase is that desire is a social product. Desire is not a solitary affair but is also the relationship with the love object.

Liu Hongyu says that the first ten stories in *Dear Life* are good examples of Lacan's psychoanalysis. Throughout the whole story "To Reach Japan", there are two voices all the time. One looks at what is going on outside the world and the other, always trying to make comments, is the desire hidden inside Greta.

At the beginning of the story Greta, accompanied by her daughter, says goodbye to Peter on the train to Toronto. Peter and Greta do not have a good relationship. It shows that she does not receive any care or affection from her husband. She is in need of the unconditional love of her husband. It lights in her writing. But their thoughts can mirror on each other. Peter's mother never interferes. While reading the poems of Greta, Peter comes to understand the needs of his wife.

Greta writes poems, whether good or not. She wants the attention of the world. So, she unconsciously writes whatever that comes in her mind. When she goes to a party in the third section, Greta receives no attention. So she represses her thoughts about the party and she begins to think of Peter. "She thinks that when she goes with Peter to an engineers' party, the atmosphere is pleasant though the talk is boring. That is because everybody has their importance fixed and settled at least for the time being." (DL 10). It reveals that Greta is bored with the life which she lives and she wants to be valued.

The upcoming sections expose Greta's longing for being valued, cared and loved by the important writer or by the journalist Harris. Since the important writer does not talk to her, Harris' care arises her passion towards him. All these secret feelings are exposed by Greta's bold self-expression when no other people are around. This incident shows her need to be loved and cared by someone close to her heart. Monologue is another technique which Munro often uses in her writing. It is a direct way to show the character's thoughts and feelings in the "unconscious".

Greta, as a writer is invited to a party by the editor of a magazine. It is interesting that Greta is hoping to see the important writer at first but she is disappointed by knowing that there is no possibility. At that time, Peter comes to her mind. When she goes to parties with him, each one claims their certain importance. Her unfulfilled desire in the unconscious mind arises from her desire upon another person. First she likes to meet the writer but later her wishes shifts into the journalist.

Greta loses herself, with no ability to control her consciousness. Or in other words, Greta disappears but her consciousness stays acted. Then Harris comes into her mind. According to Adler, love and marriage means that both should accept each other and they should understand that they are equal. As in the case of Greta she does not get the equal love she gives to Peter and so her love shifts from one person to another person. In front of another man, Greta tries to hang on to Katy because she once lost Katy due to her desire for a man. She is afraid of making the same mistake or she thinks of it as a sin but unconsciously turns her wish that she needs the man in her life.

As Liu Hongyu says, "the author uses stream of consciousness to insert herself as an obvious other, hence, the subject becomes a complete nothingness." (8). Greta is caught by her desire and does not know how to go beyond. Greta does not exist any longer as a subject of herself. The "other" becomes the subject.

When Greta meets Harris in the party she hangs out with him. Because she is left alone in the party and she feels hurt. And when he consoles her she thinks that he is able to understand her feelings better than her husband Peter. Many of the characters in Munro's stories are especially interested in how their romantic and sexual desires affect them and others. "If the partners are really interested in each other, there will never be the difficulty of sexual attraction coming to an end" (Adler 433). On the contrary in "To Reach Japan" Greta does not receive any such type of love from Peter. Even though she has misunderstanding with her husband she writes poems about him and improves their relationship.

"Amundsen" is a story which opens with Vivien Hyde having left Toronto to become a new teacher at a Tuberculosis place called Amundsen. Mary's mother works at the sanatorium, and Mary is active and happy to welcome Vivien. Mary introduces Vivien to her new boss, the doctor, Alister Fox. As they talk, Vivien quickly figures out that Fox is "the sort of person who posed questions that were traps for you to fall into" (DL 36). She knows how he is, but she is not able to deny the desire to be with him. Even though she knows him not to be a good man she needs the love from him because of her desire. He tempts her to get married with him. At the final moment he changes his mind. She marries someone else. One day they meet and they both disgust like they are happy.

"In Sight of the Lake" is about Nancy, an elderly woman who is experiencing mental issues. When the story begins she is travelling to meet a psychiatrist. Her illness is clear in the way she "mixed up Monday with Tuesday" (TMH 205) and initially goes to her doctor on the wrong day. She forgets the gender of the specialist and also where she finds the doctor's place in the park. Every time she leaves her car key somewhere and searches in the wrong place.

The title story "Too Much Happiness" is about Sophia whose marriage fails because her husband is not a perfect match for her. She wants to come out of that painful life so she

leaves Russia and moves abroad. There she meets a man named Maksim, with whom she falls in love passionately. Her love shifts to another person to equal her thoughts.

According to Adler ". . . crime is an intentional injury of others for one's own advantage. Obviously, then, the problem concerns human beings in whom social interest is not sufficiently developed" (411). "Dimensions" is a stressful tale about a woman who remains loving to her husband even after knowing that he kills her three children and is in mental hospital.

Jennifer Murray's "Reading Alice Munro with Jacques Lacan" brings the works of the writer and the psychoanalyst into dialogue. Approaching from Lacanian perspective, a close reading of Munro's texts reveals the energy at the heart of the stories and offers particular insight into aspects such as shame and humiliation that Munro presents with disconcerting insight. On taking into account, the stories of both the childhood and of adult experiences, Murray analyzes the child's fear as she confronts the mystery of parental injunctions. The stories about women in the later life speak of subjectivity in the field of relationships, where desire and love are central concerns.

Throughout the story of "Dimension" several clues are given that helps the readers to understand the painful past. For instance, there has been a picture of Doree and her children in the newspaper. There is a woman called Mrs. Sands who "spoke of moving on" and who "blushed at what she heard herself say - "death" - but did not make it worse by apologizing" (TMH 3). Mrs. Sands is a psychoanalyst.

