Guru Amar Das Block, Guru Nanak College (Autonomous), Chennai

# GURU NANAK JOURNAL
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*(Refereed, Peer-reviewed, Bi-annual Journal from Guru Nanak College (Autonomous), Chennai)*

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## From the Editor's Desk

*"Either write something worth reading or do something worth writing"*

**- Benjamin Franklin**

The Post-pandemic has expanded the horizon of all sectors. Various technologies have emerged to enhance quality, especially in the Knowledge sector. To display the array of research capabilities of our teaching fraternity as well as research scholars of Languages, Commerce, Management, Science, Information Technology and so on, a refereed, peer -reviewed, bi-annual Journal, titled, Guru Nanak Journal of Multidisciplinary Research (GNJMDR) is being released through our College and this edition is Volume 12, Issue 1.

The unique feature of this journal is to give opportunities to researchers in all disciplines to contribute their Articles on myriad topics which are creative, constructive and socially relevant. This issue contains several quality articles on Tamil Grammar, English Poetry, Bioprospecting, Ethnobotany, Pest Control, Green washing, Entrepreneurship, Human Research Management, Cryptocurrencies, Block Chain & AI, Data Mining Techniques and so on.

These hand-picked Articles have been screened at different stages checking the originality and creativity by subject experts and reviewers at national and international levels. A thorough plagiarism check is made on every Article along with the works cited.

The teachers and researchers working in various Colleges, Universities and Research Institutions may find this as a golden opportunity to share their knowledge and experience.

It is yet another learning experience for the readers of this journal who could acquaint themselves with the latest developments of  knowledge in other subjects under one roof, GNJMDR.

I wish to express my sincere gratitude to all the authors, reviewers and editorial team members who have greatly contributed to this issue of the journal. Their hard work and dedication have ensured high quality of this journal.

This edition is dedicated to all who have contributed and who are going to be benefited. Quality Articles are welcome from all for our subsequent issues.

*Wish you all a great success in your academic pursuits!*

**Dr.T.K. Avvai Kothai.**
**Editor-in-Chief**

# Guru Nanak Journal of Multidisciplinary Research

# பல்லவர்காலக் குடவரைக் கோயில்கள்

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## ஆய்வுச்சுருக்கம்

பல்லவர்கால குடவரைக் கோயில்கள் என்னும் இக்கட்டுரை குடவரைக் கோயில்கள் பின்னைய கற்றளிக் கோயில்களுக்கு முன்னோடியாக அமைந்தமை - சிற்பக் கூறுகளான தூண்கள், கூடு, போதிகை போன்ற சிற்பக்கூறுகளை உருவாக்கி வளர்த்தெடுத்தமை – குடவரைகோயில்களில் காணப்பட்ட பத்மம் என்ற நிறைவு பெற்றமைக்கான சிற்ப முத்திரை அதற்குப் பிறகான மரபுகளில் முன்னெடுக்கப்படாமை ஆகியவறை விளக்குகிறது. குறிப்பாக ஜேஸ்டதேவி என்ற மூதேவி சிலை வழிபாடு பல்லவர் காலத்தில் காணப்பட்டமையை வல்லம் குடவரையில் காணமுடியும் - அதன் பரிணாம வளர்ச்சியை கைலாசநாதர் கோயில் கொண்டுள்ளது. குடவரைக் கோயில்கள் ஏரிகளுக்குப் அருகே அமைந்தமைக்கான காரணம் விளக்கப்பட்டுள்ளது. பல்லவர்காலம் தொண்டை மண்டலத்தில் ஒரு சமூக மாற்றத்திற்கான (Transition Period) காலம் ஆகவே பல்லவர்களின் சமூக பொருளாதார மாற்றம் கோயில் அமைப்பு முறையிலும் வெளிப்பட்டது. இதற்கான புள்ளிகளை இக்கட்டுரை இணைக்க முயன்றுள்ளது. இக்கட்டுரை பகுப்பாய்வு முறைமையில் அமைந்துள்ளது.

## அறிமுகம்

பல்லவர்கள் காஞ்சிபுரத்தைத் தலைநகராகக் கொண்டு கி.பி ஆறாம் நூற்றாண்டு முதல் ஒன்பதாம் நூற்றாண்டின் முற்பகுதி வரையில் ஆட்சிபுரிந்தவர்கள். பல்லவர்கள் ஆறு நூற்றாண்டுகளாக காஞ்சியைத் தலைநகராகக் கொண்டு தொண்டை மண்டலத்தில் சிறப்பாட்சி நல்கியோர் என்கிறார் கே.மீனாட்சி (Thondaimandalam was land of Pallavas par excellency ; they held sway there for over six centuries.- K.Meenatchi, Administration and Social Life Under Pallavas, P.1) இவர்களில் சிம்ம விஷ்ணு தொடங்கி அபராஜிதன் வரையிலான பல்லவர்கால அரசர்களில் மகேந்தி ரவர்மன், நரசிம்மவர்மன் ஆகிய இருவரது ஆட்சிக்காலத்தில் குடவரைக் கோயில்கள் மிகுதியாக எடுக்கப்பட்டன. மகேந்திரவர்மனே குடவரை கோயில்களின் தொடக்கம் என்கிறார் மயிலை சீனிவேங்கடசாமி. (மயிலை.சீனி.வேங்கடசாமி, மகேந்திரவர்மன்,

ப.22) இக்குட வரைக் கோயில்கள் இவ்வாய்விற்கு உட்படுத்தப்பட்டுள்ளது. குடவரைக் கோயில் பாறையைக் குடைந்து உருவாக்கப்பட்டவை. இவை கற்றளி கோயில்களுக்கான முன்னோடி எனலாம்.நெடுநல்வாடை குன்று குயின்ற ஓங்கு நிலை வாயில் (நெடுநல்வாடை, என மலையைக் குடையும் நிகழ்வைக் காட்டியுள்ளது. ஆனால் மலையைக் குடைந்து உருவாக்கப்பட்ட குறிப்புகள் சங்க இலக்கியத்தில் இல்லை. பல்லவர்களே தொண்டை மண்டலப் பகுதியில் இவ்வகையான குடவரைகளை முன்னெடுத்தனர் என்கிறார் கே.சீனிவாசன் (K.Srinivasan, Cave Temples of Pallavas, Preface) முத்தரையர்கள், கங்காளர்கள்,முற்கால பிற்காலச் சோழர்கள், நாயக்கர்கள் இவர்கள் அனைவரும் குடவரைக் கோயிலின் பல்லவர் மரபை ஏதேனும் ஒருவழியில் பின்பற்றியுள்ளனர் என்கிறார் கே.சீனிவாசன். (The Gangas, mUtharaiyars,the earlier Cholas,the later cholas,the Pandiyas The Vijayanagara rulers and the provincial Nayakas continued the Pallava tradition in their respective zones. Cave Temples of Pallavas,Preface) தொண்டைமண்டலம் என்னும் நிலப்பரப்பினைப் பல்லவ ஆட்சியின் தொடக் கத்தில் ஆந்திரா தொடங்கி திருச்சி வரையிலான நிலப்பகுதியை குறித்தது எனலாம். சிம்ம விஷ்ணுவின் காலத்தில் சோழர்களை வென்று பல்லவ நாட்டுடன் இணைக்கப்பட்டது. காஞ்சிப் பல்லவர்களில் சிம்மவிஷ்ணுவின் மகனான மகேந்திரவர்மனு, அவனது மகன் நரசிம்மவர்மனும் மிக முதன்மையான சமூகப் பொருளாதார கலைப் பணிகளைத் தொண்டை மண்டலத்தில் நிகழ்த்தினர்.( K. Meenatchi, Administrative under the Pallavas).

வட தமிழகம் நிலவியல் படி பல மலைகளையும் குன்றுகளையும் உட்கொண்ட பகுதி. இதனால் வட தமிழ்கத்தில் சமச்சீரற்ற வளர்ச்சி (Sediment Development) நடைபெற்றதாக பர்டன் ஸ்டெயின் குறிக்கிறார். ( Burdon Stein – History

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of India,P.21) வட தமிழகம் மலைகள் நிறைந்த பகுதி என்பதால் பல்லவர்கள் மிக எளிதாக குடவரைகளை உருவாக்கினர்.

## பல்லவர்களின் குடவரைக் கோயில்கள்

வட இந்தியாவில் சாளுக்கியர்கள் லைம் ஸ்டோன், மணல்கல் (sand Stone) என்னும் கற்பாறைகளில் இத்தகைய குடவரைக் கோயில்களை அமைந்திருந்தனர். ஆயோல், படாக்கல், படாமி ஆகிய இடங்களில் சாளுக்கியர்களின் குடவரைக்கோயில்களைக் காணமுடியும். ஆந்திர பிரதேசத்தில் குண்டுபள்ளி, கந்தகிரி, விடிச்சா ஆகிய இடங்களிலும் இத்தகைய குடவரைக் கோயில்கள் காணப்படுகின்றன. பல்லவர்களின் தாக்கத்தால் இத்தகைய குடவரைக் கோயில்களைச் சாளுக்கியர்கள் அமைத்திருந்தனர். ஆனால், அவை மிக வழவழப்பான எலுமிச்சைப் பாறைக் கற்கள் வகையைச் சார்ந்தவை. ஆனால் பல்லவர்கள் கடும் பாறைகளைக் குடைந்து குடவரைகளை உருவாக்கியுள்ளனர். திருச்சிராப்பள்ளியின் அருகே உள்ள மண்டகப்பட்டு குடவரைக் கோயில் முதன் முதலில் எடுக்கப்பட்ட மகேந்திரவர்மனின் காலத்திய குடவரைக் கோயில், மகேந்திரவர்மன் காலத்தில் இறுதியாக எடுக்கப்பட்ட கோயிலாக சீயமங்கலம் குடவரைக் கோயிலைக் குறிப்பர். ( Pallava's Rock - cut Temple,pa.44)

பத்தொன்பதிற்கும் மேற்பட்ட பல்லவர்கால குடவரைக் கோயில்களில் சில முற்றுப்பெறாதவை. சில கோயில்கள் மிகப்பெரும் பரப்பிலானவை. அவ்வகையில் மண்டகப்பட்டு பல்லாவரம் ஆகிய பகுதிகளில் அமைந்துள்ள கோயில்கள் பெரிய அளவிலானவை. அவைகளுக்கு அடுத்த நிலையில் பெரிய கோயிலாக மாமண்டூர் குடவரைக் கோயிலைக் குறிக்கலாம்.

## பல்லவர்கால சமூகப் பொருளாதார நிலை

பல்லவர்காலத்தை வடதமிழகத்தின் பொருளாதார கலை மறுமலர்ச்சிக் காலம் என வரையறுக்கலாம். குறிப்பாக மகேந்திரவர்மன் காலத்திய பொருளாதார செயல்பாடுகள் தமிழகத்தில் நிலமானிய சமூக அமைப்பு உருவாக காரணமாக அமைந்தது. கி.பி 630 முதல் கி.பி. வரை ஆட்சிபுரிந்த மகேந்திரவர்மன் தன்காலத்திய நீர்மேலாண்மைக்கு முதன்மை யான செயல்பாடுகளை மேற்கொண்டுள்ளான். பாலாற்றினை தாமல் முதற்கொண்டு கடலூர் வரை பல ஏரிகளோடு இணைக்கும் பணியினைத் தொடங்கியுள்ளமை இதில் குறிக் கத்தக்க ஒன்று.

இவ்வாறே செய்யாரும் பல ஏரிகளோடு இணைக்கப்பட்டது. இத்தகைய நீர் மேலாண்மைச் செயல்பாடுகளால் பல்லவர்கள் தனக்கு முன்பிருந்த வரண்ட நிலப் பொருளாதாரத்தை (Dry Land Economy) என்பதை பாசன நிலப் பொருளாதாரமாக மாற்றினர் (Wet Land Economy) ( G.Jouveau – Dubrauil The Pallavas,P.68)

பர்டன் ஸ்டெயினின் கருத்துப்படி காவிரி படுக்கையில் விளைந்த விவசாயத்தை விட பன்மடங்கு மிகுதியான விவசாய சாகுபடிகளை தொண்டை மண்டலம் உற்பத்தி செய்ய பல்லவ அரசு முன்னின்றது. இதனால் உருவான அரச உபரி (State surplus Capital) அடுத்த பேரரசுகளுக்கு பொருளாதார ஆதாரங்களாக (Inclusive Development on Primary Sector) மாறின எனலாம். கலை இலக்கியங்கள் பொருளாதார அடித்தளத்தைக் கொண்டே உருவாகுபவை. அவ்வகையில் பல்லவர்கால புதிய பொருளாத போக்கு சமயத்தில் மறுமலர்ச்சியையும் கோயில்களில் குடவரைக் கோயில் என்னும் புதிய ஆவணமாக்க வகைமையையும் உற்பத்தி செய்தது. அதுவரை சமண மடங்களின் ஆதிக்கத்தில் இருந்த தொண்டை மண்டல விவயாசப் பகுதிகள் சைவ வட்டத்திற்குள் வரத் தலைப்பட்ட காலமாக பல்லவர் காலத்தை அணுகிறார் கே. மீனாட்சி. ஆகவே பல குடவரைகள் சைவ வைணவ மதங்களுக்கு உரியவையாகக் காணப்படுகின்றன.

பல்லவர் கால குடவரைகளில் குடவரைகளின் அமைப்பு, காணக்கிடைகும் கல்வெட்டுகளின் அடிப்படையில் திருச்சிராப்பள்ளி, பல்லாவரம்.செங்கல்பட்டு வல்லம், மண்டகப்பட்டு, தளவானூர், மகேந்திரவாடி, மாமண்டூர், மேலச்சேரி, சித்தன்னவாசல், சீயமங்கலம், குரங்கணில் முட்டம், சிங்காவரம், திருக்கழுக்குன்றம், திருக்கோகர்ணம், மாமல்லாபுரம் ஆகிய பதினைந்து குடவரைக் கோயில்கள் முதன்மையானவை. குறிப்பாக சில இடங்களில் அமைந்துள்ள குடவரைக் கோயில்கள் முற்றுப்பெறாமல் காணப் படுகின்றன. பாறைகளில் ஏற்பட்டுள்ள விரிசல்களும், உடனடியாக நிகழ்ந்த அரசியல் மாற்றங்களும் இதற்குக் காரணமாகக் கொள்ளலாம். குடவரைக் கோயில்கள் பல பல்லவ அரசர்களின் சிறப்புகளை எடுத்துரைக்கின்றன. குறிப்பாகச் செங்கல்பட்டு வல்லம் குடவரைக்கோயிலில் மகேந்திரவர்மனின் பெயர்களாக பகாபிடுகு, லலிதாங்குரன்,சத்ருமல்லன், குணபரன் ஆகிய

**பல்லவர்காலக் குடவரைக் கோயில்கள்**

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பெயர்கள் குறிக்கப் பெற்றுள்ளன. இவை பல்லவ கால வரலாற்றுச் சாசனங்களாக அமைந்துள்ளன.

## குடவரைக் கோயில்களின் பொது அமைப்பு

குடவரைக் கோயில்கள் எந்தவிதமான ஆகம விதிகளின் படியும் கட்டப் பெறவில்லை. இக்காரணங்களினாலேயே ஆழ்வார்களும் நாயன்மார்களும் குடவரைக் கோயில்களைப் பாடவில்லை. ஒவ்வொரு கோயிலின் வாயிலிலும் வாயிற்காப்போன் (துவார பாலகர்கள்) காணப்படுகின்னர். சில குடவரைக் கோயில்களின் அமைப்பு ஒன்றாகவே காணப்படுகிறது. சான்றாக பல்லாவரம் குடவரைக் கோயிலின் அமைப்பும் மண்டகப் பட்டு குடவரைக் கோயிலின் அமைப்பும் ஒன்றாகவே காணப்படுகிறது. குடவரைக் கோயில்கள் பெரும்பாலும் ஏரிகளுக்குப் பக்கத்தில் உள்ள மலைகளைக் குடைந்து உருவாக்கப் பட்டுள்ளன. ஏரி அமைப்புப் பணிகளுக்கு பின்னர் அல்லது விரிவாக்கத்திற்குப் பின்னர் இத்தகைய குடவரைக்கோயில்கள் அதனைத் தெரிவிக்கும் ஆவணமாக்கத்திற்காக உருவாக்கப்பட்டிருக்கலாம் என்பது ஒரு விவாதத்திற்கான குறிப்பாக அமைகிறது. மகேந்திர்வர்மன் காலத்திய குடவரைக்கோயில்களுக்கும் மாமல்லனின் குகைக் கோயிலும் குறிக்கத்தக்க வேறுபாடுகளும் உள்ளன. குறிப்பாக, வல்லம் குகைகோயில் -3, மாமல்லாபுரம் வராக மண்டபம்.மகிடசூர மர்த்தினி மண்டபம், திருமூர்த்தி மண்டபம் ஆகிய இம்மூன்றும் தனித்த அடையாளங்களோடு காணப்படுகின்றன என்கிறார் பல்லவர்காலத்தை இலகியச் சான்றுகளோடு எழுதிய மா.இராசமாணிக்கனார்( பல்லவர்காலம்,ப.54)

### மகேந்திரவர்மனின் குடவரைக் கோயில்கள்

மகேந்திரவர்மனின் காலத்துக் குகைக்கோயில்களில் உள்ள வாயில் காப்பவர்கள் எதிர் எதிராக நிற்பது போல அமைக்கப்பட்டுள்ளனர். பெரிய தண்டாயுதத்தைத் தரையில் ஊன்றியுள்ளனர்.சில குடவரைக் கோயில்களில் கைகளைத் தலைக்கு மேல் தூக்கியபடி காணப்படுவது பொது இயல்பு. பெரும்பாலும் இவர்கள் இரண்டு கைகளைமட்டும் கொண்டவர்கள் என்பதும் சிலர் தலையில் மாட்டுக் கொம்புகளை அணிந்துள்ளனர் என்பதும் சிறப்பான சிற்பக் கூறுகள்.

மகரண தோரணம் என்பது இரண்டு வளைவுகளாகக் காணப்படுவது, கருப்பக் கிருகத்தில் உள்ள சிவலிங்கம் உருண்மையாகக் காணப்படுவது என்பதும் பல்லவர்களின் பொதுவான குடவரைக் கோயில் அமைப்பு. மகேந்திரவர்மன் பதினேழு குகைக் கோயில்களை அமைந்துள்ளான். இவற்றில் பெரும்பாலும் அவனது சிறப்புப் பெயர்கள் இடம்பெறுவது என்பது இக்குடவரைகள் வரலாற்று ஆவணங்களுக்காகவே உருவாக் கப்பட்டது என்பதை உறுதி செய்வதாக உள்ளது.

## குடவரைக் கோயில்களின் சிற்பக் கூறுகள்

குடவரைக் கோயில்களில் உள்ள சிற்பங்கள் தனித்த ஆராய்ச்சிக்கு உரிய தனித்தன்மைகள் கொண்டவை. ஜேஷ்டா தேவியின் (மூதேவி- மூத்தவள்) சிற்பம் வல்லம் குடவரைக் கோயில் அமைந்துள்ளது. பல்லவர்காலத்தில் மூதேவி வழிபாடு இருந்தமைக்கான சான்றாக இது அமைகிறது. மூதேவி வழிபாடு பின்னர் மறைக்கப்பட்டதன் சமூக வரலாற்றுப் பின்புலம் ஆராய்ச்சிக்கு உரியது. இன்றும் மக்கள் வழக்கில் கார்த்திகை தீபத்தின் போது குப்பைக்குழியில் வைக்கும் அகல்விளக்கு அழுக்கு, குப்பை வழிபாட்டின் மூல தேவியான மூதேவி வழிபாட்டின் எச்சம் என்கிறார் தொ.பரமசிவன் (தொபரமசிவம், தெய்வம் என்பதோர்,ப39) கணத்த தலையும், புடைத்த வயிறுமாக மூதேவி காணப்படுகிறாள். இரு நூறு ஆண்டுகளுக்கு பின்னர் எழுப்பப்பட்ட கைலாசநாதர் கோயிலில் இதன் தொடர்ச்சி பரிணாம வளர்ச்சி கண்டுள்ளது. காக்கை வாகனத்துடன், மாந்தன் மாந்தி என்னும் இரு தன் குழந்தைகளுடன் மூதேவி காட்டப்படுகிறாள். மூதேவிக்குப் பக்கத்தில் உள்ள இருவரும் பன்றி தலையுடன் (அழகின்மைக்கான வடிவம்) காட்டப்பட்டுள்ளனர். மூதேவி வழிபாடு குறித்த பல்லவர்கால வழக்கினை பல்லவர்கால வரலாற்று எழுதியலாளர்களான சுப்புராயலு தொடங்கி கே.கோபாலன் (The pallavas) வரையில் யாரும் குறிப்பிடவில்லை என்பது குறிக்கத்தக்கது. கணபதியின் உருவம் குழந்தையைப் போன்று வலம்புரி விநாயகராக அமைக்கப்பட்டுள்ளது. இதனையொத்த கணபதி உருவத்தைப் புதுக்கோட்டையிலும் காணமுடியும். சித்தன்ன வாசலில் உள்ள குடவரைக் கோயில் சமண முனிவர்களுக்காக எடுக்கப்பட்டதாகும். வடபுறத்தில் உள்ள குடையுடனும் தென் புறத்தே உள்ள உருவம் ஐந்து தலை நாகத்துடனும் காணப்படுவது குறிக்கத்தக்கது. பழைய கல்வெட்டு இக்கோயிலை அறிவன் கோயில் எனக்

**பல்லவர்காலக் குடவரைக் கோயில்கள்**

குறிக்கிறது. சீய மங்கலத்தில் உள்ள முன்பண்பத்தின் துவார பாலகர்கள் நீண்ட மீசையை உடையவர்களாகவும், இடது கையில் கேடயத்தைத் தாங்கி வலது கையில் வாளை வீசுவது போலவும் காணப்படுகின்றன. சிற்பத் தூணிலில் சிங்கம் ஒன்று முன்காலைத் தூக்கி நிற்பது காட்டப்பட்டுள்ளது. பின்னர் பல்லவர் கால தூண்களில் சிம்மம் என்பது தவிர்க்க இயலாக சிற்பக் கூறாக உருவானது.

பொதுவாக தாமரை பொறிக்கப்பட்ட தூண்கள் மகேந்திரவர்மனின் காலத்தில் குடவரைக் கோயில் முழுமையாகக் கட்டி முடிக்கப்பட்டது என்பதற் கான சாட்சியமாகக் குறிக்கப்படுகின்றன. திருக்கழுக்குன்றம் குடவரைக் கோயிலில் கருப்பக் கிருகத்தின் வெளிப்புறத்தே ஒருபுறம் விஷ்ணுவும் மறுபுறம் பிரம்மாவும் புடைப்புச் சிற்பங்களாகச் செதுக்கப்பட்டுள்ளனர்.

பல்லவர் காலக் குடவரைக்கோயில்களில் உள்ள கல்வெட்டுக்கள் பல்லவ கிரந்தத்தால் எழுதப்பட்டவை. அதன் பின்னர் சோழர்கள் இக்குடவரைகளைப் பாதுக்காத் துள்ளனர்.ஆகவே அவர்களும் தமிழ்க்கல்வெட்டுக்களை இக்குகைகளில் வடித்துள்ளனர். இதனை மாமண்டூரில் உள்ள குடவரைகளில் காணமுடிகிறது.

### சிற்பங்களில் பரிணாம வளர்ச்சி

பல்லவர்கால தூணில் சிம்மத்தைச் செதுக்குவது, கூடு ஏனும் பகுதிக்குள் மனித முகத்தை வடிவமைப்பது, எண்பட்டை (எட்டு பக்கங்களைக் கொண்ட) தூன்களை வடிவமைப்பது போன்ற என்ற பல்லவர்களுக்கே உரிய இச்சிறப்பு சிற்பக் கூறுகளுக்குத் தொடக்கமாக குடவரைக் கோயில்கள் அமைந்துள்ளன. பின்னர் எடுக்கப்பட்ட பல்லவர்கால கோயில்களில் இவை மிகப்பெரும்வளர்ச்சி பெற்றன. ஒரு குடவரை கோயில் முற்றுப்பெற்றதும் தூணில் பொறிக்கப்படும் பத்மம் என்பது ஒரு மரபாக பின்னைய கோயில்களில் வளர்த்தெடுக்கப்படவில்லை. எண்பட்டை தூண்கள் விதானத்தோடு இணையும் போதிகை பிற்காலப் பல்லவர்கள் சோழர்கள், நாயக்கர்கள் என பல நிலைகளில் அலங்கார வளர்ச்சி பெற்றது. ஆக கல்லிலான சிற்பக் கூறுகளின் தொடக்கப் புள்ளியாகவும் குடவரைக் கோயில்களைக் காண வேண்டியுள்ளது. பல்லவர்காலம் ஒரு பொருளாதார தளத்தில் ஒரு உருமாற்றக் காலம் என்பதால் சிற்பக் கட்டட கலையின் கோணத்தில் அதற்கு முன்பிருந்த சில மரபுகளின்

தொடர்ச்சியின் தொடக்கப் புள்ளியாகவும், பல மரபுகளை முடித்துவைக்கும் ஒன்றாகவும் இரு வேறு நிலையில் செயல்படுகிறது.

### முடிவுரை

பல்லவர் காலம் கொண்டுவந்த புதிய பொருளாதார செயல்பாடு அவை உருவாக்கிய சமூக மாற்றம், அதனூடாக உற்பத்தி செய்யப்பட்ட சமய மறுமலர்ச்சியான சமய இயக்கங்கள், சைவமும், வைணவமும் அரச சமயமாதல், அதன் உந்துதலில் உருவான குடவரைக் கோயில்கள் என சமூகவியல் கோணத்தில் மேற்காண் புள்ளிகளை இணைக்கலாம். அதனைத் தாண்டி இக்கட்டுரை பின்வரும் முடிவுகளை முன் வைக்கிறது.

குடவரைக் கோயில்கள் அமைவிடங்கள் ஏரிகளுக்கு அருகே காணப்படுவதால் ஏரிகளை எடுப்பித்த / புதுப்பித்த நிலையோடு அதனைக் குறித்த ஆவணமாக்கமாக இக்குடவரைகளை பல்லவர்கள் அமைத்துள்ளனர்.

வல்லத்தில் அமைந்துள்ள சேஷ்டதேவியின் சிற்பத்தின் நீட்சியாகவே கைலாசநாதர் கோயிலில் அமைந்துள்ள சேஷ்டதேவியின் சிற்பத்தைக் காணயியலும். மூதேவியின் சிலை, அதன் வழிபாடு பல்லவர்காலத்தில் நிகழ்ந்தமைக்கான வரலாற்றுச் சான்றின்மை காட்டப்பட்டுள்ளது.

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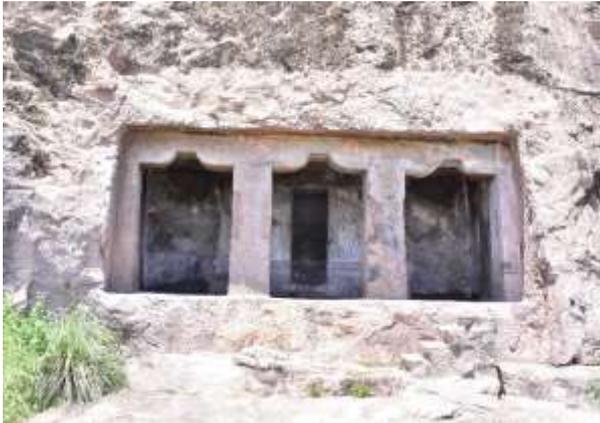
( கைலாசனாதர் கோயிலில் உள்ள ஷேஷ்டதேவி, மூதேவி) சிற்பம்)

பல்லவர்காலக் குடவரைக் கோயில்கள்

# செந்தமிழ் இதழில் இலக்கண உரையாடல்கள்

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**ஆய்வுச்சுருக்கம்**

செந்தமிழ் இதழ் தமிழில் பதிப்புச் செயல்பாடு தொடங்கிய பின் வாசிப்பு பரவலாக்கத்தின் ஒரு பகுதியாக நடைபெற்ற சமூகச் செயல்பாடு என்னும் விரிந்த தளத்தில் இக்கட்டுரை ஊடாடுகிறது. இதில் இலக்கணம் தொடர்பாக குறிப்பாக தொல்காப்பிய உரைகள், பதிப்புகள், இலக்கணக் குறிப்புகள் தொடர்பான வரையறை ஆகியனவற்றைச் செந்தமிழ் இதழ் விவாதங்களே அறுதியிட்டன. அவற்றை உரிய சான்றுகளோடு விளக்குதல் – பகுப்பாய்வு இக்கட்டுரையின் ஆய்வு முறைமை- நச்சினார்க்கினியர் தொல்காப்பிய உரை முடிவு- கணங்குழை என்பது ஆகுபெயர் ஆகாது-பிரயோக விவேகம் என்பது தமிழ் இலக்கணத்தை மேற்கொள்ளும் இலக்கண நூல் அன்று-தொல்காப்பியர் சமண சமயத்தவர், செந்தமிழ் இலக்கண விவாதங்கள் அலகைத்தொடராக (கடிதமாக) நூல் வடிவம் பெற்றமை போன்ற இருபதாம் நூற்றாண்டு இலக்கிய முடிவுகள் இருபத்தோராம் நூற்றாண்டின் முற்றுண்மைகளாக மாறியதன் பின்னணி என இதனைக் கருதலாம்.

**முன்னுரை**

தமிழ் இதழியல் வரலாற்றை எழுதுகையில் அதனைச் செந்தமிழ் இதழிலிருந்து தொடங்க வேண்டும். அந்த அளவிற்கு 1900 களின் முதன் மையான இலக்கியப் பங்களிப்பை ஆற்றிய இதழாகச் செந்தமிழ் இதழ் விளங்கியது. அரச அவைகளில் புலவர்கள் நிகழ்த்திய புலமைக் காய்ச்சல்களைத் தாண்டிய அறிவுசார் விவாதம் இருபதாம்

நூற்றாண்டில் ஆராய்ச்சி இதழ்களுக்கு மாறியது. அவ்வகையில், அரசவை என்ற விவாத வெளி ஆராய்ச்சி இதழாக மாற்றமடைந்த இருபதாம் நூற்றாண்டின் தொடக்கத்தில் தமிழில் அந்த

இடத்தைப் பற்றிக்கொண்ட இதழாகச் செந்தமிழ் இதழினைச் சுட்டலாம். அவ்வகையில், இக்கட்டுரை செந்தமிழ் இதழில் 1903 ஆண்டு முதல் 1915 ஆண்டு வரை வெளியான இலக்கண விவாதங்களையும் அதன் காரணமாக தமிழ் இலக்கணப் புலத்திற் நிகழ்ந்த சில முதன்மையான முடிவுகளையும் குறித்து விவாதிக்க முற்ப டுகிறது.

**செந்தமிழ் இதழின் தோற்றம்**

மதுரைத் தமிழ்ச்சங்கத்தின் வெளியீடாக திங்கள் இதழ் ஒன்று தொடங்கப்பட்டது. இவ்விதழிற்குத் தொடக்கக் காலத்தில் இரா. இராக வையங்கார் அவர்களும் அவர்களின் காலத்திற்குப் பின்னர் மு.இராக வையங்கார் அவர்களும் ஆசிரியர்களாக அமைந்திருந்தனர். இவ்வித ழிற்குச் செந்தமிழ் எனப் பெயரிடப்பட்டக் காரணத்தை அதன் முதலா மிதழ் பின்வருமாறு தெரிவிக்கிறது

**இஃது தமிழின் செம்மையினை உலகிற்கு நன்கு அறிவுறுத்தலானும், செந்தமிழ் வளர்ச்சியைச் செய்தலானும், செவ்விதாய தமிழானே நடத்தலானும், செந்தமிழ் நாட் டுத் தலை நகர் கண்ணே தோற்ற முடைத் தாகலானும், செந்தமிழ் எனப் பெயர் பெற்று விளங்கும்.**

(செந்தமிழ் தொகுதி,1)

இவ்வாறு தனது பெயர் பற்றிய விளக்கத்தினைத் தருக்க முறையில் அமைத்துக்கொண்ட இவ்விதழ் இரண்டு முதன்மையான காலக் கட்டங் களில் தனது பார்வையைக் குவித்தது.

**இருவேறு ஆசிரியர்கள், இருவேறு பார்வைகள்**

ரா.இராகவையங்கார் ஆசிரியராகப் பொறுப்பேற்றக் காலக் கட்டத் தில், இலக்கணப் பதிப்புகள், தமிழ் இலக்கண விவாதங்கள் ஆகிய செந் தமிழ் இதழை அலங்கரித்தன.

பின்னர், மு.இராகவையங்கார் ஆசிரி யராகப் பொறுப்பேற்றதும் கல்வெட்டுக்கள், அகழ்வாய்வுகள் குறித்த ஆய்வுகளில் செந்தமிழின் குவிமையம் மாறியது.

**செந்தமிழ் இதழில் இலக்கண உரையாடல்கள்**

இக்காரணத்தால் செந்த மிழில் மு.ரா. அவர்கள் எழுதிய கட்டுரைகள் தொகுப்பாக்கப் பெற்று **தமிழ் சிலா கவி சாசன சரிதம்** செந்தமிழ் பிரசுர வெளியீடாக வந்தது.

### இரா.இராகவையங்கார்

மதுரை சேதுபதி உயர்நிலைப் பள்ளியிலும் திருச்சி தேசியப் பள்ளியிலும் தமிழாசிரியராகப் பணியாற்றிய இவர் து. அ. கோபிநாத ராவிடம் அக்காலத்தில் கல்வி பயின்ற மாணவர். பாஸ்கர சேதுபதியின் காலத்தில் இரா. இராகவையங்கார், அவரது ஆதீன வித்துவானாக நியமிக் கப்பட்டார். 1903 இல் தொடங்கப்பட்ட செந்தமிழ் என்னும் தமிழ்ச் சங்க மாத இதழுக்கு,முதல் ஆசிரியராகவும் 1935 இல் அண்ணாமலைப் பலக லைக்கழகத் தமிழாராய்ச்சி பகுதிக்கு தலைவராகவும் பொறுப்பேற்று செயல்பட்டார். தொல்காப்பிய செய்யுளியலுக்கு நச்சினார்க்கினியர் உரையைக் கண்டுபிடித்து அதனை 1917 இல் வெளியிட்டார். இது தொடர்ந்து செந்தமிழ் இதழில் வெளியானது. நேமிநாதம், பன்னிருபாட்டியல் ஆகிய இலக்கண நூல்களையும் பதிப்பித்துள்ளார். தமிழ்ச் சங்க வெளியீடாக இந்த நூல்கள் வெளியிடப்பட்டன. இவை குறித்த கூர்மையான விவாதங்களையும் செந்தமிழ் இதழ் வெளியிட்டது.

### செந்தமிழ் இதழில் வெளியான இலக்கண உரை முடிவுகள்

தொல்காப்பியப் பொருளதிகாரத்தின் ஒன்பது இயல்களையும் ஒருசேர வைத்து 1885 ஆம் ஆண்டு முதன்முறையாக சி.வை.தா பதிப்பித்தார். இதில் மொத்தம் 664 நூற்பாக்கள் அமைந்திருந்தன. இதற்கு பன்னிரண்டு பக்கங்களில் விரிவான முன்னுரையை சி.வை.தா வரைந்திருந்தார். இப்பொருளதிகார உரை நச்சினார்க்கினியருடையது எனக் கருதியே அவர் பதிப்பித்திருந்தார். இதனை அவர் பின்வருமாறு குறிப்பிடுகிறார்.

**இஃது பரத்துவாசி நச்சினார்க்கினியர் இயற்றிய உரையோடும் பல தேசப் பிரதி ரூபங்களைக் கொண்டு பரிசோதித்து யாழ்ப்பாணம் சி.வை. தாமோதரம் பிள்ளையால் பதிப்பிக்கப்பட்டது.** (தொல்காப்பியம், சி.வை. தா. பதிப்பு. முன்னுரை)

தொல்காப்பியம் பொருளதிகரம் முழுவதும் நச்சினார்க்கினிஅர் உரை என்று கருதியே சி.வை.தா. பதிப்பித்திருந்தார். இதனை மறுத்து,இரா.ரா செந்தமிழ் இதழில் பொருளதிகாரம் ஒன்பது இயலும் நச்சினார்க்கினி யருடைது இல்லை என்று மறுத்து எழுதினார். இதற்கு முதலாவதாக அவர் செய்யுளியலை எடுத்துகொண்டு ஆராய்ந்தார்.

இந்த விவாதம் செந்தமிழ் முதல் இதழிலிருந்தே வெளியானது. தான் எழுதிய மறுப்புரைகளின் அடிப்படையில், தொல்.

செய்யுளியலுக்கு நச்சினார்க்கினியர் உரையைச் செந்தமிழ் பிரசுர வெளியீடாகக் கொண்டு வந்தார். இதில் முன்னுரையைத் தன் கருத்துக்களை பின்வருமாறு மறுப்புரையாக முன்வைத்தார்.

**தொல்காப்பியப் பொருளதிகாரம் நச்சி னார்க்கினியர் இயற்றிய உரையோடும் பதிப்பிக்கப்பட்டது என்பது அப்பொரு ளதிகாரம் அச்சிட்டார் கருத்து..... செந்தமிழ் முதற்தொகுதி முதற்பகுதி ஆராய்ச்சிக் கண் அச்சிட்ட பொருளதிகாரச் செய்யு ளியல் உரைக்காரர் பேராசிரியர் என்பதும் தெளிவாக்கப்பட்டன. அச்செய்யுளியல் நச்சினார்க்கினியர் இப்போது செந்தமிழ் வாயிலாக வெளிவருவதும் பலரும் அறிவர்.** ( செந்தமிழ் தொகுதி, 2)

இரா. இராகவையங்கார் ஆசிரியராக இருந்த காலத்தில் சி.வை. தாமோதரம் பிள்ளையவர்கள் தொல்காப்பியம் நச்சினார்க்கினியர் உரை யினைப் பதிப்பித்து வெளியிட்டிருந்தார். இதில் பொருளதிகாரத்திலுள்ள மெய்ப்பாட்டியல், உவமவியல், செய்யுளியல் , மரபியல் ஆகிய இயல்க ளுக்கான உரைகள் நச்சினார்க்கினியர் உரை அல்ல என்றும் அவை பேரா சிரியர் உரை என்றும் பல ஏட்டுச் சுவடிகளின் துணைகொண்டு நிறு வினார். இந்த உரைமுடிவு குறித்த விவாதம் ஏறழத்தாழ பல மாதங்களாக செந்தமிழில் வெளியானது.

இது மட்டுமல்லாமல், திருக்கோவையாருக்கு வரையப்பட்ட உரை பேராசிரியருடையதென்றும், புறப்பொருள் வெண்பாமாலையின் உரை யாசிரியர் மாகரல் சாமுண்டி தேவநாயர் (இன்று இக்கருத்து ஏற்றுக்கொள்ளப் படவில்லை)எனவும் தம் ஆராய்ச் சிகளால் நிறுவினார். இரா. இராகவையங்காரின் இத்தகைய முதன்மையான இலக்கண உரையாசிரியர் குறித்த முடிவுகளையே இன்றைய தமிழ்கூறு நல்லுலகம் ஏற்றுக்கொண்டுள்ளது. சி.வை.தாமோதரனார் அவர்கள் இரா. இராகவையங்காரின் ஆய்வு முடிவுகள் வெளிவருகையில், உயிருடன் இல்லை என்பது இத்தகைய விவாதங்கள் தொடராமல் போனதற்கான காரணம் எனலாம்.

செந்தமிழ் இதழ் தொடங்கப்பட்ட போதே அது இலக்கண விவாதமாக குறிப்பாக தொல்காப்பியப் பொருளதிகாரம் சார்ந்த உரை யாடலாக மாறியது.

### பிரயோக விவேகம்

பிரயோக விவேகம் என்னும் வடமொழிக்கும் தமிழுக்கும் இலக்கணம் கூறும் நூல் ஒன்று பதிப்பிக்கப்பட்டது. இந்த நூலின் சில மறக்கத்தக்க பகுதிகளைக் குறித்து,உபசர்க்கம் என்னும் தலைப்பில் 1903 ஆம் ஆண்டு ( செந்தமிழ் இதழ் -2) கட்டுரை ஒன்றினை வரைந்தார். வடமொழி முனொட்டுக்களாகிய $p$இர, பிரா, அப, சம, சம், அது, அறு, அவ, நிஸ், நிர், துஸ்

ஆகியவைகளின் பயன்பாடு குறித்து கட்டுரை விவாதிக் கிறது.

இதே இதழில் அ.குமாரசாமிப் புலவர் இலக்கண ஆராய்ச்சி என்னும் தலைப்பில் நன்னூல் விருத்தி உரைக்காரரை மறுத்தும் எழுதியுள்ளார். விருத்தி உரைக்காரரோடு புலவர் முரண்கொள்ளும் இடங்கள் பல உள்ளன. இதனை மிக விரிவாக ஆராய்ச்சிக் குறிப்பினை சபாபதி நாவலர் முன்னெடுத்தார் என்பதை க. கைலாசபதி அவர்கள் குறிப்பிடுகிறார். (நாவலர் பற்றி க. கைலாசபதி,ப.44)

**ஆகுபெயர், அன்மொழித்தொகை விவாதங்கள்**

ஆகுபெயர், அன்மொழித்தொகை என்னும் தலைப்பில் நாகப்பட்டினத்திலிருந்து ஞானசாகரம் என்னும் இதழின் ஆசிரியராகச் செயல்பட்ட மறைமலையடிகள் கட்டுரை ஒன்றும் காணக்கிடைக்கிறது. திருக்குறள் காமத்துப்பாலில் முதல் திருக்குறளான **கணங்குழை** என்பது ஆகுபெயர் என்பது பரிமேலழகர் கருத்து. அதனை மறுத்து சிவஞான முனிவர் இலக்கண விளக்க சூறாவளியில், **கணங்குழை** என்பது அன்மொழித்தொகை என மறுத்து எழுதினார். இது தொடர்பான நீண்ட இலக்கண விவாதத்தை மறைமலையடிகளார் முன்வைக்கிறார். அவர், சிவஞான முனிவரைத் தம் கருத்துக்களால் ஆதரிக்கிறார் என்பது சுட்டத்தக்க ஒன்று.

அன்றைய நாளில் இலக்கணப் பெரும்புலவராக திகழ்ந்த ஆ. சண்முகம் பிள்ளை, சி கணேசையர் ஆகிய இருவரும் இவ்விவாதத்தில் பங்கு பெற்றனர். அ. சண்முகம் பிள்ளை ஆகுபெயர் என்றும் சி. கணேசையர் அன்மொழித்தொகை என்றும் விவாதித்தனர். இதன் பின்னர் மறைமலையடிகள் ஒருவாறாக இந்த பல இதழ்களாகத் தொடர்ந்த விவாதத்திற்கு முற்றுப்புள்ளி வைத்தார்.

**அவ்வாகுபெயர் கனங்குழை என்னும் தொகை மேல் வந்தது. மற்றி அதன் புறத்தொக்க மகள் என்னும் சொல்லின் கண் செயற் கைப்படுதுரைத் தோன்றியதா மென்று ணர்க. ஆசிரியர் சிவஞான யோகிகள் கனங் குழை அன்மொழித்திகை என நிறுவி அவரை மறுத்தெள வாய்மையாமென்பதும் உணர்க.** (செந்தமிழ் தொகுதி,22-24. ப.240) இதன் பின்னர் இவ்விவாதமானது முடிவிற்கு வந்தது.

**தொல்காப்பியரின் சமயம்**

தொல்காப்பியர் சமண சமயத்தைச் சார்ந்தவர் என்பது இன்று அறிவார்த்தமான தமிழ் ஆய்வாளனின் முதன்மையான எடுகோள். இதனை ஆரம்பக் காலத்தில் சான்றாதரங்களோடும் தத்துவார்த்த நோக்கோடும் நிறுவியவருள் முதன்மையானவராக ச.வையாபுரிபிள்ளை

அமைகிறார். (ந.மு.வேங்கடசாமி நாட்டார் கட்டுரைகள்,ப.30)

1915 ஆம் ஆண்டு தொல்காப்பியம் முழுவதுமாகப் பதிப்பிக்கப்பட்டு வெளிவந்த நிலையில், தொல்காப்பியர் எச்சமயத்தைச் சார்ந்தவர் என்ற விவாதம் மேலெழுந்தது; இதற்கும் செந்தமிழ் இதழே களமமைத்துக் கொடுத்தது. 1915 இல் ச.வையாபுரிப்பிள்ளை தொல்காப்பியர் சமயம் எனும் கட்டுரையை எழுதினார். தொல்.இளம்பூரணர் உரையை 1868 இல் சோடாவதனம் சுப்புராயச் செட்டியாரல் பதிப்பிக்கப்பட்டு வெளியானது. ஆகவே, இளம்பூரணர் உரையை உதாரணம் காட்டி வையாபுரிபிள்ளை தமது விவாதத்தை முன்வைக்கிறார். **பல்புகழ் நிறுத்த படிமையோன்.** என்று இளம்பூரணர் தொல்காப்பியரைக் குறிக்கிறார். படிமை என்பது சமண சமய வழக்கு என்பதை ஆங்கிலத்தில் ஸ்டீவன்சன் எழுதியுள்ள சமண சமயத்தின் இதயம் எனும் கட்டுரையை எடுத்துக்காட்டி நிறுவு கிறார்.

**இதனால் படிமை என்பது ஜைன சமா வழக்குச் சொல் லென்பதும்.... ஆகவே, பல்புகழ் நிறுத்த படிமையோன் என்று சிறப்பிக்கப் பெற்ற தொல்காப்பியர் ஜைன சமாத்தவர் என்பதும்.... அகத்தியனாரது மாணக்கருள் ஒருவராகிய அவிநார் ஜினரென்று மகாமகோபத்திய சாமிநாதையர் அவர்களால் அவரது மைலை நாதர் பதிப்பில் காட்டப் பட்டுள்தது. ஆதலால், தொல்காப்பியரும் ஜெனரென்று கொள்வதில் ஆதொரு தடுமாற றமும் உண்டாதற்கில்லை.** (ச.வே. சுப்பிரமனியன், தொல்காப்பியப் பதிப்புகள், ப.82). வையாபுரிபிள்ளையின் கருத்துகளுக்கு அதாவது தொல்காப்பியர் சமண சமயத்தைச் சார்ந்தவர் என்பதற்கு ஆதாரமாக, சோடாவதனம் சுப்புராய செட்டியாரின் இளம்பூரணர் உரைப்பதிப்பும், மைலை நாதர் உரையும் சான்றாதாரங்களாக அமைந்தன.

**கடிதங்கள் வழியிலான இலக்கண விவாதங்கள்**

தொல்காப்பியப் பொருளதிகார ஆராய்ச்சி தொடர்பாக பா.வே மாணிக்க நாயக்கர் அவர்களுக்கும் இரா.இராகவையங்கார் அவர்களுக்கும் நடந்த கடிதப் போக்குவரத்தை தொகுத்து **'தமிழலகைத் தொடர்'** என்னும் பெயரில் நூலாக வெளியிட்டுள்ளனர். இந்நூல் **1924** ஆம் ஆண்டு வெளியாகியுள்ளது. **"தங்கள் வினாக்கள் பொருளதிகார ஆராய்ச்சியில் இன்னின்ன முறையைக் கையாள வேண்டும் என கற்பிக்கின்றன. ஆராய்ச்சித்துறையில் இருப்போருக்கு இஃது உதவக் கூடும். ( இரா.இராகவையங்கார், தமிழலகைத் தொடர்,ப.34)** என்று மு.இராகவையங்கார் மிக நிதானமான முறையில் மாணிக்க நாயக்கரது வினாக்களுக்கு விடையளிப்பதைக் காணலாம்.

**செந்தமிழ் இதழில் இலக்கண உரையாடல்கள்**

மு.இராகவையங்கார் பா.வே.மாணிக்க நாயக்கர் ஆகிய இருவர் இடையே நிகழ்ந்த **'எழுத்துப் போக்குவரத்து'** என்னும் துணைத்தலைப்பிடப் பெற்றதான **'தமிழலகைத் தொடர்'** என்னும் இந்நூல் நாற்பது பக்கங்களில் அச்சாக்கம் பெற்றுள்ளது. இதில் தொடர்ச்சியாக இருபது வினாக்களை பா.வே.மாணிக்கனார் எழுதி அனுப்புகிறார்.

உரிய பதில்களை மு.இராகவையங்கார் தருகிறார். ஆனால் இத்தகைய கடித விவாதங்கள் தொல்காப்பியப் பொருளதிகாரம் தொடர்பான பல நுட்பமான கேள்விகளையும் பதில்களையும் உடையதாகக் காணப்படுகிறது. மு.இராகவையங்காரது தொல்காப்பியப் பொருளதிராக ஆராய்ச்சி மதுரைத் தமிழ்ச்சங்க வெளியீடாக வெளியிடப்பெற்றது என்பது சுட்டப்பட வேண்டிய ஒன்று. ஜெம் கம்பெனி டாட்சன் அச்சகம், திரிசிரபுரம் என்னும் முகவரியில் இருந்து இந்நூல் வெளிவந்துள்ளது. இவ்விரு தமிழறிஞர்கள் இடையேயான கடிதப் போக்குவரத்தின் தன்மையைப் பின்வரும் வினாவின் மூலமாக அறியலாம். **"அடியோர் பாங்கினும் என்பது கொண்டு விற்றுக் கொள்ளற்குரிய அடிமைகள் இருந்தனர் என ஆராய்ச்சிக்காரர் கூறுவது பொருத்தம் அற்றதென்றே தோன்றுகிறது. (வினா எண் 7) (இரா.இராகவையங்கார், (தமிழலகைத் தொடர்,ப.14)** இரண்டு பகுதிகளாக இக்கடிதங்களை வெளியிடலாம் என்பது தொடக்க காலத்திட்டம். ஆனால் இரண்டாம் தொகுதி **'தமிழலகைத் தொடர்'** வெளிவரவில்லை. அச்சில் என்பதாக மட்டுமே பல நூல்களின் பின்விவரக் குறிப்புகள் காட்டுகின்றன. இவ்வாறு தொல்காப்பியப் பொருளதிகாரத்திற்கு விவாதங்கள் பல மேற்கொண்ட காரணத்தால் மு.இராகவையங்கார் தொல்காப்பியப் பொருளதிகார ஆராய்ச்சி என்னும் நூலினை எழுதியுள்ளார். மேலும் இந்நூலினை இத்தகைய விவாதங்கள் ஊடாகவே தாம் எழுதத்துணிந்ததாக குறிப்பிடுகிறார் மு.இராகவையங்கார். (மு.இராகவையங்கார், ஆராய்ச்சித்தொகுதி,ப223)

## நிறைவுரை

செந்தமிழ் ஆராய்ச்சி இதழ் அது தொடங்கப்பட்ட காலமாகிய 1903 ஆண்டு முதல் ஏறத்தாழ 1915 ஆம் ஆண்டு வரையில் மிக அதிகமாக இலக்கணப் பதிப்புகள், இலக்கண ஆராய்ச்சிகள் ஆகியன தமிழ் அறிஞர்களிடையே வளர்வதற்கு மிகப்பெரும் வெளியை ஏற்படுத்தியது எனலாம். இவை இன்றைய ஏற்றுக்கொள்ளப்பட்ட இலக்கணம் சார்ந்த பல பொது உண்மைகளாகத் தமிழ் ஆராய்ச்சிப் புலத்தை வலம் வருகின்றன. அதாவது இலக்கணம் தொடர்பான இன்றைய கால பொது கருத்தியலை இருபதாம் நூற்றாண்டின் தொடக்கத்தில் வெளிவந்த இதழின் விவாதங்களே முடிவு

செய்தன. அதில் செந்தமிழ் இதழின் இடம் மறுக்க முடியாத ஒன்று எனலாம்.

செந்தமிழ் இதழில் தொடராக வந்த பல இலக்கண விவாதங்கள் இலக்கணப் பதிப்புகளாகவும் நூல்களாகவும் செந்தமிழ் பிரசுர வெளியீடாக வெளிவந்தன. இது, இவ்விதழின் கூடுதலான பதிப்புச் செயல் பாடாகும்.

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செந்தமிழ் இதழில் இலக்கண உரையாடல்கள்

# திறனாய்வாளர் நா.வானமாமலையின் கலை இலக்கியக் கோட்பாடும் சமூக நோக்கும்

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**ஆய்வுச் சுருக்கம்**

நவீன தமிழாய்வுப் பரப்பில் தத்துவம், வரலாறு, பண்பாடு, மானுடவியல், நாட்டுப்புறவியல், திறனாய்வியல் எனப் பன்முக அறிவுக்களங்களின் தன் ஆளுமையைக் கொடையளித்தவர் நா.வானமாமலை அவர்கள். பொதுவுடைமை மெய்யியலை அடிப்படையாகக் கொண்ட வரலாற்றியல் – சமூகவியல் நெறி அவரது ஆய்வு முறையாக அமைந்தது. அவர் நடத்திய ஆராய்ச்சி (1969) இதழ் தமிழியல் ஆய்வில் புதிய சிந்தனைப் பரிமாணத்தை அறிமுகம் செய்தது. தமிழ்த் திறனாய்வின் சமூகவியல் தத்துவப்புலத்தில் அவர் நெடிது நீளும் மாணவர் பரம்பரை கொண்ட தனித்த சிந்தனைப் பள்ளியாக விளங்கினார். அவரது பங்களிப்புகளைத் தொகுத்து நோக்குவது சமகால சமூக வரலாற்றுப் பாடுகளின் மீது நமக்குப் புதிய அறிதல்களை அளிக்கும். இவ் ஆய்வுக் கட்டுரை நா. வானமாமலையின் கலை இலக்கிய கோட்பாட்டையும் அவரது சமூக நோக்கையும் ஆராய்கிறது. நா.வானமாமலை பொதுவுடைமை கண்ணோட்டம் சார்ந்த இலக்கிய அழகியலை உருவாக்கியுள்ளார். புறம் அகம் என்னும் இரு நிலைகளுக்கிடையில் இயங்கியல் ரீதியான செயலூக்கமான உறவை முன்வைத்துள்ளார். புதுக்கவிதை வடிவின் தனிநபர் மற்றும் அகவயக் குரலை முதலாளிய சமூகப் பண்பாட்டு விளைவாக மதிப்பிட்டுள்ளார். நாட்டார் வழக்காற்றியல் மற்றும் தமிழர் மெய்யியல் மரபுகளை வரலாற்றுப் பொருள்முதல் பார்வையில் விளக்கியுள்ளார். நவீன இலக்கிய போக்குகளை பொதுவுடைமைவாதம் கூறும் சமூகப் பொருளியலின் அடிப்படைகளில் இருந்து மதிப்பிடுள்ளார்.

## நா.வானமாமலையின் மார்க்சிய அழகியலும் பிரதிபலிப்புக் கொள்கையும்

தமிழ் அறிவுப் புலத்தில் மார்க்சிய அழகியல் குறித்து முதலில் கோட்பாட்டு முறைமையில் உரையாடல் புரிந்தவர் நா.வா. அவர்களே. பிரதிபலிப்புக் கொள்கையை (reflection theory) அடிப்படையாகக் கொண்ட அவரது "மார்க்சிய அழகியல்" என்னும் புகழ்பூத்த நூல் 1978 இல் வெளியானது. கலைக்கும் புறவயமான சமூக இருப்புக்குமான உறவுகளை விஞ்ஞானபூர்வமாக விளக்கிவிட இந்நூல் முனைந்தது.

கலை கலைக்கானதா, மக்களுக்கானதா?, அகம்தான் புறத்தை வார்க்கிறதா அல்லது புறமே அகத்தை நெறி செய்கிறதா? போன்ற தீர்க்கப்படாத விவாதங்களுக்கு நா.வா.வின் புதிய கருத்துநிலைகள் விடைகண்டன. அதற்கு அடித்தளமாய் அமைந்த பிரதிபலிப்புக் கோட்பாடு பற்றிய அவரது கண்டறிதல்ககள் இன்றியமையாதனவாகும். புற உலகமானது மனித சிந்தனைக்கு அப்பால் தனித்த இயக்கம் கொண்டுள்ளது. புற உலகப் பொருட்கள் தன்னியல்பில் நிறைவு பெற்றுள்ளன. மனித மனமும் கலையும் புற உலக எதார்த்தத்தைப் பிரதிபலிக்கின்றன. இப்பிரதிபலிப்பு சமூகத்தின் உற்பத்தி நிலைமைகளுக்குக் கட்டுப்பட்டே நிகழ்கின்றது. எனினும் மனிதப் பங்கேற்பின் காரணமாக கலைக்குள் எதார்த்தானது மனிதாயப்பட்ட தோற்றத்தைப் பெறுகிறது. வரலாற்றின் கட்டுகளிலிருந்து மனிதன் முன்னெழ முயல்கிறான்.

இது கலைக்குள் குறிக்கோளுருவாக்கமாகச் செயல்படுகின்றது. எனவே எதார்த்ததைப் பிரதிபலித்து உருப்பெறும் கலை மனித

அம்சத்தின் காரணமாக எதார்த்தத்தை மாற்றவும் முனைகிறது. இவ்விதம் புறத்திற்கும் அகத்திற்குமான உறவு இடையறாத இயங்கியல் நிகழ்வாக அமைகின்றது.

கலைப் படைப்பு என்பது உலகைப் பிரதிபலிப்பது மட்டுமன்று, புதிய மதிப்புகளைப் படைப்பதும் ஆகும் எனக் கருதிய நா.வா. அவர்கள் வரலாற்றில் நிகழும் மாற்றங்களில் கலைப்படைப்பு அழகியல் ரீதியானா பங்ளிப்பைச் செலுத்த வேண்டும் என்றார். படைப்புருவாக்கத்தில் மார்க்சிய அழகியலை உள்வாங்கிய சமூகவியல் வரலாற்றுணர்வை வலியுறுத்தினார். தூலமான சூழலில் தூலமான மனிதன், " concrete man in concrete environment" என்னும் லெனினின் மேற்கோளை எடுத்துக்காட்டி கலைப் படைப்பில் மனிதர்கள் தூலமான புறவய சமூகப் பொருளியல் நிலைமைகளில் சித்திரிக்கப்பட வேண்டும் எனவும் அங்கு மனிதன் படைப்பூக்கமான வினையாற்றுபவன் என்ற நோக்கும் வெளிப்பட வேண்டும் என்றும் வலியுறுத்தினார்.

" புறவயமான, ஸ்தூலமான, வரலாற்று ரீதியான நிலைமைகளில் வாழும் மக்களை அவர்கள் சமூகத்தின் types ஆக அல்லது அவர்களின் வாழும் வரலாற்றுக் காலத்தின் types ஆகக் கலைஞன் (social types or historical types ) படைக்கிறான் " (1999:26) என்ற கூற்று இத்தொடர்பில் சுட்டத்தக்கது.

### புதுக்கவிதை முற்போக்கும் பிற்போக்கும் : நா.வாவின் நிராகரிப்பும் ஏற்பும்

"மார்க்சிய அழகியல்" நா.வானமாமலையின் கோட்பாட்டு நூல் என்றால், **" புதுக்கவிதை முற்போக்கும் பிற்போக்கும்"** என்பது அவரது செயல்முறைத் திறனாய்வு எனலாம். 1975 இல் வெளியாகிய இந்நூலில் அன்றைய புதுக்கவிதை இயக்கத்தின் போக்ககில் முற்போக்கு – பிற்போக்கு என இரு வேறு திசைகளை இனம்பிரித்துக் காட்டினார் நா.வானமாமலை. சி.சு.செல்லப்பாவின் **எழுத்து** இதழின் வழி வளர்ந்திருந்த புதுக்கவிதையின் நவீனத்துவ அம்சங்களைச் சமூக முன்னேற்றத்தில் பங்களிக்காதவை, அவநம்பிக்கையை வெளிப்படுத்துபவை என்றும் அவ்வடிப்படையில் அவை பிற்போக்கானவை என்றும் அவர் மதிப்பிட்டார். பொதுவுடைமை தத்துவத்தின் அடிப்படையில் இயங்கிய முற்போக்கு அமைப்பைச் சேர்ந்த கவிஞர்களின் சமூகவய கவிதைகளை அவர் முற்போக்கு நெறியினதாகச் சுட்டிக் காட்டினார். **எழுத்து இதழ்( 1959-1970)** கவிதைகளில் வெளிப்பட்ட இருத்தலியல் (exsistentialism), ஃபிராய்டியம், மீஎதார்த்தம் (surrealism) முதலிய நவீனத்துவ பிரதிபலிப்புகள் அனைத்தும் மேற்கு நாடுகளில் ஏகபோக முதலாளித்துவ வளர்ச்சியின் கட்டத்தில் தோன்றியவையாகும். இவையணைத்தும் தனி மனிதவாதத்தை முன்னிறுத்துபவை. புற நிலைமைகளை விட அகத்திற்கு முதன்மையளிப்பவை. இவற்றில் வெளிப்படுவது நம்பிக்கை வறட்சியே . இக்கோட்பாடுகள் முதலாளித்துவத்தின் அகமுரண்பாடுகளில் இருந்து தோன்றியனவாகும். மனிதனை சமுதாயத்திலிருந்து இவை தனிமைப் படுத்திப் பார்க்கின்றன. முதலாளிய வர்க்கத்திற்கும் தொழிலாளி வர்கத்திற்கும் இடையே ஊசலாடும் சிறு முதலாளிகள், நடுத்தர வர்க்கத்தினர், அறிவாளிகள் முதலியோரின் உளவியல் நெருக்கடிகளே இப்புதிய இசங்களாகும். இவை வர்க்கப் போராட்டத்தை மழுங்கச் செய்பவை. வாழ்க்கை மீது அவநம்பிக்கைவாதம் புரியும் இக்கோட்பாடுகளும் அதுசார்ந்த தனிநபர்வாதக் கவிதைகளும் அடிப்படையிலேயே பிற்போக்கானவை என்பதாக நா.வாவின் மதிப்பீடு அமைந்தது.

"இவர்களது சோக ஓலங்களும் நம்பிக்கை வறட்சி ஒப்பாரிகளும் சாவுக் காதல் கீதங்களும் வாழ்க்கை மறுப்புப் பாடல்களும் நல்வாழ்வுக்காக நம்பிக்கையோடு போராடும் மக்களுக்குச் சிறிதும் தேவையற்றவை. இவர்களுடைய புதுக்கவிதைகளில் புதுமையுமில்லை, கவிதைத் தன்மையுமில்லை, புரட்சியுமில்லை " ( 1999: 51) என்ற சொற்களில் வெளிப்படும் புதுக்கவிதையின் நவீனத்துவ போக்கு மீதான நா.வா.வின் கடும் நிராகரிப்பைக் கண்டு கொள்ளலாம். உள்ளடக்கம் X வடிவம், புறம் X அகம், அழகியல் X அரசியல் , மேற்கட்டுமானம் X கீழ்க்கட்டுமானம், முற்போக்கு x பிற்போக்கு போன்ற துருவநிலைப்படுத்தப்பட்ட அணுகுமுறைகள் நா.வாவின் அணுகுமுறைகளில் தீவிரகொண்டிருந்தது புலனாகிறது. அவரது உள்ளடக்கவாதம் புதுக்கவிதையின் நவீனத்துவ அம்சங்களை நிராகரித்தாலும் புதுக்கவிதை ஆய்வில் அவரது மதிப்பீடு முக்கியமான விவாதக் கோணத்தை அறிமுகப்படுத்தியது. முற்போக்கு அழகியல் என்ற ஒன்று உருவாவதற்கும் தளமமைத்தது. 1970கள் , புதுக்கவிதையில் ஒரு மாறுநிலைக் காலம். புதுக்கவிதையின் பொருண்மையில் படைப்பளியின் அகமனம் மட்டுமன்றி சமூகவெளியும் இடம்பெறத் தொடங்கியது. இடதுசாரிப் பார்வையின் எழுச்சி, வானம்பாடி இயக்கம், முற்போக்குவாத அலை ஆகியன ஓர் உடைப்பை நிகழ்த்தின. இப்போக்கின் மேல் ஆதரவான மதிப்பீடுகளை முன்வைத்து இதுவே புதுக்கவிதையின் வளர்ச்சிப் போக்கு என மதிப்பிட்டார் வானமாமலை.

### தமிழியல் ஆய்வில் மார்க்சிய சமூக-வரலாற்றியல் நோக்கு

தமிழர் வரலாறு, நாட்டார் வழக்காற்றியல் , தமிழர் மெய்யியல் எனப் பன்முகக் களங்களிலும் இயங்கியவர் நா.வானமாமலை அவர்கள். நாட்டார்வழக்காற்றியலில் முதன்முதலில் மானுடவியல் – சமூகவியல் நோக்கைச் செலுத்தியவர் அவரே. கட்டபொம்மன் கதைப்பாடல், கட்டபொம்மன் கூத்து, கான் சாகிபு சண்டை, முத்துப்

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பாட்டன் கதை, காத்தவராயன் கதை, தமிழர் நாட்டுப்பாடல் முதலியன அவரது நாட்டார் பாடல் தொகுப்புகளாகும். நாட்டார் பாடல்களை தொகுப்பதில் முதன்முதலில் சமூகவியல் அணுகுமுறையைக் கையாண்டவர் நா.வா அவர்களே. அவரது தொகுப்புகளில் பாடல்கள் பொருள் அடிப்படையில் வகைமை செய்யப்பட்டன. சுருக்க விளக்கங்கள், பாடல் வழங்கிய இடம், சேகரித்தவர் பெயர், தகவல் அளித்தவர் பெயர் போன்ற புறவயமான தரவுகள் இடம்பெற்றன. ஒரு பாடலுக்கு வழங்கும் புறநிலைக் குறிப்புகளால் அதன் பொருள் இன்னும் ஆழமாக சமூக நோக்கில் உணரப்படும் என அவர் கருதினார். நாட்டார் இலக்கியங்கள் சமூகத்தின் கூட்டுப் படைப்புகள், செவ்விலக்கியத்தின் அடிவேர்கள், சமூக வாழ்வியலின் இயல்பான பதிவுகள் என்ற புரிதலை அவர் ஏற்படுத்தினார். நா.வா வின் ஆய்வில் தமிழர் வரலாறும் முக்கிய இடம் வகித்தது. அவரது **"தமிழர் வரலாறும் பண்பாடும்"** என்னும் நூல் இத்தொடர்பில் குறிப்பிடத்தக்கதாகும். மார்கியத்தின் வரலாற்றுப் பொருள் முதல்வாதத்தையும் இயங்கியலையும் கையாண்டு தமிழக வரலாற்றின் இயக்கத்தை புதிய பரிமாணத்தில் அவர் விளக்கினார்.

### தமிழர் மெய்யியலும் பொருள்முதல் விஞ்ஞானக் கூறுகளும்

இந்திய அளவில் மார்க்சியத்திற்கு இணக்கமான ஒரு இந்திய தத்துவ மரபைக் கண்டறியும் முயற்சி ஒன்று நடந்தது. இந்திய தத்துவ வரலாற்றில் வைதீக மரபுகளுக்கு எதிரான குரல்களையும் உலகாயத சிந்தனைக் கூறுகளையும் தொகுத்து இந்திய தத்துவ மரபை மார்க்சிய மெய்யியல் நோக்கில் கட்டமைக்கும் முயற்சியில் தேவிபிரசாத் சட்டோபாத்யாய், டி டி கொசாம்பி முதலியோர் ஈடுபட்டனர். இத்தகையதொரு முயற்சியை தமிழ்ச் சூழலில் முதலில் தொடங்கியவராக நா.வா.வைக் குறிப்பிடலாம். தமிழ் இலக்கியங்களில் வைதீக மறுப்புச் சிந்தனைகளையும், பொருள் முதல்வாத சிந்தனைகளையும் கண்டறிந்து அவற்றின் வழி மார்க்சியத்திற்கு இணையான தமிழர் மெய்யியலை எடுத்துக் காட்டுவதில் அவர் ஈடுபாடு காட்டினார். **"தமிழ பண்பாடும் தத்துவமும்"** என்னும் நூலை இத்தொடர்பில் குறிப்பிடலாம். சங்க இலக்கிய வாழ்வில் உலகாயத தத்துவத்தின் வெளிப்பாடுகள் இருக்கின்றன. ஐந்திரம் என்பது உலகாயதத்தின் தமிழ் வடிவமே, சங்கக் கவிதைகளின் திணையியலானது பொருள்முதல்வாதக் கூறுகளைக் கொண்டுள்ளது முதலிய பல கருத்துகளை அவர் முன்வைத்தார். புற நானூற்றுப் பாடல்களில் உலகாயதப் பார்வை வாழ்வியல் அனுபவமாக மட்டுமன்றி தத்துவ வடிவிலேயே பல இடங்களில் வெளிப்பட்டுள்ளன என்றும் எடுத்துக் காட்டினார். இவ்விதம் தமிழர் தத்துவமும்

பண்பாடும் பொதுவுடைமை நோக்கிலானா தமிழர் மெய்யியல் பற்றிய தேடலாக அமைந்துள்ளது.

தொகுத்துக் காண்கையில் நா.வானமாமலையின் மார்க்கிய மெய்யியல் அடிப்படையிலான தமிழாய்வுகள் சமூகவியல் சார்ந்த விமர்சன அணுகுமுறையில் முன்னோடிப் பங்களிப்புகளை ஆற்றியுள்ளன. சமூக மனிதனைக் கட்டமைக்க விழையும் மார்க்கிய அழகியல், செயலூக்கமான அகமும், அகத்தை நெறி செய்யும் புறமுமான இயங்கியல் உறவு கொண்ட பிரதிபலிப்புவாதம் ஆகியன அவர் கொடையளித்த இன்றியமையா கருத்துநிலைகள். புதுக்கவிதையின் நவீனத்துவ இருப்பியல் நெருக்கடிகள் முதலாளித்துவ தனிநபர்வாதமே என்னும் சமூக முன்னகர்வின் கனவைப் பிரதிபலிப்பதே முற்போக்கு இலக்கியம் என்னும் அவர் வலியுறுத்தினார். தமிழர் மெய்யியலை மார்க்சியம் காட்டும் பொருள்முதல் விஞ்ஞானத்தின் மூல வடிவாக எடுத்துக் காட்டியிருக்கிறார். நாட்டார் வழக்காறுகளில் வெகுமக்கள் பண்பாட்டுத் தளத்தின் ஆற்றலை நிறுவியிருக்கிறார். இருபதாம் நூற்றாண்டு தமிழாய்வுப் புலத்தில் சமூகவியல் – வரலாற்றியல் நோக்கிலான நா.வானமாமலையின் ஒப்பற்ற பங்களிப்புகள் மிக முன்னோடியானவையும் சமகால அறிகளங்களின் மீதும் தொடர்ந்து ஒளியூட்டுபவையும் ஆகும்.

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# प्रकृति और पर्यावरण सुरक्षा में गांधी विचारधारा की आवश्यकता

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### शोध सार

हमारी दुनिया, जिसमें पेड़-पौधे, पशु इत्यादि हैं उसमे मनुष्य सर्वश्रेष्ठ प्राणी है जिसके आधार पर वह कई तरह के कार्य कर लेता है, उसने कितने ही आविष्कार किए, नए-नए यंत्रों का निर्माण किया और नई-नई ज्ञान की बातें सामने आई है। इस दिमाग मस्तिष्कीय क्षमता के आधार पर संभवत: मनुष्य को सर्वश्रेष्ठ प्राणी का दर्जा देना असंगत नहीं लगता परंतु उसे यह ज्ञात होना चाहिए कि पृथ्वी सिर्फ़ मनुष्यों के लिए नहीं हैं बल्कि वह अन्य जीव-जंतुओं का भी आश्रयदाता है। मनुष्य और प्रकृति एक दूसरे पर निर्भर है जिससे पर्यावरण बनता है और इसीलिए पर्यावरण में संतुलन बनाए रखना बहुत ज़रूरी है।

आज का मानव औद्योगीकरण के जंजाल में फंसकर स्वयं भी मशीन का एक ऐसा निर्जीव पुर्जा बनकर रह गया है कि वह अपने पर्यावरण की शुद्धता का ध्यान भी न रख सका। अब एक और नयी समस्या उत्पन्न हो गयी है - वह है प्रदूषण की समस्या। इस समस्या की ओर आजकल सभी देशों का ध्यान केंद्रित है। इस समय हमारे समक्ष सबसे बड़ी चुनौती पर्यावरण को बचाने की है क्योंकि पानी, हवा, जंगल, मिट्टी आदि सब-कुछ प्रदूषित हो रहा है। इसलिए प्रत्येक व्यक्ति को पर्यावरण का महत्व बताया जाना चाहिए क्योंकि यही हमारे अस्तित्व का आधार है। यदि हमने इस असन्तुलन को दूर नहीं किया तो आने वाली पीढ़ियाँ अभिशप्त जीवन जीने को बाध्य होंगी।

प्रकृति द्वारा प्रदान किया गया पर्यावरण जीवधारियों के अनुकूल होता है। प्रकृति स्वयं में संतुलित हैं, हमारी पोषक हैं। प्रकृति का दुरुपयोग न करें। शांति, सुख और सुरक्षा का ध्यान रखे। इसे समझे और व्यवहार में लाए। जब वातावरण में कुछ हानिकारक घटक आ जाते हैं तो वे वातावरण का संतुलन बिगाड़कर जीवधारियों के लिए हानिकारक सिद्ध हो जाते है। ऐसे अनेक प्रकार के कारणो से वातावरण के दूषित हो जाने को ही प्रदूषण कहते हैं। जनसंख्या की असाधारण वृद्धि और औद्योगिक प्रगति ने प्रदूषण की समस्या को जन्म दिया है और आज इसने इतना विकराल रूप धारण कर लिया है कि उससे मानवता के विनाश का संकट उत्पन्न हो गया है।

"The Earth has enough resources for our need but not for our greed." अर्थात हमारी धरती अपने सभी जीवों की आवश्यकताओं की पूर्ति तो बखूबी कर सकती है, लेकिन उनकी लालच और हवस की पूर्ति कतई नहीं कर सकती। गांधी द्वारा अक्सर उद्धृत किया जाने वाला यह वाक्यांश प्रकृति और पर्यावरण के प्रति उनकी चिंता को दर्शाता है। गांधीजी के अनुसार धरती हमारी माँ है और हमें इसकी पूजा और रक्षा करनी चाहिए। परंतु आज का मानव विकास के नाम पर अपने सुख-सुविधाओं के लिए धरती का नाश कर रहा है। पेड़ों को काटकर नए-नए कारखनों के लिए जगह उपलब्ध कराना, उसके कूड़े-कचड़े से स्वच्छ नदियों को अशुद्ध करना, उसी पानी के उपयोग से मनुष्य और पशुओं का बीमार पड़ जाना आदि ये सब पर्यावरण के सभी जीवधारियों के लिए हानिकारक है। गांधीजी के शब्दों में "मनुष्य को जीवन बनाने की कोई शक्ति नहीं है, इसलिए उसे जीवन को नष्ट करने का कोई अधिकार नहीं है।" मनुष्य को अपने स्वार्थ के लिए पर्यावरण को नुकसान पहुँचाने का कोई अधिकार नहीं है, अगर ऐसा हुआ तो इसके दुष्परिणाम हमें ही भुगतने पड़ेंगे। अगर हम गांधीजी के विचारों को अपने जीवन में लागू करें तो अवश्य ही हम पर्यावरण और प्रदूषण समस्या का निदान कर सकते है।

राष्ट्रपिता महात्मा गांधी संसार के उन चंद महापुरूषों में से एक हैं जिनके विचार सदैव मानव सभ्यता के विकास में बहुमूल्य साबित होते रहे हैं। गांधी जी ने केवल सामाजिक और राजनीतिक ही नहीं बल्कि जीवन के सभी क्षेत्रों में अपना दृष्टिकोण व्यक्त किया है। आज जबकि मानवीय मूल्यों और पर्यावरण में होते ह्रास के कारण पृथ्वी और यहाँ उपस्थित जीवन के खुशहाल भविष्य को लेकर चिंताएँ होने लगी है, ऐसे

समय में उनका विचार हमें इसका समाधान खोजने में काफ़ी हद तक कारगर सिद्ध हो सकता है।

पर्यावरण की शुद्धता को बनाए रखने के लिए हमें गांधीजी की बातों का स्मरण करना चाहिए। पर्यावरण को प्रदूषित करने वाली मानवीय गतिविधियों पर नियंत्रण कर हम इसमें काफ़ी हद तक कमी ला सकते हैं। इसके लिए आधुनिक प्रौद्योगिकियों के साथ पर्यावरण मित्र यानी इको-फ्रेंडली जीवन शैली को अपनाना होगा, तभी प्रदूषण रूपी दानव पर काबू पाया जा सकेगा। गांधीजी के विचारों के अनुसार, 'सबकी भलाई में ही व्यक्ति की भलाई निहित होती है' ऐसे में प्रकृति के साथ मेल बिठाने के लिए कम से कम प्रयोग और ज्यादा से ज्यादा त्याग किया जाना चाहिए। उनका मानना था कि सीमित संसाधनों के साथ जीवन बीताने और पर्यावरण संरक्षण के द्वारा ही भावी विनाश से बचा जा सकता है।

यह तभी मुमकिन है जब हम गांधीजी के मूल मंत्र "सदा जीवन उच्च विचार" को अपनाए। यह मंत्र धरती को स्वर्ग बनाने की क्षमता रखता है। मानव बिना किसी लोभ-लालच के सुख-शांति से स्वस्थ पर्यावरण में जी सकेगा। लोग नए-नए उपकरणों के पीछे नहीं दौड़ेंगे, बाह्य आडंबरों के लिए ज़्यादा पैसे खर्च नहीं करेंगें, सबको समान अवसर एवं अधिकार प्राप्त होगा, दहेज मांगने और देने की नौबत नहीं आएगी, किसी को धन, नाम और शौरत पाने के लिए छल-कपट, धोखाधड़ी, बेईमानी और झूठ का सहारा नहीं लेना पड़ेगा और इस प्रकार सरल जीवनचर्या से पर्यावरण प्रदूषण भी कम होगा। सत्य और अहिंसा के पुजारी गांधीजी ने ऐसे ही एक संसार की कामना की थी।