At the hospital, Doree meets an older man Lloyd, and a year later she becomes pregnant and so she marries him. Doree has three children and with this the first instance of Lloyd's strange nature is revealed. He gets angry when he hears that Doree stops breast-feeding their youngest son. "Lloyd squeezed one breast after the other with frantic determination and succeeded in getting a couple of drops of miserable-looking milk out. He

called her a liar. They fought. He said that she was a whore like her mother. "All those hippies were whores, he said" (TMH 7).

Llyod's desire is to have his children very healthy. He doesn't consider the needs of his wife. She wants to have good familial relationship with her husband. She needs her husband to love and understand her. This is the first problem which is found in the character of Llyod. He needs to punish his wife so he projects his anger to his own children and unconsciously kills them. Lloyd becomes crueler and when he and Doree is having a fight, Doree runs to a friend for comfort. Lloyd overreacts and in an act of jealousy he kills his three children.

Strangeness is produced not by something supernatural, but by the deformed mind of the protagonist himself. Danger and fear is generated by the self. Thus, the 'other' in "Dimensions" is not a supernatural being, but Lloyd himself. He appears to be very traditional and creates hatred towards women, who, according to him are bearers of children. Here Doree's sexual desire is not fulfilled by her husband. For instance, he does not want Doree to take anti-conception. As a result, she gives birth to her first child at the age of sixteen, quickly followed by two other babies.

Adler says "Criminals look and speak and listen in a different way from other people" (413). As said by Adler, Llyod thinks and speaks differently. Lloyd sees this as an opportunity for the children's good health, because he gives importance to their health. After the murder, Lloyd becomes insane. As Adler says ". . . criminals are actually cowards. They are evading problems they do not feel strong enough to solve" (414). He is a coward. As a husband he should talk with his wife and concern her thoughts and he should solve his problems but instead of that he murders his three children like a coward.

In "Dimensions", otherness is hidden inside the self. Lloyd does not consider the feelings of his wife, he only thinks about the health of his children, and his worry about his

children leads to their death. He overreacts after seeing Doree with a tin of spaghetti that is on sale because there is "a very slight dent in it" (TMH 17). Psychologically affected persons do not ask the reason but react suddenly without their conscious. They assume something in their mind and suddenly decide the end. He thinks that she is trying to poison her family. Always Lyold has some unwanted matters in his unconscious mind. It makes him to behave rudely as day passes.

Jacques Lacan and Alice Munro are ever aware of each other's work. Yet, because of Munro's spontaneous grasp of the complexities of human subjectivity and her ability to articulate intricacies and ambiguities. Her fiction shares many of the insights of Lacan's theoretical advancements of the same period. They are concerned with bringing the unclear undercurrents of the psyche to light.

In "Wenlock Edge", Nina's life story starts when she is fifteen and gets pregnant and decides to marry the father of the child. Soon she has a second baby. Her husband goes to another town for a job and never returns. As a woman, she is longing for the love from her husband. Nina's lack of unconditional love possesses her into another relationship. When she meets a stranger, she falls in love. The girl who stays before Nina comes, she agrees because she wants to prove that she is not just a bookworm but that she is as daring as Nina. She blames herself and Nina because she understands that she must have known it from the start:

> Nina would know. She had been too preoccupied with Ernie to say anything that morning, but there would come a time when she would laugh about it. . . . And she might even tease me about it. Her teasing would have in it something like her tickling, something insistent, obscene. Nina and Ernie. In my life from now on. (TMH 89)

Someone insults her that she is always with the books. For those who insult her, she wants to prove herself so unconsciously and so she removes her dress.

"Deep-Holes" explores the deep rooted holes within the family members. The title of the story itself says that something is inside the mind of the family members. Alex finds his wife only as a sex object, and the fact that sex results in having children is the only problem for him . He does not show any particular feelings for his children, he is not worried at all. One day, Kent falls into a deep hole. Alex rescues his son. Kent sees Alex as his hero and saviour. Kent sees his father's act of rescuing him as a sign that he loves him, which Alex denies, he "would have rescued anybody" (TMH 100).

Adlerian theory says that the childhood memories shape the life. As Kent experiences a lot from his father he does all those things in his life. Like his father, Kent becomes a selfish person; he wants to think of himself without taking others into account. Unlike his father, he is not interested in any relationships, not even physical ones, since he calls himself selfish. He tries to justify himself by saving other people, just like his father does when Kent falls into the hole. His father's way of living affects his son. Generally, children see their parent as a role model for them. In this story the otherness is seen in the character of Alex and Kent.

In "Child's Play" the narrator, Marlene, is reflecting upon an incident from her childhood which is not revealed until the last page. She recalls a summer camp where she finds a friend called Charlene. Marlene and Charlene appear like twins and after the camp they grow together and share their feelings with each other. One day, Marlene tells Charlene about a mentally disabled girl, Verna who lives nearby. Marlene has the hatred feeling towards her from the very first day she sees her.

Verna does nothing to enrage the narrator, but she hates her without any reason. Marlene and Charlene take pleasure on spying Verna and also they view her as disgusting and monstrous she is. On the final day of the camp, the children are allowed to have one last swim. The camp atmosphere starts to be filled with danger.

Marlene and Charlene drown Verna after the attack of a big wave which comes from a motor boat. Both leave the place before anybody discovers Verna's body. They make a silent agreement not to keep up with each other for not to be reminded of their terrible act. Verna has enviable swimming ability. In a case study Adler quotes his patient "I saw a man who had nice trousers, and I hadn't; so I had to kill him" (413). In this story too Verna is a disabled girl any how she has the talent of swimming. While analyzing with Adler's theory it is the reason behind this story.

After the camp, she represses the facts. Years later Charlene sends Marlene a letter after having read her article entitled *Idiots and Idols*, about the attitude of the people of various cultures toward people who are mentally or physically unique. This proves that Marlene is still haunted by the past.

Thus this chapter deals with the unconscious psychological problems in Munro's characters. They somehow find the otherness within themselves. Their desire forces them to stick on to their past life.

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காட்டுக்குட்டி புதினம் புலப்படுத்தும் சமூக அவலம்

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(அழகப்பா பல்கலைக்கழக இணைவு பெற்றது), பரமக்குடி-623701, தமிழ்நாடு, இந்தியா.

ஆய்வுச் சுருக்கம்

மலர்வதி குமரிமாவட்டத்தைச் சேர்ந்தவர். தனது இரண்டாவது புதினமான தூப்புக்காரி நாவலுக்காக சாகித்திய அக்காதெமி விருதினைப் பெற்றவர். அவரது இன்னொரு புதினம் காட்டுக்குட்டி. இதில் அவர் சாதி, மதம், ஆண், பெண், பலம், பலவீனம், பொருள், பொருளின்மை, கௌரவம், ஏமாற்றுத்தனம், என்ற நிலைகளில்" சமூக அவலம் சார்ந்த பல விசயங்களையும் முன்வைக்கின்றார். இப்படியாக மனிதனால் மனிதனுக்கு நிகழ்த்தப்படுகின்ற பேரவலத்தை இது ஒரு பெண்ணின் யதார்த்த கதையாக புனையப் பட்டுள்ளது. படைப்புக்கான பொருளும், கதாபத்திரங்களின் நிலம் சார்ந்த யதார்த்த மொழியும், படைப்புக்கான மொழியுமாக ஒரு திமிர் பிடித்த ஆண் வாசகனின் நெஞ்சையும் பதறவைக்கின்றார் மலர்வதி.

கலைச்சொற்கள்

காட்டுக்குட்டி, பாலியல், குடும்பம், ஆணாதிக்கம், பெண்ணியம், அவலம், கற்பு, ஒழுக்கம், இரத்தம், வன்முறை

முன்னுரை

காட்டுக்குட்டி புதினத்தை மலர்வதி ரமணி, ரமணியின் மகள் காட்டுக்குட்டி, அப்பு, ராயன், நீத்தா, முத்து உள்ளிட்ட பல திறன் வாய்ந்த கதாபத்திரங்களின் வழியாக உருவாக்கியுள்ளார். குறிப்பாக இந்த சமூகம் ஆணின் துணை இல்லாத அல்லது சூழல் வயப்பாட்டால் பரத்தை மகளிர் நிலைக்கு உள்ளாக்கப்பட்ட ஒரு பெண்ணை பார்க்கின்ற பார்வையினையும், அத்தகையதான ஒரு பெண் இந்த சமூகத்தை பார்க்கின்ற பார்வையுமாக எடுத்துரைத்துள்ளார். தந்தையை வெளிப்படுத்த இயலாத ஒரு குழந்தையின் பிறப்புக்குக் காட்டுக்குட்டி என்ற ஒரு அவப்பெயரைச் சூட்டி அந்த அவலத்தில் இந்த சமூகம் பூரிப்படைவதை மலர்வதி தனக்கே உரித்தான குமரிமண்ணின் மேற்கு பகுதி சார்ந்த மலையாள மொழியின் ஆளுமையோடும் முன்வைக்கின்றார். புதினம் முழுமைக்குமே பெண்சார்ந்த அவலம் பேசப்படுகின்றது. குறிப்பிட்டுச் சொல்வதானால் ஆணாதிக்கம் சார்ந்த ஒரு சமூகநோயினையே மலர்வதி நாவல் முழுமைக்கும் விவரிக்கின்றார் என்பது கவனத்திற்குரியது. அவை குறித்து ஆய்வு நோக்கில் விவரிப்பதாக இக்கட்டுரை அமைகிறது.

புதினத்தின் மையக்கருத்து

காட்டுக்குட்டி புதினம் மூன்று முக்கிய விசயங்களை பேசுகின்றது. ஒன்று காட்டுக்குட்டியாக அறிமுகமாகின்ற குட்டிமணிக்கு ஏற்படுகின்ற வாழ்வியல் நெருடல்கள். இன்னொன்று ரமணி, மகாராணி பாத்திரங்கள் சூழல்வயப்பாட்டாலும், வறுமையாலும் தாங்கள் விபச்சார நிலைக்கு தள்ளப்படுதலும் அதனால் அவர்களுக்கு நேர்கின்ற இன்னல்களும், இன்னொன்று மானுட இறப்பு பற்றியான வேறுபட்ட சிந்தனைகளை முன்வைத்தல் என்பதாகப் பார்க்க முடிகிறது. மேலும் ரமணி, குட்டிமணி, அப்பு, முத்து, பாலுராசி, சந்தானம், ரோசம்மா, மகாராணி உள்ளிட்ட பாத்திரங்கள்

புதினத்தை இயக்கும் ஆற்றல் மிகு பாத்திரங்களாக விளங்கச் செய்வதிலும் மலர்வதி வெற்றி பெற்றுள்ளார்.

புதினத்தில் ரமணியே கதையின் மைய பாத்திரமாக விளங்குகிறாள். ரமணி இல்லாமல் கதை இல்லை. ரமணியின் மூலமாகவே மலர்வதி பெரும்பாலான சமூக அவலங்களை அதுவும் பெண்களின் அவலங்களைப் புதினத்தில் எடுத்து வைக்கின்றார்.