संयम, सादगी, स्वावलम्बन, और सच पर आधारित गांधीजी का सही मायने में सभ्य और सांस्कारिक जीवन दर्शन, पर्यावरण की वर्तमान सभी समस्याओं के समाधान प्रस्तुत कर देता है। अगर पर्यावरण को गिरावट से बचाया जाना है तो हमें मशीनरी के उपयोग से बचने या सीमित करना होगा। यही वह जगह है जहां गांधीजी का खादी और ग्रामोद्योग का प्रचार आज स्वतंत्रता संग्राम के दौरान अधिक प्रासंगिक हो गया है। हमें गांधीजी के रचनात्मक कार्यक्रम को पढ़ना चाहिए।

'द टाइम' मैगज़ीन ने अपने 9 अप्रैल 2007 के अंक में दुनिया को ग्लोबल वार्मिंग से बचाने के 51 उपाय छापे। इसमें से 51वां उपाय था कम उपभोग, ज्यादा साझेदारी और सरल जीवन। दूसरे शब्दों में कहें तो टाइम मैगज़ीन जैसी पत्रिका जिसे पश्चिमी देशों का मुख्यपत्र कहा जाता है, वह अब ग्लोबल वार्मिंग के खतरों को रोकने के लिए गांधीजी के रास्तों को अपनाने के लिए कह रही है। ये सब तथ्य बताते हैं कि पृथ्वी को बचाने के लिए गांधीजी की मौलिक सोच और उनके विचार कितने महत्वपूर्ण और गहरे हैं।

*प्रकृति और पर्यावरण सुरक्षा में गांधी विचारधारा की आवश्यकता*

# नारी मुक्ति और सशक्तिकरण : भारतियार का दृष्टिकोण

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*शोध सार*

तमिलनाडु में अनेक कवियों का जन्म होने पर भी अपना नाम व यश के कारण जनता के मन में चिरस्थायी स्थान प्राप्त कर चुके तमिल कवि हैं- भारती। भारती, बीसवीं सदी के तमिलनाडु के कवियों में सर्वाधिक प्रसिद्ध हैं। इन्होने राजनीति की स्वंतत्रता और देश की स्वंतत्रता को अपनी दो आँखें मानी। अंग्रेज़ों से देश की आज़ादी के लिए भारती ने कई मार्ग दिखाए। इन्होने जातिगत स्वतंत्रता , भाषायी स्वतंत्रता, धार्मिक स्वतंत्रता, नारी स्वतंत्रता, नारी मुक्ति और सशक्तिकरण आदि को सामाजिक परिवर्तन का आधार माना। सामाजिक परिवर्तन के मूलाधारों में **नारी मुक्ति और सशक्तिकरण** महत्वपूर्ण अंश है। नारी मुक्ति से सम्बंधित अपने क्रांतिकारी सिद्धांतों को भारतियार ने अपनी रचनाओं के द्वारा बखूबी व्यक्त किया है।

समाज नर और नारी से मिलकर बना है। समाज में दोनों का स्थान समान होता है। ये दोनों एक- दूसरे के बिना नहीं रह सकते हैं। यह दशा एक दूसरे के बंधन को दिखाती है। यदि नर और नारी अपने अपने रास्ते पर चलते हैं तो कोई उलझन नहीं आती है, परंतु अगर एक अपने रास्ते से हटकर दूसरे के रास्ते पर जाने के यत्न करता है तो समस्या उठ खड़ी हो जाती है। नारी जाति के अपने अधिकारों को त्यागने से भी समस्या उत्पन्न हो जाती है। नारी जाति की उन्नति के लिए भारती के निर्देश इस प्रकार है-

**यौवनारम्भ के बाद ही विवाह करना। लड़की को वर के चयन करने का अधिकार देना। विवाह रद्द करने का अधिकार। विधवा विवाह। राजनीति में स्थान लेने का अधिकार। विदेश जाने की अनुमति। वैवाहिक जीवन में अगर रुचि न दिखाएँ तो उनके निर्णय का विरोध न करना। उच्च शिक्षा पाने का अधिकार व स्वतंत्रता आदि।**

भारतियार काल के पूर्व काल में अंतर्जातीय विवाह को रोकने हेतु बालिका अवस्था में ही नारी को वैवाहिक बंधन में बांध देते थे। ज़्यादातर बाल विवाह ही होते थे। समाज के विकास के विभिन्न कालों में अंतर्जातीय विवाह को अपराध मानकर उसके लिए दंड भी दिया जाता था। भारतियार के काल में कठोर दंड तो नहीं दिया गया, लेकिन ऐसे लोगों को समाज अपनी जाति से हटाते थे अपने समाज के अंदर उनको आने नहीं देते थे। बाल विवाह के कारण ,नारी जाति को पूर्ण जीवन जीने और समस्याओं को सामना करने का अवसर नहीं दिया गया। उन्हें विवाह के पूर्व पिता, विवाह के बाद पति के अधीन रहना पड़ता था। संतान होने के बाद उनकी देखभाल में ही सारा समय निकल जाता था। परिवार या घर से सम्बंधित कोई भी समस्या या निर्णय पुरुषों तक सीमित रहता था। इसलिए अधिकांश नारियों को अकेले समस्याओं का सामना करने का मौका नही मिलता था। हर चीज़ के लिए अपने पिता ,पति और संतानों की सहायता मांगनी पड़ती थी। इनकी अनुपस्थिति में रिश्तेदारों के घर में अनाथ की तरह रहने की बुरी स्थिति भी होती थी। यह उस ज़माने में स्त्रियों की दास्य जीवन के बारे में बताता है।

भारतियार ने अपनी कहानियों की सभी नारी पात्रों का विवाह, युवावस्था होने के बाद ही करवाते थे। स्वर्णकुमारी, मीणा , विसालाक्षी , तुलसीबाई आदि पात्रों के परिपक्व होने के बाद ही उनकी शादी भारतियार ने करवाई थी। इन नारियों ने भी अपनी इच्छा के विरुद्ध होनेवाली शादी का मना किया था वे खुद अपनी इच्छानुसार वर का चयन करके विवाह करती थीं।

आज कितनी औरतें उच्च शिक्षा पाकर,ऊँचे पदों पर विराजमान हैं, लेकिन इन औरतों का प्राकृतिक स्वाभाविक डर को शिक्षा नहीं हटा सकती है। अधिकांश औरतें समाज के डर से सामाजिक नियंत्रण के साथ ही जीवन जीती हैं। अधिकांश लड़कियां अपनी इच्छानुसार विवाह न कर सकती तो अपने माँ ,बाप की इच्छानुसार विवाह करती हैं या खुदकुशी कर लेती हैं।

भारतियार ने अपने काल में औरतों की बुरी स्थिति से होकर उनकी उन्नति के लिए ,अपनी रचनाओं की नारी पात्रों को स्वेच्छानुसार विवाह, उच्च शिक्षा ,विधवा विवाह ,बाल विवाह का खंडन और विदेश जाकर काम करने आदि पर ज़ोर दिया था। इससे हम को यह नहीं मानना चाहिए कि उनके ज़माने की स्त्रियों की स्थिति भी उनसे रचित स्त्री पात्रों जैसी रही होगी | उन्होंने उनकी उन्नति की कल्पना करते हुए अपनी नारी पात्रों पर उन परिवर्तनों को दिखाया ताकि समाज में उसका असर पड़े। भारती ने आज़ादी के पहले ही आजाद होने की कल्पना करके कई गीत रचे। बाद में उनका सपना, सच हुआ। वैसे ही नारियों की उन्नति भी होगी। यही उनका विचार था |

**नारी स्वंतत्रता पर भारती की गीत की कुछ पंक्तियाँ –**
**नारी मुक्ति मिलने की खुशियाँ**
**बोलकर खुशी से हम गावें .....**
**तालियां बजाओ पूरे तमिलनाडु में**
**गूँज उठने के लिए तालियां बजाओ**
**हमको पकड़े भूत पिशाच गए**
**भलाई देख ली है , तालियां बजाओ- ( अनूदित )**

**विधवा विवाह का समर्थन** भारतियार ने इसलिए किया था कि पिता या भाई की सहायता न मिलने की स्थिति में अन्य मर्दों से आफत आने की सम्भावना है। भारती नर - नारी के समत्व का समर्थन करनेवाले थे। समाज में पुरुष के लिए यह मान्यता थी कि वे पत्नी की मृत्यु के पश्चात पुनः विवाह कर सकते थे, पर अपने पति की मृत्यु के बाद पत्नी को दूसरी शादी करने को समाज स्वीकार नहीं करता था। इस अन्याय के विरुद्ध आवाज़ देने के लिए ही भारतियार ने विधवा विवाह का समर्थन किया था। भारतियार के काल में बाल विवाह ही होता था। कई लडकियां अपने पति का चेहरा देखे बिना ही विधवा बन गयी थीं। अनपढ़ और समाज के बारे में अपरिचित होने के कारण उनको अनगिनत समस्याओं का सामना करना पड़ा। उनके माता -पिता के न होने से या भाई के न होने से उन्हें रिश्तेदारों के घर में दासी जैसी काम करना पड़ता था। आज भी विधवा विवाह का समर्थन करनेवाले न के बराबर है, खास तौर पर तमिल समाज में। विधवा विवाह के विरोध में मर्द से ज़्यादा औरत ही खड़ी होती हैं। अपने हाथों से अपनी आँखों को भेदती हैं। जो समाज औरतों को घर से बाहर जाने को मना करता था उसी समाज में नारी और नारित्व की महिमा का आदर करनेवाले क्रांतिकारी कवि भारती थे।

**नारीत्व की महिमा का भारतियार की गीत का अंश द्रष्टव्य है –**

नारा लगाएंगे कि नारीत्व जीते रहो।
नारा लगाएंगे कि नारीत्व की जीत हो।
यश, सुख, पुण्य जुड़ गए।
माँ और पत्नी के नाम से |– (अनूदित )

**आजकल विवाह विच्छेद की समस्या** समाज की स्थिति को और कुरूप बना रही है। छोटी सी बात को लेकर विवाह विच्छेद की बात औरतें करती हैं। इससे उनकी उनसे जुड़े हुए समस्त परिवार और समाज की बुराई होती है। शिक्षित और कमाऊ होने के कारण, अपने पति की बातों के विरोध में उनका सामना करने के लिए वे तैयार हैं और इसको अपना गौरव मानती हैं| उनको अपनी इच्छानुसार नचाना जानती हैं | अगर उनके पति मानते नहीं तो विवाह विच्छेद करने से हिचकती नही हैं। भारती ने विवाह विच्छेद के अधिकार पर इसलिए ज़ोर दिया था अपनी पत्नी का उचित आदर और स्थान न देनेवाले पति से उसे मुक्ति मिले। भारतियार का मानना था कि विवाह विच्छेद के कारण, पत्नी को विवाह के नाम पर सतानेवाले , क्रूर पति को ठीक रास्ते पर ला सकें। पर उन्होंने अपनी रचनाओं में कहीं भी विच्छेद हुए पात्रों का चित्रण नहीं किया | शायद विवाह विच्छेद के डर से अनेक पुरुष अपनी पत्नी का उचित स्थान देने की आशा से उन्होंने विवाह विच्छेद की बात उठाई होगी।

आजकल यह समस्या ज़्यादा हो गयी है। पढ़ी लिखी और नौकरी करनेवाली लड़कियां अविवाहित रहना पसंद करती हैं। इसका कारण यह हो सकता है कि अपने से ज़्यादा पढ़ा-लिखा

और कमानेवाले वर प्राप्त करना हो और अपने वैवाहिक बंधन में बांधकर रहना दास्यता मानते हैं। भारतियार के काल में लड़कियों की शादी छोटी उम्र में और गरीब लड़कियों की शादी बूढ़े व्यक्तियों से और दूसरी पत्नी के रूप में विधुर से की जाती थी। अनपढ़ और अबोध होने के कारण उस काल की लड़कियां इस विषय में मौन ही रही। उनकी स्थिति को बदलने के लिए भारतियार ने उन्हें अविवाहित रहने को भी कहा था। इसका मतलब यह नहीं है कि भारतियार ने सभी लड़कियों को अविवाहित रहने को कहा था।

भारतियार के समय में औरतें अकेली या साथियों के साथ नहीं जा सकती थीं। उनको यह स्वंतत्रता प्राप्त नहीं थी। औरतों को उस समय का समाज, घर छोड़कर और कहीं जाने की अनुमति नहीं देता था। भारती ने औरतों को **विदेश** भी जाने को भी कहा था। भारतियार के काल में अंग्रेज़ों का शासन था। अगर भारतीय नारी विदेश जाकर काम करने लगीं तो प्रसिद्ध हो जाएंगी और साथ ही विदेश में काम करनेवाली औरतों की प्रशंसा अगर अंग्रेज़ करेंगे तो उनको भारतीय समाज भी मानेगा। यही भारतियार का विचार था।

आज औरतें अकेले विदेश जाती हैं। अक्सर ये औरतें विदेशी आदमियों से या विदेश में काम करनेवालों से शादी कर लेती हैं। इसी देश में काम करनेवाले अधिकांश लड़के इन लड़कियों से शादी नहीं करते क्योंकि ये लड़कियां विदेशी सभ्यता व संस्कृति का पालन करती हैं। **विदेश जाने से ही हम को विदेशी नहीं मानना चाहिए। भारतीय नारी को हमारी संस्कृति का अनुसरण हमेशा करना चाहिए , चाहे विदेश में रहे या इसी देश में ऊँचे पद पर रहें , मिली हुई आजादी का दुरुपयोग करना नारी जाति को ही नहीं समाज के लिए भी हानिकारक होता है | नारी मुक्ति और सशक्तिकरण पर भारतियार का दृष्टिकोण यही था |**

**राजनीति** समाज के लिए आवश्यक नियमों को बनाती है और अधिकार दिलानेवाला स्थान प्रदान करती हैं | इस राजनीति में मात्र पुरुष भाग लेने से नारी जाति की भलाई नहीं होगी | क्योंकि मर्द जाति मात्र अपनी जाति को मन में रखते हुए नियम बनाएंगे | इसलिए भारती ने औरतों को भी राजनीति में भाग लेने को कहा था | पर अपनी कहानियों की नारी पात्रों को कहीं भी भाग लेते हुए नहीं दिखाया | राजनीति में भाग लिए सीयूसीन और लक्ष्मी बाई के बारे में अपने लेखों में चित्रण किया था | भारतियार के काल में तमिलनाडु की औरतों ने राजनीति में भाग नहीं लिया फिर भी आजकल अधिक मात्रा में औरतें राजनीति में भाग लेती हैं | **भारतियार के कथन आज शत प्रतिशत सत्य हुआ है |**

भारतियार के ज़माने में औरतों की स्थिति बहुत बुरी रही, इसलिए उनको उठाने के लिए उन्होंने अनेक सुझाव दिए। उसके बारे में तमिल साहित्य पढ़कर इन्हें समझ सकते हैं। उनके सिद्धांतों का पालन आज की अधिकांश नारियां करती हैं। इससे समाज में औरतों के जीवन में आनेवाली समस्याएं नहीं टली।

**नारी मुक्ति और सशक्तिकरण : भारतियार का दृष्टिकोण**

भारती काल की औरतों की तुलना में आज की औरतों को अनिगनत समस्याओं का सामना करना पड़ता है। इसका कारण शायद यह होगा कि भारती के सिद्धांतों को सही रीति से नर और नारी दोनों ने नहीं समझा।

`भारतियार की कल्पित क्रांतिकारी नारी का गुण यह होगा –

**शास्त्र कई सीख लेंगी।**

**सुविधाएं कई बनाएंगी।**

**पुरानी झूठी बातें सभी का नाश करेंगी।**

**रूढ़िवाद के बंधन सब तोड़ देंगी।...**

**लोगों की प्रशंसा पाएंगी।**

**सुन लिया क्या आप सब ने**

**हमारी क्रांतिकारी औरतों के नवीन सिद्धांत। (अनूदित)**

अगर भारतियार के सिद्धांतों के अनुरूप रहें तो, भारती के सपनों की नारी, क्रांतिकारी स्त्रियों का जन्म हमारे देश में होगा। भारती का सपना सच होगा जिससे मात्र नारी समाज की ही नहीं बल्कि पूरे देश की भी भलाई होगी।

**सन्दर्भ सूची ग्रंथ :-**

1. **भारतियारिन कथै मगलीर (**मूल)

व.उमरानी ,

बिक्री केंद्र और अधिकार:-

येंतिनै पतीबगम ,

चेन्नई .

प्रिंटर्स :-

निराई मोली पतिपगाम

१२४, वेळाचेरी

फर्स्ट एडिशन - १९८९

**२. भारतियारिन कविताईगल**

संपादक - तमिलवेल मय्यप्पन ,मनिवासागर पतिपगम

चेन्नई .

प्रिंटर्स :-

शक्ति प्रोसेस, चेन्नई - ८१

फर्स्ट एडिशन – २००१

**सार**

महाकवि भारती, भारत की राष्ट्रीय धारा। जन्म हुआ एट्टयपुरम में, पढ़ाई की काशी में, ज़िंदगी बिताई- कडैयम, चेन्नई ,पुदुचेर्री में। देश कवि, पत्रकार, ज्ञान का रथ, नारी मुक्ति। उनके अनेक रूप होने पर भी अंत तक रहे- मानवीय कवि। भूख, गरीबी आदि ने इनको खूब सताया। फिर भी अपने परिवार को छोड़कर ज्ञानी जैसे घूमकर अपने लक्ष्य प्राप्त करने तक ,किसी भी समझौते के बिना अपनी ज़िन्दगी बिताई। क्रांतिकारी कवि। बाल विवाह का खंडन, विधवा विवाह, स्त्री शिक्षा ,मिश्रित जाति विवाह आदि का समर्थन करके नारी मुक्ति के लिए अपनी रचनाओं के माध्यम अपनी आवाज़ उठाई। ऐसे ज्ञानी ,क्रांतिकारी कवि थे भारतियार जिन्होंने नारी मुक्ति को अपना सपना माना और उसे सच भी बना दिया।

**मुख्य शब्द**

विधवा विवाह, बाल विवाह, क्रांतिकारी, नारी मुक्ति, वैवाहिक बंधन, रूढ़िवाद, सामाजिक परिवर्तन, अंतर्जातीय विवाह।

**नारी मुक्ति और सशक्तिकरण : भारतियार का दृष्टिकोण**

# श्री गुरु नानक देव जी के काव्य में मानवतावादी स्वर एवं धार्मिक सद्भाव

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## शोध सार

सर्वविदित है कि भक्ति आन्दोलन की शुरुवात दक्षिण भारत के तमिल प्रदेश के आलवार भक्तों के द्वारा ईसा से पांचवी-छठवीं शती में ही किया जा चुका था | वहां से कर्नाटक, महाराष्ट्र फिर सीमावर्ती क्षेत्रों से होते हुए लगभग समस्त उत्तर भारत में भक्ति की लहरें आलोड़ित होने लगी | भक्ति काल के सभी संत पहले भक्त, कवि बाद में थे | अपने आराध्य की भक्ति से प्रेरित होकर ही उनकी अभिव्यक्त की गई वाणियाँ, साखियाँ, सबद और पद सहज ही काव्य का रूप ग्रहण करते गए | सच्ची आस्था के साथ हर भेदभाव से मुक्त होकर मानवता का प्रचार-प्रसार करना, ईश्वर के प्रति अपने प्रेम को अलग–अलग माध्यमों से दर्शाना ये सब इस काल के सभी संतों-भक्त कवियों की विशेषता रही | परन्तु गौर से देखा जाय तो इन समानताओं के होने के बावजूद हर संत-भक्त की अपनी एक विशिष्टता है |

तत्कालीन जनता जिसमें हिन्दू-मुसलमान दोनों ही थे, वे उत्पीड़न, भेदभाव, शोषण तथा ऊँच-नींच से व्यथित थे, आतंकित थे | तो ऐसे समय में उस वक्त के दो शक्तिशाली धर्म, एक जो इस धरती की ही उपज था और दूसरा जो बाहर से आकर यहाँ की धरती में जड़े जमाने का प्रयास कर रहा था | तो इन दोनों धर्मों के अनुयायिओं को प्रेमपूर्वक साथ-साथ रहने के लिए कुछ अलग सामान्य साधना पद्धतियों की आवश्यकता अनुभव हुई जिसमें हिन्दू –मुसलमान दोनों ही अपनी साधना कर सकें और जिससे उनके बीच व्याप्त भेदभाव, वैमनस्य, कटुता थोड़ी तो कम की जा सके | भारतीय समाज में जातीय श्रेष्ठता और निम्नता का भाव सदैव विद्यमान रहा है | निम्न समझी जाने वाली जातियों की उपेक्षा, अनादर, अवमानना बहुत लम्बे समय तक रही थीं | तत्कालीन उपदेशकों ने सम्प्रदायों की स्थापना की किन्तु उनका उद्देश्य नया वर्ग बनाना नहीं था,

वे समाज को एकता के सूत्र में बांधना चाहते थे | अतः श्री गुरु नानक देव जी ने लोगों में एकता स्थापित करने के लिए सिख पंथ की स्थापना की | श्री गुरु नानक देव जी का विचार था कि "परम तत्व पर दार्शनिक चिंतन करने की बजाय प्रमुख समस्या मानवीय जीवन में व्याप्त दुःख, असंतोष, पीड़ा और संत्रास पर विचार करने की है और उन्हें दूर करने की है क्योंकि जो परम तत्त्व सत्य स्वरुप कर्ता, पुरुष, निर्भय, अकाल, स्वयंभू है, मानव बुद्धि उसके बारे में सोच ही कैसे सकती है ? उसका तो बस अनुभव किया जा सकता है |"

वर्तमान में जब जरा सी चूक से धार्मिक विद्वेष की चिंगारी सुलग उठ रही है, जब अपने निजी स्वार्थों को साधने की होड़ में आम जनता के मानस में एक दूसरे के धर्मों के प्रति विषवृक्ष रोपें जा रहें हों तो हमें बार –बार सैकड़ों वर्ष पूर्व के उन सभी संतों, गुरुओं और कवियों के पास लौटना ही होगा जिनके काव्य का मूल स्वर ही धार्मिक सद्भाव और मानवतावादी मूल्यों का विकास करना रहा है | तो इन दृष्टियों से देखा जाय तो वर्तमान में संत श्री गुरु नानक देव जी के काव्य में निहित उनके मानवतावादी स्वर और धार्मिक सद्भाव अति प्रासंगिक है | श्री गुरुनानक देव जी की वाणियों में ना सिर्फ हिन्दू, मुस्लिमों बल्कि इस जातिभेद का भी निराकरण करने का अथक प्रयास दृष्टिगत होता है | श्री गुरुनानक देव जी की वाणियों में निहित उनके मानवतावादी स्वर और धार्मिक सद्भाव को रेखांकित करना ही इस शोध प्रपत्र का अभीष्ट है |

**बीज शब्द** - मानवतावादी स्वर, धार्मिक सद्भाव, साधना पद्धतियों, सामूहिकता, चिंतन–मनन, अनुगमन, प्रासंगिक, मार्गदर्शन, निर्भय, अकाल, स्वयंभू आचरण इत्यादि |

प्रपत्र - वर्तमान में जब ज़रा सी चूक से धार्मिक विद्वेष की चिंगारी सुलग उठ रही है, जब अपने निजी स्वार्थों को साधने की होड़ में आम जनता के मानस में एक दूसरे के धर्मों के प्रति विषवृक्ष रोपें जा रहें हों तो हमें बार –बार सैकड़ों वर्ष पूर्व के उन सभी संतों, गुरुओं और कवियों के पास लौटना ही होगा जिनके काव्य का मूल स्वर ही धार्मिक सद्भाव और मानवतावादी मूल्यों का विकास करना रहा है | ऐसे ही महान पुण्यात्मा संतों में से एक श्री गुरु नानक देव जी का नाम स्वर्णाक्षरों में हमेशा अंकित रहेगा | हमारे राष्ट्र कवि श्री मैथिली शरण गुप्त जी ने अपने 'गुरुकुल'

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काव्यग्रथ में गुरु नानक देव जी के बारें में सत्य ही लिखा है -
"मिल सकता है किसी जाति को आत्म बोध से ही चैतन्य ,
नानक सम उद्बोधक पाकर हुआ पंचनद पुनरपि धन्य ॥
हुआ उचित ही वेदिकुलमें, प्रथम प्रतिष्ठित गुरु का वंश ,
निश्चय नानक में विशेष था, उसी अकाल पुरुष का अंश
॥ [1]

सर्वविदित है कि भक्ति आन्दोलन की शुरुवात दक्षिण भारत के तमिल प्रदेश के आलवार भक्तों के द्वारा ईसा से पांचवी-छठवीं शती में ही प्रारंभ हो चुकी थी | वहां से कर्नाटक, महाराष्ट्र फिर सीमावर्ती क्षेत्रों से होते हुए लगभग समस्त उत्तर भारत में भक्ति की लहरें आलोड़ित होने लगी | भक्ति काल के सभी संत पहले भक्त और बाद में कवि थे | अपने आराध्य की भक्ति से प्रेरित होकर ही उनकी अभिव्यक्त की गई वाणियाँ, साखियाँ, सबद और पद सहज ही काव्य का रूप ग्रहण करते गए | सच्ची आस्था के साथ हर भेदभाव से मुक्त होकर मानवता का प्रचार-प्रसार करना, ईश्वर के प्रति अपने प्रेम को अलग–अलग माध्यमों से दर्शाना ,ये सब इस काल के सभी संतों-भक्त कवियों की विशेषता रही | परन्तु गौर से देखा जाय तो इन समानताओं के होने के बावजूद हर संत-भक्तकी अपनी एक विशिष्टता रही है |

ज्ञातव्य है कि ईश्वर के सगुण और निर्गुण रूपों की आराधना तो वैदिक काल से ही चली आ रही थी | भक्तिकाल में भी ये दो धाराएँ और भी विविध रूपों में प्रबल हुई | निर्गुण काव्य में भी ज्ञानाश्रयी शाखा     (नानकदेव जी, कबीर, रैदास तथा अन्य) और प्रेममार्गी शाखा (जायसी, कुतुबन तथा अन्य आदि | इसी प्रकार सगुण काव्य में सूरदास, तुलसीदास, मीराबाई,रसखान आदि से हम सुपरिचित हैं |

विदित है कि 11वीं-12वीं शती से भारत के राजनीतिक, सामाजिक और धार्मिक हालात बहुत तेजी से परिवर्तित हो रहे थे | बाहरी संस्कृति के आगमन से भारतीय समाज में उथल-पुथल मची हुई थी | तत्कालीन जनता जिसमें हिन्दू-मुसलमान दोनों ही थे, वे उत्पीडन, भेदभाव, शोषण तथा ऊँच-नींच से व्यथित थे, आतंकित थे | तो ऐसे समय में उस वक्त के दो शक्तिशाली धर्म ,एक जो इस धरती की ही उपज था और दूसरा जो बाहर से आकर यहाँ की धरती में अपनी जड़े जमाने का प्रयास कर रहा था | तो इन दोनों धर्मों के अनुयायिओं को प्रेमपूर्वक साथ-साथ रहने के लिए कुछ अलग परंतु सामान्य साधना-पद्धतियों की आवश्यकता अनुभव हुई जिसमें हिन्दू –मुसलमान दोनों ही अपनी साधना कर सकें जिससे उनके बीच व्याप्त भेदभाव, वैमनस्य, कटुता थोड़ी तो कम हो सके | तो इन दृष्टियों से देखा जाय तो वर्तमान में संत श्री गुरु नानक देव जी के काव्य में निहित उनके मानवतावादी स्वर एवं धार्मिक सद्भाव तथा अति प्रासंगिक है | भारतीय समाज में जातीय श्रेष्ठता और निम्नता का भाव सदैव ही विद्यमान रहा है| निम्न समझी जाने वाली जातियों की उपेक्षा, अनादर, अवमानना बहुत लम्बे समय तक रही थीं | श्री गुरुनानक देव जी की वाणियों में ना सिर्फ हिन्दू, मुस्लिमों बल्कि इस

जातिभेद का भी निराकरण करने का अथक प्रयास दृष्टिगत होता है | प्रश्न यह है कि इतने जटिल समय में वह संभव कैसे हुआ ? इस प्रश्न के उत्तर में इसका श्रेय उनकी दूर देशों की की गयी यात्राओं को दिया जा सकता है | "उन्होंने सभी दिशाओं में यात्राएं की थी | इस सन्दर्भ में सभी धर्मों और मतों के अनुयायी, संतो से उनकी भेंट होती रहती थी | फलस्वरूप समाज और धर्म के सम्बन्ध में उनकी विचारधारा अनुभूति तथा समन्वय पर आधारित थी"[2]यह तत्कालीन समय में बहुत ही महत्वपूर्ण बात थी | "क्योंकि एक ओर रूढ़ियुक्त सामाजिक परम्परा के बनाये रखने के पक्षधर थे तो दूसरी ओर प्रगतिशील वर्ग परिवर्तन चाहते थे"[3] समाज की एकरूपता, अखंडता तभी संभव है जब जाति,वर्ण और वर्ग भेद ना हो | श्री गुरुनानक देव जी ने निरंतर यात्राएं करते हुए सत्संग नाम–जप से अपनी उपासना पद्धति को एक विशिष्ट रूप दिया ताकि हर वर्ग और जाति के लोग उसे हृदय से स्वीकार कर सके | "तत्कालीन उपदेशकों ने सम्प्रदायों की स्थापना की किन्तु उनका उद्देश्य नया वर्ग बनाना नहीं था, वे समाज को एकता के सूत्र में बांधना चाहते थे | श्री गुरु नानक देव जी ने लोगों में एकता स्थापित करने के लिए सिख पंथ की स्थापना की | उनका मानना था कि राम और रहीम एक ही हैं हम सब उसके बन्दे हैं |" [4]

श्री गुरुनानक देव जी अन्य शोषित-वंचित वर्गों के समान स्त्री के सामाजिक प्रतिष्ठा के पक्षधर थे, उसकी मुक्ति के आकांक्षी थे| उन्होंने उन सभी मान्यताओं का विरोध किया जो स्त्री के सहज जीवन में बाधास्वरुप थी| ज्ञातव्य है कि तत्कालीन समय में सामाजिक क्षेत्र में तमाम विकृतियाँ आ गयी थी| उस काल के अनेक संत भी कुछ रूढ़िवादी सोच से ऊपर नहीं उठ सके थे | किसी ने नारी को माया कहा तो किसी ने ठगिनी तक कहकर संबोधित किया| उसे साधना पथ से विचलित करने वाली बाधा के रूप में ही समझा गया| कबीर जी लिखते है "नारीनसावै तीन गुण,जो नर पासे होय"|

भक्ति,मुक्ति नित ध्यान में पैठी सके नहीं कोय|| " यानी स्त्री का संग करने वाले को मोक्ष प्राप्त नहीं हो सकता | परन्तु गुरु नानक देव जी के यहाँ इस प्रकार की कोई उक्ति नहीं है | वे स्त्री को सर्वोच्च स्थान देते हुए उसके माता तथा जननी रूप को नया अर्थ तथा नए सन्दर्भ देते हैं| इस बारे में उनकी मान्यता है कि "स्त्री से ही मनुष्य जन्म लेता है, स्त्री के उदर में प्राणी का शरीर निर्मित होता है| स्त्री से ही जगत की उत्पत्ति का क्रम चलता है | ऐसी स्थिति में स्त्री को बुरा क्यों कहा जाय?"[5] सच्चे भक्त और परमात्मा के बीच आदर्श सम्बन्ध की व्याख्या करते हुए भी श्री गुरु नानक देव जी ने स्त्री के प्रेम का ही उदाहरण दिया है | श्री गुरु नानक देव जी ने अपने धर्म ,दर्शन, साधना का मार्ग घर-गृहस्थी और सामाजिक जीवन में पूर्ण सक्रिय रहते हुए निकाला | हिंदी साहित्य के प्रसिद्ध आलोचक-लेखक आचार्य रामचंद्र शुक्ल लिखते है कि "संसार से तटस्थ रहकर शान्ति सुखपूर्वक लोक व्यवहार सम्बन्धी उपदेश देने वालों का उतना अधिक महत्त्व नहीं होता जितना संसार के भीतर घुसकर उसके व्यवहारों के बीच

**श्री गुरु नानक देव जी के काव्य में मानवतावादी स्वर एवं धार्मिक सद्भाव**

सात्विक विभूति की ज्योति जगाने वालो का हैं|"[6] एक एक व्यक्ति से समाज का चरित्र बनता और विकसित होता है| इसलिए श्री गुरु नानक देव जी सबसे ज्यादा बल सच्चे जीवन तथा सच्चे आचरण पर दिया| समता और सेवा भाव को इसलिए ही नए अर्थ में प्रकट किया | व्यक्तिवादिता के स्थान पर सामूहिकता की भावना का विकास किया| श्री गुरु नानक देव जी का विचार था कि "परम तत्व पर दार्शनिक चिंतन करने की बजाय प्रमुख समस्या मानवीय जीवन में व्याप्त दुःख, असंतोष, पीड़ा और संत्रास पर विचार करने की है और उन्हें दूर करने की है क्योंकि जो परम तत्त्व सत्य स्वरुप कर्ता, पुरुष, निर्भय, अकाल, स्वयंभू है, मानवबुद्धि उसके बारे में सोच ही कैसे सकती है ? उसका तो बस अनुभव किया जा सकता है |"[7]

इस बिंदु पर आकर हमें गुरु नानक देव जी की इस वाणी की स्मृति हो आती है जिसमें वे कहते है "भनति नानकु करे विचारु| साची वाणी सिऊ धरे पिआरु| ता को पावै मोख दुआरु | जपु तपु सभु इहु सबदु है सारु |" जिसका आशय है कि यदि कोई गुरु की सच्ची वाणी से प्यार करे तो वही मोक्ष द्वार प्राप्त करता है | शब्द (नामजप) ही वास्तविक जाप तप और सबकुछ है |"[8] व्यक्तिगत उद्धार से बहुत आगे बढ़कर जिस सामाजिक उद्धार की बात गुरु की वाणियों में कही गयी उनका महत्व आज भी बहुत ज्यादा है | एक और उदाहरण जिसमें श्री गुरु नानक देव जी जी कहते हैं कि " मंने तरै तारे गुरु सिख, मंनै नानक भवहि न भिख|" यानि प्रभु के नाम का निरंतर चिंतन–मनन करने वाला स्वयं तो संसार रूपी सागर को पार करता है साथ ही अपने संगी-साथियों का भी उद्धार करता है|" [9] गुरु हमें सचेत करते हुए कहते हैं कि " रैण गवाई सोई कैं, दिवसु गवाईयाँ खाय | हीरे जैसा जनमु है, कउड़ी बदले जाय || इसलिए जगह जगह गुरु अपनी वाणियों में परिश्रम करने की और लोगों को खेती-किसानी के लिए प्रेरित करते है | श्री गुरु नानक देव जी के अनेक पदों में मनुष्य को कृषि किस भाव से करनी है और साधना किस भाव से करनी चाहिए, का मिला जुला रूप दर्शित है | स्पष्ट है कि वे चाहते थे कि उनके शिष्य इस प्रकृति के चक्र को ठीक भाव से समझे | चूँकि उनका सबसे ज्यादा बल सच्चे जीवन तथा सच्चे आचरण पर था तो वे समझाते थे कि प्रकृति के साथ भी हमारा आचरण सदैव मर्यादित होना चाहिए| उनकी एक प्रसिद्ध वाणी है – "इहु तनु धरती, बीजु करमा करो, सलिल आपऊ सारिंग पाणी, मनु किरसाणु हरि रिदै, जमांई लै इउ पावसि पद निरवाणी| इस पद में नानक जी भक्त को स्वयं के शरीर को धरती तथा अपने अच्छे कर्मों को बीज बनाने के लिए कहते हैं| सारंगपाणी (ईश्वर) को सिंचित करने के लिए जल बनाने का निर्देश देते हैं | मन को किसान बनाकर ईश्वर को हृदय में स्थित रखकर ही मुक्ति-मोक्ष रूपी फल को प्राप्त करने के अधिकारी हुआ जा सकता है |"[10] इसी क्रम में एक और वाणी ध्यातव्य है"अमलू करि धरती बीजु सबद करि सच की आब नित देहि पाणी | होई किसाणुईमानु जमांई लै भिसतु दोजक मूडे एवं जाणी | इसका आशय यह है कि हे प्राणी, शुभ कर्मों को धरती तथा परमात्मा के नाम का बीज बनाओ , सत्य की कीर्ति एवं जल से उस पृथ्वी को नित्य सींचो इस प्रकार के किसान बनकर विश्वास को अंकुरित करो |"[11] इस प्रकार यह दर्शित हो रहा है कि भक्ति के तरीको को बताते हुए खेती किसानी से संबधित बातें स्वयं ही आ रही क्योंकि वे खुद खेतों में परिश्रम करते थे | प्रसिद्ध आलोचक-लेखक आचार्य रामचंद्र शुक्ल अपने निबंध "कविता क्या है" में लिखते हैं कि "वन,पर्वत,नदी,नाले,निर्झर,कछार,चट्टान,वृक्ष,लता,सरोवर,पशु-पक्षी,आकाश,नक्षत्र, पृथ्वी इत्यादि तो मनुष्य के आदिम सहचर हैं ही ....सृष्टि के नाना रूपों के साथ मनुष्य की भीतरी रागात्मिका प्रवृति का सामंजस्य ही कविता का लक्ष्य है |"[12] इसी भीतरी रागात्मिका प्रवृतिके कारण ही काव्य सृजन लक्ष्य ना होते हुए भी गुरु नानक देव जी के वाणियों में सृष्टि के अनेक पक्ष समाये हुए हैं | प्रकृति के प्रत्येक तत्व पर प्रत्येक प्राणी का अधिकार है |हिंदी के राष्ट्रकवि के नाम से प्रसिद्ध श्री मैथिलि शरण गुप्त जी ने अपने काव्य ग्रंथ "गुरुकुल" में गुरु नानक देव जी के इस भाव को शब्द दिए है "खेत चरे जाते थे उनके, गाते थे वे हर्ष समेत, भर भर पेट चुगो री चिड़ियों, हरि की चिड़ियाँ, हरि के खेत ||"[13] जाहिर है कि प्रकृति का अंग प्रत्यंग एक दूसरे पर निर्भर है | एक छोटी सी चिड़िया के भरपेट भोजन के अधिकार को वे महत्व देते हैं | आज पर्यावरण से बहुत से जीव जंतु नित्यप्रति लुप्त होते जा रहे है | आज हम 'पृथ्वी दिवस' 'जल दिवस' तथा 'गौरया दिवस' मनाने पर विवश हो चुके है | खेती किसानी की स्थिति दिनों दिन गिरती ही जा रही है | ऐसे में गुरु नानक देव जी के ये पद हमारा मार्गदर्शन करते हैं | "अनुगामियों के लिए इससे बड़ा संबल और क्या हो सकता है कि वे जिसका अनुगमन कर रहे हैं, वह स्वयं अपने जीवन में एक एक छण को अपने विचारों की कसौटी पर कस कर उनकी सार्थकता प्रमाणित कर रहा है | गुरु नानकदेव जी के रूप में उन्हें एक ऐसा रहनुमा दिखाई पड़ा जो केवल उन्हें उपदेश ही नहीं दे रहा था, उन पर खुद अमल भी कर रहा था |"[14]

अंत में निष्कर्ष स्वरुप यही कहा जा सकता है कि श्री गुरुनानक देव जी की वाणियाँ अपने मानवतावादी स्वर तथा धार्मिक सद्भाव के लिए आज भी प्रासंगिक है | आज जब समस्त संसार धर्म-समुदाय, वैमनस्य और तृष्णा से ग्रस्त है तथा युद्ध में रत है, ऐसे समय में श्री गुरु नानकदेव जी की वाणियाँ और उनका काव्य अमृत समान जीवनदायिनी है | इन वाणियों को ना केवल पढ़ना बल्कि अब उनको अनिवार्य रूप से अमल में लाने पर बल दिया जाना चाहिए |

*श्री गुरु नानक देव जी के काव्य में मानवतावादी स्वर एवं धार्मिक सद्भाव*

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# Meeting and Melting of Cultures:
# A Study of *the Time of the Peacock*

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*Abstract*

***"The Time of the Peacock"* written by Mena Abdullah (born 1930, an Australian writer) and co-authored by Ray Mathew is a collection of twelve short stories. In almost all the stories there are vivid images, symbols and descriptions which add a lyrical quality to the stories. More importantly, they highlight the different facets of the Indian immigrants' situation in Australia. This includes nostalgia of the parent culture, anxiety and alienation felt in the immigrant culture and the attempt to accept and understand both.***

***This Article attempts to study the adults' reactions to India and Australia and the role played by the children in bridging this gap.***

*Keywords: alienation, anxiety, nostalgia, immigration, diaspora.*

## Introduction
## Diaspora

The term, "Diaspora", in Greek, means dispersal, distribution, or spreading. It has been applied to a number of ethnic and racial groups living in distance from their traditional homelands. When writers speak of the Indian Diaspora, they generally refer to the persons of Indian birth or ethnicity living abroad.