ரமணி தன்னை விரும்பிய ஒருவனோடு உடலுறவு வைத்துக் கொள்ள அவள் கருவுறுகின்றாள். ஆனால் திருமணம் எனும் நிலை வருகின்ற போது அவனின் வீட்டில் உள்ளவர்களின் பேச்சைக்கேட்டு அவன் ரமணியை திருமணம் செய்யாது வெளியூரில் சென்று தங்கிவிடுகிறான். இதனால் ரமணி மனம் வெதும்பிய இருக்கிறாள். ரமணி கருவுற்றிருப்பதை அம்மா ஞானேந்திரியும், ரமணியின் மாமி பவளமும் தெரிந்து கொள்கின்றனர். ரமணியின் அம்மா ஞானேந்திரி மகளின் செயலை அவமானமாகக் கருதி தான் கட்டியிருந்த சேலையிலே தொங்கி தற்கொலை செய்து கொள்கின்றாள். இச்செயல் ரமணியின் அம்மா மற்றும் மகள் ஒழுக்கத்திற்கு கட்டுப்பட்ட குடும்பம் என்பதை முன்னுணர்த்தி நிற்கின்றது. தன்னுடன் படுத்திருந்த தாயினைக் காணாது துடித்துப்போகும் ரமணியின் பதற்றம் நெஞ்சைப் பதறவைப்பதாக உள்ளது.

"அம்மோ... ஓ... அவள் படுத்துக் கிடந்த இடத்தில் காணவில்லை. அழைத்துக் கொண்டு வெளியே வந்தாள்... கொன்னை மரத்தை சுற்றிலும் காகங்கள் கரைந்து கொண்டே சுழன்றன... அவற்றின் கரச்சி சத்தத்தில் பிணம் தின்னும் வேட்கைத் தெரிய அச்சுறுத்தும் அந்த காகங்களை பார்த்தாள் ரமணி.

அம்... மோ.. அவள் உதடுகள் முனகியது. கொன்னை மரத்தை நோக்கி ஓடினாள். அதன் தடிமத்தைப் பிடித்துக் கொண்டு அண்ணாந்துப் பார்த்தாள். மரத்தின் உச்சானிக் கொம்பில் ஞானேந்திரி அவள் உடுத்தியிருந்த சேலையில் செத்து நின்று தொங்கினாள். வெறும் பாவாடை, செம்பறோடு கண்கள் வெளித்தள்ள, நாவும் துறுத்திக் கொண்டு வெளியில் தொங்க பீயும் மோளும் சாட விகாரமாக தொங்கியவளைப் பார்த்து அம் ..மோ.. ஓ... எனக்க அம்... மோ... ஓ... என்று அலறிய அலறல் இன்னும் நினைவில் வர தன்னை உலுக்கிக் கொண்டு நின்றாள் ரமணி"[1]

மேலும் தாயின் இறப்பு ரமணிக்கு இன்னும் பெரிய நெருக்கடியைக் கொடுக்கிறது. மட்டுமல்லாது இந்த சமூகம் மானம், கற்பு, புனிதம், ஒழுக்கம் என விதித்து வைத்திருக்கின்ற வரையறைகள் மனித வாழ்வில் பலரின் உயிரை பறித்து விடும் அளவிற்கு நெருக்கடியை ஏற்படுத்துவதும் முக்கியமான விமர்சனமாக கொள்ளத்தக்கதாகிறது. மேற்சுட்டியதைப் போன்ற புனிதம் சார்ந்த வார்த்தைகளின் சமூக உருவாக்கம் போலவே, மனிதனை இழிவுபடுத்தும் சொற்களும் இந்த சமூகத்தால் உருவாக்கி வைக்கப்பட்டுள்ளதில் வியப்பேதுமில்லை. அந்த வகையில் உருவாக்கப்பட்ட ஒரு சொல்லே தந்தையின் பெயரைச் சொல்ல முடியாத நிலையில் பிறந்த ஒரு குழந்தையை காட்டுக்குட்டி என சுட்டப்படுவது. இது அடிப்படையில் குமரி மாவட்ட வழக்குச் சொற்களில் ஒன்றாக அம்மக்களிடம் அங்கிகரிக்கப்பட்டு கிடக்கிறது. மேலும் சாதி சார்ந்தும், பொருளாதார தாழ்வுநிலை சார்ந்தும், செயல் சார்ந்தும் இத்தகையச்சொற்கள் ஏராளமாய் புழக்கத்தில் உள்ளதை அறிய முடிகின்றது. அதனால்தான் சொல்லின் வலிமை அறிந்த திருவள்ளுவர்,

"தீயினால் சுட்டப் புண் உள்ளாறும் ஆறாதே
நாவினால் சுட்டவடு"[2]

என்று ஒரு சொல்லினைச் சொல்லும்போது கவனமாக கையாளுமாறு அறிவுறுத்துகின்றார் போலும்.

காதலன் ராயனால் கைவிடப்பட்ட நிலையில் ரமணிக்கு பிறந்த பெண்குழந்தைக்கு அவள் "குட்டிமணி" என பெயர் சூட்டி அழகு பார்த்தாலும்

சமூகம் அந்த குழந்தைக்கு காட்டுக்குட்டி எனும் பெயர் சூட்டி ரமணியையும் குழந்தையையும் பெருந்துயருக்கு உள்ளாக்குகிறது. வாழ்வு மலினமாக்கப்பட்ட இருவரின் கற்பையும் ஆணாதிக்கச் சமூகம் பறிக்க முற்படுகிறது. குறிப்பாக முத்து என்பவன் குட்டிமணியை சூறையாடுவதில் அதிக கவனம் செலுத்தியதையும், அதிலிருந்து குட்டிமணியைக் காத்துக்கொள்ள இறுதி வரை ரமணி போராடி உயிர்விட நேர்வதையும், கூடவே ரமணியின் வாழ்வைப் புரிந்து துணைநின்ற "அப்பு" என்ற உறவுப்பாத்திரமும் குட்டிமணியை காக்க உயிர் விடுவதோடு, முத்துவை கொலை செய்து விடுவதும் சமூக அவலத்திற்கு எதிரான ஒரு போராட்டத்தை சதாகாலமும் செய்துகொண்டே இருக்க வேண்டிய அவசியத்தை மலர்வதி புதினத்தில் சுட்டிச் செல்கின்றார். புதினம் பற்றிக் குறிப்பிடும் பேரா சு. செல்வகுமாரன்,

"புதினத்தில் கருத்துருவாக்கமும், தருக்கம் சார்ந்த உரையாடல்களும் ஒரு புதிய எடுத்துரைப்பு முறையாகவே அமைந்து விடுகிறது. மேலும் புதினத்தில் ஆங்காங்கே சுட்டப்படும் பெண்ணியம் சார் எழுத்துக்களும், ஆணின் திமிரை அடையாளப்படுத்தும் எழுத்துக்களும், உலகமயமாக்கலின் விளைவாய் நிகழும் நிலஅழிப்புகள் குறித்த பதிவுகளும், தலைவலிக்கு பிணத்தின் மண்டையை உரசிப் போடும் ஒருவித மாந்திரீக/நாட்டார் நம்பிக்கைசார் மருத்துவம் குறித்த எடுத்துரைப்பும், சமாதியைக் கடைசி வீடாக பார்த்தல், பாடசாலைக் கல்விக்கும் அனுபவக்கல்விக்குமான வேறுபாடுகள், குழந்தைகள் மீது நிகழ்த்தப்படும் பாலியல் வன்மங்கள் எனத் தொடர்கிறது. மட்டுமல்லாது விளிம்பு நிலை வாழ்வியல் சார் பதிவுகளை வெளிப்படுத்தும் அப்பு, கடவக்காரி கமலம், சந்தானம், பவளம், பாக்கியம் போன்ற பாத்திரங்களைக் கொண்டு புதினத்தையே ஒரு கழிவிரக்கத்தோடு வாசிக்கக்கூடிய ஒரு சூழலை மலர்வதி ஏற்படுத்தியிருக்கிறார். எனினும் மலர்வதியின் இந்த சமூகத்தின் முரண்பட்ட செயல்பாடு குறித்து குறுக்குவெட்டு தோற்றத்தில் எழுப்பப்படும் கேள்விகள் புதினத்தில் சதா நிகழ்ந்து கொண்டிருக்க கூடிய கழிவிரக்கச் சிந்தனைகளை அசைத்து ஒரு அதிர்வை ஏற்படுத்துகிறது."[1]

என்பதும் கவனத்திற்குரியது.

காட்டுக்குட்டி புதினமும் - பெண்ணியச் சிந்தனையும்

புதினத்தில் மலர்வதி மேற்கட்டிய நிலையில் முன்வைக்கும் அவலத்தை பெண்ணிய நோக்கிலும் அணுகற்தக்கது. ஏனெனில் புதினம் முழுமையுமே பெண்ணை மையப்படுத்தும் எழுத்தாகவே உள்ளது. பெண்ணிய எழுத்தாளர் இரா. பிரேமா, பெண்ணியக் கோட்பாட்டாளர் "அப்ரா பென்"யை பற்றிக் குறிப்பிடுகின்ற போது,

"பாலியலைப் பற்றி விரிவாகவும் துணிவாகவும் விமர்சித்த முதல் ஆங்கிலப் பெண் இவரேயாவார். கவிதைகள் உள்ளிட்ட இவருடைய எழுத்துக்கள் ஒரு பெண் தன்னுடைய பாலியல் சுதந்திரத்தை நிலை நாட்ட வேண்டும் என்ற கருத்தை முன்வைத்தன. ஆணோடு பெண் ஒத்துப் போனாலும் தனக்கெனச் சில இச்சைகளைச் சுதந்திரத் தன்மையோடு உறுதிப்படுத்திக்கொள்ள வேண்டும் என்று வாதாடினார். சமூகத்தில் கண் மூடித்தனமாகக் கடைபிடிக்கப் பெற்று வந்த பழைய மரபுகளை இவர் தீவிரமாக எதிர்த்துள்ளார். திருமணம் என்பது ஒரு சடங்கு தானே தவிர்த்து தனிப்பட்ட ஒருவரது பாலியல் உறவை அது எந்த விதத்திலும் கட்டுப்படுத்தாது என்ற புரட்சிகரமான வாதத்தை முன்வைத்தார். இவர்...

1905 ல் அப்ரா பென்னின் புதினங்களை தொகுத்து வெளியிட்ட பேக்கர் அதன் முன்னுரையில் தற்போதைய நாகரீக உலகில் இவரது பாலியல் சிந்தனைகள் அதிகம் குற்றப்படுத்தப்படாது என்று விமர்சித்துள்ளார். அத்துடன் எழுத்துலகில் இவரை

முன்னோடியாகக் கொள்ள நாம் உண்மையில் அதிர்ஷ்டம் செய்திருக்க வேண்டும் என்றும் கருத்துரைத்துள்ளார்.

மொத்தத்தில் அப்ராபென்னின் வாழ்வும் எழுத்தும் புரட்சிகரமான ஒன்றாகும். அவர் காலகட்டத்தில் அவரது வாழ்வும் எழுத்தும் புறக்கணிக்கப்பட்ட போதிலும் பிற்காலத்தில் அவர் பெண்ணிய வாதிகளின் முன்னோடியாக ஏற்றக் கொள்ளப்பட்டார். பெண்களின் பாலியல் சுதந்திரம் பற்றிய இவருடைய தீவிரக் கண்ணோட்டம் பிற்காலத் தீவிரப் பெண்ணியவாதிகளுக்கு வழிகாட்டுதலாக அமைந்தது"[4]

என்பார். மேலும் இவர் போன்று பலரும் பெண்ணியச்சிந்தனைகளை வெளிக்கொணர ஒரு கட்டத்தில் அடித்தளமிட்டுள்ளனர். குறிப்பாக மேரி வோல்ஸ்டோன் கிராப்ட், சாரா மார்கரேட் ஃபுல்லர், லூசிஸ் டோன் போன் றோர் பெண்களைத் தனியாக விடுங்கள் பின் அவர்களைப் பொறுத்திருந்து பாருங்கள் எனும் கருத்தை மையப்படுத்தி பேசியவர்கள். அவர்களின் தொடர்ச்சியாகவே இன்று பல பெண்ணிய ஆய்வாளர்களும், எழுத்தாளர்களும் உருவாக்கம் பெற்றுள்ளனர். அந்த வகையில் மலர்வதியின் எழுத்தும் இன்று பாலியல், காமம், கருவழிப்பு, காதல் போன்ற பல விஷயங்களை புரட்சிகரமாக, வெளிப்படையாக பேசியுள்ளமை சமூகப் பொறுப்புமிக்க ஒரு படைப்பாளியின் படைப்பாக்கமாக காட்டுக்குட்டியை இனங்காணமுடிகிறது.