## Immigration

The term refers to the status of a person who comes as a settler into another country, but not as a tourist or visitor. For instance, Indian immigrants in Australia.

## Relation between Diaspora and Immigration

Immigration and Diaspora are interrelated to some extent. In both the cases, there is a feeling of alienation existing as a result of considering their birthplace to be their true home. A.L. Mcleod defines 'Diaspora' with reference to various times. "In the context of recent times, it has been applied to a number of ethnic and racial groups living distant from their traditional homelands and it is said that many immigrants are first-generation expatriates who continue to consider India their true home, the place of their nurture, values and extended families as well as their deepest sympathies and attachments." (IX)

*The Time of the Peacock, written by Mena Abdullah and co-authored by Ray Mathew, is a* collection of twelve short stories that discuss the Indian immigrants' situation in Australia.

The Common themes of the twelve short stories are

### 1. "The Time of the Peacock"

Nimmi Kushil, the narrator is creating an Indian world within the Australian world thus, preserving the Indian culture, customs and traditions. The brilliant use of the image of the peacock which is brought from India to alien land (Australia) describes the similar situation of Indians in Australia. Further, Nimmi Kushil's vision of the peacock opening its tail in the first short story "The Time of the Peacock" is an optimistic note for the second generation migrant.

### 2. "Because of the Russila"

The inevitable uprooting from the parent culture and the assertion of national and cultural identities are emphasized by the tragic loss of the bird, Rusilla which belongs to Lal.

### 3. "Kumari"

Vixen, Rashida Bani's pet animal is not accepted by its own race as it has smelt humans. It has a connection to the racial conflict in town where the Indians are derogatorily described as "nigger" in the story "Because of the Rusilla".

### 4. "Mirbani"

In this story, there is a meeting of two cultures (Hindu and Muslim) leading to acceptance. The prayers of Hindu grandmother and Uncle Sayed save Lal from death.

### 5. "The Outlaws"

An Australian bushranger and a Punjab dacoit, the two outlaws who love horses seem to promote the easy interaction of the migrant into the new land.

### 6. "The High Maharajah"

Eagle is the High Maharajah, who guides the innocent children in finding the lost singing kite of India. Kites play an important role in reminiscing the past of India.

### 7. "The Singing Man"

Though Uncle Sayed belongs to a minority community in Australia, he plays a dominant role in the case of an Irish man Paddy-the -Drunk. The Irish man's hatred towards Uncle Sayed increases, but his hat redness and pride is shattered by a saint and he is transformed to the position of devil and Uncle Sayed to a saint.

**"The Child that Wins"**

The feeling of alienation tremendously accelerates in Hussein's father, when Hussein declares to marry Anne. Hussein's father is worried about his grand children who may not be black as Hussein or white as Anne, but yellow and brown not belonging anywhere.

**8. "The Dragon of Kashmir"**

Grandmother Shah is haunted by her childhood memories. The recollection of memories of Kashmir makes it impossible to come to terms with the Australian reality.

**9. "The Babu from Bengal"**

Inspite of the rivalry between the two friends, Ishak Khan and Mohmoud Ali, their friendship lasts for ever. This shows their true bond of love and affection.

**10. "Grandfather Tiger"**

Joti's parents and grandmother recreate India in Australia by adopting their customs and culture in the alien land.

**11. "A Long Way"**

Nazit, a Muslim lady is helped by a Hindu couple, untouchables, Bishop, and the Potter to reach her destiny irrespective of their caste, creed and community.

The three stories (*Grandfather Tiger, The Dragon of Kashmir, and High Maharaja*) appeared under Mena Abdullah's sole name in the brittle newsprint of The Bulletin. Ray Mathew, a young poet of lyric verse, co-authored all the other stories. The twelve stories are interlinked with various factors such as alienation, nostalgia, adaptation to the new environment, questioning of the old values and seeing the old connections between the old and the new culture

The narrator of the story is a child, Nimmi Kushil, and the story is about the Indians in Australia and their isolation to the alien land. Ama, Father, Uncle Sayed, Hussein, Shareef Khan, Rashida Bani, Nimmi Kushil, Lal, Jamila Shahnaz are some of the important characters in *The Time of the Peacock.* The narrator vividly portrays the plight of the immigrants in *The Time of the Peacock.* The silhouettes of the pleasant memories of the homeland (India) loom largely in their alien land. They continue to consider India their true home.

In the first story *The Time of the Peacock*, a peacock is brought from India to Australia and Nimmi Kushil describes its atmosphere and state in Australia as "I am as big as that", I said. "I can do anything". And I hopped on one leg to the end of the garden where the peacock lived. "Shah-Jehan!" I said to him that was his name. "It is spring and the baby is coming, pretty Shah-Jehan" But he didn't seem interested. "Silly old Shah-Jehan ", I said. "Don't you know anything? I can count ten"". "He was a silly bird. Why, he had to stay in the garden all day, away from the rooster. He couldn't run everywhere the way that I could. He couldn't do anything." (2) Through the image of 'peacock,'the narrator wants to convey that the atmosphere in which the peacock is living is almost similar to that of the Indians living in Australia.

Ama, the mother of Nimmi Kushil was a Brahmin before her marriage, but after her marriage with Nimmi

Kushil's father, a Muslim, she becomes a Muslim. Though, she is a Muslim now, the images of her past life linger in her mind, she remembers her old ways and puts out the milk for the snakes. Ama's stories of Lord Shiva; God Krishna, the flute-player and his moving mountains; legends about brave young rajahs using kites as messengers of lovers - all reveal Ama's love for India, though in Australia.

In the story *The Child that Wins,* Hussein is a protagonist who wants to marry an Australian Christian, a White girl. His father opposes his idea to marry a Christian White girl, because he has a different image about that girl. He calls her a Christian, an eater of pig and is of the view that the children born to them will be yellow and brown as his son is black and Anne is white. He is worried that his grandchildren may not belong anywhere, and their ways may be completely different and he calls Hussein a traitor to India.

In the short story *Mirbani,* Nimmi Kushil describes the beautiful garden that Ama creates in Australia "I went into Ama's garden, her Indian world and I looked out through the squares in the lattice at paddock and sky at the five hills that were our hills. Ama gave them to each of us when we were born. As soon as she was well, she carried each new one, each Australian, out through the garden with its Indian Jasmine and Kashmiri roses and Himalayan violets and out through the lattice-gate where all the Australian world was watching" (39) The beautiful description of Ama's Garden demands the readers to visualize the garden of Eden.

Though the Indians are in Australia, the culture and customs of people remain unchanged as in *Grandfather Tiger*, "The house was the same, but the home was different, because Joti's parents kept the custom of their people. The took off their shoes before entering the house. They decorated the garden path for the Hindu festivals. They cooked curry and rice and chapatties. The friends who came there for dinner sat on the floor and felt at home" (94) Further, the custom of Hindus greeting others is described in the story, *Grandfather Tiger* by Joti. Recreation of India in Australia by Joti's parents and grandmother, and the assertion of national and cultural identities by the family show that they still consider India to be their home country.

In the story, *A Long Way,* an old woman greeting Nazit, a Muslim lady as "Ram Ram. Peace be with you." (108) shows their deep-rooted unchangeable customs that predominated in the lives of the Indians.

Most of the characters in *The Time of the Peacock* are Punjabi Muslims. They believe in Allah for anything and everything. When Nimmi Kushil questions about the tail of the peacock, her father says that "Allah has given them tails so that no one will look at their feet" (5) because the feet of the peacock are ugly. In the story *Mirbani* Lal falls sick. Uncle Sayed says, "Lal will get well, Allah's kind".

One among the five pillars of Islam is prayer (Namaz), and Islamic people must pray five times a day and the picture of 'call for prayer' from the mosque is visualized by the narrator and described as "The Sun was going down as we sighted home. It was the time that father

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called the Glory of Allah" (20) in the story, *Because of the Rusilla,* Ama, father and Uncle Sayed converse with each other about their old days, old ways and the Punjab birthdays and describe "Hindi" as a sweet Hindi.

Ama's mother is a Brahmin and during her visit nobody eats meat. This is revealed when Uncle Sayed says to the children of Ama "Your grandmother is a wretch of a Brahmin. It would not be right to have meat in the house" (34)

Though in Australia, the Australian culture is alien to Ama, Father, Uncle Sayed, Shareef Khan, and there is a sense of nostalgia for the old culture, customs and traditions of the past. On the other hand, children are happy, enjoying the world adapting to the new environment, the pious, traditional grandmother's voyage to a distant, and alien Australia, Ama's conversion from Hindu to Islam and her adaptation to new and alien Australian culture, reveals the connections between the old and the new culture. Though there is a sense of questioning of the old values and the connection between the old and the new cultures, the Punjabi culture in Ama, Father, Uncle Sayed remains strong.

One can find a neat confluence of the traditions of the Hindus and the Muslims. By revealing the conflicts and acceptance, Meena Abdullah shows how the diversities unite in the common context provided by Australia. Though each individual strongly upholds her/his faith, they certainly attempt to understand the other tradition. Thus, the book provides highlights of both traditions.

However, Children play an important role in the stories of *The Time of the Peacock*. They bridge the gap between here and there, now and then. They teach the value of innocence, curiosity, and acceptance. There is no sense of alienation or nostalgia in them. Rashida Bani, Nimmi Kushil (narrator), Lal are happily moving from their Indian World to their Australian world and vice-versa as Nimmi Kushil says "I went into the latticed yard that was Ama's Indian place, full of Kashmiri roses and pomegranates and jasmine and tuberose" in the story of "Kumari" (22).

They are curious to know about the things happening around them. Their curiosity is revealed when Nimmi Kushil asks questions such as "Do babies always come at night." (7) Why do peacocks have ugly feet? And Lal asks, "Can we change the newborn baby, Jemila into a boy?" reveal their innocence and curiosity (8).

Astonishment is seen among the children when Rashida struck a key in the piano, Nimmi Kushil says "A miracle happened" (18) and their surprised on hearing the whistling sound of kettle and each one interpreting it as a different thing, Rashida says it is "like a locust", "Magic" says Nimmi Kushil, "Rusilla" says Lal (19). Again, their joy has no bounds when they see the teeth of Jamila, their younger sister, "Lal" I shouted says Nimmi Kushil "Jamila has a tooth! Two teeth! Come and see" (43) and the eagerness of Lal to see the teeth made him run with his spade and dirty hands. Further, Nimmi Kushil's excitement in knowing what are the other birthday gifts, her wish to go on a ship for her next birthday and their habit of swinging and climbing on the top of the gate and the way they are called as monkeys, mosquitoes, monsters, useless anything but nice by Hussein.

The innocence and ignorance of Lal are revealed when he thinks that Kashmir is over the hills and the ships sail on the land and his readiness to stay at home to look after Ama, Rashida and the baby when Ama says "I am afraid" "when there is no man here". Lal fails to understand that it is Ama's unwillingness to send, instead, he says, "Men must look after women" reveals his innocence, but at the same time reflects his sense of responsibility (45)

Children are enjoying and understanding the world around them. They are moving happily from the Indian world to the Australian world and from the Australian world to the Indian world. There is no feeling of alienation among the children as felt by Ama, Father, Hussein's father and others. But it is pertinent to note that the narrator's family is not in conflict with Australia, but they maintain a distinctive Indian identity. This is understood from their attitude to Indian (both Hindu and Muslim) Culture. The book advocates the fact that they are Indians irrespective of their caste, creed and community.

In these stories, the characters may be divided according to their stated faith. The Islamic faith is strongly reinforced by Uncle Sayed and Father whereas grandmother upholds the Hindu faith. However, Ama bridges these beliefs, and the children carry forward this understanding through their successful relationships with grandmothers, Uncle Sayed and Father.

By accepting good and bad experiences with an open heart, the children seem to teach the adults to have open-mindedness to embrace novelty. With open arms, the children move from innocence to experience. Thus, they overcome all divisions between India and Australia, Hindus and Muslims, and the Past and the Present. The adults, and the children teach a lesson to the immigrants that if they are open to new experiences, there can be an easy assimilation of the two cultures.

Vince Marotta quotes Bottomley in "The Ambivalence of Borders: The Bicultural and the Multicultural" and defines multiculturalism as an 'openness' and a 'process' rather than closure and exclusion. It destabilizes the social and cultural boundaries which both the host and the migrant culture erect around themselves." (183)

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Meeting and Melting of Cultures: A Study of *the Time of the Peacock*

# *Waiting for Lefty & Awake and Sing!*
# by Clifford Odets –

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**Abstract**
       *This Article studies Clifford Odets' plays, Waiting for Lefty and Awake and Sing! under the lens of Marxist theory. Clifford Odets is one of the most well-known playwrights of America who voiced out for the cause of common people in the 1930s, which was a decade of economic instability and political unrest. In these select plays, there is a depiction of class struggle, oppression, social injustice, economic crisis and finally, a call for action. Thereby the researcher attempts a Marxist approach to study this play, which is appropriate. The Article throws light on various social crises portrayed in the plays and analyses their causes. The researcher also examines the way individuals respond to problems and their potential to survive the situation. This study attempts to bring out how the playwright was able to appeal affirmatively to people to revolt against the evils of society and insist on them for a change for the betterment of society.*
*Keywords: Marxism, class struggle, capitalism, oppression, social injustice and call for action.*

## Introduction

       Clifford Odets was a prominent American playwright and screenwriter who rose to fame during the Great Depression era of the 1930s. His work was known for its social commentary and political undertones, particularly its Marxist perspective on American society. This research paper will examine two of Odets' plays, Waiting for Lefty and Awake and Sing!, through a Marxist lens, exploring the ways in which the playwright's work reflects Marxist ideas and critiques American capitalist society. The playwright was able to appeal affirmatively to people to revolt against the evils of society and insisted on them for a change for the betterment of society. Marx and Engels state their ideas on the revolution in the concluding part of The Communist Manifesto as follows:

       The Communists disdain concealing their views and aims. They openly declare that their ends can be attained only by the forcible overthrow of all existing social conditions. Let the ruling classes tremble at a Communistic revolution. (96)

Marxism is a social, economic, and political theory developed by Karl Marx and Friedrich Engels. It views society as a class struggle between the bourgeoisie (the ruling class) and the proletariat (the working class), where the latter are exploited by the former. Marxists believe that capitalism creates inequalities that can only be resolved through a socialist revolution, where the working class takes control of the means of production. According to Abrams, Marxists view literature "not as works created in accordance with timeless artistic criteria, but as 'products' of the economic and ideological determinants specific to that era" (149).

Clifford Odets, through his first play, *Waiting for Lefty* created a great sensation among the people, who had a tough time during the Depression era. The Great Depression made Odets focus on the social disorder of the 1930s and made him portray it in his plays. After joining the American Communist Party in 1934, the taxi drivers' strike became an inspiration to him to write this play. The theme of this play is the working class and their strike. Class struggle and oppression are predominant in this play. It was exactly a propaganda play with explicit political messages to the people. It also became a prime example for the genre called 'Agitprop' – (agitation + propaganda).

       Being written in the era of the Depression, this play is primarily a propaganda play, which tried to incite strong feelings of fear and abhorrence in the minds of people. The Marxist influence is apparent in the aspect of its delineation of contemporary society and in the sense of capturing the impact of society upon the individual characters. In this play, Odets expressed his anger towards the socio-economic problems prevailing in that period. It is full of emotional appeal to the audience. The central theme is a proposed strike by a group of taxi drivers. Through this play, Odets tries to instigate the exhausted American people of the 1930s to rise above capitalism. Through each character, he vividly expresses how the individuals are affected due to socio-economic factors prevailing in the

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Depression Era. He uses his characters to send a strong social message to the audience. His main focus lies on socio-economic issues and he stimulates the audience in order to get the desired response. The play's dialogue is full of Marxist language and ideas, such as the significance of collective action and the necessity for workers to group together to fight against their capitalist oppressors.

*Waiting for Lefty* can be studied through a Marxist lens, as it depicts the struggles of the working class against the capitalist system. The play's setting, the taxi drivers' union meeting, is a microcosm of the larger struggle between the working class and the ruling class. The taxi drivers struggle to make ends meet and the capitalist employers exploit them as they are more concerned with their own profits than the welfare of their employees. Harold Clurman in his The Fervent Years observed that,

"It was the birth cry of the thirties. Our youth had found its voice. It was a call to join the good fight for a greater measure of life in a world free of economic fear, falsehood, and craven servitude to stupidity and greed. "Strike!" was Lefty's lyric message, not alone for a few extra pennies of wages or for shorter hours of work, strike for greater dignity, strike for a bolder humanity, strike for the full stature of man." (148).

The play is presented in a series of vignettes, each of which focusses on how individuals got affected through social turmoil. The main setting of the play is in a union hall where all the members are waiting to go for a strike. The corrupt union leader Harry Fatt discourages them, whereas the members eagerly await the arrival of the leader of the strike, Lefty Costello. Every member came out with a story to emphasise the necessity of the strike. Every story has a strong emotional appeal. When they all know that Lefty has been murdered, the meeting ends with a unanimous demand to go for a strike.

The class disparity has been brought out by Odets in a significant way through his characters. Harry Fatt, an arrogant union leader discourages the workers to go for a strike. He represents Capitalism. The workers didn't pay attention to him. Joe, one of the members speaks out in favour of a strike. He tells them how he is not able to earn enough for his family, which makes his wife Edna to threaten him to leave him. His confrontation with his wife clearly illustrates how the people are suffering due to the inequities of the Socio-economic system, which allows the capitalists to suppress the working-class people. Thereby he resolved to go for a strike. Odets exposes the consequences of the bad economic system of society through the struggle for survival of Joe and Edna. This episode portrays the impoverished condition of Joe and Edna, who are not able to provide their children with even two satisfying meals per day and who are dependent on the capitalists. The capitalists determine the economic and political factors of society with their wealth and power.

Then the scene shifts to Miller, who was a laboratory assistant and now becomes a taxi driver as he refused to compromise his principles. He is offered a

promotion by Fayette, who wants to manufacture poison gas, which is harmful to mankind. Fayette represents the capitalist mind, who wants to earn money by hook or crook. Miller, on the other hand, is distressed much as he lost his brother and relatives in the war. Miller refuses to do the spying though Fayette tries to persuade him to do so. The working-class people are intentionally oppressed by the capitalists. They are mere puppets dangling from the strings controlled by their masters who are rich owners. Eventually, Miller as a taxi driver now is forced by society to go for a strike. Even in his despair, Miller does not compromise with his self-respect. Odets vividly portrays the social inequalities through Fayette and Miller.

Subsequently the scene moves to Sid and Florrie, the young lovers, who want to get married. But they are forced to depart because of Sid's financial status, who is a poor taxi driver. This scene indicates how the middle-class workers still continued to be in a low status suppressed under the powerful bigshot money men. The lovers get separated because of the financial condition prevailing at that time. Economic problems play a pivotal role in shaping the future of people. Odets makes the audience aware of the situation that love cannot be sustained in a capitalistic society without money. One of the major concepts of Marxist Criticism is the class division where money is powerful and the people with no money are considered to be the under privileged. The poor people cannot afford to their wishes as they have been suppressed economically by the capitalists. Sid and Florrie have been trapped by society.

Later we are introduced to Dr. Benjamin, who is a senior doctor. He is upset that he is replaced for surgery on a poor woman in charity by an incompetent doctor, who is the nephew of a senator. He is so distressed when he comes to know that the woman has died after the surgery. Dr. Benjamin decides to leave and is even ready to get a job as a taxi driver. The playwright exposes the evils of class distinction, which is a result of the capitalist system. This scene indicates how the socio-economic factors necessitate a great change. The playwright here tries to make the audience aware of the necessity of a revolt against the evils of society.

The next scene shifts to Agate, who expresses his agony for the lack of strength of working-class people. He provokes the taxi drivers with his emotional speech about the rich men suppressing the poor working-class people. He asked them to be united and to fight against them. By that time, a man runs into the group and says that Lefty is shot dead. The character of Lefty, who never appears in the play, is a symbol of hope and change. Lefty is a union organizer who has been blacklisted by the bosses for his radical views. His absence is felt throughout the play, as the characters wait for him to arrive and give them the inspiration to carry out a strike. Lefty represents the revolutionary potential of the working class, who can only attain their goals through collective action and solidarity.

Finally, Agate demands the workers to go for a STRIKE. It's a direct call to the audience who are watching

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the play. Agate gives the final persuasive words to make the workers decide to go on a strike: AGATE: Hear it, boys, hear it? Hell, listen to me! Coast to coast! HELLO AMERICA! HELLO WE'RE STORM-BIRDS OF THE WORKING–CLASS. WORKERS OF THE WORLD … OUR BONES AND BLOOD! And When we die they'll know what we did to make a new world! Christ, cut us up to little pieces. We'll die for what is right!
Put fruit trees where our ashes are! (31)

Through each character, Odets represents the economic and social turbulence of that period. The class distinction is well portrayed and the sufferings of the middle-class people demand a solution. Every member of the working class gets affected by the impact of social ills. John Howard Lawson in his Theory and Technique of Playwriting comments on Waiting for Lefty, "… it is assumed that the social forces which create the decision [in the scenes of the play] are absolute and that the intuitive recognition of these forces is a moment of supreme climax" (53).

This play is a call for a revolt against social disorders. With the political messages predominant in this, it has become very successful. It was the voice of the Thirties in America. It is an appeal to the people, who lost their social as well as economic status, for a revolution. Though it is a short play, it has a very great impact on the minds of the people to go a change. It ends with an optimistic note for a revolution to bring a change in society. The playwright vividly presents how the oppressed people overcome their oppressions and he also offers a solution to the problems. Glenn Hughes ascertains in A History of The American Theatre 1700 - 1950, "This revolutionary little piece, based on the New York taxicab strike of 1934, revealed a remarkable technique and an ability on the part of the young writer to inflame an audience" (421).

Similarly, in *Awake and Sing!*, Odets portrays the struggles of a working-class Jewish family living in the Bronx during the Depression. The play examines the tensions between the family members, particularly between the father, Myron, and his son Ralph. Myron symbolizes the older generation of workers who have accepted their life, while Ralph is a young Marxist who is disappointed with the capitalist system and dreams of a better life. The play, which was written and first performed in the 1930s, is noteworthy for its use of Marxist themes and ideas, and for its portrayal of working-class struggles and aspirations. Harold Cantor in Clifford Odets, Playwright-Poet rightly acclaims that "Odets is the paradigmatic spokesman for the Jewish middle class in the thirties in drama. Further, he became a poetic playwright and myth-maker for middle-class ethics and aspirations and the dilemmas they produce" (xii).

The play is set in the Berger household, where a Jewish family is trying to make ends meet. Every individual was struggling hard to get the basic requirements due to the economic crisis. Weales, in Odets the Playwright, states that "It is the middle of the Depression;

work is scarce, dull, badly paid; simple survival is about as exalted a goal as any of the characters can hope to reach" (62).

The head of the family, Myron Berger, is a hard-working but dissatisfied man who feels trapped in his life as a struggling working-class man. His wife, Bessie, is a domineering and unscrupulous matriarch who is obsessed with saving money and ensuring that her family adheres to traditional values. Their children are Ralph, a dreamy idealist who wants to break free from his family's poverty and limitations, and Hennie, a young woman who is desperate to escape her suffocating home life and find a husband. Each member of the family is thwarted by financial conditions and they represent the plight of the people of the 1930s. Murray commends this play in Clifford Odets: The Thirties and After as,

An absorbing enactment, told with anger and pity, with humor and love and above all with verbal brilliance of people caught in a moment of time, it nevertheless transcends the thirties to reveal the human being in the agony and longing that represents the continuing spiritual plight of man in the twentieth century (52).

Jacob, the grandfather, is an idealist who discards the materialistic society and prefers to retreat to the comforts of books and music. Jacob is unable to do anything against the false system prevailing in society and he insists that Ralph will be able to revolt against it. Jacob acknowledges his inability to rebel against society and admits his failure to Ralph. Through this character, Odets articulates his Marxist ideas. Jacob condemns the capitalist system which oppresses poor working-class people. Jacob hallucinates the past and anticipates that the youth of America can bring a better future by changing history.

The entire family is struggling with poverty. Gerald Rabkin states, "The basic image of Awake and Sing! is resurrection, the emergence of life from death. For the life of the Berger family in Depression, age America is spiritual death, dehumanized by a thousand irritants, frustrated by the exigencies of economic breakdown" (182-183). Bessie's father Jacob lives with them and Moe Alexander rents a room in their house. Hennie aspires to a merry life. As she becomes pregnant, she is forced to marry Sam. Ralph becomes angry when his grandfather did nothing to stop it but commits suicide. His grandfather has stimulated him to create a better society. Recalling his own former dreams, Jacob urges Ralph to identify himself with the cause for the betterment of the world by saying in Marxist terms:

JACOB: Boychick, wake up! Be something! Make your life something good. For the love of an old man who sees in your young days his new life, for such love takes the world in your two hands and makes it like new. Go out and fight so life shouldn't be printed on dollar bills. (48)

Moe Alexander allures Hennie to abandon her husband and to run away with him, which she accepts. Ralph encourages her in this plan. Through every character, Odets shows how they are trapped. Odets depicts Ralph as a sensitive and

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intelligent boy who is living with his family. He is struggling hard to find a chance. He is disillusioned by the lack of opportunities. At the same time, Ralph's mother disapproves of his working-class girlfriend, Blanche. The young lovers are forced to get separated because of the economic crisis. There is a change in Ralph's mind after the death of his grandfather, who has instructed him to bring out a change for a better society. Herr claims that, "The goal of Awake and Sing! was to show ... that petty conditions and historical traps can be overcome, that life doesn't have to be printed on dollar bills". (74).

Like the earlier play, this play is also a depiction of the false economic system and its effects upon the individuals. Fleischman in *Twentieth Century American Dramatists* says that Odets' *Waiting for Lefty and Awake and Sing! "*condemns the economic system which traps the individuals into a treadmill of hopelessness" (129).

To conclude, Odets's plays, *Waiting for Lefty and Awake and Sing!* are both powerful Marxist critiques of American society during the Great Depression era. Fleischman in *Twentieth Century American Dramatists* says that Odets' *Waiting for Lefty and Awake and Sing*! "Condemns the economic system which traps the individuals into a treadmill of hopelessness" (129). Odets presents a contemptuous indictment of capitalism through his characters and dialogue. He argues that the system exploits and subjugates the working class. Through a Marxist lens, these plays can be seen as a reflection of the class struggle of the time, where the working class was being exploited and oppressed by the ruling class. The playwright appeals to the people with a message of hope, as the characters come together to demand better working conditions and wages. Waiting for Lefty and Awake and Sing! remain a relevant and timely play that continues to inspire social and political change.

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# A Critical Analysis on Achieving Sustainable Development Goal 6 - Clean Water and Sanitation: A Case Study of Chennai City.

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**Abstract:**

The water scarcity problem has become a constant phenomenon in Chennai. At times, it becomes acute. Water scarcity reduces people's living standards by increasing their health expenditure and working hours, reducing their actual income. The fall in income will reduce consumption, and finally it reduces the welfare of the people. The UNDP has set 17 Sustainable Development Goals (SDGs), of which the 6th goal is achieving clean water and sanitation by 2030. By providing clean water and sanitation, we can achieve other goals of poverty eradication, reducing hunger, and women's equality. Hence the sixth goal plays a crucial role in enhancing welfare. Can we achieve goal 6 in the Chennai context by 2030? This paper tries to provide an answer to this question by way of critically analyzing the water supply situation in Chennai. The paper focuses on the pitfalls of the current supply-side dominated approach and provides solutions for the water crisis by suggesting a more demand-oriented approach.

## Introduction

Out of 17 Sustainable Development Goals (SDGs), goal 6 aims to achieve universal and equitable access to safe and affordable drinking water by 2030 (UNDP, 2015). Since water is fixed in supply, addressing the water scarcity problem depends mainly on substantially increasing water-use efficiency across all sectors and ensuring sustainable withdrawals and supply of freshwater. A close look at SDG 6 will reveal that it is a fundamental goal closely linked with various other goals. Goal number 1which aims at zero poverty depend largely on how effective goal number 6 is being achieved. This is because poverty in developing countries is caused mainly by environmental problems in general and water issues in particular.

Lancet Committee Report (2018) reveals that in India, around 4.5 lakh people were killed by water pollution in 2017; the number of people living with the illness may be double the number of people killed. What is its implication on poverty?

The poorer people cannot afford to pay for good quality drinking water and medical expenses; as a result, they bear the entire burden of the cost of mortality and morbidity caused by water pollution. Since the poorer people will have to live with illness or if the family's breadwinner is getting killed by pollution, the entire family may live in prolonged poverty. Water pollution affects children the most, compared to adults. Malnutrition problems and these problems usually cause the problems of 'stunting' and 'wasting' among children, get intensified by poor water quality as well. Children's cognitive development is adversely affected by stunting and wasting. This leads to a lack of skill development, and as a result, these children cannot participate in the competitive labor market when they become adults. They end up in low-paid jobs and poor living conditions that perpetuate poverty, even for several generations. As poor quality water becomes a key factor for perpetuating poverty that affects generations together (see Dasgupta, 2001), providing good quality water has tremendous potential to achieve SDG number 1.

Goal number 2 deals with zero hunger and clean water have an impact on reducing hunger among people. The nonavailability of clean water makes most of the poorer households in water-stressed countries, spend a significant amount of their productive time on water collection; in those areas where water markets have emerged, poorer people end up spending a significant amount of their income on buying relatively good quality water from the market and this creates a budget constraint on buying food. So, making clean water available for poorer people will release a significant amount of their time and money spent on water towards buying more food thereby reducing hunger.

SDG goal 3 talks about 'good health and wellbeing'. As we have already seen, good health and overall well-being of the

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people depend largely on the availability of basic amenities such as good quality water supply. An empirical study in Argentina suggests that providing clean water reduces infant mortality by around 26 percent among poorer households (Galiani et al. 2005). Similarly, SDG goal 4 prescribes quality education for all by 2030. In many African countries, it was found that the non-availability of water at the household level leads adversely affects the education of especially girl children. When water becomes scarce, households will have to travel a long distance to fetch more water, leading to increased demand for household laborers. While male children will be engaged in income-earning activities, the female children will be used for fetching water. Similarly, the non-availability of water and sanitation in schools leads to increased dropout among girl children (UNSECO, 2018). All empirical studies on water and education in poorer countries categorically establish that providing clean water and sanitation has tremendous potential to improve the educational status of the people, thereby increasing the countries' human capital.

Goal number 5 dealing with gender equality is closely linked to goal 6 dealing with clean water and sanitation. Ensuring water at the household level is mostly a woman's responsibility in most developing countries. Women suffer a lot when water becomes scarce at the household level. Most of their time is spent fetching water, preventing them from effectively participating in the labour market and making them economically less empowered. Providing clean drinking water will help them reallocate their time to participate in the labour market and earn a decent income, empowering them economically. During the recent water crisis in Chennai in 2019, we have observed that it is basically women who had to sacrifice even their sleep in the night, expecting the water Lorries, whose arrival is not certain, to come into their locality so that they can collect water for household purpose. Many working women had to forego their earnings due to their paid time allocated to water collection. This implies that access to clean water will not only empower women and reduce gender inequality (SDG-Goal-5), but will also make them achieve decent work and contribute to economic growth, a matter dealt with by Goal number 8.

Similarly, provision of clean water to all will reduce the inequality in income and wealth (SDG-Goal-10). Providing clean water to all poor people by our government will increase the cash on hand for their consumption and savings. It will reduce the inequality in income and wealth (SDG-Goal-10).

In this way, providing clean water plays a key role in achieving various other SDGs. However, accessing clean water is becoming a serious issue in many urban areas in India. Chennai, being one of the metropolitan cities, is always reeling under an acute water scar problem, and therefore, this paper critically analyses the water situation in Chennai, the issues involved in achieving SDG 6 and it also attempts to provide some policy suggestions towards achieving SDG 6.

**Water Crisis in Chennai:**

Can we achieve providing clean water to all in Chennai by 2030? Chennai city is one of the fastest-growing urban economies with industries such as the car manufacturing industry, IT firms, and other commercial and residential establishments. Chennai is also constantly attracting migrants from rural areas due to agricultural distress in rural areas of the state. In recent years, skilled and semi-skilled migrant workers from north India are also coming to Chennai to work in the industry and service sectors. Hence, Chennai's population has been constantly increasing over time, putting more pressure on water demand. Recent estimates suggest that the population of the Chennai Metropolitan Region, consisting of Chennai city and its agglomeration, is 10.71 million in 2019. A conservative estimation of the total demand for water in Chennai stands at 1200 million liters per day (MLD) while the actual supply is about 830 MLD from public sources. Chennai city gets water from multiple sources. The major reservoirs that supply water to Chennai are Poondi Lake (3,231 Mcft), Sholavaram Lake (881 Mcft), Red Hills Lake (3,300 Mcft), and Chembarambakkam Lake (3,645 Mcft). In addition, there are bore wells around Chennai which are supplying water to Chennai city and its neighbourhoods.

Two desalination plants –one in Minjur and another one in Nemmeli- supply approximately 200 MLD of water. Krishna water from Andhra Pradesh and Cauvery water through the Veeranam project are the sources coming from far away distances. In recent years, water from quarry mines is also being drawn. During the summer of 2019, Cauvery water, supplied to Jolarpet has been brought to Chennai by trains. Despite augmenting water from multiple sources, the supply-demand gap is unfavourably high. In the coming years, the increase in water demand will also outweigh the supply, thereby leading to a huge water deficit. For example, water demand is expected to go up to 2,248 MLD, and supply is estimated to be only 1,535 MLD in 2026 . A deficit of 715 MLD is expected to prevail in the year 2026 and therefore, achieving SDG 6 by 2030 appears to be a mammoth task as far as Chennai city is concerned.

Transferring water from far-away sources like Veeranam tends to generate environmental refugees. Drawing water from rural water bodies adversely affects rural people dependent on water for irrigation and livestock. When agriculture and allied activities fail due to water transfer, they migrate largely to Chennai, increasing the demand for additional water. This will make the government

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to go to more rural water bodies creating more environmental refugees who migrate to Chennai, creating further demand for water, etc. This vicious cycle becomes more pronounced under the future climate change regime when the rainfall pattern is going to change completely unfavourably.

To meet the current deficit, the consumers depend largely on private water markets which emerged as a major informal institution to supply water in Chennai. It is reported that households, and commercial and industrial establishments in Chennai pay around Rs. 1250 crores per annum on purchasing private water alone . Consumers pay even more during periods of acute water scarcity, such as the one that prevailed in the summer of 2019. If we add other costs such as the opportunity cost of waiting time, the total cost incurred on the water by all consumers would go up significantly. Studies conducted among the slums suggested that even poorer people pay around 6 -10 percent of their monthly income on purchasing water. All the above imply that the lack of availability of clean water in Chennai city will have larger implications on employment, income, women empowerment, and various health issues.

## Solutions

Achieving SDG 6 in the context of the prevailing acute water scarcity problem in Chennai city assumes paramount importance since water scarcity in the city exerts hardship and welfare loss not only to the city population but also to people in other parts of the state. Many solutions have been proposed to reduce water scarcity and its negative impact on the economy and human well-being. These solutions can be broadly classified into, supply-based and demand-based solutions.

**Supply-Based Solutions:**

Rainwater harvesting' is considered a major solution to the ongoing and future water crisis in Chennai city. The government of Tamil Nadu has been taking certain concrete measures to encourage all stakeholders to take up rainwater harvesting measures. The Chennai region lies in the drainage basin of the Cooum, Adayar, and Kosathalayar watersheds. So, most of the rainwater in the drainage basin goes off run-off into the Bay of Bengal. During heavy rainy seasons, the city is flooded and stormwater drainage becomes a menace. Rainwater harvesting not only reduces the scarcity of water but also the negative impact of flooding and problems associated with stormwater drainage.

Rainwater harvesting is done at two levels: a) at a micro level, by households, commercial establishments, and government organizations; and b) at the macro level by way of harvesting rainwater in small waterbodies, irrigation tanks, lakes, and rivers. Rainwater harvesting at micro and macro levels are complementary to each other. The government of Tamil Nadu has been undertaking macro-level rainwater harvesting through desilting and eco-restoration measures of

various water bodies. These measures not only increase the water levels in the surface areas of the water bodies but also increase the water levels in the sub-surface area which can be used long-term. Increasing the water storage levels of the water bodies would reduce flood impacts both in their upstream (catchment) and downstream (drainage) areas. An empirical study conducted by research organisations such as Madras Institute of Development Studies (MIDS), Chennai, suggests that around 3600 water bodies in Chennai and its neighbouring districts, namely, Kancheepuram and Thiruvllur, have the potential to supply a significant amount of water to Chennai city in case all these water bodies are properly managed and rainwater is harvested and stored in these sources. So, managing water bodies on a long-term basis for adequately harvesting rainwater in this region would resolve the water scarcity problem in Chennai on a long-term basis.