சூழல்வயப்பாட்டல் பாலியல் தொழிலுக்கு தள்ளப்படும் ரமணி, தன் மனதளவில் தன்கற்பு கெட்டுப் போகவில்லை என குட்டிமணியிடம் ஓரிடத்தில் உரைப்பதும், தான் கெட்டுப் போனாலும் தன்மகள், மற்றும் பாலியல் தொழிலுக்கு முத்துவால் அழைத்து வரப்படும் கல்லூரிப் பெண்களின் வாழ்வு கெட்டுப்போய் விடக்கூடாது என அதில் அதிக கவனம் செலுத்துவதும், மகாராணியின் துயரம் குறித்து பகிர்வதுமானச் செயல்பாடுகளும் சமூகஅவலம், பெண்துயரை அடையாளங்காட்டுதல் என்பதாக பார்க்க முடிகிறது.

"பேருந்து நிலையத்தின் ஓரமாக தென்பட்ட கழிவறைக்குள் ஒன்றிரண்டு கல்லூரிப் பெண்கள் தங்கள் கல்லூரி சீருடைகளை அணிந்தவாறு அவசர அவசரமாக நுழைந்தார்கள். "வயிற்றுக்கு சரியில்லையா இருக்கலாம்" அப்படித்தான் ரமணி நினைத்தாள். ஆனால் அந்த இளம்பெண்கள் அதற்காக உள்சென்றவர்கள் போல் தெரியவில்லை..., போன வேகத்தில் வெளியே வந்தவர்கள் இப்போது மாற்று உடை அணிந்திருந்தார்கள். அவர்கள் முகத்தில் பவுடர் போட்ட மினுக்கு தெரிந்தது. உதட்டில் சிவப்பு சாயம் தென்பட்டது.. தலைமுடி அழகு செய்யப்பட்டிருந்தது... அவர்களில் எதோ அவசரம் தெரிய அங்கும் இங்கும் பார்த்துக் கொண்டு ஏதோ மறைவான தப்புக்கு போகிறவர்கள் போன்ற தொனியில் தெரிய ரமணி மனதுக்குள் லேசாக அதிர்ந்தாள். அவள் இதயம் பட் பட் என துரிதமாகத் துடிக்க அந்தப் பெண்களை நோக்கி வேகமாக நடந்தாள்.

இந்தா சாயை... கடைக்காரர் சொல்வது காதில் விழுந்தபோதும் அதையும் உள்வாங்காமல் அவள் அந்தப் பெண்களிடம் ஓடினாள். அவள் சாயை காபியை புறக்கணித்துவிட்டு ஓடுவதை கடைக்காரர் எரிச்சலோடு பார்த்தார். ரமணி கல்லூரி மாணவிகளின் அருகில் போவதற்கு முன்பு அந்தப் பெண்களை மறித்துக்கொண்டு வந்தது சிவப்பு நிற வாகனம். அதிலிருந்து வேகமாக இறங்கினான் முத்து என்பவன், அவனைக் கண்டதும் ரமணியின் உயிர்வரை துவண்டது. நின்ற வேகத்தில் அந்த மூன்று பெண்களை இங்கும் அங்கும் பார்த்து விட்டு அந்த வாகனத்திற்குள் கல்லூரிப் பெண்களை ஏற்றினான்.

வே... ண்டா... ம் அலறிக்கொண்டு ரமணி அந்த வாகனத்தை நோக்கி விரைந்தாள்."[5]

என்பதோடு தொடர்ந்து அவர் கூறும் வரிகள் கல்லூரிப் பெண்களுக்கு யதார்த்த வாழ்வு

குறித்து ஆசிரியர்களைக் கற்பிக்க வலியுறுத்தும் பகுதி கல்ஞாரி பாடங்களை கற்பதற்கு மட்டுமல்ல வாழ்வையும் கற்பதற்குதான் என்கதை உணர்த்த முற்படுகிறது.

புதினத்தில் இன்னொரு முக்கியமான பகுதியாக உலகில் ஒரு பெண்ணுக்கு தாய்மைப் பரிசை வழங்க கருவுறும் குழந்தைகளை கொண்டாடும் இவ்வுலகில் காட்டுக்குட்டிகளின் அழிப்பு பற்றியான ஒரு சித்திரத்தை முன்வைப்பதும் அது குறித்து உரையாடுவதும் குழந்தைகளின் புனிதத்தை கேள்விக்குட்படுத்துவதாக உள்ளது. சமூக விதிமுறைகளுக்கு உட்படாத நிலையில் உருவாகும் ஒரு குழந்தையைக்காத்து அதன் உயிரைக்காப்பதா? அல்லது தன்னளவில் அவமானங்களைத் தவிர்த்த வாழ்வைக்காப்பதா என்ற ஒரு பெரும் கேள்வி மலர்வதியால் முன்வைக்கப்படுகின்றது.