Another supply-based solution to augment more clean water for Chennai city is to recycle and reuse huge amounts of wastewater being let out into to Cooum, Adayar, and Buckingham canal systems. It should be noted that around 85% of the water consumers use comes as wastewater. In Chennai, every day around 1500 MLD of wastewater is generated . The present capacity of the wastewater treatment plants is equivalent to 727 MLD only . However, reports suggest that only around 486 MLD of water is being treated in these facilities . This implies that nearly 1014 MLD of untreated sewage is being let into water bodies. So, recycling and re-use of wastewater generated have more significant potential to resolve water problems in the city in the coming years.

Some experts propose to the government that it will have to install more desalinization plants to augment additional water supply to the city in the future. However, there are opponents of such a proposal. The opponents argue that desalinisation technology is a costly technology and therefore, we need to focus more on rainwater harvesting measures that are more cost-effective in nature.

**Demand-Based Solution:**

Even though supply-based measures are necessary for achieving SDG 6, a sufficient condition is to adopt certain demand-based solutions. Unless the scarce water is used most efficiently, bringing scarce water at a huge cost to the consumers becomes economically non-viable. In this regard, metering water consumption and monitoring how much water is being consumed by different consumers are important. Currently, only 16% of the water connections in Chennai city have meters. Non-metered water consumption may lead to wasteful use of water. The next important component of water management is the pricing of water. The pricing of water should be based on a block tariff system –up to a certain level of consumption, the water is free and

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beyond this basic level, each block will have an increased tariff rate.

Block tariff ensures that the consumers using water for basic needs are subsidized and the consumers using water over and above their basic needs are taxed. In this way, the equity issue involved in water supply can be addressed properly, making overall water use more efficient. Appropriate pricing of fresh water would encourage consumers to harvest more rainwater, reuse and recycle waste water significantly.

## Conclusion

Equitably providing clean drinking water for all will eradicate poverty, reduce hunger, improve gender equality, improve educational and health status and achieve decent work for all. In other words, achieving the SDG 6 has tremendous potential to achieve various other SDGs. However, providing clean water in an urban area like Chennai has become a great challenge for various economic and technical reasons. At any given time, there is a huge supply-demand gap prevailing in Chennai city and this gap will expand in the coming years, rather than shrink. The ever-increasing gap imposes a significant amount of loss of social welfare. To reduce this gap and increase the social welfare, experts suggest various measures that can be broadly classified into demand-based and supply-based measures. We have argued that implementing rainwater harvesting, reuse and recycling of wastewater, metering of water consumption and pricing of water using block-tariff will eventually improve the water supply situation in Chennai city in the coming years.

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# A Comparative Study of Growth and Composition of Foodgrain Production of Southern States

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*Abstract*:

Agriculture sector plays a vital role in Indian economic development all time. This sector still provides a livelihood support to sixty percent of the country's population and a single largest occupation of unorganized sector. The socio-economic well-being of the country's people closely related to agricultural production. Agriculture sector is one of the largest contributors to the country's Gross Domestic Product (GDP), in spite of decline in its share in the GDP from 51.8 per cent in 1950-51 to 19 per cent in 2021-22. Nevertheless, there are no significant changes in the proportion of workforce depending on agriculture. Agriculture sector balanced use of land and water maintaining the balanced ecological system in India. However, a sustainable and balanced country's economic growth will critically depend on sustainability of agricultural growth. The agriculture sector in India is undergoing the major structural change in the recent years, firstly, the share of allied sectors in agriculture; mainly dairying, fisheries and poultry are becoming more important. In fact, the share of livestock products in gross value of agricultural product is progressively increasing. Secondly, the changes in the pattern of landholdings reveal that marginal and small holdings dominate the landholding. The latest report showed that 85 per cent of the small and marginal farmers hold around less than 50 per cent land in the country's agricultural area. Also the land cultivating in the small and marginal holdings is progressively increasing. In spite of it we find two-third of cultivated land in India is still depending on vagaries monsoons. India's annual average rainfall is 650mm. Irrigation, on the other hand, helps agriculture by reducing dependence on monsoon, improving agricultural productivity, and ensuring food security in India. It is a network of major and minor canals from rivers, groundwater system, tanks, and other water harvesting projects. The current debate on linking rivers is expected to pave the way to solve irrigation problems in Indian Agriculture. Nevertheless, the agriculture sector still more is questionable in Indian. In this circumstance, the present study seeks to analyze the performance of agriculture in terms of growth and composition of foodgrain production of southern states in India viz., Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana between 2011-12 and 2021-22. The present study completely relies on the secondary source of data available in the handbooks of statistics of RBI and study finds that the highly volatile crop production during the study period is highly volatile. This study further suggests that the future direction of Indian agriculture is largely depending on the domestic agricultural policy. The agricultural policy should seek to provide strength of rural infrastructure to support faster agricultural growth and development

Key Words: Foodgrains, Rice, Wheat, Coarse Cereals and Pulses

## INTRODUCTION

Since independence, there are three major changes have been taken place in the agricultural crop composition. Firstly, the share of non-food crops has increased in terms of area cultivated. Secondly, the noteworthy development took place in some crops like sugarcane, oil seeds, spices, fruits and vegetables, etc. Thirdly, the most important changes have been taken place in the share of superior cereals like rice and wheat in the total foodgrains production. The Indian topography supports the agriculture by plenty of the perennial rivers. The effort of state policies in the area of crop production occupies a significant place towards agricultural development. Though the some Indian states are financially sound in the state income, the support on the agriculture development and other relevant activities are inadequate. In this present scenerio, this study attempts to analyse the trend in the foodgrain production of southern states viz., Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana covering period between 2011-12 and 2021-22. Particular focus has been made towards the analysis of annual growth rate of production of different food crops in southern states and relation with in the growth rate of food crop production at all India level. While analyzing the trend in the crop production, we could understand the performance of growth of foodgrain production in southern states.

### Objective of the Study

i. To study the trend in foodgrain production of southern states during 2011-12 to 2021-22.
ii. To analyse the growth and composition of foodgrain production of the southern states.
iii. To study a comparative growth of foodgrain production among southern states.

### Sources of Data & Methodology

The study relies on the secondary source of data available in the report on annual Handbook of Statistics on Indian Economy published by Reserve Bank of India, Annual Handbook of Statistics of State Governments, Central Statistical Office, National Sample Survey Organization and Ministry of Agriculture (Government of India) etc. In order to study the trends in the foodgrain production of southern states the statistical tools such as averages, ratios and growth rates have been widely used.

**Economic profile of Southern States**

The southern states of India comprises of Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana. The annual average of economic growth rates of southern states have experienced consistently exceeded country's average growth rate after 1970. The growth rates of southern states noted to be more reform oriented in terms of economic policy when compared to other Indian states. The annual average state-income of southern states has grown eight per cent in last decade. In the southern regions, around forty eight per cent of population is engaged in agriculture. Agriculture in these states are largely dependent on seasonal monsoons for cultivations. The major crops in southern states are paddy, coarse cereals, sorghum, pulses, sugarcane, cotton, chilli, ragi, etc. The crops like coffee, tea, vanilla, rubber, pepper, tapioca and cardamom are cultivated on the hills, while coconut is grown in abundance in coastal areas.

**Growth of Foodgrain Production of Southern States**

The present study analyses the foodgrain production like rice, wheat, coarse cereals and pulses of southern states covering period between 2011-12 and 2021-22. The table-1 revealed that an annual average growth rate of rice production in southern states selected for the study showed a positive growth rate of rice production during the study period. Among the states, the annual average of growth rate of rice of Telangana was highest, it was constituting on an average of 27.8 per cent, followed by Tamilnadu, it was 15.9 per cent. While Karnataka and Kerala same stood at 1.6 per cent and Andhra Pradesh at 0.2 per cent during the study period. But some negative growth rates were found in all southern states during the study period. In absolute terms, the rice production in Andhra Pradesh, which stood at 3047.0 thousand tonnes in 2015-16 increased to 12302.2 thousand tonnes in 2021-22. There was no significant change in rice production in all other states of southern regions selected for study. The rice production in all India stood at 105310.9 thousand tonnes in 2011-12 increased to 130290.6 thousand tonnes in the year 2021-22.

The annual average growth rate of wheat production in southern states showed a positive growth rate the states selected for the study it can be seen from the table-2. Among the states, the annual average of growth rate of wheat in Andhra Pradesh was highest, constituting an average of 86.4 per cent, followed by Telangana at 11.5 and Karnataka at 4.6 per cent during the study period. No record has been found on wheat cultivation by Andhra Pradesh after 2015-16. This study further shows no record has been found on the cultivation of wheat by Tamilnadu and Kerala during the study period. In absolute terms, Karnataka's wheat production, which stood at 193.0 thousand tonnes in 2011-12 increased to 211.5 thousand tonnes in the year 2021-22. There were no significant changes in wheat production in other states of southern regions during the study period. The wheat production in all India stood at 94876.7 thousand tonnes in 2011-12 increased to 106844.9 thousand tonnes in the year 2021-22. The study further revealed that the southern states selected for the study showed a less focus on cultivation of wheat cultivation among the other Indian states.

It can be seen from the table-3 that an annual average growth rate of coarse cereals production in southern states selected for the study revealed a positive growth rate during the study period. Among the states, the annual average growth rate of coarse cereals in Tamilnadu was highest, constituting an average of 19 per cent, followed by Kerala was 9.8 per cent and Telangana was 8.6 percent during the study period. But there were some negative growth rates found in all southern states during the study period. In absolute term, the coarse cereals production in Karnataka, which stood at 6813.0 thousand tonnes in 2011-12 increased to 7296.6 thousand tonnes in the year 2021-22. There were no significant changes in coarse cereals production in other states selected for study. The coarse cereals production in all India stood at 42041.3 thousand tonnes in 2011-12 increased to 50895.2 thousand tonnes in the year 2021-22.

The table-4 showed that the annual average growth rate of pulse production in southern states of India. This study found that all the states in the southern regions a positive growth rate of pulse production during the study period. Among the states, the annual average of growth rate of pulses in Telangana was highest, it was constituting on an average of 21.5 per cent, followed by states of Tamilnadu was 14 per cent, Kerala was 10.6 per cent, Karnataka was 7.5 per cent and Andhra Pradesh was 5.2 per cent. But some negative growth rates were found in all southern states during the study period. In absolute terms, Karnataka's pulse production, which stood at 1134.1 thousand tonnes in 2011-12 increased to 1967.9 thousand tonnes in the year 2021-22. There were no significant changes in pulses production in other states of southern regions during the study period. The pulse production in all India stood at 17088.9 thousand tonnes in 2011-12 increased to 27692.1 thousand tonnes in the year 2021-22.

The present study revealed that Telangana's annual average growth rate of total foodgrains production was highest, constituting an average of 21.3 per cent during the analysis period, whereas the state of Tamilnadu was of 14.9 per cent in the same period. In all India, the annual average growth rate of total foodgrains was 2.1 per cent during the study period. A negative growth rate was found in all southern states during the study period. In absolute terms, the pulse production in Tamilnadu, which stood at 10151.8 thousand tonnes in 2011-12 increased to 12046.3 thousand tonnes in 2021-22. There were no significant changes in pulses production in other states of southern regions during the study period. The pulse production in all India stood at 259323.2 thousand tonnes in 2011-12 increased to 315722.7 thousand tonnes in the year 2021-22. It can be seen from the table-5.

**Conclusion and Suggestion**

The present study found that all the states in the southern regions selected for the study revealed a positive annual growth rate of all foodgrains viz., rice, wheat, coarse cereals and pulses during the study period. Among the states, the annual average of growth rate of rice of Telangana was highest than other states selected for the study, it was constituting on an average of 27.8 per cent. While a highest wheat production of Andhra Pradesh was

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86.4 per cent, coarse cereals of Tamilnadu was 19 per cent, and pulses of Telangana was 21.5 per cent during the study period. The study also found that Telangana's annual average growth rate of total foodgrains production was highest, constituting 21.3 per cent than any other states during the period selected for study. The total foodgrains of all India showed a positive annual average growth rate of 2.1 per cent at same period. A negative growth rate was found in all southern states and all India during the study period. The reason behind the highly volatile in nature of foodgrain production has been the gambling of monsoon. This study also suggests that the future direction of Indian agriculture is largely depending on the domestic agricultural policy. The government's agricultural policy should improve the strength of rural infrastructure and support faster agricultural growth and development.

**Table 1: Annual Average Growth Rate of Rice of Southern States (2011 – 2022)**

(In Thousand Tonnes / Per cent)

| Year | Andhra Pradesh | Growth Rate (%) | Karnataka | Growth Rate (%) | Kerala | Growth Rate (%) | Tamil Nadu | Growth Rate (%) | Telangana | Growth Rate (%) | All India | Growth Rate (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011-12 | 7746.2 | - | 3955.0 | - | 569.0 | - | 7458.7 | - | - | - | 105310.9 | - |
| 2012-13 | 6862.4 | -11.4 | 3364.0 | -14.9 | 508.3 | -10.7 | 4049.9 | -45.7 | - | - | 105231.6 | -0.1 |
| 2013-14 | 6969.7 | 1.6 | 3572.6 | 6.2 | 509.2 | 0.2 | 5349.8 | 32.1 | - | - | 106645.5 | 1.3 |
| 2014-15 | 7233.9 | 3.8 | 3541.0 | -0.9 | 562.1 | 10.4 | 5727.8 | 7.1 | - | - | 104798.5 | -1.7 |
| 2015-16 | 7488.7 | 3.5 | 3021.0 | -14.7 | 549.3 | -2.3 | 7517.1 | 31.2 | 3047.0 | - | 104408.2 | -0.4 |
| 2016-17 | 7452.4 | -0.5 | 2604.8 | -13.8 | 437.1 | -20.4 | 2369.4 | -68.5 | 5173.4 | 69.8 | 109698.4 | 5.1 |
| 2017-18 | 8166.2 | 9.6 | 3017.1 | 15.8 | 521.3 | 19.3 | 6638.9 | 180.2 | 6262.2 | 21.0 | 112757.6 | 2.8 |
| 2018-19 | 8234.7 | 0.8 | 3431.0 | 13.7 | 578.3 | 10.9 | 6130.9 | -7.7 | 6670.0 | 6.5 | 116477.8 | 3.3 |
| 2019-20 | 8658.9 | 5.2 | 3634.5 | 5.9 | 605.6 | 4.7 | 7171.1 | 17.0 | 7427.8 | 11.4 | 118870.3 | 2.1 |
| 2020-21 | 7882.9 | -9.0 | 4291.7 | 18.1 | 633.8 | 4.7 | 6881.2 | -4.0 | 10217.1 | 37.6 | 124368.3 | 4.6 |
| 2021-22 | 7789.2 | -1.2 | 4333.4 | 1.0 | 630.0 | -0.6 | 8067.3 | 17.2 | 12302.2 | 20.4 | 130290.6 | 4.8 |
| Annual Average | | 0.2 | | 1.6 | | 1.6 | | 15.9 | | 27.8 | | 2.2 |

*Source: Handbooks of statistics on Indian Economy, RBI*

**Table 2: Annual Average Growth Rate of Wheat of Southern States (2011 – 2022)**

(In Thousand Tonnes / Per cent)

| Year | Andhra Pradesh | Growth Rate (%) | Karnataka | Growth Rate (%) | Telangana | Growth Rate (%) | All India | Growth Rate (%) |
|---|---|---|---|---|---|---|---|---|
| 2011-12 | 11.0 | - | 193.0 | - | - | - | 94876.7 | - |
| 2012-13 | 1.0 | -90.9 | 179.0 | -7.3 | - | - | 93506.5 | -1.4 |
| 2013-14 | 4.0 | 300.0 | 210.0 | 17.3 | - | - | 95849.8 | 2.5 |
| 2014-15 | 6.0 | 50.0 | 261.0 | 24.3 | - | - | 88938.4 | -7.2 |
| 2015-16 | - | - | 156.0 | -40.2 | 8.5 | - | 92287.5 | 3.8 |
| 2016-17 | - | - | 171.0 | 9.6 | 7.0 | -17.6 | 98510.2 | 6.7 |
| 2017-18 | - | - | 230.2 | 34.6 | 5.6 | -20.0 | 99869.5 | 1.4 |
| 2018-19 | - | - | 163.6 | -28.9 | 9.4 | 67.9 | 103596.2 | 3.7 |
| 2019-20 | - | - | 179.7 | 9.8 | 9.2 | -2.1 | 107860.5 | 4.1 |
| 2020-21 | - | - | 262.1 | 45.9 | 15.8 | 71.7 | 109586.5 | 1.6 |
| 2021-22 | - | - | 211.5 | -19.3 | 10.9 | -31.0 | 106844.9 | -2.5 |
| Annual Average | | 86.4 | | 4.6 | | 11.5 | | 1.3 |

*Source: Handbooks of statistics on Indian Economy, RBI*

**Table 3: Annual Average Growth Rate of Coarse Cereals of Southern States (2011 – 2022)**

(In Thousand Tonnes / Per cent)

| Year | Andhra Pradesh | Growth Rate (%) | Karnataka | Growth Rate (%) | Kerala | Growth Rate (%) | Tamil Nadu | Growth Rate (%) | Telangana | Growth Rate (%) | All India | Growth Rate (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011-12 | 2188.3 | - | 6813.0 | - | 0.6 | - | 2323.8 | | - | - | 42041.3 | - |
| 2012-13 | 2433.6 | 11.2 | 6061.0 | -11.0 | 0.3 | -50.0 | 1333.0 | -42.6 | - | - | 40044.2 | -4.8 |
| 2013-14 | 2486.8 | 2.2 | 6825.8 | 12.6 | 0.3 | 0.0 | 2819.7 | 111.5 | - | - | 43294.9 | 8.1 |
| 2014-15 | 2310.2 | -7.1 | 6946.0 | 1.8 | 0.3 | 0.0 | 3142.6 | 11.5 | - | - | 42860.0 | -1.0 |
| 2015-16 | 1916.0 | -17.1 | 5608.2 | -19.3 | 0.3 | 0.0 | 3406.6 | 8.4 | 1834.0 | - | 38522.3 | -10.1 |
| 2016-17 | 1982.0 | 3.4 | 5281.0 | -5.8 | 0.2 | -33.3 | 1345.2 | -60.5 | 2768.2 | 50.9 | 43772.1 | 13.6 |
| 2017-18 | 2776.1 | 40.1 | 6592.6 | 24.8 | 0.4 | 100.0 | 3518.4 | 161.6 | 2639.3 | -4.7 | 46970.2 | 7.3 |
| 2018-19 | 1864.5 | -32.8 | 5519.9 | -16.3 | 0.6 | 50.0 | 3708.0 | 5.4 | 2155.7 | -18.3 | 43059.4 | -8.3 |
| 2019-20 | 2531.2 | 35.8 | 6813.6 | 23.4 | 0.7 | 16.7 | 3493.2 | -5.8 | 3138.9 | 45.6 | 47748.4 | 10.9 |
| 2020-21 | 2321.6 | -8.3 | 7931.2 | 16.4 | 0.7 | 0.0 | 3470.0 | -0.7 | 1922.9 | -38.7 | 51323.8 | 7.5 |
| 2021-22 | 2388.7 | 2.9 | 7296.6 | -8.0 | 0.8 | 14.3 | 3506.0 | 1.0 | 2241.8 | 16.6 | 50895.2 | -0.8 |
| Annual Average | | 3.0 | | 1.9 | | 9.8 | | 19.0 | | 8.6 | | 2.2 |

*Source: Handbooks of statistics on Indian Economy, RBI*

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**Table 4: Annual Average Growth Rate of Pulses of Southern States (2011 – 2022)**

(In Thousand Tonnes / Per cent)

| Year | Andhra Pradesh | Growth Rate (%) | Karnataka | Growth Rate (%) | Kerala | Growth Rate (%) | Tamil Nadu | Growth Rate (%) | Telangana | Growth Rate (%) | All India | Growth Rate (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011-12 | 933.6 | - | 1134.1 | - | 2.5 | - | 369.3 | - | - | - | 17088.9 | - |
| 2012-13 | 1132.7 | 21.3 | 1259.3 | 11.0 | 3.2 | 28.0 | 209.9 | -43.2 | - | - | 18342.5 | 7.3 |
| 2013-14 | 1061.8 | -6.3 | 1600.5 | 27.1 | 2.8 | -12.5 | 613.8 | 192.4 | - | - | 19252.9 | 5.0 |
| 2014-15 | 950.0 | -10.5 | 1390.0 | -13.2 | 1.4 | -50.0 | 753.2 | 22.7 | - | - | 17191.3 | -10.7 |
| 2015-16 | 1229.0 | 29.4 | 1138.8 | -18.1 | 4.3 | 207.1 | 554.8 | -26.3 | 239.6 | - | 16348.2 | -4.9 |
| 2016-17 | 931.0 | -24.2 | 1737.9 | 52.6 | 1.7 | -60.5 | 427.1 | -23.0 | 536.0 | 123.7 | 23131.1 | 41.5 |
| 2017-18 | 1217.4 | 30.8 | 1951.2 | 12.3 | 2.0 | 17.6 | 556.3 | 30.3 | 514.0 | -4.1 | 25416.2 | 9.9 |
| 2018-19 | 739.6 | -39.2 | 1773.9 | -9.1 | 2.3 | 15.0 | 551.2 | -0.9 | 440.1 | -14.4 | 22075.9 | -13.1 |
| 2019-20 | 1166.7 | 57.7 | 2155.9 | 21.5 | 2.2 | -4.3 | 605.4 | 9.8 | 549.2 | 24.8 | 23025.2 | 4.3 |
| 2020-21 | 1094.6 | -6.2 | 2065.0 | -4.2 | 1.9 | -13.6 | 472.5 | -22.0 | 589.7 | 7.4 | 25463.1 | 10.6 |
| 2021-22 | 1088.0 | -0.6 | 1967.9 | -4.7 | 1.5 | -21.1 | 473.0 | 0.1 | 540.5 | -8.3 | 27692.1 | 8.8 |
| Annual Average | | 5.2 | | 7.5 | | 10.6 | | 14.0 | | 21.5 | | 5.9 |

*Source: Handbooks of statistics on Indian Economy, RBI*

**Table 5: Annual Average Growth Rate of Total Foodgrains of Southern States (2011 – 2022)**

(In Thousand Tonnes / Per cent)

| Year | Andhra Pradesh | Growth Rate (%) | Karnataka | Growth Rate (%) | Kerala | Growth Rate (%) | Tamil Nadu | Growth Rate (%) | Kerala | Growth Rate (%) | All India | Growth Rate (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011-12 | 10868.1 | - | 12095.1 | - | 572.1 | - | 10151.8 | - | - | - | 259323.2 | - |
| 2012-13 | 10429.8 | -4.0 | 10863.3 | -10.2 | 511.8 | -10.5 | 5592.8 | -44.9 | - | - | 257124.7 | -0.8 |
| 2013-14 | 10522.3 | 0.9 | 12208.9 | 12.4 | 512.4 | 0.1 | 8783.2 | 57.0 | - | - | 265043.2 | 3.1 |
| 2014-15 | 10494.1 | -0.3 | 12138.0 | -0.6 | 563.8 | 10.0 | 9623.7 | 9.6 | - | - | 252676.5 | -4.7 |
| 2015-16 | 10633.7 | 1.3 | 9924.0 | -18.2 | 553.8 | -1.8 | 11478.5 | 19.3 | 5129.0 | - | 251540.0 | -0.4 |
| 2016-17 | 10365.4 | -2.5 | 9794.7 | -1.3 | 439.0 | -20.7 | 4141.6 | -63.9 | 8484.6 | 65.4 | 275111.9 | 9.4 |
| 2017-18 | 12159.8 | 17.3 | 11791.2 | 20.4 | 523.8 | 19.3 | 10713.6 | 158.7 | 9421.1 | 11.0 | 285013.5 | 3.6 |
| 2018-19 | 10838.8 | -10.9 | 10888.4 | -7.7 | 581.2 | 11.0 | 10390.1 | -3.0 | 9275.2 | -1.5 | 285209.3 | 0.1 |
| 2019-20 | 12356.8 | 14.0 | 12783.7 | 17.4 | 608.4 | 4.7 | 11269.8 | 8.5 | 11125.0 | 19.9 | 297504.5 | 4.3 |
| 2020-21 | 11299.0 | -8.6 | 14550.1 | 13.8 | 636.4 | 4.6 | 10823.6 | -4.0 | 12745.6 | 14.6 | 310741.7 | 4.4 |
| 2021-22 | 11266.0 | -0.3 | 13809.4 | -5.1 | 632.2 | -0.7 | 12046.3 | 11.3 | 15095.4 | 18.4 | 315722.7 | 1.6 |
| Annual Average | | 0.7 | | 2.1 | | 1.6 | | 14.9 | | 21.3 | | 2.1 |

*Source: Handbooks of statistics on Indian Economy, RBI*

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A Comparative Study of Growth and Composition of Foodgrain Production of Southern States

# The Growing Prominence of Sub-Regionalism in South Asia: A Study of SASEC, BBIN, and China-Pakistan Cooperation

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**Abstract**

South Asia has witnessed failed attempts at establishing regional cooperative networks, with the most infamous failure being that of the SAARC. However, in the current scenario, the region has seemed to adopt to its situation and has paved the way for smaller regional groupings or sub-regional cooperative networks. These sub-regional cooperations have replaced more extensive networks and are more efficient in working as they face lesser differences and hassle while working towards a goal. The prominence of these sub-regional cooperatives has diminished the hopes of ever reviving the earlier regional cooperation's like SAARC, but their efficient working is commendable. Hence, this paper seeks to discuss the concepts of regionalism and sub-regionalism and how regionalism's failure in South Asia paved the way for sub-regional groups now operating within the region. The paper further discusses three sub-regional groups/cooperative relationships of the region that are playing a significant role in the development and politics of the region. The three groups are the South Asia Sub-Regional Economic Cooperation (SASEC), Bangladesh-Bhutan-India-Nepal (BBIN), and the relationship between China and Pakistan. The paper's primary objective is to address the influence, potential, and importance of sub-regional organizations in South Asia to materialize ambitious goals of the region.

Keywords- South Asia, Regionalism, Sub-Regionalism, SAARC, BBIN, SASEC, China, Pakistan, Cooperation

## Introduction

In the contemporary world order, the necessity to engage in cooperative agreements and practices at the international level has increased manifold. The nations can preach self-reliance as much as they want, but they will remain at each other's mercy owing to the complex interdependence of the world. In this age of globalization, where each nation is somehow connected to the other, a shake in the system of any country around the world can cause the whole structure to choke. Recently it has been evident in the cases of Russia's invasion of Ukraine and earlier during the blockade of the Suez Canal, among other such cases. However, this interdependence also leads to increased insecurities and mistrust among countries at the world level, which is a fair concern given the vulnerability of the whole system. This is where the idea of regionalism gains currency.

In international relations studies, 'regionalism' refers to the process of integration of a larger network of countries or institutions primarily based on common goals and challenges. Regionalism or regional cooperations emerge as integrated political entities to facilitate cooperation and mutual assistance in various aspects. (Bloor, 2022) The war-torn economies of the Post-World War era found it difficult to reestablish themselves on their own; thus, the concept of regional cooperation proved to be a lifeboat for them. These sub-systems within the global order of inter-relationships forming the international system define regionalism more clearly. These are formed with voluntary initiation and participation of states which share similar ideologies and face challenges which could be countered with mutual assistance. These groupings are based on economic benefits through trade agreements also. However, their scope has also increased to include military and strategic cooperative agreements in the contemporary era.

## South Asia's journey from Regionalism to Sub-Regionalism

South Asia is infamous for its failed attempts at creating a regional cooperation network, with the most prominent failure being that of the South Asian Association for Regional Cooperation (SAARC). The region took its time to finally accept the need to create such a network, while cooperations like the Association of South East Asian

Nations (ASEAN) and the European Union (EU) saw positive outcomes from their initiatives. SAARC was established in 1985, and given South Asia's common history of prolonged exploitation by various invaders and the woeful colonial past, SAARC should have enjoyed a successful materialization. (Shukla, 2019) However, the existing friction between the neighbors in South Asia and disagreement on various issues led to its failure. This further led to an open opportunity for the countries in South Asia to engage in sub-regional cooperative agreements, weakening the idea of collective growth in the region.

Sub-regionalism has proven effective when it comes to countering the multifunctional security needs of the contemporary era, from drug smuggling and terrorism to food and health security threats. Regarding sub-regionalism in South Asia, the formation of cliques between the countries in the region has become more obvious. With India and Pakistan failing to establish cordial and peaceful relations, the sub-regional groups show clear signs that these nations can't survive in a cooperative network. Consequently, the support of China to Pakistan has helped build a good cooperative setup for both of them, while other groups bar Pakistan. The likes of the Bangladesh-Bhutan-India-Nepal (BBIN) cooperative framework and the South Asia Sub-regional Economic Cooperation (SASEC) do not include Pakistan but other countries of the region.

## South Asia Sub-regional Economic Cooperation (SASEC)

The countries that comprise the South Asia Sub-regional Economic Cooperation (SASEC) include India, Bangladesh, Myanmar, Nepal, Bhutan, Sri Lanka, and Maldives, and work as cooperation to foster sub-regional prosperity, expanding possibilities of mutual economic growth, and maintain better lifestyle and living standards for the locals. The member nations of SASEC are united in their goal of fostering regional trade and collaboration within South Asia. Furthermore, the cooperation aims to expand and facilitate trade with Southeast Asia by extending cooperative invitations to the rest of the world, especially Myanmar and the People's Republic of China. (Regional Cooperation and Integration: SASEC) SASEC members meet periodically to discuss, address, and collaborate on plans to face challenges and overcome difficulties. The member countries signed the SASEC Operational Plan 2016-2025 in 2016 at their meetings and agreed to develop an economic corridor facilitating the SASEC countries. The grouping also seeks to increase intraregional trade and create new trade prospects with East and Southeast Asia. To enhance cross-border transportation networks, the initiative supports the development of a cutting-edge and efficient customs system that shortens border crossing times and lowers transaction costs. The seven SASEC nations, which continue to be among the least economically linked globally, have great untapped potential for profitable trade. (Regional Cooperation and Integration: SASEC) The Asian Development Bank (ADB) acts as the secretariat for the SASEC. Furthermore, the grouping has successfully implemented over 61 regional projects in energy, trade corridors, transport, and ICT development sectors. (Regional Cooperation and Integration: SASEC) Almost a decade of successful cooperation has enhanced the trust between the nations and improved the scope of more such collaborative initiatives in the future.

## Bangladesh-Bhutan-Nepal-India (BBIN)

The Bangladesh-Bhutan-India-Nepal (BBIN) is a sub-regional cooperative network formed within the ambits of the SAARC initially but grew out of its umbrella over time. The initiative claims an obstacle-free movement of people, cargo, transport, etc., within the BBIN countries as its primary objective. Although the member countries signed the BBIN pact in June 2015, the process was rather hefty for the members.

The idea to create a smaller sub-regional group within SAARC took inspiration from the success stories of other such groupings in other parts of the world. The idea was first proposed by the four countries headed by Nepal during a SAARC foreign ministers' conference in 1996 under the name of the South Asian Growth Quadrangle (SAGQ) and was easily approved by them. However, the SAGQ was not well received by the other SAARC members, especially Pakistan. While the Maldives and Sri Lanka eventually agreed to it, Pakistan kept viewing it as a conspiracy to isolate it. (Shukla, 2019) Regardless, the SAGQ couldn't take off successfully owing to friction between Nepal and Bangladesh's domestic politics getting in the way of the project.

Fast forward two decades, India vows to revitalize its Neighborhood First Policy and started to reconfigure ways to materialize its foreign policy goals. At a SAARC summit in 2014, the Indian Prime Minister shed light on SAARC's inability to work on its goals and succeed as regional cooperation. However, banking on the region's potential to work as a regional collective, he revived the idea of BBIN in 2015 and signed a sub-regional motor vehicle agreement to ease up traffic and movement across borders of personal and cargo vehicles for the member countries with the primary objective of boosting economic growth in the region. The initiative saw an expansion in its second Joint Working Group (JWG) meeting, where the areas of cooperation were expanded to include Water Resources Management, energy, and hydropower. (Gambhir & Saxena, 2020)

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The BBIN program has the potential to drastically alter the working process of current trade-related operations, opening the door for improved market access for the manufacturing entities of the sub-regions hubs. With the inclusivity of the BBIN members' economies and India's assumption of the asymmetrical burdens, any advancement in the concerned sectors of the initiative will inevitably lead to increased access for smaller member states to the big Indian market. Moreover, Bhutan and Nepal could use a multi-modal transportation network to connect the sub-region because they're both landlocked states. They would be able to benefit from affordable transit across the borders, especially to the ports in Bangladesh and India. Furthermore, all the member countries can easily benefit from each other by collaboration in the energy sector as Nepal and Bhutan's potential to generate hydropower and India and Bangladesh's potential to generate thermal power could be combined to facilitate supply wherever and whenever required in the sub-region. (Shukla, 2019). It is safe to say that the BBIN cooperative network has a successful future as a sub-regional group if it plays its cards rightly in the future.

## The China-Pakistan cooperation dynamic

Pakistan's relationship with most countries hasn't always been smooth, and the claims of terror fugitives residing there further deteriorated its reputation. Its laidback attitude towards the terrorism spawning in its country has left a forever bad perception in other countries' minds. Therefore, the bad blood with Pakistan is visible, most prominently in its relations with India and other neighbors. However, despite such shady historical perceptions, China is one neighbor who has always walked beside Pakistan, weathering all seasons of their relationship. As China attempts to establish itself as a global behemoth to possibly overtake the United States of America regarding economic growth, Pakistan remains a key component for stabilizing its hold in South Asia.

When the People's Republic of China was born on 1st October 1949, Pakistan was the first country to respond to Mao Zedong's call to establish diplomatic relations with other nations. The historical currents that had molded the new course included the deterioration of Sino-Soviet and Sino-Indian ties at the start of the 1960s, which prompted the US to send military aid to India in response to that country's border clashes with China in October and November 1962. But when China firmly supported Pakistan during and after the 1965 Indo-Pakistan conflict, goodwill with China became ingrained in Pakistani society. An important turning point in Pakistan-China relations and a source of increased trust was the border treaty of 1963. Subsequently, in 1964, Pakistan started operating flights to China as the first non-communist nation. The Chinese have used Pakistan International Airlines for years when traveling abroad. Pakistan has offered China technical support in its discussions with the World Bank. In a significant move, Pakistan criticized the Americans' "Two China policy" in March 1965. Pakistan is now seen by China as a reliable South Asian partner. Pakistan had also significantly changed its foreign policy by indicating a desire to cooperate with China. Their relationship was ready to take a big step by the middle of the 1960s.

China has been a significant source of support for Pakistan in trade, commerce, and economic assistance, especially as it relates to developing its industrial base and infrastructure. Although the formal diplomatic relationship between China and Pakistan took off in 1950, it goes back to when traders used the Silk Route that connected China to the Middle east. In the contemporary era, Pakistan has maintained its relationship with China through its isolation phase in 1960-70. It has been supported by not adhering to the US' demands during the Korean war, etc. Similarly, China has proven to be a loyal brother by supporting Pakistan with military, technological, and economic assistance over the years. (Panigrahi, 2022) The two countries have supported each other for decades to maintain their influence in South Asia and beyond.

As we move towards a more inclusive world order, various questions concern the actual strength of this relationship between China and Pakistan. China's foreign policy has attempted to establish itself as a well-wisher for all, with an overshadowed attempt to safeguard its powerful position in the world sphere. The China-Pakistan Economic Corridor (CPEC) was made possible by their strong efforts to improve economic cooperation. Several major infrastructure and transportation initiatives are currently under progress with the primary aim of enhancing the ease of trade and commerce, which should benefit both countries greatly. Pakistan was the first country to sign up for the Belt and Road Initiative (BRI), which now has over a hundred member countries worldwide. China has also assisted Pakistan in overcoming significant energy crises, economic setbacks, and other climatic and environmental challenges under the ambit of the CPEC. The Covid-19 pandemic proved to be a roadblock in the operations of the CPEC, temporarily slowed down its development but improved the situation later by broadening its remit by including collaboration in oil and gas, agriculture, industry, science, technology, and information technology, as well as in education, tourism, and socioeconomic programmes. (Panigrahi, 2022)

Pakistan's political atmosphere being highly susceptible to sudden changes, witnessed another change in guard last year with the removal of Imran Khan. The constant changes in the leadership have also not been able

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to shake the ship of the China-Pakistan relationship, as both states understand the importance of each other for their survival. The recent developments in South Asian affairs have somehow made it more difficult for Pakistan to keep afloat, but they are handling it all. The Taliban takeover of Afghanistan revitalized the terrorist movement across its border from Pakistan, making the domestic politics of the latter more hostile again. It was visible in the surge in bomb attacks in recent months, along with an assassination attempt on Imran Khan at a public rally. Its relationship with China suffered a slight strain when the Chinese workers in the Balochistan province were attacked by the locals, but the situation was somehow mended. CPEC remains at the heart of Chinese foreign policy at the moment, and with Pakistan being its largest contributor to the project, their relationship is deemed to strive more prosperously in the future.

## Conclusion

South Asia is a vulnerable region regarding differences based on culture, language, ethnicity, religion, etc. Thus, it's very easy to develop differences among the nations in the region. These differences and conflicts pose a serious threat to any cooperative initiative that South Asia might embark upon. Therefore, the role of these growing sub-regional factions within the region becomes crucial in developing South Asia as a whole or in general.

There are several ways to initiate or strengthen regional or sub-regional cooperations, and one of the most important catalysts in this process could be the youth or the scholarly population of countries. South Asia represents a region that has not been using its young population efficiently when it comes to initiating cooperative dialogues or networks. The scholars are the ones who will ultimately be in positions where they'll be leading the state and making decisions for the same. The people in such positions eventually influence the state's behavior and manipulate popular opinion. Therefore, as a policy recommendation, setting up universities and institutions that teach courses related to regional integration could go a long way. Europe has been working marvelously in this regard with its European studies program taught across the continent, encouraging its scholarly population to understand the value and ideas behind such cooperative networks. In South Asia, the setting up of South Asian University (SAU) as an initiative of SAARC was a step forward in this pursuit; however, that is not enough. (Waqif, 2001) Engaging the scholarly population into believing in the idea of a cooperative and peaceful future would work wonders when these scholars take up positions through which they can drive change.

South Asia also struggles with an acute case of political instability. The region's countries rarely enjoy stable leadership, making it tough to initiate cooperative dialogues with others. This results in unstable alliances based on fluctuating national interests and domestic political shifts. This increased fear of unprecedented abandonment of alliances poses a valid dilemma in the minds of all states. Regardless, it is almost impossible for a country to survive on its own, and the increasing global interdependence has only made it clearer that all countries need support. For South Asia to embark on a journey of stable cooperative friendship, be it regional or sub-regional, it would require it to overcome these challenges and efficiently tap the due potential of the region. Sub-regional cooperations within South Asia only focus on their growth and benefit. However, common challenges, such as the fight against climate change, can be fought at an individual level, as the individual development of countries in this regard could also lead to the region's growth as a whole. Most non-traditional security issues are easier to combat as a regional or sub-regional cooperative since the countries in closer proximity understand the issue better and are also affected by it. Hence, South Asia must realize its untapped potential in terms of regional cooperation to flourish and grow significantly internationally.