"இன்னா கலக்கி வச்சிருக்கிய ரெத்தம். எனக்க வயித்துக்குள்ள பிள்ளையா வந்த குழந்தையில்லியா? எவனோ முட்டுன அவசரத்தில் முளச்சி வந்த குழந்தையை அல்லவா கொன்னு கலக்கி ரத்தமா வச்சிருக்கியேன். முகவரியத்த விதையிக்க கொலைதான் இந்த வாளியில ரெத்தமா நிக்கி."[6]

என்பதன் மூலம் மேலும் காட்டுக்குட்டிகளை பெற்றெடுக்கும் உரிமை மட்டும் இருந்திருந்தால் இவ்வுலகில் மற்றப் பிள்ளைகளை விட இவர்களின் எண்ணிக்கையே அதிகமாக இருக்கும் என்பதான ஒரு கருத்தும் பதிவு செய்யப்பட்டுள்ளது. இன்னொரு இடத்தில் ஆணுக்கு கர்ப்ப பாத்திரமுண்ணு ஒண்ணு இல்லாமப் போனதுனால அவனவன் தப்பியிட்டு இருக்கியான். அது மட்டும் இல்லாட்டா நானும் தப்பியிருப்பேன் என்பதும் கூட கர்ப்பப்பையின் புனிதத்தை கேள்விக்கு உட்படுத்துவதோடு உடல் அமைப்பு சார்ந்தே ஆண் காக்கப்படுவதும் இன்னும் இன்னுமாய் தொடரும் சமூக அவலங்களை மலர்வதி தொடர்ந்து ஒரு சங்கிலியாக புதினத்தில் பதிவு செய்திருக்கிறதைப் பார்க்க முடிகிறது.

காட்டுக்குட்டி புதினமும் அதன் பன்முகமும்

புதினம் ஒரு மையத்தைக் கொண்டிருந்தாலும் அதனைத் தாண்டியதாக அதற்கென பன்முகமும் இருக்கத்தான் செய்கிறது. குறிப்பாக, ஆண் மற்றும் குடும்பம் குறித்த பதிவுகள் செய்கின்ற போது, ஆணின் ஆதிக்கமும், தவறும் சுட்டிக்காட்டப்படும் அதே வேளை ஒரு பெண்ணால் கைவிடப்பட்ட ஆணாக அப்புவைக் காட்டுவதும் சமூக ரீதியில் முக்கியமான ஒரு பார்வையாகிறது. இங்கு பெண்ணின் மனதை புரிந்து கொள்கின்ற ஒரு கருணை மனம் கொண்டவனாக அப்பு காட்டப்படுகிறான். இவை இந்த சமூகத்தின் அங்கமாக ஆணும் பெண்ணும் இருப்பதை சுட்டுகின்றது. அது போல குட்டிமணியின் திருமணம் குறித்த பேச்சுகள் வருகின்ற போது ஒரு ஆணின் துணை அல்லது குடும்பங்களின் தேவை குறித்தும் பேசப்படுகிறது. அது போலவே குடும்பங்களின் தேவையின்மையும் பேசப்படுகிறது.

புதினத்தின் இறுதிப் பகுதியில் முத்து, குட்டிமணியை பாலியல் தொழிலில் ஈடுபடுத்த அவளைக்கடத்த முயல்கிறபோது ரமணி மீதும், குட்டிமணி மீதும் பேரன்பு கொண்டிருந்த அப்பு அதை தடை செய்ய முயல்கிறான். அதற்கு முத்து நீ என்ன வந்து தடுக்கிறாய் நீ என்ன ரமணிய கெட்டுனியா? என்று ஒரு கேள்வியை எழுப்புகின்றான். அதற்கு அப்புவின் உள் மனதின் மூலம் பதில் சொல்லும் மலர்வதியின் வரிகள் சமூக மாற்றத்தின் தேவையை வலியுறுத்தும் முற்போக்கான வரிகளாக விளங்குகின்றன.

"நீ கேக்கிறது போல நான் அவளுக்கு ஆளு கூட்டி கல்யாண மேடை வச்சி தாலி வேண்டுக் கெட்டி எனக்க பெண்டாட்டியில்லு உள்ளத காட்டேல. பெண்டாட்டியின்னா ஒங்களுக்கெல்லாம் தாலி காட்டணம் இல்லியா? அடிமப் போல ஒரு பெண்ணை ஆக்கிக்கிற ஒங்களுக்கெல்லாம் தாலி பெருசா காணும்.

ஆனா எனக்க மனசுக்குள்ள மகாராணிப் போல வச்சிருக்கிற எனக்க ரமணியிக்கி தாலிபோட்டுதான் எனக்க பாசத்தைக் காட்டணமுண்ணு உள்ள அவசியம் இல்ல. வாண்ணா வந்து, போண்ணா போய், கிடண்ணா கிடந்து, ஒன் வீட்டு அடுக்களை வேலையை செய்து, ஒனக்கும் ஒன் குடும்பத்துக்கும் அடிமை சாசனம் எழுதிக்கொடுத்த பெண்ணுக்கு நீயெல்லாம் கட்டுற தாலியால பெண்ணுக்கு என்ன முன்னேத்தம் வந்து? பெண் மனசைப் புரியாத தாலியால எவளுக்கு விடுதலை கிட்டுச்சி? எனக்க மனகல ரமணி எசமானிப் போல இருக்கியா... அந்தக் குட்டியிட்ட நான் வச்சிருக்கிய பாசத்துக்கு தாலிப்போட்டு காட்ட அவசியமில்ல. எல்லா பாசத்துக்கும் ஒனக்க ஒலகம் அடையாளம் கேக்குது. அந்த அடையாளம் எனக்குத் தேவையில்ல. அவளுக்கு ஒண்ணுண்ணா இந்த உயிரும் மனசும் துடிச்சிப் போகுதே... இதான் பாசம். இதுக்கு தாலியிண்ணு உள்ள அடையாளம் தேவையில்ல..."[7]