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# Technology as an Enabler for Terrorism Financing – Bird's Eye View on the Emerging Paradigms Globally and its Implications for India

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**Abstract**

**Financial networks of terrorist groups have undergone a paradigm change in recent times. From using traditional sources of finances such as drugs, small arms etc., terrorist groups have dived deep into technology-enabled terrorism finance mechanisms. While rapid advances in technology and globalization have spawned a new chapter in global development and growth, it has concomitantly led to the birth of new generation terrorism financing mechanisms, creating heightened threat levels for the global community. Online payment systems, prepaid cards, and cryptocurrencies are some of the technology-enabled terrorism financing mechanisms which terrorist groups are exploiting. While one cannot wish away technology as it is a part of the common man's everyday life, the global village has to understand how to strike a balance between technology and its negative fallout as a facilitator for terrorism. When the international community is grappling with these changes, the Indian scenario is next to precarious as there are no measures to stanch these financial flows from technology-enabled terrorism financing mechanisms. This is precisely what this article attempts to bring out, revealing lacunes, and citing real-time terrorist events elsewhere from other countries to showcase this clear and emerging threat. In attempting to pen the truth, this article aims to enlighten the readers on how these new age mechanisms easily sidestep our financial sentinels, creating a grave threat to humanity using data derived from secondary complemented with primary sources.**

## CURTAIN RAISER

On 16 March 2023, the National Investigation Agency (NIA) of India filed a chargesheet related to multiple arson and sabotage attacks in Karnataka last year. On the face of it, this case may appear to be "just another" case related to terrorism, but what stands out in this case, is the fact that both the accused Maaz Muneer Ahmed (23 years) and Syed Yasin (22 years) of Shivamogga, Karnataka has conducted these terrorist attacks which were financed by funds sent by their terrorist handlers outside India through cryptocurrencies. According to NIA (2023), "Maaz received Crypto equivalent to around INR 1.5 lakhs from the online handler into accounts of his friends, whereas Syed Yasin received INR 62 K into the account of a friend (Sic)". Startling as it may be for the unlearned, the use of cryptocurrencies for financing terrorist activities is on the rise globally, especially by groups such as the Islamic State. Incidentally, this is not the first time, cryptocurrencies have been in focus for terrorist-related activity in India. Last year, Mohsin Ahmed, a student of Jamia Millia Islamia is believed to have collected donations in India as well as outside India and has used cryptocurrencies to transfer the money to financial facilitators of the Islamic State based in Syria (Livemint, 2022). These instances showcase the fact that technology-enabled terrorism finance mechanisms such as cryptocurrencies are not only used to move money into India but also out of India as well. Usage of this emerging phenomenon of technology-enabled terrorism finance mechanisms is not restricted to one terrorist group such as the Islamic State or to a country like India alone, but also abused by other terrorist groups in different countries.

## TERRORISM FINANCING – THEN AND NOW

Traditional sources of terrorism financing are kidnap for ransom, abuse of charity fronts, the proliferation of drugs, small arms, etc., These funds are moved through formal financial systems and Hawala to the end use. Groups such as Lashkar-e-Toiba (LeT), Jaish-e-Mohammed (JeM), Liberation Tigers of Tamil Eelam (LTTE), and Al Qaeda were using traditional terrorism financing methods. After the 9/11 terrorist attacks in 2001, the international community clamped down on the finances of major terrorist groups, effectively disrupting the financial flows of terrorist groups. The United Nations Security Council initiated resolutions 1267 (1999) and 1373 (2001) which targeted the finances of terrorist groups along with formation. The

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formation of the Financial Action Task Force (FATF) which spearheaded the fight against terrorism financing also played a significant role. FATF which is an intergovernmental body issued recommendations (called as 40+9) specifically focussed to address the lacunae in the global financial system to curb terrorism financing and money laundering. These steps effectively reduced the finances, curbing the ability of terrorist groups to mount major attacks on a mass casualty scale.

Despite these measures, groups such as the Islamic State and to some extent, Al Qaeda, started harnessing new-age technology-enabled terrorism financing mechanisms, driven by globalization complemented with the advent of social media. The Islamic State, with a much wider support and sympathizer base across the globe, has tapped into the practice of "Crowdfunding" - sourcing donations from a large group of people, complemented by effective use of technology-enabled technology platforms to raise and move funds at on go. Given its widely dispersed sympathizers and followers, the Islamic State exploited various technology-based financing mechanisms. Some of these methods have been briefly discussed below.

## ONLINE PAYMENT PLATFORMS

Abuse of online payment platforms such as E-Money and PayPal by terrorist groups has been observed immediately after the Islamic State was declared in 2014. Using legitimate online mechanisms to fund terrorist activity was rampant as early as the 2000s. A United States government (USG) congressional report entitled "Terrorism and Digital Financing: How Technology is Changing the Threat" published in July 2021 claims "between 2005 to 2015, every extremist group they tracked featured a PayPal button on their website." (USG, 2021 p 2). While some of these sites have been taken down, some groups appear to be using online payment systems like PayPal to finance terrorism. In 2015, at least 6 Bosnians were convicted in the United States for sending money to Islamic State modules using PayPal (Laksmi, 2017). Similarly, a US-based journalist's PayPal account was hacked twice in an attempted siphoning-off operation to be used for the Islamic State. Both these incidents indicate the vulnerability of online payment mechanisms such as PayPal (Laksmi, 2017).

These instances created an awareness among the sentinels who started to regulate online payment platforms including PayPal. However, terrorist groups improvised by creating charity fronts instead of accepting donations directly. In 2018, PayPal shut down its payment services for a charity called International Alliance in Germany, which was believed to be closely linked to the Popular Front for

Liberation of Palestine (PFLP). This charity was using its website to receive donations and was channeling those funds to terrorist groups using PayPal services (Weinthal, 2018). Once the international community clamped down on mainstream media and their websites, groups started migrating to social media applications like Telegram to solicit donations using PayPal. Using Telegram, a lesser-known media group linked to the Islamic State called "Tawheed" and "Jihad Media" was calling for donations to equip fighters in conflict zones (Balasubramaniyan, 2022) (Image 1). This group sought donations in Bitcoin, Western Union and PayPal.



**Image 1- Screenshot of Tawheed and Jihad Media calling for Donations**
**Source:** Telegram Channel of Jihad and Tawhid Media

Using online payment mechanisms such as PayPal for terrorist financing exposed both the donor and the recipient as it was by default linked to bank accounts, exposing their identity. To offset this vulnerability, terrorist groups adopted newer technology-enabled terrorism financing methods such as prepaid cards, which would not expose their identity relatively compared to online payment mechanisms.

## PREPAID CARDS

Prepaid cards are legitimate financial products that are widely used by travelers worldwide as a substitute for carrying cash. Gift cards which are issued by Apple and Google can be used in any financial jurisdiction easily circumventing the regulations which are in place to monitor them. For instance, the 2015 terrorist attack in Paris carried out by the Islamic State, was partly financed from the payment made through prepaid cards. Other groups such as Al Qaeda are not far behind in using prepaid cards. According to a report published by the United States Department of Treasury, a sympathizer was arrested in

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2020 for financing an Al Qaeda operation by giving a prepaid card worth USD 500 to an Al Qaeda financial facilitator (USG, 2022).

These prepaid cards offer anonymity and ease of use. According to a report published by the European Parliament, terrorists find it convenient to use them as they are not issued in an individual's name and one does not require a bank account if the amount involved is below a particular threshold (EU, 2017). As it is not required to provide any identification while remitting a small amount, the identity of the donor and the receiver is preserved which augurs well for the financial facilitators to move money across financial jurisdictions without being detected. For example, a sympathizer in United States is approached through social media applications for donations, who in turn buys a prepaid card of a value below the reporting threshold, without requiring to provide any identification nor link to the bank account. This card is then handed over to financial facilitators or local conduits of a terrorist group. This card is then carried physically across to financial jurisdictions near conflict zones where it is encashed or exchanged for consumables that terrorist groups use. In this way, small amounts are transferred across various jurisdictions without being detected or noticed by physically transferring the cards to the end-use destination. However, the international community in a bid a regulate this mechanism placed stringent requirements on verifying identity before purchasing prepaid cards. For example, Europe brought down the threshold limit to EUR 150 with increased requirements for verifying identity. These measures to an extent curtailed the usage of prepaid cards for terrorist financing. However, terrorist groups have attempted to plug this vulnerability by adopting cryptocurrencies which ensured that the identity of both the sender and receiver is protected.

**CRYPTOCURRENCIES**

In 2021, in a hearing before the Subcommittee on Intelligence and Counter Terrorism, experts underscored the importance of monitoring and regulating online mechanisms as they are vulnerable to terrorist financing risk (USG, 2021). This hearing, published as a report, emphasized the abuse of virtual assets such as cryptocurrencies, cryptocurrency coupons, etc., for terrorism financing. According to this report (USG, 2021), the US government had discovered at least three financial networks linked to the Islamic State, HAMAS (Ḥarakah al-Muqaawamah al-Islaamiyyah) and Al Qaeda. The report (USG, 2021) further states, the seizure involved "millions of dollars" spanning 300 cryptocurrency accounts, four websites, and four Facebook pages. These instances strongly underscore how various digital technologies are being used to finance terrorism globally.

Interestingly, some groups directly collected donations by advertising their crypto-currency address. One such campaign was called the Ribaat campaign launched by Al Sadaqah linked to a terrorist group in Syria. This campaign which was widely propagated in Telegram accounts carried the slogan "Supporting the Mujahideen in Syria with Weapons, Financial Aid and other projects assisting the Jihad" (Balasubramaniyan, 2019) (Image 2). Al Sadaqah called for donations in Bitcoins, the most famous cryptocurrency globally.



**Image 2 – Al Sadaqah seeking donations in Bitcoins**
Source: Telegram Account of Al Sadaqah

Once the government agencies started clamping down on this activity, terrorist groups improvised and changed their methodology. A 2021 report by the Analytical Support and Sanctions Monitoring Team of the United Nations explains the latest modus operandi of financing terrorist activity through cryptocurrencies (United Nations, 2021). According to this report, around 8 individuals were arrested for sending money to Al Qaeda. The prospective donors would purchase cryptocurrency coupons online in France. The donor would then pass on the secret code to the financial facilitator who would encash the funds at the other end using that code at virtual asset trading platforms. Unlike the online payment systems or the prepaid card system, there is no physical movement of money, cards or coupons but only the code is exchanged with the end user which is used to retrieve the value stored in the coupons. In this way, terrorist groups were able to evade detection.

Studying these small changes and evolutions that bypass monitoring mechanisms is germane to understanding how financial networks have evolved over a period of years and how these evolutions are creating new challenges for policy planners. Abjuring traditional methods of earning through the illicit drug trade and small arms trafficking, the new generation of terrorist groups such as the Islamic State with a global diaspora, have found it

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ideal to use this technology-enabled terrorism financing mechanism to underwrite terrorist attacks. As smaller and smaller groups tend to gravitate toward these mechanisms, it creates new challenges for policy planners. However small the amounts might be, stanching these flows is the need of the hour for every country and India is no exception.

## DISCUSSION AND CONCLUDING THOUGHTS

Firstly, the technology-enabled terrorism financial network acts as a force multiplier. A traditional terrorist financial network constitutes 3 distinct stages i.e., raising funds, moving funds across financial jurisdictions, and storing those funds for end use. Terrorist groups raise funds through various sources such as drugs, donations, and abuse of charities. These funds are moved either through formal systems such as banks or informal systems such as Hawala. These funds are parked either in formal systems or informal mechanisms such as currency, precious gems, etc. till they are deployed for organizational and operational uses (Balasubramaniyan, 2022). Organizational costs pertain to costs incurred for recruitment, radicalization, weapons, training, and safe houses. Operational costs pertain to costs incurred for mounting specific terror attacks. Conventionally, 90 % of the budget is allocated to organizational costs while the remaining 10% is allocated to operational costs. However, with these technology-enabled terrorism finance mechanisms, the movement and storage mechanisms are under one mode. If one adds to it, hacking or phishing, the source of funds is also taken care of, bringing all three stages under one mode, making it most lucrative for terrorist groups (Balasubramaniyan, 2022). In India, activities of larger groups such as Lashkar-e-Toiba have been curtailed to a large extent. However, smaller groups or autonomous modules with flat structures constituted by a motley group of members may find this technology-enabled terrorism finance mechanism more appealing as their costs will be minimal given their zero organizational costs due to the lack of infrastructure. Given this attractiveness, increasingly small groups may emerge and wreak havoc in India.

Secondly, though the amount of money that can be sent through single or linked multiple tranches could be lower using cryptocurrencies, PayPal, or prepaid cards, not many could fathom the gravity of the situation where these small amounts can add up to underwrite many attacks. As their financial networks evolve, so do their organizational and operational budget outlays. Larger the group, the higher the organizational costs, and vice versa. Small autonomous

groups mean limited resources in turn curtailing their ability to mount a bigger terrorist attack, who then tend to plan low-scale attacks that are less expensive. This is in alignment with past data on terrorist attacks that suggest that the cost of carrying out terror attacks has been gradually going down. Compared to mass casualty attacks in the past such as the 2001 US attacks costing USD 500,000 (9/11 attacks) (United Nations, 2004) and the 2008 Mumbai attacks costing USD 350,000 (Balasubramaniyan, 2015), the cost of conducting terrorist attacks conducted in recent times appears to be waning down (Table 1). Even though commensurate with the decreasing costs, the lethality of the attacks has also gone down, these attacks could still convey a deadly message. Given such low costs of recent attacks, the technology-enabled terrorist financing mechanisms are ideally suited to finance these attacks. Hence, instead of one mass casualty attack with a large financial budget, a particular module could mount multiple attacks of arson, sabotage, and bomb blasts repeatedly on a small scale. This was amply demonstrated in the Karnataka module case where the accused received INR 2.2 lakhs for carrying out around 25 attacks over a period without being detected.

**Table 1 - Estimated Cost of Terror Operations (1998-2022)**

| Terrorist Incidents – International | Terrorist Incidents - India |
|---|---|
| 1998 - Al Qaeda US embassy bombings in Kenya and the Tanzania cost $50,000 | 2008 - Lashkar-e-Toiba bombings in Bangalore cost $ 6400 |
| 2000 - Al Qaeda USS Cole attack in Yemen cost $10,000 | 2008 - Indian Mujahideen bombings in Ahmedabad cost $ 2000 |
| 2001 - Al Qaeda 9/11 attacks cost $ 5,00,000 | 2008 - Mumbai attacks cost $ 350,000 |
| 2002 - Al Qaeda Bali bombings cost less than $50,000 | 2012 - Indian Mujahideen bombings in Pune cost $ 6000 |
| 2003 - Al Qaeda Marriot bombing cost $30,000 in Indonesia | 2022 - Islamic State multiple attacks in Karnataka cost $ 2750 (Rs.2.2 lakhs) |
| 2003 - Al Qaeda Attacks in Istanbul cost less than $40,000 | 2022 - Islamic State Coimbatore Blast cost $ 3000 (Rs 2.5 lakhs) |
| 2004 - Al Qaeda Attacks in Madrid cost $10,000 | |
| 2007 - Al Qaeda London train Bombings cost $13000 | |
| 2009 - Attacks in Kabul by Haqqani Network cost $ 350 | |
| 2013 - Boston Marathon bombings cost $ 360 | |
| 2013 - Xinjiang bombings cost $ 6000 | |
| 2015 - Islamic State Paris Attacks cost $ 10000 | |

Source – data on international incidents compiled from United Nations reports in 2004 and other open-source data.

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Data on Indian incidents were compiled by the researcher using primary and secondary sources. All figures are approximate and indicative only.

Thirdly, in India, online payment mechanisms such as PayPal are to an extent regulated and monitored. However, there is no mechanism to monitor the usage of prepaid cards such as those issued by Google and Apple as these instruments are not widely used. On the other hand, given the negative fallout of cryptocurrencies, India has attempted to regulate cryptocurrencies and exchanges. However, recent reports indicate that India may ban cryptocurrencies totally. This discussion on the prospective measures was initiated last year, despite the presence of cryptocurrency exchanges in India since 2017. This slow reaction indicates a lack of understanding about how cryptocurrencies operate and how they are linked to criminal and terrorist activities. These negative aspects were studied only recently, possibly indicating that the Indian policy planners woke up to the risk only now. Despite these measures, cryptocurrencies which are technology-driven, are still purchased online in India and elsewhere which creates a nightmare for India's security planners.

As is evident from the above, the financial networks of terrorist groups have evolved and have adopted newer and meaner methods of financing. Compared to a traditional financial network which would contain different methods for sourcing funds, moving funds, and storing them, the new generation methods act as force multipliers where the technology-enabled terrorism finance mechanisms not only act as the sourcing mechanism but also for moving and storing funds as well, in turn decreasing the vulnerability of exposure. In this game of cat and mouse, terrorist groups have improvised and stayed one step ahead of law enforcement agencies. From directly accepting donations through online payment systems to using anonymous cryptocurrencies, terrorist groups have been creative and intelligent. From a law enforcement point of view, understanding these emerging paradigms is the first step to countering them. Till such a clear understanding is achieved, technology-enabled terrorism financing mechanisms will be a clear and present danger to the global security architecture.

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# The Outline of Agricultural GDP and its Determinants in India

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**Abstract:**

**The paper aims to use a simple regression analysis to look into how agricultural determinants affect agricultural GDP in the Indian economy from 2007–2008 to 2021–2022. The dependent variable is agricultural GDP, and the independent variables are fertilizers, irrigated areas, pesticides, sown areas, loan disbursement, and food inflation rate. According to the study, factors like fertilizers and pesticides are not statistically significant, which indicates they did not significantly affect agricultural GDP from 2007–2008 to 2021–2022. Additionally, the analysis demonstrates that variables like sown area, irrigation, and food inflation are statistically significant, and it is implied that these variables significantly influenced agricultural GDP throughout the abovementioned data period. The authors contend that the agricultural industry's input and output sides are open to government intervention. The study emphasizes the importance of revitalizing public sector investments because it has a compounding impact on the sector's aggregate GCF. As a result, it is essential to develop a long-term perspective plan for infrastructure facilities that concentrate on infrastructural projects that have the greatest overall impact and connections.**

**Key: Gross Sown, Pesticides, Fertilizer, Productivity, GDP**

## Introduction

In India's economy, agriculture is crucial. The agricultural sector supports more than 70% of rural households. Since agriculture employs over 58% of the population and accounts for about 17% of the country's GDP, it is a significant sector of the Indian economy. Over the past few decades, Indian agriculture has grown significantly. The challenge with an agro-economy like the one in India is that the agriculture sector depends so heavily on the production, distribution, and consumption cycle. Productivity is a different issue in the agricultural sector. India's farmers currently fall well short of their potential, producing only 2.4 tonnes of rice per hectare of land. Yet, China and Brazil produce 4.7 and 3.6 tonnes of rice per hectare. Despite its drawbacks, India's economy depends most heavily on agriculture.

With around 41.49% of the workforce in agriculture and related industries including forestry, animal husbandry, and fisheries in 2020, they made up 17.5% of the GDP (gross domestic product) in 2016. In regard to net cropped area, China, the United States, and India are in that order. While India's economy as a whole is expanding, agriculture's economic contribution to GDP is progressively dropping. A considerable part of India's overall socioeconomic structure is played by the agricultural sector, India's largest economic sector in terms of demographics. From March to June 2020, exports of agricultural products totalled USD 3.50 billion. India was the seventh-largest agricultural exporter globally and the sixth-largest net exporter in 2013 with $38 billion in agricultural exports. The emerging and least-developed countries receive the majority of their agricultural exports. India exports agricultural, horticultural, and processed goods to about 120 nations, mainly Japan, Southeast Asia, SAARC nations, the European Union, and the United States. So, we must confirm the current state of agricultural GDP using the key factors affecting agriculture in India.

### Position of agriculture production in India

According to the Economic Report 2020-2021, agriculture's contribution to GDP has increased to approximately 20% for the first time in the last 17 years, making it the only sector showing promise for GDP growth in 2020–21. Agriculture was the only sector to have shown a positive growth of 3.4% at constant prices in 2020–21, while other sectors experienced a decline, due to the farming community's perseverance in the face of challenges.

From 17.8% in 2019–20, the contribution of agriculture to the GDP climbed to 19.9% in 2020–21. The agricultural sector's 20% GDP contribution was last reached in 2003–2004. After the devastating drought of 2002, when

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the sector's growth rate was negative, this was also the year when it had a 9.5% GDP growth." Agricultural and related sectors' increase in GVA (gross value added) has fluctuated throughout time. However, the poll found that while the GVA for the total economy shrank by 7.2% in 2020–21, the GVA for agriculture maintained positive growth of 3.4%. Food security was also made possible by the constant supply of agricultural products, particularly staples like rice, wheat, lentils, and vegetables. According to fourth advance estimates, the nation's overall production of food grains (296.65 million tonnes) increased in 2019–20 over 2018–19 by 11.44 million tonnes. Also, it exceeded the average production of 269.78 million tonnes for the preceding five years (2014-15 to 2018-19) by 26.87 million tonnes.

**Importance of the Research**

Knowing the level of agricultural production in India and the factors affecting it are essential for this topic's study. We are all aware that India is primarily an agricultural nation, and the overwhelming of its Indian citizens depend on it. To fulfill global development goals, healthy, sustainable, and inclusive food systems are essential. The growth of agriculture is one of the most effective methods for reducing extreme poverty. Compared to other sectors, the agriculture sector's growth is two to four times more successful at increasing the incomes of the poorest people. The economic expansion also depends heavily on agriculture.

**Methodology of the study**

The secondary data are the sole source for the study. The necessary variable data for the years 2007–2008 to 2021–2022 were taken from the RBI's annual reports, while the pertinent information was taken from journals, books, and research articles, among other sources. The Reserve Bank of India is where most of the information has come from. The association between the variables was determined using statistical tools, including regression and correlation analysis. ANOVA and a t-test were used to assess the significance level.

**Objectives of the study**

✓ To know the position of Agricultural GDP in India.
✓ To find the relationship between Food Inflation and Agricultural GDP
✓ To assess the association between Fertilizer usage, Pesticides Usage, and Agricultural GDP.
✓ Suggest measures to improve GDP in the agricultural sector.

**The Hypothesis of the Study**

In simple terms, we can say that a hypothesis is the statement of a goal. A hypothesis is a logically conjectured relationship between two or more variables expressed as a testable statement. The phrase "no (significant) association between two variables" or "no (significant) difference between two groups" is used to represent the null hypothesis,

which demonstrates the exact relationship between two variables. An assertion establishing a link between two variables or highlighting disparities between groups is the alternative hypothesis. In this research study, there are two hypotheses, and they are as follows:

➢ There is no relationship among the variables like gross sown area, gross irrigated area, fertilizer usage, pesticide usage, loan distribution by commercial banks for agriculture, and level of food inflation on the level of agricultural GDP in India.

➢ There is no association between the trends of agricultural GDP and the Quantity of Pesticidand es (pesticide), fertilizers usage.

➢ There is no correlation between Gross irrigation area and Agricultural GDP

**Limitations of the study**

The study analysis is done based on collected information (source) and the statistical information may vary with the different sources. (So the presented data is not reliable)

Since it (IT) recorded growth of 3.6% in 2020–21 and improved to 3.9% in 2021–22, agriculture and the allied sector proved to be the most resilient to the Covid–19 shock, fueling the total Indian economy's real GDP expansion of 9.2% in 2021–22. Just 1% of the world's pesticides are used in India. FAO data shows India used approximately 59740 tonnes of pesticides in 2018. In 2017, only 0.31 kg of pesticides were applied per acre. At 63.94 million MT consumed overall in 2021–2022, this is a 5.4% decrease from 2020–20. From 6.5:2.8:1 in 2020–21 to 7.7:3.1:1 in 2021–22, India's overall NPK utilization ratio widened. $N+P_2O_5+K_2O$ use per hectare decreased from 160.1 kg in 2020–21 to 146.7 kg in 2021–22.

The total land area of India is 329 million hectares. Of this, 141 million hectares are neatly seeded and 195 million hectares are grossly cropped. Yet, there are only 65.3 million hectares of net irrigated land. The remaining acreage is rainfed. From the middle of 2008 onward, food costs in India began to rise. Inflation generally exceeded 10% for the entire year of 2010–2011. Based on yearly changes in the wholesale price index (WPI), the inflation rate for primary food items was 12.46% from March 2008 to November 2011 and averaged 11.5% in 2011–2013. It was still very high in 2013–14 as well.

**The factors influencing agriculture GDP:**

**Gross sown area:** The gross sown area is the total area in which crops are sown, but if there are two crops sown in a year in this area, it will be counted twice. It's also known as Gross Cropped Area (GCA).

**Gross irrigated area:** Gross irrigated area is the total irrigated area under various crops during the year, counting

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the area irrigated under more than one crop during the same year as many times as the number of crops grown, crops sown mixed being taken as one crop. Thus, if a crop is grown for more than one time in an agricultural year, the gross irrigated area will count the irrigated area for more than once.

**Fertilizer:** Fertilizers are additional substances supplied to the crops to increase their productivity. These are used by the farmers daily to increase the crop yield. These fertilizers contain essential nutrients required by the plants, including nitrogen, potassium, and phosphorus. They also enhance the water retention capacity of the soil and increase its fertility.

**Pesticides:** Pesticides are chemical substances that are meant to kill pests. The term pesticides are often treated as synonymous with plant protection product. It is commonly used to eliminate or control a variety of agricultural pests that can damage crops and livestock and reduce farm productivity.

**Commercial banks finance to farmers:** Banks provide direct finance to farmers for the purchase of pump-sets, tractors and other agricultural machineries, for sinking and deepening wells, for land development, for raising crops, and for setting up dairy, sheep/ goat, poultry, fishery, piggery, sericulture units. Commercial banks also provide indirect finance, which includes loans for distribution of fertilizers and other inputs.

**Food inflation:** Food inflation can be defined as a consistent rise in the price level of agricultural food items and can happen because of decreased production and increased demand for food.

**MODEL: 1**

There are number of factors that influencing the level of agriculture GDP in India. Based on the theoretical grounds, some of the most plausible factors were selected for the analysis. The factors has been written in the equation form as:

$$GDP = f(FER, PES, SOW, IRR, LOA, WPI) \ldots\ldots\ldots\ldots..(1)$$

Where,

GDP - Agriculture GDP
FER - Fertilizer usage
PES - Pesticides usage
SOW - Gross sown area
IRR - Gross irrigated area
LOA- Total loans issued
WPI - wholesale price index (food articles)

Econometrically, it can be expressed as,

$$GDP = \alpha + \beta_1 FER + \beta_2 PES + \beta_3 SOW + \beta_4 IRR + \beta_5 LOA + \beta_6 WPI + e_t$$

**The estimated regression model as follows:**

**GDP = 3.367 – 0.1846 FER – 0.0178 PES + 0.6156 SOW + 0.5781 IRR – 0.0680 LOA + 0.1013 WPI**

To estimate the relationship between agricultural GDP and its determinant variables we mentioned here, the study uses regression techniques to show the relationship among the dependent and independent variables. To quantify the extent of the significance, each point on the regression line estimates the expected or mean value of Y (dependent variable here agricultural GDP) corresponding to the chosen X values (explanatory variables). The value of $\beta_1$ = - 0.1846, $\beta_2$ = - 0.0178, $\beta_3$ = 0.6156, $\beta_4$ = 0.5781, $\beta_5$ = - 0.0680 and $\beta_6$ = 0.1013, which measures the slope coefficients of the line, shows that, within the sample ranges of all the explanatory variables between 2007 – 08 to 2021 – 22 annual growth rate as X variable increases, say 1 %, the estimated increase in the mean or average annual growth rate of agricultural GDP rate to about due to gross sown area is 6.16 percent, change in gross irrigated area influencing about 5.78 percent, and rate of food inflation induce the agricultural GDP by 1.03 percent, whereas, the one percent change in fertilizer usage, pesticides usage and agricultural loan reducing the agricultural GDP by 1.85 percent, 0.18 percent and 0.68 percent respectively because these variables appears on the regression model as negative sign (which indicates inverse or negative relationship) which also implies when over usages of pesticides make solil infertility in this connection the farmer get loan from commercial banks, that makes the burden to the farmers so he may worried about to reducing repay capacity because of infertility land all these things impose to reducing the efficiency level of both farmer as well as the land so the percentage wise the rate of GDP is get fall.

The value of intercept 3.367 indicates that the average level of annual growth rate of agricultural GDP when all determinant variable what we included in the model is zero. However, this is a mechanical interpretation of the intercept term. In regression analysis such literal interpretation of the intercept term may not always be meaningful, although in the present research model it can be argued than an agricultural GDP of the nation without above mentioned variables might maintain minimum level of agricultural growth rate either by interest rate reduction or interest free for agricultural activities, monsoon favour, subsidies, effective policies for agricultural improvement etc.,

**Multiple R –** It discusses the linear relationship between the independent and dependent variables. This model's calculated multiple R value is 0.8019, indicating a perfect positive linear relationship between the independent and dependent variables.

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**R – Square**– It tells how much the independent variable explains the changes in dependent variable. In this model, the calculated value of $R^2$ is about 0.6431 shows that about 64 percent of the variation in the agricultural GDP is explained by its determinants in the model and about 36 percent was captured by other factors which have substantial influence on agricultural GDP but were excluded from the model.

## Trends of Agricultural GDP and its Determinants

### Table: 1

| Year | Agriculture GDP (Rupees in Crores) | Fertilizer Usage (Lakhs Tonnes) | Pesticides Usage (Thousand Tonnes) | Gross Sown Area (Area in lakh Hectares) | Gross Irrigated Area (Area in lakh Hectares) | Total Loans Issued for Agriculture (Rupees in Crores) | WPI (Food Articles) |
|---|---|---|---|---|---|---|---|
| 2007-08 | 1312283 | 226 | 41.6 | 1952 | 881 | 194953 | 64.1 |
| 2008-09 | 1309079 | 249 | 43.86 | 1953 | 889 | 245976 | 70 |
| 2009-10 | 1297556 | 265 | 41.82 | 1892 | 851 | 286390 | 80.6 |
| 2010-11 | 1411634 | 281 | 55.54 | 1977 | 889 | 344878 | 93.2 |
| 2011-12 | 1501947 | 278 | 52.98 | 1958 | 918 | 455290 | 100 |
| 2012-13 | 1524288 | 255 | 45.62 | 1942 | 922 | 659383 | 110.9 |
| 2013-14 | 1609198 | 245 | 60.28 | 2010 | 958 | 730123 | 124.5 |
| 2014-15 | 1605715 | 256 | 56.71 | 1984 | 965 | 845328 | 131.5 |
| 2015-16 | 1616146 | 268 | 56.7 | 1971 | 966 | 915510 | 134.9 |
| 2016-17 | 1726004 | 259 | 58.6 | 2002 | 981 | 1065755 | 140.3 |
| 2017-18 | 1840023 | 266 | 63.4 | 2000 | 1001 | 1162617 | 143.2 |
| 2018-19 | 1878598 | 273 | 59.7 | 1973 | 1027 | 1256830 | 143.7 |
| 2019-20 | 1982303 | 294 | 61.7 | 2007 | 1053 | 1392729 | 155.8 |
| 2020-21 | 2048032 | 325 | 63.46 | 2101 | 1071 | 1575398 | 160.3 |
| 2021-22 | 2109697 | 343 | 66.21 | 1953 | 1190 | 1863363 | 167 |

Source: RBI Data

**Table: 2**

| Regression Statistics | |
|---|---|
| Multiple R | 0.801936 |
| R Square | 0.643101 |
| Adjusted R Square | 0.375426 |
| Standard Error | 2.413039 |
| Observations | 15 |

Source: Calculated by the researcher

**Table: 3**

| **ANOVA** | | | | |
|---|---|---|---|---|
| | df | SS | MS | F |
| Regression | 6 | 1013047686618.35 | 168841281103.06 | 89.77 |
| Residual | 8 | 15047316092.05 | 1880914511.51 | |
| Total | 14 | 1028095002710.40 | | |

Source: Calculated by the researcher

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**CORRELATION MATRIX**

**Table: 4**

| | Agriculture GDP | Fertilizer usage | Pesticides usage | sown area | irrigated area | loans issued | Wpi (food articles) |
|---|---|---|---|---|---|---|---|
| Agriculture GDP | 1 | - | - | - | - | - | - |
| Fertilizer usage | 0.7547 | 1 | - | - | - | - | - |
| Pesticides usage | 0.8847 | 0.6459 | 1 | - | - | - | - |
| sown area | 0.6118 | 0.3570 | 0.6658 | 1 | - | - | - |
| irrigated area | 0.9571 | 0.7906 | 0.8342 | 0.4765 | 1 | - | - |
| loans issued | 0.9879 | 0.7614 | 0.8583 | 0.5489 | 0.9706 | 1 | - |
| WPI (food articles) | 0.9551 | 0.6678 | 0.9131 | 0.5975 | 0.8958 | 0.9602 | 1 |

Source: Calculated by the researcher

**Hypothesis testing:**

**Hypothesis: 1**

H0 – There is no relationship among the variables like gross sown area, gross irrigated area, fertilizer usage, pesticide usage, loan distribution by commercial banks for agriculture, level of food inflation on agricultural GDP in India.

H1 – There is no relationship among the variables like gross sown area, gross irrigated area, fertilizer usage, pesticide usage, loan distribution by commercial banks for agriculture, level of food inflation on level of agricultural GDP in India.

Where,

H0 - Null hypothesis;    H1 - Alternative hypothesis

**Decision Rule:**

F Calculated value > table value: reject null hypothesis and accept alternative hypothesis

F Calculated value < table value: accept null hypothesis and reject alternative hypothesis

Hence we can be tested by analyzing variance techniques and the attendant F test. The analysis of the variance table is given above. Under the usual assumptions, we obtain the calculated value 89.77 which is distributed as the F distribution with 6 and 8 df. The computed value at 5 percent is highly significant, we can reject the null hypothesis, that the agricultural GDP is significantly influenced by the fertilizer usages, pesticide usage, gross sown area, gross irrigated area, loan disbarment and food inflation in India.

**MODEL: 2 FACTORS RELATIONSHIP BETWEEN THE VARIABLES.**

**Hypothesis: 2**

❖ There is no relationship between agricultural GDP and the Quantity of Pesticides, and fertilizers usage.

**Hypothesis: 3**

❖ There is no correlation between Gross irrigation area and Agricultural GDP

✓ Further, the statistical relationship between two variables is measured by correlation. The correlation between agriculture GDP and other variables is highly correlated. This can also be tested and shown in table 4.

The result can be interpreted as:

✓ The correlation coefficient of WPI (food article) on agriculture GDP is 0.9551, the highest correlation value in the table and proves a robust positive correlation between agriculture GDP and WPI.

✓ The correlation coefficient of total loans issued and agriculture GDP is above 0.9879 which is the highest value after WPI and it's showed that very strong positive correlation between agriculture GDP and total loans issued.

✓ The correlation coefficient of gross irrigated area on agriculture GDP is 0.9571, the third highest value and robust correlation between agriculture GDP and gross irrigated area.

✓ The correlation coefficient of pesticide usage and agriculture GDP is 0.8847, which shows an 88.47 percent relationship between these two variables.

✓ The correlation coefficient of fertilizer usage on agriculture GDP is 0.7547 which clearly depicts as approximately 75 percent positive relationship between these two variables.

✓ The correlation coefficient of gross sown area on agriculture GDP is 0.6118, the lowest value in the table and shows the positive correlation between variables.

**Suggestions to improve agricultural GDP**

➢ Soil health enhancement through using chemical-free pesticides and fertilizers.

➢ Improve green forming and give incentives for the same.

The Outline of Agricultural GDP and its Determinants in India

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➢ Maintain a proper water management system to reduce water consumptions which may improve ground water level.

➢ Proper campaigns and policies to promote agricultural insurance

➢ Arrange subsidies for an organic way of farming

➢ Make periodical revisions in agricultural policy that may enhance agricultural productivity.

➢ Teach the farmers to use and upgrade the latest technology in the agricultural sector.

➢ Make reliable laws and policies to prohibit a middle man

➢ Create more regulated markets and cooperative markets for the farmers.

➢ Teach farmers to involve in other agricultural activities like animal husbandry, horticulture, dairy farming, fishery etc.

## Conclusion

Micro land holdings are a problem for farming in India because they restrict any farmer's ability to practise mixed farming, switch to growing several crops at once, or even adopt novel crop-growing techniques. In order to lessen the burden of informal setup in agri and allied services, the government has been aggressive in recent years in building the best platform and implementing necessary procedures. Encouragement of Farmer Producer Organizations across the nation is one such initiative that has benefited and inspired the farming industry as a whole. Currently, the Indian agricultural industry is heading towards a new green revolution. Low output in the agricultural sector is caused by a variety of issues, including illiteracy, a lack of funding, and ineffective marketing of agricultural products. The average size of farms in the sector is extremely tiny, which has led to low productivity, and this is another factor in the reduction in India's agricultural growth rate (GDP). In India, the agricultural sector's development rate has also slowed down as a result of the country's lack of adoption of contemporary technology and inadequate irrigation infrastructure. In order to improve agricultural growth, the Indian government must therefore take action to strengthen the agricultural sector.

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# Acute Toxicity of Chlorpyrifos on Various Blood Parameters in Climbing Perch, *Anabas testudineus* (Bloch, 1792)

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**Abstract**

Over the years, the unsystematic use of various pesticides in the agriculture industry to stop crop spoil from pests and insects have increased in emergent countries. Chlorpyrifos is a synthetic pesticide. Pesticides are used across the globe to control various crop insects and pests. Farming overflow influences the activities of aquatic life in nearby aquatic media, resulting in water pollution. Pesticides can originate behavioral, physiological, and biochemical changes in freshwater fishes and population reductions. Farmers nowadays use authentic insecticide and pesticide for agricultural activities in modern agriculture. Water bodies are often contaminated with a variety of unsafe chemical substances. Fish are essential for human nutrition. Various pesticides, including organophosphate, pyrethroids, and organochlorine, have been studied for their impact on freshwater fish. In freshwater fish *Anabas testudineus*, the result of the insect-repellent Chlorpyrifos on different blood components such as Hb, WBC and RBC was investigated. For 10, 20, and 30 days, the fish were exposed to sublethal concentrations of Chlorpyrifos (1/10, 1/20, and 1/30). Blood samples were analyzed at the end of each exposure period. Increased WBC and decreased RBC and Hb values were observed in all sublethal concentrations of Chlorpyrifos at all exposure times (10, 20, and 30 days) when compared to the control and experimental groups. During the 30th day of exposure, a sublethal concentration of 1/10 showed significant variation.

As a result, the current experiment attempts to investigate the pesticide's toxicity to blood parameters of the freshwater fish Anabas testudineus. Through consumption, Chlorpyrifos impacts fish and organisms in the food chain. The effect of Chlorpyrifos changes on the level of various blood parameters such as Hb, WBC and RBC in freshwater fish Anabas testudineus was studied in this study. As a result, the utilization of Chlorpyrifos, which is legally prohibited in India, can be justified. It has been demonstrated by numerous researchers and confirmed in the current study that the use of Chlorpyrifos causes severe injuries to the blood parameters of *Anabas testudineus*. To prevent pesticide pollution, the use of Chlorpyrifos in agricultural fields near fresh water bodies such as lakes and ponds should be reduced.

**Keywords:** *Anabas testudineus*, Chlorpyrifos, Haemoglobin, White Blood Cells, Red Blood Cells.

## INTRODUCTION:

The insecticide chlorpyrifos is thought to be the most dangerous to aquatic life[1]. When sprayed in controlled regions, even pesticides are taken away by rains and modify the physicochemical properties of water bodies such as rivers and ponds. The world's growing population necessitates diverse agricultural practices to meet food demands[2]. Pesticides persist in the environment for long periods of time, concentrating the bodies of animals and endangering aquatic life[3]. Pesticides are extensively utilized in recent agriculture to help with food production. Some pesticides, on the other hand, have the achievable to origin severe health and ecological harm. Pesticide remains enter the atmosphere through direct application from farming field runoff and influence biotic life[4]. Pesticides are widely used around the world, primarily to control pests in agricultural practices[5]. However, the increased use of pesticides can be destructive to livelihood and contribute to chemical pollution[6]. Farmers use chlorpyrifos to control insect pests in their fields. Pesticide residues alter the environment and disrupt the well atmosphere and water bodies. Insecticide Chlorpyrifos is primarily utilized in farming and creature husbandry[7]. Non-targeted organisms, such as fish, are primarily affected by pesticide toxicity, which causes harm to individual utilization. Several destructive pesticides have been analyzed for their ability to cause a variety of hematological and biochemical changes in fresh water fish at sublethal levels. Farmers prefer the organophosphate pesticide Chlorpyrifos; many studies have been conducted on the sub-lethal toxicity of chlorpyrifos on various species of freshwater fishes. Pesticides alter blood parameters such as RBC and WBC counts and Hb levels. Blood is an excellent intracellular and intercellular transport medium. The most important body fluid blood is a disease protection vehicle. Its composition reflects the fish's physiological state. A variety of tissues and organs of the body come into direct contact with blood stream. The blood parameters of an organism reflect its physiological status. Insect killing agents binds to blood proteins, causing changes in blood hematology such as blood glucose levels, serum protein levels, and WBC and RBC counts. Hematological analysis is a simple tool for determining fish health[8]. Hematological parameters define pathophysiological changes in animals. Blood indices vary with environmental conditions and

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chemicals[9]. Unwanted changes in aquatic media reflect in blood parameters via gills[10]. Blood components such as RBC, WBC, and Hb are critical diagnostic factors for determining the functional status of fish exposed to chlorpyrifos toxins. Blood parameters can be useful for detecting biological and physiological changes in aquatic animals[11]. Hematological parameters are used as a stress indicator to protect fish species[12]. In the field of aquaculture, hematological studies are frequently used to diagnose diseases in aquatic organisms such as fish[13]. The ultimate aim of this study is to examine the consequence of Chlorpyrifos at different sublethal (1/10, 1/20, 1/30) concentrations on blood parameters (WBC, Hb and RBC) of fresh water fish Anabas testudineus treated for different periods of time (10, 20 and 30 days). The current research is critical since this is not only examining the fish health but as well observes the lasting results of insect repellent on aquatic organisms.

## Materials and Methods

The healthy Climbing perch, *A. testudineus*, was collected from Sathankuppam Lake, Kelambakkam - 603103, which is 35 kilometers from Chennai on the Old Mahabalipuram Road in Tamil Nadu, India (Figs, 1 and 2). The specimens were transported to the Guru Nanak College, Zoology laboratory in a thick polythene cover with adequate aeration and water. The fish were kept in a rearing glass tank with traditional aeration. The fish weighed 60-80g on average and measured 15-17 cm in length. The fish were pale brown, and the water was exchanged every day. The fish tank was cleaned with a 0.1% $KMnO_4$ solution. The fish were fed with rice bran and groundnut-oil cake. The selected fish ranged in length from 15 to 17 cm and weight from 18 to 20 grammes. The pesticide Chlorpyrifos was used in the current study. A standard method was applied to determine the sublethal concentration of Chlorpyrifos[14]. Chlorpyrifos had a 96-hour $Lc_{50}$ value of 4.5 mg/l. The experimental system was divided into four different groups: such as Group-1 included ten fish in fresh water, Group-2 included ten fish in 1/10th sublethal Chlorpyrifos treated water, Group-3 included ten fish in 1/20th sublethal Chlorpyrifos treated water, and Group-4 included ten fish in 1/30th sublethal Chlorpyrifos treated water (Fig. 3 and 4). Blood sample was collected from each tank fishes at the end of each study period like once in a 10 days[15]. The Neubauer hemocytometer was used for total WBC and RBC[16] counts, and a standard method was used for Hb estimation. For experimental analysis, the ANOVA and Turkey tests were used. [17]
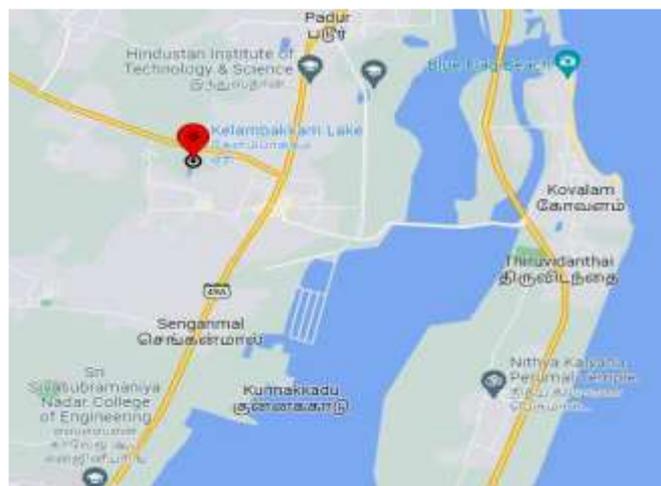


**Fig. 1 - Map showing the collection site**



**Fig. 2 - Sathankuppam Lake**



**Fig. 3 – Acclimatization of fishes**

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**Fig. 4 – Sublethal concentration group fishes**

## Results

Fish exposed to various sublethal concentrations of (1/10th, 1/20th, and 1/30th) Chlorpyrifos had lower RBC, WBC, and haemoglobin levels on 30th day of treatment when match up to controls.

### RBC Count

Fish introduced to 1/10th, 1/20th, and 1/30th sublethal application levels of Chlorpyrifos for 10, 20, and 30 days had lower RBC values when compared to controls. Maximum RBC decrease noticed in 30 days at 1/10th of the sublethal concentration of Chlorpyrifos introduced tanks. At 1/30th level of sublethal concentration, a minimum level of RBC was recorded after 10 days of treatment (Table. 1 and Fig. 5).

### WBC Count

The highest total WBC count was recorded in Chlorpyrifos-introduced fish throughout the study periods at various sub-lethal concentrations compared to the control tanks. The 30th day of Chlorpyrifos exposure in fish revealed a highest improved level of WBC at 1/10th sub-lethal concentration. The 10th and 20th day treated fishes at 1/10, 1/20, and 1/30 sublethal concentrations had higher WBC count when analyzed to the control fishes (Table. 2 and Fig. 6).

### Haemoglobin Count

Decreased haemoglobin content was recorded in all three treated periods 1 - 30 days at different sub-lethal concentrations of Chlorpyrifos matched to the control fishes. At 1/10th sub-lethal cypermethrin exposure, Hb levels were found to be significantly lower on the 30th day. The 10th and 20th day treated fishes at 1/10, 1/20, and 1/30 sublethal applications of chlorpyrifos also had lower amount of haemoglobin analyzed to the control fishes (Table. 3 and Fig. 7).

**Table. 1. Total RBC count from the blood samples of *A. testudineus* introduced to different sublethal concentrations**

| S. No | Different groups of *A. testudineus* with various sublethal concentration of Chlorpyrifos | Treatment for 10 days | Treatment for 20 days | Treatment for 30 days |
|-------|-------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|
| **1.** | Control | 18.73±0.05 | 18.26±0.07 | 18.27±0.27 |
| **2.** | Lower level (1/30) | 20.34±0.31 | 20.76±0.12 | 21.01±0.51 |
| **3.** | Medium level (1/20) | 21.42±0.23 | 22.48±0.36 | 22.89±0.48 |
| **4.** | Higher level (1/10) | 22.38±0.30 | 23.54±0.77 | 23.69±0.10 |

**Table. 2. Total WBC count from the blood samples of *A. testudineus* treated to various sublethal concentrations of Chlorpyrifos in different days of exposure in (cu.mm)**

| S. No | Different groups of *A. testudineus* with various sublethal concentration of Chlorpyrifos | Treatment for 10 days | Treatment for 20 days | Treatment for 30 days |
|-------|-------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|
| 1. | Control | 5.27±0.18 | 5.79±0.52 | 5.99±0.42 |
| 2. | Lower level (1/30) | 4.69±0.34 | 4.21±0.35 | 4.08±0.56 |
| 3. | Medium level (1/20) | 3.81±0.22 | 3.35±0.41 | 3.19±0.23 |
| 4. | Higher level (1/10) | 1.76±0.41 | 2.16±0.57 | 2.02±0.71 |

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**Table. 3. Total level of hemoglobin from the blood samples of *A. testudineus* treated to different sublethal concentrations of Chlorpyrifos in different days of treatment in (%)**

| S. No | Different groups of *A. testudineus* with various sublethal concentrations of Chlorpyrifos | 10 days of exposure | 20 days of exposure | 30 days of exposure |
|---|---|---|---|---|
| 1. | Control | 10.63±0.14 | 10.91±0.13 | 10.89±0.18 |
| 2. | Lower level (1/30) | 8.95±0.32 | 9.52±0.34 | 9.13±0.32 |
| 3. | Medium level (1/20) | 8.66±0.59 | 9.01±0.19 | 8.72±0.41 |
| 4. | Higher level (1/10) | 7.98±0.29 | 8.21±0.35 | 8.02±0.56 |
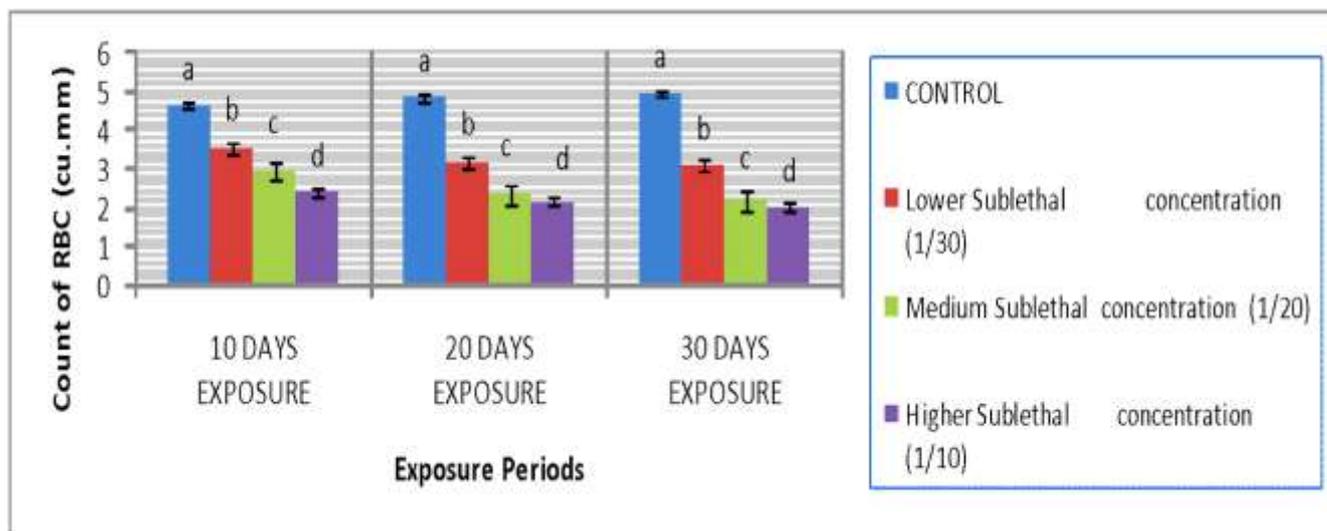


**Fig. 5. Total RBC count from the blood samples of *A. testudineus* treated to various sublethal concentrations - Chlorpyrifos on different days of exposure in (cu.mm)**



**Fig. 6. Total WBC count from the blood samples of *A. testudineus* treated to various sublethal concentrations - Chlorpyrifos on different days of exposure in (cu.mm)**

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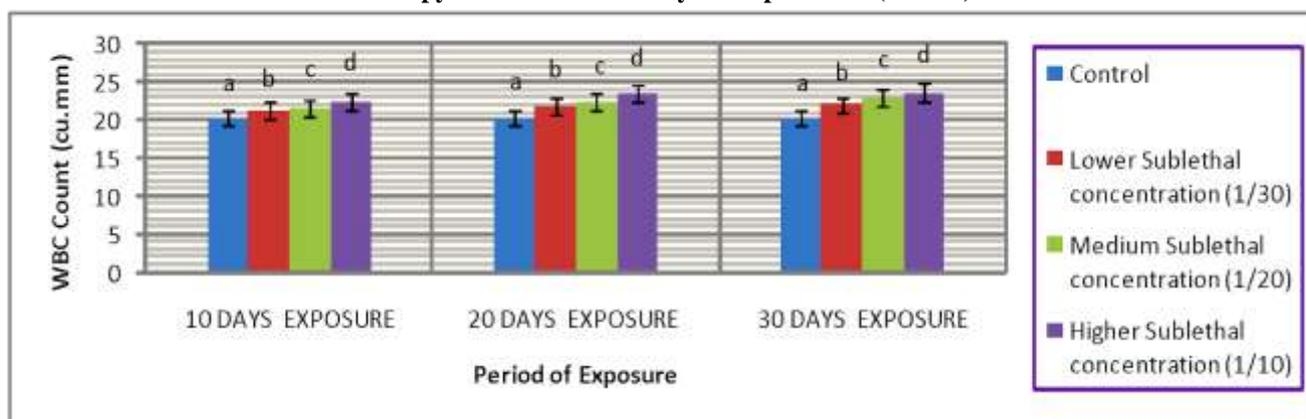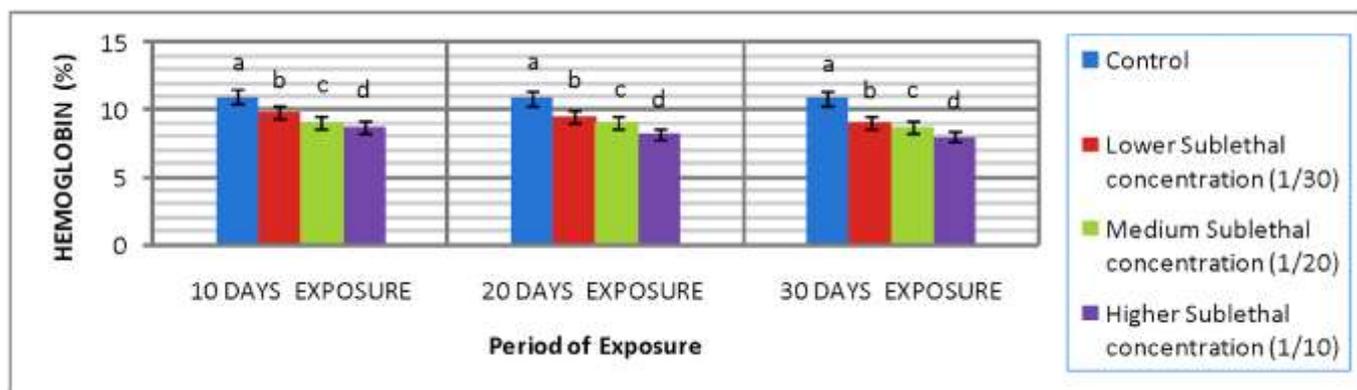


**Fig. 7. Total level of hemoglobin from the blood samples of *A. testudineus* treated to different sublethal concentrations - Chlorpyrifos in different days of treatment in (%)**

## Discussion

Hematological tests have evolved into an important diagnostic tool. Changes in water features and atmosphere affect the blood components of fish. In the current research work, RBC was drastically reduced in Chlorpyrifos-treated fish *A. testudineus* at various sublethal concentrations (1/10th, 1/20th, and 1/30th). Reduced RBC levels have been observed in pesticide-exposed fish, which causes Erythropoietic tissue damage[18]. Bashmohideen and Reddy[19] discovered a decrease in RBC subsequent to 48 hours of cypermethrin action in the fish *Cyprinus carpio*. Cazenave et al.,[20] have reported similar findings. Significant reduction in RBC count in treated fish, resulting in anemia due to inhibition of haemosynthesis, erythrocyte destruction, and erythropoiesis.

Adedeji *et al*.,[21] reported a reduction in RBC in Cypermethrin-exposed *Labeo rohita* and African catfish, *C. gariepinus* treated with diazinone. RBC reduction after insecticide exposure indicates haemorrhage and hemolysis in fish. Variation in RBC count indicates a nonfunctioning haemopoietic nonfunctioning of the haemopoietic system. Pesticide chlorpyrifos extends the poisonous cause on fishes, causing a decrease in RBC count in exposed fishes, as reported by Panigrahi[22] and Agarwal[23]. Freshwater fresh water fish exhibit anemia after being exposed to sublethal doses of lead.[24]. In the current study, the decreased level of Hb observed in Chlorpyrifos-exposed fish *A. testudineus* at various sublethal concentrations (1/10th, 1/20th, and 1/30th) for various durations (10 to 30 days) might be due to improved obliteration and less production of haemoglobin due to the poisonous cause of Chlorpyrifos. Adhikari *et al*.,[25] found a considerable decline in Hb and RBC levels. The reduction in hemoglobin content of exposed fish may signify a decrease in Hb combination as well as a decline in oxygen transport capacity. Ramaswamy *et al*.,[26] observed noteworthy hemoglobin decline and condensed RBC levels in the blood of freshwater fish *S. mossambicus* treated with dimecron insect repellent. WBC levels increased in Chlorpyrifos-treated A. testudineus fish for 30 days.

The value of leucocytes Increased as a result of the stimulation of hemopoietic tissues. Germysz[27] stated that a decrease in hemoglobin in Japanese quail RBC level was caused by an organophosphorus insecticide. Hemoglobin levels in Coho salmon exposed to pulp mill effluent were also reduced[28]. The current experiment's hemoglobin reduction is supported by a toxic study on *Cyprinus carpio*[29]. In the current research, the overall WBC level of the Chlorpyrifos-exposed fish *A. testudineus* increased significantly at various sublethal applications during one month periods. Venkataraman *et al*.,[30] observed similar results. WBC Increase WBC level has been thought to be an animal adjustment to demanding circumstances. The WBC count of Channa punctatus decreased significantly after exposure to various sublethal ammonia concentrations[31]. Dabrowaska and Wlasow[32] discovered a decrease in the level of WBC counts in Cyprinus carpio. Hickely[33] discovered that Leucopenia has an exact reaction to poisonous strains associated with fish behaviors. The current research clearly shows that insect killer strain accelerates the production of WBC during the treatment period. The current research work concluded that Chlorpyrifos causes blood parameters changes in the blood hemoglobin; WBC and RBC of freshwater fish *Anabas testudineus* depending on pesticide toxicity, amount reaction, and contact duration of the fish.

## Conclusion

The hematological changes observed in the current experiment of fresh water fish *Anabas testudineus* on treatment to chlorpyrifos toxicity, in the various blood parameters show decreased RBC's count, decreased haemoglobin level, and enhanced WBC count, implying that treated fishes developed a defense activity to overcome the stress of Chlorpyrifos toxicity. These changes could be affecting the survival of the fish Anabas testudineus. The current study concluded that using chlorpyrifos above the safe level disrupts blood parameters and may decrease the continued existence capacity of the fresh water fish *Anabas testudineus*. The current research work results raise alertness about the protected use of Chlorpyrifos in agriculture. As a result, the employ of Chlorpyrifos, which is lawfully prohibited in India, can be acceptable. It has been demonstrated by a number of researchers and confirmed in the current study that the application of this Chlorpyrifos causes severe injure to the blood parameters of *Anabas testudineus*. To prevent pesticide pollution, the use of chlorpyrifos in agricultural fields near fresh water bodies such as lakes and ponds should be reduced.

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**Acute Toxicity of Chlorpyrifos on Various Blood Parameters in Climbing Perch,** *Anabas testudineus* **(Bloch, 1792)**

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Acute Toxicity of Chlorpyrifos on Various Blood Parameters in Climbing Perch, *Anabas testudineus* (Bloch, 1792)

# Bioprospecting of Pest Control Agents from Plants

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**Abstract**

**Chemical insecticides are available in the market for managing insect pests. Nevertheless, careless application of such chemicals hasn't just harmed mammals and other beneficial organisms in the ecosystem & natural surroundings. Thus, using phytochemicals is a viable option for reducing the impact of insect pests without harming the environment. Compared to man-made pesticides, phytochemicals are significantly safer for humans & environment & may be just as effective in preventing the spread of the pest. The pest takes substantially longer to build resistance to phytochemicals due to the complexity of their component composition. Plants have natural defensive mechanisms, which may be used in pesticides. This has led to the development of plant-based pesticides that can effectively and safely reduce insect populations. Thus, we advise using plant-based insecticides to curb insect populations & boost agricultural output. Hence, this review article focused to discuss about the definition, classification, significance and application of plant based pesticides. In addition, this review article suggests using plant-based pesticides instead of synthetic pesticides to combat insect pests, sustain crops, & address potential food shortages, all while protecting environment & people's as well as animals' health.**

*Keywords:* **Bioprospecting, pest control, chemical pesticides, phytochemical, environmental protection**

## INTRODUCTION

India stands second in the world population with about 1.04 billion people. Population constantly increases day by day. At this rate it is expected that Indian population may reach around 1.5 billion by the end of 2030. This increased population will require about 240 million tonnes of grain per year. In order to produce such an enormous amount of food grain, India would require extra land for cultivation which is beyond our scope as it would surely cause ecological disturbances. The only current alternative is to improve the existing crop varieties to yield more. Green revolution in 1960s and '70s contributed to an increase in food production by improving crop varieties and cultivation practices. Therefore, crop production must be increased (Pathak et al., 2018). Several industrialized nations now use about 3,000 g/ha of pesticides annually. Since synthetic pesticides are so crucial to pest control in India, their misuse poses a threat to human & ecosystems. Deterioration of soil fertility, increase of alkalinity, pest - resistant, a rise in hazardous leftovers across food chain & an increase in health issues are only some of impacts caused due to the application of chemical pesticides. Chemical pesticide has negatively impacted on environment despite its positive effects on crop output. As a result, it's essential to implement different strategies to overcome the impact of chemical pesticides. Hence,

researchers found an alternative way through biological control of insects, such as biopesticides & nano-formulations. These eco-friendly and cost-effective bio-control methods may offer long-term solutions to these problems (Gonçalves, 2021).

### What is Pesticide?

They are protecting plants against pests, weeds, illnesses, and people from vector-borne diseases including malaria, dengue fever, & schistosomiasis. Pesticides are compounds or mixes of substances often employed in agricultural & public health protection programs. A few examples include pesticides, fumigants, herbicides, rodenticides, & growth regulators for plants. In addition to their usage in agriculture, these products have a wide variety of non-agricultural applications, including as creation & upkeep of public urban green spaces and sports grounds. Moreover, those chemicals have other, less well-known uses, including pet shampoo, construction materials, & boat bottoms, all aiming to reduce or eliminate the presence of pests. (Van Oosten et al., 2017).

### Synthetic Pesticides & ists Deleterious Effects

Agricultural systems are impacted when using synthetic pesticides for the management of weeds & insect pests. In 1952, India began producing benzene hexachloride and DDT as synthetic insecticides. With an annual output of 92,000 tonnes, India is among Asia's leading producers of pesticides & ranks 12th in the world in this sector. Organochlorine insecticides, such as DDT & HCH, were formerly widely utilized and exported from India. Organochlorines, organophosphates, carbamates, pyrethroids, triazines & neonicotinoids are major classes into which synthetic pesticides fall. (Nicolopoulou-Stamati et al., 2016).

### Organochlorine pesticide

DDT (Dichloro Diphenyl Trichloroethane) is most well-known organochlorine pesticide, but its unchecked usage has led to serious problems for both humans & environment. Other organochlorines used as insecticides include dieldrin, endosulfan, heptachlor, dicofol and methoxychlor. Health problems include endocrine disruption, altered embryonic development, altered lipid metabolism, and abnormalities to liver & blood have all been linked to exposure to organochlorine pesticides.

### Organophosphate pesticide

Malathion, parathion, & dimethoate are all examples of pesticides that belong to this group; some of these chemicals are known to affect endocrine system. Impacts upon functioning of cholinesterase enzymes, reduced insulin secretion, interference with normal cellular protein metabolism, carbohydrates, & fats, genotoxic

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impacts, as well as impacts upon mitochondrial function have all been linked to this class of pesticides, which in turn causes cellular oxidative stress as well as issues in endocrine and nervous systems. (Kalafati et al., 2018).

## Carbamate pesticide

Pesticides of carbamate, including aldicarb, carbofuran, & ziram, have also been linked with endocrine-disrupting activities, potential reproductive problems, impacts upon cellular metabolic pathways & mitochondrial function. Furthermore, in vitro investigations show that exposure with carbamate pesticides may lead to cytotoxic & genotoxic impacts in hamster ovarian cells as well as produce apoptosis, necrosis of human immune cells, natural killer cells, & apoptosis in T lymphocytes. (Kalliora et al., 2002).

## Pyrethroid pesticide

The important pyrethroid class pesticides like fenvalerate, permethrin, & sumithrin, are thought to be some of least harmful options for use in agriculture, though, that pyrethroid class pesticides may exhibit endocrine-disrupting action & influence reproduction parameters into experimental animals. Disruption to human sperm DNA caused by a pyrethroid metabolite raises worries about compound's potential impact upon human reproductive health. (Chang et al., 2003).

## Neonicotinoid pesticide

Neonicotinoid pesticides, which include imidacloprid, thiacloprid, & guadipyr are newer insecticides which were marketed as being safe for use with non-target creatures. Neonicotinoid pesticides exhibited the possible impacts on endocrine & reproductive parts of the experimental animals. Moreover, a recent research showed that neonicotinoids may raise the transcription of enzyme aromatase, that is involved in the development of breast cancer (Ruiu, 2018).

## Bioprospecting of Pesticides

Conventional agricultural practices are called into question when large quantities of synthetic pesticides are used, that leads to overreliance upon non-renewable resources. Pesticide and its residues entered food, soil and water and cause hazards for farm employees managing pesticides. Despite their beneficial effects on crop output, synthetic pesticides pose serious threats to surrounding ecosystem. Hence, these chemical substances must be applied with utmost precautions. Precautions must be observed during pre- and post-application so that the plants completely utilize the applied dose. The left over residue of these chemicals lead to water pollution. They destroy the fertility of soil, if used continuously at a place, because the organic matter in the soil is not replenished. Moreover, the microorganisms present in the soil get harmed by constant use of synthetic pesticides. Hence, it's important to find out the new ways for pest management practice. (Gurr et al., 1999).

Many researchers focused to formulate a viable substitutes for synthetic pesticides to mitigate insect infestation and increase the crop yields. Plants are often regarded as our best option for finding solutions to this issue, since they create incredible chemicals to adopt with difficulties caused by nature & climate. In order to combat agricultural pests & illnesses, scientists have turned to biopesticides, which are naturally occurring substances or agents that come from animal, plants, & microorganisms including bacteria, cyanobacteria, & microalgae. Biopesticides are "made from natural resources including animals, plants, microbes, and certain minerals. These bio-control agents' byproducts, such genes or metabolites, may be employed to protect crops against harmful insects. Using biopesticides is an excellent way to enhance efficacy of agrochemicals in protecting crops against invaders and pathogens. Hence, the production and application of biopesticides are inevitable and supports the sustainable agriculture practices (Magierowicz et al., 2020).

## Types of Biopesticides

Biopesticides may be categorized based on source, molecules, compounds & methods of extraction. (Ali et al., 2017). A few types of biopesticides are given below:

- Microbial pesticides
- GMO products
- Biochemical pesticides
  o Insect pheromones
  o Plant extracts/oils

## Microbial pesticides

They come of several kinds of microbes like bacteria, fungus, & viruses. Entomopathogenic nematodes and other pest species are vulnerable to active molecules/compounds extracted from such organisms. Examples: Bacillus thuringiensis, Pseudomonas, Yersinia, Chromobacterium, Beauveria, Metarhizium, Verticillium, Lecanicillium, Hirsutella, Paecilomyces etc. Microbial pesticides are safe to mammals, environment, and nontarget organisms (Halder et al., 2013).

## GMO products

Genetically engineered organisms are used in production of such pesticides (GMOs). Plant-incorporated protectants (PIPs) are pesticides made using genetic material inserted in plant. When genetically modified (GM) crops carrying transgenes from Bacillus thuringiensis can resist against a few insect pests which infect cotton. (Tripathi et al., 2009).

## Biochemical pesticides

Chemical pesticides employ synthesized compounds that kill bugs, while biochemical pesticides utilize naturally occurring products that control pests via harmless method. The effectiveness of biochemical pesticides in reducing insect populations may be categorized into (i) insect pheromones and (ii) plant extracts/oils. (Parker et al., 2019).

## Insect pheromones

In Integrated Pest Management (IPM) programs, pheromone is used to control insects by emulating the compounds that insects naturally release to attract and maintain a mate. It has been shown that such compounds may effectively interrupt insect mating to reduce amount of offspring produced. Insects are utilized as pheromone

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dispensers, however their signals are muddled when pheromone flumes are released into the environment. Pheromones don't kill insects, but rather change their behavior through olfactory system, hence they cannot be considered "insecticides". (Svidritskiy et al., 2013).

### Plant extracts/oils

Natural insect repellents made from plant oils & extracts of plants are gaining popularity as viable substitutes for synthetic pesticides. Such insecticides, which include a wide variety of bioactive compounds & originate from plants are considered natural insecticides. Plant extracts & essential oils (EOs) have a broad spectrum of actions against insects, based upon physiological traits of insect species & type of plant. For example, they could indeed behave as repellents, inducers, antifeedants, & they could also inhibit respiration, impede recognition of host plants through insects, impede oviposition, & reduce adult occurrence through ovicidal as well as larvicidal effects. (Parker et al., 2019).

### Pesticidal Activities of Some Plant Species

Plants have been used as insecticides for a very long time. Indians hav been using neem leaves for hundreds of years to protect their homes from pests. These leaves have been put in home, grain storage areas and closets. (Schuwirth et al., 2006).

### Citrullus colocynthis

Larvicidal activities against early fourth instar larvae of Aedes aegypti & Culex quinquefasciatus by the methanolic extract of C. colocynthis studied by many scientist. The ovicidal effects against Culex quinquefasciatus have been shown in tests using extracts of Citrullus colocynthis leaves. In tests, larvicidal characteristics of seed extracts were shown to be effective against Culex quinquefasciatus, Anopheles stephensi & Aedes aegypti larvae in their third instar. (Duan et al., 2016).

### Laurus nobilis

The aphid-killing properties of pure Laurus nobilis essential oil have been shown against the insect, Brevicoryne brassicae. The essential oil from leaves has also been demonstrated to be poisonous like a fumigant against all growth phases of Tribolium confusum as well as having repelling properties against Tribolium custaneum & Rhyzopertha dominica. (Dhaliwal et al., 2004).

### Madhuca latifolia

Madhuca latifolia is a member of the Sapotaceae family. Both the seeds and the bark of this plants may effectively kill pests. Saponins, triterpenoids, steroids, flavonoids, glycosides, & phenolic & terpene acids are all present. Cystine, glycine, isoleucine, leucine; saponin, quercetin, linoleic & oleic acid are all found in the bark of the mahua tree. The phyto compound like saponin's from this plant functions as an anti-feedant for some insect pests. (Pavela et al., 2016).

### Ocimum basilicum

There is evidence that essential oil from Ocimum basilicum plant may kill insects like, Acyrthosiphon pisum, Myzus persicae, & Musca domestica.

### Pachyrhizus erosus

Tuberous legumes and Pachyrhizus erosus (yam bean), are members of Fabaceae family. In addition to its potential use as a medicine, the plant is well-known for its pest-control abilities. Most bug larvae are killed by eating yam bean leaves. (Isman, 2006).

### Pongamia glabra

Pongamia glabra oil is converted into a pesticide in form of nano-emulsion in order to ward off Tribolium castaneum second pest of storage grains. The aqueous filtrate prpeared from solid cake of P. glabra exhibited insecticidal properties. (Dhaliwal et al., 2004).

### Strychnos nuxvomica

Strychnos nuxvomica is belongs to Annonaceae. The pest fighting qualities of this plant are in its seed. Seeds have around 1.5% strychnine & dried flowers have about 1.0%. Strychnine, a common insecticide (Asase et al., 2005).

### Terminalia arjuna

Terminalia arjuna is a member of Combretaceae family. The pesticidal capabilities of plants are most often found in their bark. Bark of Terminalia arjuna has three primary elements namely arjunic acid, arjunetin & arjugenin and these exhibited the antifeedant activities (Isman, 2006).

### Pesticidal Properties of Phytochemical Extracts

Many plant extracts have been examined to be utilized for plant protection due to their putative ecofriendly qualities and this evaluation has been going on for some years now, focusing on their activities towards agriculturally essential pests. Also, several such extracts have been shown to be effective in recent research. As a result of this, there is now a greater push to investigate plant biodiversity for additional sources of bioactive phytochemicals & extractives that might be employed as pest management (Arena et al., 1995).

### Isobutylamides

Several unsaturated isobutylamides with a wide variety of insecticidal activities have been discovered from Piper (Piperaceae) plant species. Piper nigrum, Piper acutisleginum, & Piper thomsonii are only few of the species from which these chemicals have been identified. (Benelli, 2015).

### Limonoids and Quassinoids

Triterpenoid precursor euphol is used to produce two main classes of metabolically mutated triterpenes, limonoids & quassinoids. These chemicals are found only in Rutaceae, Meliaceae, Cneoraceae, Simaroubaceae & Burseraceae families. Similar insecticidal effects may be found in both classes of chemicals. (Pavela et al., 2009).

### Napthoquinones

Tabebuia serratifolia wood extract is known to contain naphthoquinones,which have antifungal properties & have been demonstrated to be very effective against Aedes aegypti larvae. (Sidhu et al., 2003).

### Rocaglamides

The plant genus Aglaia has an abundant of phyto-chemicals. These chemicals are remarkable for being efficient against

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many types of resilient insects, such as B-biotype of tobacco whitefly, B. tabaci that causes widespread damage to crops all across globe. (Mkenda et al., 2015).

**Future Outlook**

Since we depend highly on agriculture for our food and other daily needs. We are in the need of producing high yield from agriculture practices. Hence, producing fertilizers, pesticides etc., is inevitable for good agriculture practices with high yields. Synthetic chemicals supports the agriculture productivity at the same time it damage the ecosystem. The necessity to develop ecofriendly alternative chemicals for agriculture is inevitable and need of an hour. There four main approaches should be practiced carefully before formulating nature based chemicals, they are: organize the natural resource, adopting standardization, modifying regulatory restraints etc. Industrialist & researchers facing four important obstacles during biopesticides discovery, productions, formulations and marketing. The important obstacles are botanical resource maintenance, extracts standardization, regulatory approval and IPR procedures. Once these obstacles are mitigated, it may pave the way for huge production of organic biopesticides (Schorderet et al., 2019).

**Conclusion**

The popularity of organic foods has increased due to the growing health awareness among Indian population. This points to enormous room for development in bio-pesticides industry. India's vast and varied indigenous populations house a wealth of untapped traditional wisdom that might provide important insights for improving biopesticide. The use of biopesticides by farmers is warranted by trend toward organic farming & need for residue-free products.

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# Effect of piperidine on ultra-morphological changes in the fat body of adult male *Odontopus varicornis* (Heteroptera: Pyrrchocoridae)

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**Abstract**
**The male insect's reproductive organs can be visibly impacted by chemicals, leading to induced sterility. This sterility may be caused by a complete halt in the production of sperm, which results in a loss of fertility due to dominant lethal characteristics. Insecticides that disrupt nervous systems or hormonal balance can disturb insect behavior and physiology without causing direct fatality. Consequently, this can affect the insect's ability to reproduce using several elements. Although these effects could be significant in the field, they have been researched to a lesser extent than immediate lethality. Piperidine structure unit is found in many natural alkaloids, including piperine, giving a spicy taste to black pepper. Observe 24-hour mortality up to 96 hours, and lethal doses were found to be approximately 0.15% at 48 hours. Fat bodies showed significant variations in scanning electron microscopy (SEM), like shrinking wrinkled membranes with very small pinocytotic pores.**
**Keywords: *Odontopus varicornis*, SEM, fat body, piperidine**

## Introduction

Insecticides are applied to compounds for their repellent, attractant, and bactericidal effects on insects. Toxins interfere with the regular functioning of certain tissues & cells in insects, as is known in humans and other higher animals. Essentially, the chemical processes of an animal are affected to effect deviations in its functions. Such changes are sometimes misunderstood as the poison's primary effect on the body. (Vasantharaj David & Kumaraswami, 1982). Pests, particularly in developing countries severely hamper crop productivity. Problems regarding health risks, pollution of the environment, & bad effects on non-target creatures have led to a rise in the use of natural plant extracts as substitutes for synthetic pesticides. (Sharma *et al*., 2006).

While there has been a rise in the number of plant derivatives with biological activity for pest management, only a select handful have shown promise as botanical insecticides. The development of plant-based treatments has been hampered by chemical unpredictability, regulatory barriers & lack of new synthetic chemicals that are inexpensive & reasonably innocuous compared with traditional pesticides. Although these pesticides are most effective when used on organic crops, they are nonetheless useful for protecting food in developing nations. (Isman, 2006). Herbal pesticides are preferable to synthetic insecticides since they are safer for both human health & environment. (Moreira *et al.,* 2007).

The fat bodies of insects are organized differently depending on their order. (Keeley, 1978). Insects' fat bodies are organized into layers, sheets, or strings to maximize fat's interaction with hemolymph. Cells may be seen in the blood cavity as either tight clusters or more dispersed groups; they are covered with a thin basement membrane. (Chapman, 1969). Scanning electron microscopy (SEM) showed that young larval fat bodies consisted of multiple intricate bands of cells. As observed in Ecdyonurus venosus, they change in flat leaflets in adult larvae. We observed a continuous basal membrane covering adipose tissue, which serves to anchor cells in place. (Elda Gaino and Massimo Mazzini, 1986). There is one layer of fat among the epidermis & digestive tract, & fat cells there tend to aggregate into clumps. (Zara and Caetano, 2001). As observed by Zara and Caetano (2001), the plasma membrane of adipocytes may be broken down to expose several vesicles containing amorphous components. According to morphological research, there are cytoplasmic connections in fat body cells of mature Pachycondyla villosa males & females. (Zara & Caetano, 2004).