சமூகத்தில் நிலவும் அநீதிகளுக்கு எதிரான போராட்டங்கள் எத்தனையோ வழிகளில் நடைபெறுகின்றன. அவற்றில் மிக முக்கியமானது எழுத்து வழியாக நடைபெறும் போராட்டம். அநீதி கண்டு, மனதளவில் வெகுண்டெழுந்து, தனக்குத் தெரிந்த மொழியில், அதனை அப்படியே எழுத்து வடிவில் கொட்டி, எழுத்தையே நெருப்பாக மாற்றும் வல்லமை சில எழுத்தாளர்களுக்கு மட்டுமே உண்டு. அவர்கள் எதற்காகவும் எழுதுபவர்கள் அல்ல. சக மனிதரின் அவலத்தைப் போக்க வேண்டும் என்னும் உந்துதலில் மட்டுமே எழுதுகோலைப் பிடிப்பவர்கள். உள்ளதை உள்ளபடி எழுதும் அத்தகைய எழுத்தளர்களே இன்றைய உலகிற்குத் தேவையான எழுத்தாளர்கள். அந்த வகையில் கவனம் பெற்றவர் எழுத்தாளர் மலர்வதி. இங்கு மலர்வதி பற்றியும், காட்டுக்குட்டி பற்றியும் குறிப்பிடும் முனைவர். வா.நேரு,

"பாலியல் தொழில் செய்யும் ஒரு பெண். அவளைப் பற்றிக் கவலைப்பட இந்த உலகத்திற்கு என்ன இருக்கிறது? ஏன் அவளைப் பற்றிக் கவலைப்பட வேண்டும்? உடல் கொழுப்பில் உடம்பை விற்கிறாள். இப்படித்தான் சமூகத்தில் இருக்கும் ஆண்களின் கருத்தாக இருக்கிறது. ஏன் பல பெண்களின் கருத்தாகக்கூட இருக்கிறது. அப்படி ஒரு கருத்து உடையவர்கள் இந்த நாவலைப் படித்தால், படித்து முடித்த பின், வேறொரு கருத்திற்கு வருவார்கள்.

தொடர்ந்து படிக்க இயலாமல், கண்ணில் நீர் கோர்க்க, நிறுத்தி நிறுத்தி, மீண்டும் மீண்டும் இந்தப் புதினத்தைப் படிப்பவர்கள். எவ்வளவு கொடுமையான உலகம் இது? மனதளவில் எத்தனை பேர் மாந்தர்களாக இருக்கிறார்கள் என்பதை எப்படி அறிவது அல்லது எதிரில் இருக்கும் உருவம் மனிதனா அல்லது மிருகமா என்பதனை ஒரு பெண் எப்படிக் கண்டு பிடிப்பது? மனிதனாக இருப்பவன் காமவெறி பிடித்த மிருகமாக எப்போது மாறுகிறான் என்பதை எப்படிக் கண்டு பிடிப்பது? "நாங்க பெண் உடம்போடு பிறந்திட்டோம். பிறப்பு முதல் இறப்பு வரை எங்கே போனாலும் இந்தப் பெண் உடம்பைப் பாதுகாப்பதே எங்கள் பாடாக இருக்கிறதே? – இதைத் தன் மொழியில், கோப மொழியில் ஒரு பெண்ணாகக் கொட்டித் தீர்த்திருக்கிறார் மலர்வதி."[8] என்கிறார்.

மேலும் ரோசம்மா என்ற பெண்ணுக்குத் திருமணம் நடைபெற்ற பதினொன்றாம் நாளிலேயே கணவன் இறந்து போகிறான். அவள் ஆணின் துணையற்ற ஓர் அனாதையாக இறுதி வரை வாழ நேரிடுகிறது. மேலும் சாதிமாறி திருமணம் செய்ததால் வாழ்வின் துயரை அனுபவித்து நிற்கும் அப்புவின் தாயார் பவளமும், கடவமுடைந்து விற்று அதில் பிழைப்பு நடத்தி வரும் கடவக்காரி கமலமும், மனைவியை பறிகொடுத்து வாழும் சந்தானமும் என விளிம்புநிலை மனிதர்களின் வாழ்வையும் அவர்களின் துயரையும் மலர்வதி

இக்கதாபாத்திரங்களின் ஊடாக உலாவ லிடுகின்றார். அதுபோலவே குழந்தைகள் மீது திகழ்த்தப்படும் பாலியல் வன்மத்தையும் பதிவு செய்திருக்கிறார். கடவக்காரியை மகனும், மருமகளும் வயதான நிலையில் ஒரு மனிதனாகப் பார்க்காது ஓரங்கட்டுவதன் மூலம் முதியவர்களின் அவலமும் புலப்படுத்தப்படுகிறது. அத்தோடு கடவக்காரி இறந்தவுடன் என் அம்மோ எனவும், என் மாமியே எனவும் கூச்சலிட்டு நடிக்கும் அவலத்தையும் மலர்வதி அப்பு எனும் கருணை நிறைந்த பாத்திரத்தின் மூலம் பதிவு செய்கிறார்.

முடிவுரை

ஆக மேற்கண்ட நிலையில் காட்டுக்குட்டி புதினத்தில் பேசப்பட்டுள்ள பெரும்பாலான விசயங்கள் சமூகத்தின் வேறுபட்ட அவலங்களையே பேசுகின்றன. குறிப்பாக யாவும் பெண்சார்ந்தவையே. அவற்றுள் சாதிசார்ந்தவை, குழந்தைகள் சார்ந்தவை, மாணவிகள் சார்ந்தவை, பாலியல் தொழிலுக்கு ஆளாகும் பெண் சார்ந்தவை என்பதாக விரிவடைந்து காணப்படுகின்றன.

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DECLARATION

I hereby declare that the details and information given above are complete and true to the best of my knowledge and belief.

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To provide accessible, affordable and personalized educational opportunities and character building founded on the Christian values of Faith, Hope and Love

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