It has been discovered that an adult insect's fatty body comprises nutrient-delivering cells, a rough membrane resembling a web, and many pinocytotic pits. Among the most noticeable aspects of a stocky body is an abundance of protrusions that dot its exterior. (Nirajana devi *et al*., 2009). Reproductive physiology alterations in *Gryllotalpa africana* were observed after exposure to endosulfan, as shown by SEM of insect fat body, which revealed a narrower wrinkled membrane with tiny pinocytotic holes. (Sumathi, 2002). When *Orechromis mossambicus* was subjected to dichlorvous, Verma & Raj (2000) also found similar outcomes.

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SEM analysis reveals that treated insects' fat bodies differ from those of untreated insects in a number of ways, including the presence of constricted, wrinkled membranes with tiny pinocytotic pits. The mean fatal dosage of piperidine applied to *Odontopus varicornis* might be to blame for such alterations. Energy dispersive spectroscopy & SEM were used to examine lipids' surfaces and learn more about their characteristics. Elemental makeup of fat body of mature male insect, *Odontopus varicornis*, may be better understood with use of this technique.

## Materials and methods

The adult male *Odontopus varicornis* insects were collected from Annamalai University campus, the researchers brought them in lab and put them in 45 x 32 x 30 cm wooden cages. The wire mesh used in construction of bug cage's walls allows light and air to circulate freely and makes for better viewing. Fine sand was used to line bottom of enclosure & was mildly wet with water every day to keep humidity level constant. Cotton (*Bombax ceiba*) seeds and those of his host plants, *Stericulia foetida & Gossypium sp.*, were soaked in water and given to the insects every day. *Sechium edula* (Chow Chow) fragments have been employed as well to supplement diet of these insects. The insect population exploded as a result. Every morning, bug cages were scrubbed clear of day's accumulation of waste and other detritus. To ensure the continual culture, eggs they deposited were moved to separate cages.

### Range finding test

Solutions are prepared in a wide range of concentrations. The test is performed on adult insects by injecting each insect with 0.025 mL using a 2.6 gauge syringe needle. Place 10 treated insects in smaller insect cages (29×25×11 cm) & observe 24 h mortality up to 96 h. Observed results from exploratory trials indicated a range of pesticide concentrations.

### Scanning electron microscopic study

Anesthetized specimens had their fat bodies removed and were preserved in Karnowski's solution (2% paraformaldehyde and 2.5 glutaraldehyde in 0.2 M sodium solution) (cacodylate buffer) before being scanned by SEM. After that, tissues were dehydrated in a 1:1 mixture of 70% ethanol & 100% acetone, then washed four times in 100% acetone. The samples were dried, then gold-coated aluminum stubs were used for further examination and imaging under a Joel JSM-P15 SEM. (Wood Ward, 1972).

## Results

Scanning electron microscopy (SEM) showed that the fat body of control insects was made up of variations, whereas SEM analysis of the fat body of Odontopus varicornis revealed that it was made up of numerous complicated cellular bands. The multiple bulges on the fat body's exterior were the most noticeable characteristic. (Figs.1 & 2).

Although cytoplasmic connections were not detected, a tight connection could be seen amongst those cells. Although amorphous substances are seen through vesicle's plasma membrane. The membranes of these vesicles have a distinctive wavelike shape. There are several glomeruli & secretory vesicles in tubular lumen, all of which secrete fluid. (Figs. 3 & 4).

Scanning electron micrographs of fat bodies treated with Piperidine (Phytopesticide) revealed significant impacts, including a reduced ruffled membrane with tiny pinocytotic pits. The projections were observed to be diminished around cells' centers. Pinocytotic pits appear to have lost their outer membrane. (Figs. 5 & 6). Even the secretory globules broke down. Disorganization of tiny blebs linked to cytoplasmic invaginations suggested that the insects used fewer storage compounds to prevent stress following Piperidine intoxication.

## Discussion

In current research, SEM-specific changes were observed in treated inserts compared to control insects, such as narrowed wrinkled membranes with small pinocytotic pores. Such alterations could be ascribed in treatment by mean lethal concentration of the botanical insecticide Piperidine on Odontopus varicornis. Similar findings were also reported by Sumathi (2002) for *Gryllotalpa africana.* Niranjana Devi (2007), reported that the fat body has been observed as highly pyogenic, relatively shrinking, & excretory apical cell granules were decomposed & disorganized when cockroaches were treated. Treatment with botanical insecticides, yellow of the neem gold. In addition, disorganized cytoplasmic monitoring has been shown to indicate that insects likely use less storage to avoid stress during piperidine intoxication.

### Conclusion

The results of this study indicate that a biologically active piperidine compound, such as organic compounds extracted from a plant, is called a pesticide. This pesticide, which affects all reproductive tissues and stimulates the functional activity of reproductive organs, induces ultra-structural changes in various ways that attack the severe cotton pest, *Odontopus variants*. This compound can be recommended to farmers to eradicate different pests from agricultural land for sustainability and reduce pollution problems due to synthetic pesticides under IPM (Integrated Pest Management). This organic compound can be recommended for pest control.

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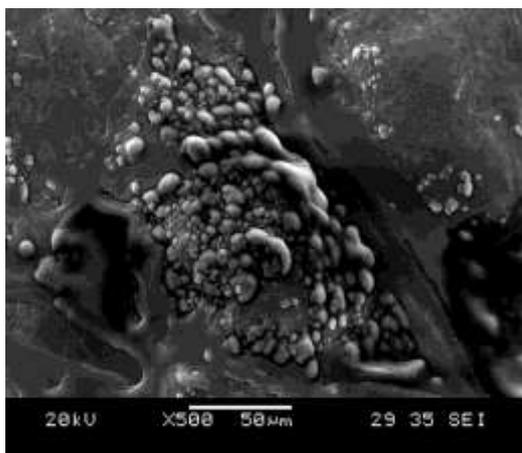
Fig .1 Scanning electron micrograph showing the fat body of the control insect
SG – Secretory globules X 500
SS – Secretory substances
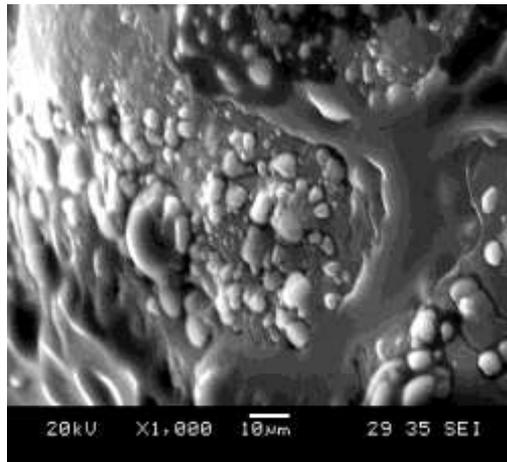
Fig.2.Scanning electron micrograph showing the fat body of the control insect
SPM -Shrunken pinocytotic pits   X 1000
SRM -Shrunken ruffled membrane
A -Amorphous materials
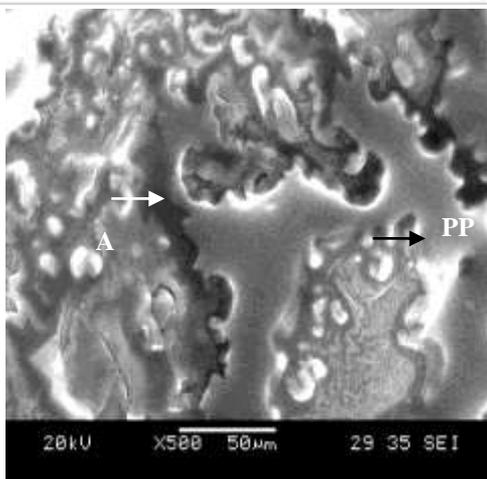
Fig.3.Scanning electron micrograph showing the fat body of the control insect
A –Amorphous materials   X 500
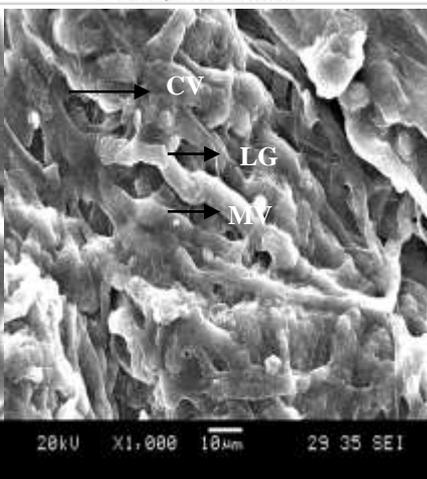
Fig.4.   Scanning electron micrograph showing the fat body of the control insect
CV -Cytoplasmic vesicle   X 1000
MV -Microvilli
LG -Lipid globules
PP – Pinocytotic pits
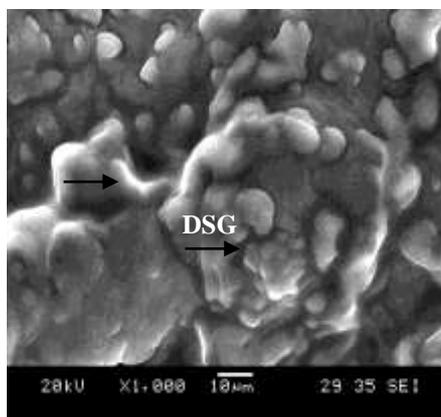
Fig. 5. Scanning electron micrograph showing the fat body of the treated insect
DSG -Disintegrated secretory globules   X 500
DSV -Disintegrated secretory vesicles
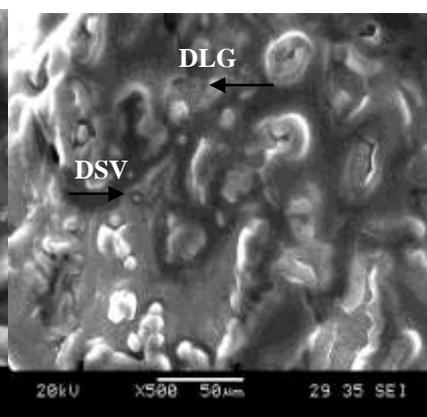
Fig.6.   Scanning electron micrograph showing the fat body of the treated insect
DLG -Disintegrated lipid globules X 1000
DSV -Disintegrated secretory vesicles

Note: The section referred to the Scanning electron micrographs in figures 1-6, are Kamovsky fixed.

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# A Deeper Meaning of Sustainable Tribal Knowledge in Biodiversity Conservation and Life in India

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**Abstract:**

Tribes are renowned in the nation for their close relationship with nature. The term "tribe" was not specified in the Indian constitution; it has been content to declare in Article 342 that the scheduled tribes are the tribes or tribal groups that the president can specify by public notice. It has been reported that tribal people in India live in forests, hills, plateaus, and naturally, isolated regions and are variously referred to as Adivasi (original settlers), Adam Niwasi (Oldest ethnological sector of the population), Adimjati (primitive caste), Aboriginal (indigenous), Girijan (hillsmen), Vanyajati (forest caste), Vanavasi (forest inhabitants), Janjati (folk community The most common of these words is Adivasi, and their constitutional name is AnusuchitJanjati (Scheduled Tribes). In India, some communities were considered as the world's most primitive human cultures, relying entirely on the forests for life and living in complete balance with nature. Onges, Jarawas, Sentinels, Kobo, and Shompens of the Andaman and Nicobar Islands are examples of indigenous peoples. The five tribes of Chhattisgarh, Abhujhmaria, Baiga, Pahari Korwa, Kamar, Birhors, Kani, Kurumba, Malayali, Irular, and Vadugar in Tamil Nadu, have been designated as primitive tribes by the Government of India. Studies show that some of these indigenous groups are on the brink of extinction. The real pioneers of the wealth of nature and experts in herbal medicine are ethnicities from different world regions. Despite the technical advances and changing communities of ethnic groups, conventional aboriginal wisdom transferred orally for decades is increasingly declining. As the steady decline of plant supplies contributes to environmental deterioration, individuals have begun to pay attention to their survival and sustainable usage. In olden times, for centuries, traditional wisdom has been passed down primarily through oral folklore, with a limited amount of information passed down through other means of preservation such as sign language on artifacts, rock art, archaeological traces, even, more recently, texts. Humans are now isolated from the benefits of plants in metropolitan regions, although citizens in tribal areas continue to rely heavily on them. But in the present scenario, this standard healing mastery is gradually diminishing, so for future generations, it must be procured and conserved in varied incarnations. There has recently been a need to understand the rational and social importance of traditional tribal expertise, and many researchers are interested in applied ethnobotany. This chapter argues that various Indian tribal groups and their associated information structures will contribute to the sustainable dialogue about biodiversity conservation. The focus is on the insights that aboriginal Knowledge can provide, on the principles that govern aboriginal relationships with nature, such as reciprocal recognition and care.

**Keywords: Tribes, biodiversity, medicinal plants, ethnobotany, drug.**

## 1. Introduction:

Around 100 million indigenous tribe's makeup India's communities. There are 705 Scheduled Castes and Tribes groups in India. (MOTA, GoI, 2018; Das, M.B et al. 2010; Government Census 2011). The main areas of tribal occupation are the countries of Burma and North-East China, as well as the highlands and plains of Peninsula India. In central India, the Scheduled Tribes were referred to as Adivasis or indigenous peoples. Many other indigenous groups were not legally recognized as Scheduled Tribes, which is creating concern. Racial groups worldwide are real keepers of Nature's bounty and have been recognized as real treasurers of natural medicines. Traditional native Knowledge has been passed down orally for several decades and is gradually fading due to technological advancements resulting in the culture of indigenous groups (Ganasen 2004). In India, tribal people were classified as Adivasi (original settlers), Vanyajati (forest caste), Aboriginal (indigenous), Girijan (hillsmen), Adimjati (primitive caste), Vanavasi (forest inhabitants), Adam Niwasi (The population's earliest ethnological subgroup), and Janjati (forest inhabitants). Adivasi is the most well-known of these terms, though Anusuchit Janjati (Scheduled Tribes) is the

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legislative term. Tribes or ethnic communities were well known across the globe, which have their very own cultures, traditions, social and religious status, folklore, folktales, legends, taboos, totems, poetry, rituals, and food and medicine theories. Trees and plants play a major role in tribe's life (Figure 1).
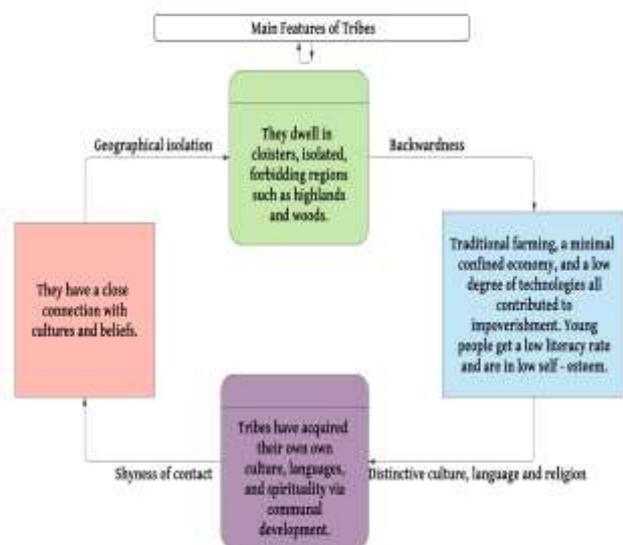


**Figure :1 Main Features of Tribes**

Most of the Indian tribes are believed to be the most primitive human societies, totally dependent on the forest for life and living in absolute harmony with nature. The Andaman and Nicobar Islands, Jarawas, Sentinels, Shompens, Onges, and Kobo are among these native populations. Abhujhmaria, Baiga, Kamar, Abhujhmaria, Birhors, the five tribes of Chhattisgarh, Abhujhmaria, Kani, Abhujhmaria, Kurumba, Malayali, Vadugar, and Irular of Tamil Nadu, have also been identified by the Indian Government. Tribal populations like these are on the edge of extinction. The Indian Constitution guarantees indigenous people equal rights under Article 466 (Suranjit K. Saha 1996). Native peoples have their history, worship ceremonies, eating habits, and a strong understanding of traditional medicine (Harsha 2003). Native phytocure methods have been maintained by the tribe as part of their culture in the midst of many of these challenges. Furthermore, these people are a little hesitant to change their way of living. However, in the present scenario, traditional Knowledge on medicinal plants is fading; it should be preserved and passed to next for generations (Burmol et al. 2007).

The states of Sikkim, Bihar, Uttar Pradesh, Assam, Kerala, West Bengal, Himachal Pradesh, and Bihar have the maximum tribal groups. Ethnic peoples' livelihoods dependent on how well they manage their ecosystem because their survival depends on it. These organizations have been designated as "true ecologists" because they take care of their land and habitat more than everyone else (Table: 1).

The tribes have similar traits and are far more homogeneous and self-contained than other non-tribal social groups, who were particularly given regional variations. As a result, inside tribal links and the relationship among tribes and the state, numerous inconsistencies (both visible and invisible) emerge. The conventional and widely accepted solution is to maintain tribal communities' rights and their relation to assimilation while defining the contours of a national policy that allows them to sustain their way of life without jeopardizing development.

**2. Tribes role in Indigenous Botanical knowledge (IBK):**

Tribal communities play a major role in preserving the biodiversity of a diverse range of natural forests and preserved various plants and animals in protected tribal groves, which would otherwise have perished from the natural ecosystem (Vartak, K.V.D, 1996). Indigenous intelligence and Knowledge about one's neighborhood obtained by indigenous communities that is exclusive to their ethnic community (Panghal, M 2010). Scientific investigation and recording of aboriginal information about plant products are critical strategies for gaining a better understanding of the cultural lifestyles of indigenous people (Gurib-Fakim, A2006). An orthodox herbal formulation based on indigenous wisdom is regarded as the world's oldest and greatest method of health treatment. They utilizes plant species as primary sources of medication and is also believe that they are major role in curing all ailments. Common plants with little harmful effects are a part of our everyday lives, and their toxic metabolites have a strong correlation with human health. Over centuries, traditional people have used toxic seeds, either refined or untreated, to cure diseases (Mukherjee, P.K. Wahile, A 2006, Sevugaperumal, G. 2004).

**2.1. Tribes Ethno botany and Traditional practices:**

Ethnobotany is the studying of the "interrelationships between flora and fauna, plants and humans, and plants and plants." Over the last few decades, ethnobotany has gained much importance as a study area focusing on supporting protection of Knowledge at the tribal level; historical cultural information has been used for resource management and biological diversity protection, ecology, habitat, forest form, and regional levels (Lewis, W.H,

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Elvin-Lewis, M.P 2003). Ethnobotanical material, on the other hand, has been established to the extent that different terms may be represented in different contexts. Indigenous Botanical Knowledge (IBK) and Indigenous Traditional Knowledge (ITK) are two terms that have been recently used to describe the material of ethnobiology (Figure 2).

Also, it is very evident that documenting information is absolutely essential in ethnobiology since; it offers evidence for subsequent research that could be motivated by metaphysical or primarily utilitarian concerns (Berlin. 1973, 1992). We can only appreciate the interaction between plants and human cultures through an interdisciplinary approach that incorporates botany, chemistry, anthropology, ecology, archaeology, psychology and pharmacology (Balick et al. 1996), Ethno-pharmacology has historically taken a utilitarian view, aiming to investigate experimentally and validate medical plant and bioactive natural medicines (Balick and Cox, 1996). Ethnopharmacology's extensive approach contextualizes nature and examines how plants are perceived, used, pharmacology, and physiology in human cultures (Etkin. 1988, 2005). Cultural anthropology stresses the influence of thinking and emotion on cultural behavior, while ethnobotany seeks to improve comprehension of both the reason for plant usage and the classification of the natural environment (Berlin, et al. 1992; Endicott et al. 2003). Ethnopharmacology is particularly pertinent when it comes to further evolving and testing indigenous pharmacopeias (Robineauet et al. 1996; Frei 1998a; Leonti2001). In either event, will the specificity of study goals for "ethno-pharmacologists of all backgrounds" be improved "by projecting pharmacologic evidence against a context of medical ethnography, as well as by extending information resource of medical practice by an exploration of plant physiologic potentials" (Etkin, 2001).
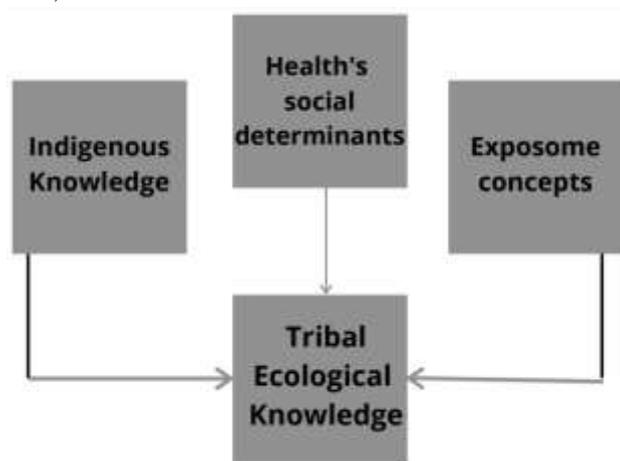


**Figure-2 Flow of Tribal Ecological Knowledge**

## 2.2. Tribes relationship with Flora protection:

Tribals had protected long list of flora through their indigenous practices that are available in practice for centuries, it happens through their regular interaction between them and the plants as follows

The tribals-plant interaction is classified into two categories, i.e. (a) Abstract relationship (b) Concrete relationship (Jain et al. 1989).

(a) **Abstract relationship:** It involves belief in the beneficial or harmful properties of plants, taboos, sacred plants, spirituality, and mythology. Plant-based similes and descriptions are used in folklore, as are fables or scriptures concerning, or references to, plants.

(b) **Concert relationship:** It involves material uses such as food, medicines, house construction, agricultural practices, other household activities, exchange, aesthetic drawings, carvings, house decoration, and domestication, as well as plant restoration, improvement, and degradation. All human-plant relationships are first classified as material, cultural, economic, and religious relationships and then further classified into four categories:

(a) Interactions beneficial for both humans and plants.

(b) Interactions beneficial to man and harmful to plants.

c) Plant-human relationships are beneficial to plants but detrimental to humans.

(d) Interactions safe to both humans and plants.

World's tribal and ethnic people have learned to survive under the most hostile natural conditions in the universe. The most interesting characteristic of both local and ethnic groups is that they mostly live in areas. This indigenous community has always played an important role in environmental protection as well as sustainability because they have cultural expertise that helped in eco-restoration. Moreover, people understand and practice how to function by nature. In India, there are 68 million inhabitants from 227 national groups and 573 tribal societies. These indigenous tribes have long protected and conserved the habitats of their communities. These tribes seek refuge in the forest and consume native plant species both raw and cooked. The flowers and fruits were usually consumed fresh, while the tubers, leaves, and seeds were fried. Tribal people make use of timber, and forest produce. These tribes have been living in the forest for a long time and have formed a special bond in protecting the flora prevailing there.

It has been observed that there are 45,000 species of wild plants, with 9,500 being viral of these 7,500 species, 7,500 are used medicinally in traditional health practices. Tribes consume approximately 3,900 plant species are consumed as food, 525 species has been used for fiber, 400 for fodder, 300 for the preparation and extraction of bioactive compounds used as natural sources of insecticides and

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pesticides, and 300 for the extraction of resins, gum, dyes, and perfume. Aside from these, numerous plant were used as timber and building materials, approximately 700 plant species are significant in terms of religious, cultural, aesthetic, moral, and social significance. The Indian subcontinent is one of twelve mega-centers of flora and fauna, indicating two of the eighteen hotspots of biodiversity, one in the North-Eastern Himalayas and the other in the Western Ghats. (Rajiv Rai 2012).Table -2

| S .No | STATE | REGION | TRIBAL COMMUNITIES | TOTAL POPULATION (in lakhs) | WORSHIPING GOD | WORK DONE TO CONSERVE FOREST |
|---|---|---|---|---|---|---|
| | | | | | | Table:1 List of Tribal Communities |
| 1 | Andaman and Nicobar Island | Andaman | Andamanese, Nicobarese,Onge,Jarawa,Shompen,Sentenalese | 3.81 | Sun | Herbal science and Traditional knowledgr of practitioners use leaf extract for Healthcare |
| 2 | Andhra Pradesh | Nallamala Forest | Chenchu,Yandai,Kurumba,Khond,Bagdaz | 493.87 | Sun | Roots of Aloevera as food during Famine |
| 3 | Arunachal pradesh | Central Region | Aptani,Mishmi,Daffla,Miri,Aka,Sinpho,Khamti etc. | 13.84 | Sun | Leaves of *Ageratum conyzoides*for blood clotting |
| 4 | Assam | South-Central Region of Asiatic descent | Chakma,Mikir,Kachari,Bora etc. | 312.06 | Goddess Tusu | Tea Gardan Community (Tea-Tribes) |
| 5 | Bihar | Jharkhand | Santhal,Oraon,Munda,Kharwar,Kharia,Bhumji,Ho | 1040.99 | Sun | *Leonotisnepetifolia*for curing skin Disease |
| 6 | Chandigarh | Border of Both States | Ad Dharmi,Bangali,Chanal,Darain,Dagi,Garga,Kori,Nat,Pasi,Sanhal | 10.55 | Hindu Goddess Chandi | Leaf paste of *Pyracanthacrenulata*is used for burns |
| 7 | Chhatisgarh | South of Kanker, Forested KeshkelGhat | Parja,Bhattra,Agaria, Bhil,Saharia,Kowra, Halba | 255.45 | Rain | Conserve Wild Fruits and Seeds |
| 8 | Dadra and Nagar Haveli | Silvassa | Dhodia,Dubla,Kathodi,Kokna,KoliDhor, Naikda,Varli | 3.44 | Sun and Moon | Regulated and Planned Cutting of Trees |
| 9 | Daman and Diu | Diu | Dubla,Dhodia,Varli, Naikda,Siddi | 1.58 | Sun | Protects Green Forests and Winding Rivers |
| 10 | Goa | Interior of Goa | Gowdas,Kunbis,Velips,Dhangars | 14.59 | Lord Shiva | Soil Conservation and Water Harvesting |
| 11 | Gujarat | Valasd,Surat,Dangs | Bavacha,Charan,Bharwad,DholiBhil,Vasava,Chaudhari | 604.4 | Tigar crocodile and Snake | Conserve Teak and Bamboo Widely |
| 12 | Haryana | Hisar,Bhiwani,Faridabad | Bazigar,Mirasi,Sikligar,Spera | 253.31 | Kali | Land Reclamation ans Soil Conservation |
| 13 | Himachelpradesh | Hamirpur,Kullu,Kangar, Spiti | Gaddi,Gujjar,Kinnar | 68.65 | Phoomi | protection of Forest by Reforestation and Afforestation |
| 14 | Jammu and kashmir | Doda,Ganderbal,Anantnag | Gaddi, Bakarwal | 125.41 | Sun | Conserve Forest Ecology |
| 15 | Jharkand | Kol,Savar,Oraon | Kharia,Oraon, Santhal, Munda Paharia, , Ho,Birhor, ,Tamaria | 329.88 | Peace | Thrown out Timber mafia and conserved forest |
| 16 | Karnataka | Chikmangalur,Udupi,Hassan | KoliDhor,Gond,Naikda,Marati | 610.95 | Ancestors | Adopted the policy of no harm to Flora and Fauna |
| 17 | Kerala | Malabar District,Malappuram,Hosedrug | Irula,Kurumba,Kadar ,Puliyan | 334.06 | Ancestors | Work to avoid Forest Fire |
| 18 | Ladakh | Leh,Kargil | Mon, Bot, Beda, Garra, Changpa | | Monasteries | Protect Land forms and wild fruits |
| 19 | Lakshadweep | laccadive,Minicoy,Amindivi | Andrott,Amini,Bitra, Minicoy,Kavaratti | 0.64 | Mandaps | Conserve the species of sponges and protect their Ecosystem |
| 20 | Madhya pradesh | Bhopal,Schore,Vidisha,Tikamgarh | Hill Maria, Muria, Dandami,Gond, Baiga | 726.27 | Lord Shiva | Guardians of Wildlife especially Tigers |
| 21 | Maharastra | Chandrapur,Hiangoli,Jalni | Bhil,Garasia,Kokni,Kawar,Pardhan | 1123.74 | Vishnu | Conserve their dense Forest ,protection of Bamboo |
| 22 | Manipur | Churachandur,Kangpokpi,Tamenglong,Thoubal | Kuki,Lepcha,Mugh | 28.56 | Sun | Conserve Wildlife |
| 23 | Meghalaya | Khasi Hills,JaintiaHills,Garo | Garo,Khasi,Janitia,Hamar | 29.67 | Nature | Conserve Forest by Sacred Grooves |

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| | | hills | | | | |
|---|---|---|---|---|---|---|
| 24 | Mizoram | Siaha,Lungeli,Aizawal | Mizo,Lakher | 10.97 | Sun | Conservation of Environment and Wildlife |
| 25 | Nagaland | Wokha,Phek,Mon,Kohima,Dimapur | Angami, konyak, Lotha | 19.79 | Natural World | Conservation of Nature and Protection of Forest |
| 26 | Odisha | Nabarangpur,Koraput,Gajapati,Kadhamal | Zuang, Sawara, Karia, Khond, Kandh | 419.74 | Animal and Nature | worship and protect Forest as God |
| 27 | Puducherry | Yanam, Karaikal | Adivasi | 12.48 | Sun | Protect Land and Water Resources |
| 28 | Punjab | Bhagat Singh Nagar,Sri Muktsar Sahib,Jalandhar,Moga | Gurjar,Jats,Labana, | 277.43 | Sun | Land Reclamation and Soil Conservation |
| 29 | Rajasthan | Banswara, Dungarpur, Chittorgarh | Bhil,Meena,Kathoria, Garasia | 685.48 | Sun,Lordn Shiva ,Vishnu | the Religious act of these community is to conserve forest |
| 30 | Sikkim | Gangtok,Mangan | Lepchas,Bhutias,Nepalese | 6.11 | Sun,Shiva | Preserve Nature through Tradition |
| 31 | Tamil Nadu | Nilgari, Pudukotti,Karur, Salam | Toda,Kota,Kurumba, Bagada | 721.47 | Birds,Animals ,Snakes,Rock Hillocks | conserve Ecology and Protect Forest |
| 32 | Telungana | Khammam, Warangal, Adilabad | Koya,Bagata,Gadaba | 351.94 | Snake and Tiger | Conserve Wildlife and Social Forestry |
| 33 | Tripura | Sipahijala,Khowai | Bhutia,Chakma,Garo, Kuki | 36.74 | Goddess Lakshmi | Conservation of Biodiversity by Cultural Heritage |
| 34 | Uttarakhand | Nainatal,Udham Singh Nagar,Uttarkashi | Raji ,Khasa, Bhuia, Kharwar, Manjhi | 100.86 | Lord Rama and Krishna | Conservation of Forest and Wildlife |
| 35 | Uttar pradesh | Agariya,Bhotia,Buksa,Chero | Tharu, Bhatia, Jaunsari, Bhoksha, Kol | 1998.12 | Sun | Conservation of Biodiversity by plantations |
| 36 | West Bengal | Hooghly,Bankur, Alipurduar | Asur,Bhumji, Birhor, Lodha, Lepcha, Mag, Mahali, Malpaharia, Polia | 912.76 | Sun | Conservation and Preservation of ForestResources |

| S.No | Botanical name of the flora | Family & Local Name | Region of the tribe where consumed |
|---|---|---|---|
| 1 | *Achyranthes Aspera* | Amarathaceae&Apamarg | Andhra Pradesh |
| 2 | *Basellarubra* | Basellacaeae & Poi | Uttar Pradesh |
| 3 | *Chenopodium album* | Chenopodiaceae & Chaulai | Uttar Pradesh & Madhya Pradesh |
| 4 | *Dipsacusinermis* | Caprifoliaceae&Wopal Haakh | Jammu and Kashmir |
| 5 | *Stellaria media* | Caryophyllaceae& Koku, Kokuwa | Himachal Pradesh, Jammu and Kashmir |
| 6 | *Malvaneglecta* | Malvaceae &Sonchal | Himachal Pradesh, Jammu and Kashmir |
| 7 | *Hydrocotyle Javanica* | Araliaceae & Manimuni | Assam |
| 8 | *Alangiumsalvifolium* | Alangiaceae | Uttar Pradesh & Andhra Pradesh |
| 9 | *Bauhinia purpurea* | Caesalpiniaceae | Madhya Pradesh |
| 10 | *Phoenix sylvestris* | Arecaceae | Madhya Pradesh & Andhra Pradesh |
| Table-2 Relationship with Flora of various Religion Tribes in India | | | |

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## 2.3. Ethnic and aboriginal peoples' role in flora conservation:

As per the Indian Ethno-biology Survey undertaken by the MoEF India, over 7,500 plant species can be used for human and veterinary health care which is protected and used by 4,635 ethnic communities throughout the country. 90% of flora and fauna are protected in their natural environment by tribes, owing to tribal beliefs, the habitats', they were considered as living God. The tribal cultures are widespread in the parts of Central India like Madhya Pradesh's Dindori, Mandala and Balaghat districts, and Chattisgarh's Bilaspur and Kawardha districts. Moreover, natural forests in Central, Peninsular India and North-East are known as holy groves. Many wild varieties of classical seed varieties of rice, fruits, millets, maize, legumes, beans, and vegetables have been conserved by indigenous people in the central, peninsular regions and north-east of India. These varieties are superior to currently cultivated rice varieties in characteristics such as scent, grain consistency, digestibility, protein content, and bug/ pest resistance and disease tolerance. 40 % of herbs and shrubs in the forest are used as anti-venom for scorpion- sting and snake bite by tribal herbal practitioners. Tribes use stem and leaves of Moringa *oleifera*, rhizomes of *Acorus calamus, Achyrnthus aspera, Gynandropsis gynandra* for fever, cough, for digestion. Stem bark of *B. lanzan* and *B. ceiba* are used as antidotes for scorpion stings and snake bite. Similarly, Rhizome paste is made and applied to wounded areas (Eliazer Nelson, et al 2014). Several endangered types of plants are prevented in their natural environment and used by native medicinal healers to set bone fractures and in orthopedic care. The paste made from the stems and leaves of plants such as *V. tessala* and *A.sessiles*, as well as the roots of *C. adnata, B. purpurea*, and *S. cordata*, is tied over the wound and allowed to heal for more than two weeks on broken bones. Tribal herbal healers preserve these plants in natural forests for orthopedic treatments. For several decades, primitive and tribal societies used several parts of the plants to treat illness, and these plants have gained widespread popularity in conventional medical usage. Plants such as *E. ramosissimum* and *A. maxicana* are processed, ground and applied as a paste to infested skin and wounds. Plants such as *Albizzi alebbeck, Sidaacuta, Bauhinia purpurea, Grewia hirsutum, Jatropha curcus*, and *Capparis deciduas* are protected since they are used to treat muscle discomfort, headache, fever, and body inflammation. Jhum cultivation performed by tribes in India's northeast and southern states is the best practices, they harvesting and shift the yielded crops and store in special vats/ pots or vessels made by special metals, which hold and preserve the grains for more than 20 decades. In abandoned areas, valuable plants such

as *Ardisia polycephala, Phoenisx, Meliosmaipata, Ardisiacripsa, Casearia glomerata* and *Rhus sp*. are planted. The indigenous tribes play a pivotal role in sustaining the biodiversity of many forest reserves and help in conserving many flora and fauna in tribal sacred groves. This flora and fauna would have perished from the natural ecosystem if they hadn't been saved, so maximum human contact with flora was carefully monitored in sacred groves (Zubair A. Malik, et al 2017). There are many reports of aboriginal groups acting as the greatest conservationists and defenders of the natural environment. Aerial imagery and academic analyses have shown that indigenous peoples maintain and process the soil in such a way that, they can be prevented against erosion (Arora R.K, 1991, 1991a, 1997).

### 2.4. Tribal Relationship with Fauna:

Animals were imbued with immense symbolic meaning in many Indigenous communities. The natural world taught man the following aspects

(i)   How to live close to the earth,

(ii)  Link that has been formed between the animals and man

(iii) Instilled the concept of practicing the conventional way healing

(iv)  Respect for all life which directly or indirectly benefit us (Bruchac, Margaret M. 2014).

Despite the interconnectedness of animals and humans, Aboriginal Peoples were vigilant as well as conscientious of the natural life cycles of the animals with which they shared the Earth; they made attempts not to overfish, overhunt, or overharvest. However they also hunted fished, and gathered everything they needed to feed their relatives, tribes, or clans, but not made the whole habitat to extinct. In any situation, if the animal were found dead due to ill-health, they follow subsequent ceremonies and practices and show their gratitude and respect towards them. Overharvesting has little impact on stock or species decline (Nasi, R., 2008).To ensure that humans and animals coexist comfortably, India's biodiversity conservationists need the intervention of tribal groups rather than symbolic advocacy from the metropolitan (Biplab De, 2010). Human-animal relationship is fundamental to most tribal value structures since it is providing sacred and mutual bond. Tribal lands provide a safe refuge for the most vulnerable native species and plants. Tribes have long maintained their lands and native habitat. Tribal folklore aids in the understanding and protection of different animal types. Their anti-hunting and anti-cow-killing legislation will assist in

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the survival of animal habitats in modern times (Philip Hunter (2007).For example, the Baiga tribe in India has launched their initiative to "save the forest from the forest department" outlining guidelines for both their people and visitors to follow and to conserve the forest and its biodiversity. Consequently, plant wealth has improved, and they have been able to harvest more herbs and medicines from the trees (Vikram Singh, 2018). Baiga do not hunt tigers; also on the alternative, they refer to the tiger as their little brother. Nonetheless, thousands of Baiga, like many other tribal populations in India, have been unlawfully and forcefully evicted from their ancestral homeland in the name of "tiger conservation"(Bijoy, C.R. 2010). The Monpa and Shertukpen tribes of Arunachal Pradesh have followed a tradition where they capture cattle, birds, and fish and release them in a safer place. Tsedar is the name assigned to this exercise. People have a deep conviction that liberating horses, insects, and fishes would bring bad cause to them. Generally, it is strictly regulated that, people should not slaughter freed creatures, thus saving them. The majority of animal liberation occurs in nature reserves and monasteries that are lawfully or culturally secured, guaranteeing the welfare of those species. Buddhists believe the lakes to be holy and prohibit fishing and any other kind of extraction. As a result, fish are mostly covered in such holy lakes. They often release fish into holy lakes and waterways to maintain a healthy harbor (Namsa, N.D. 2011). In all the above mentioned examples it is very clear and evident that tribals not only worship and manage them but also help in protecting their availability

## 2.5. Tribes role in conservation of Insects

Insects are the most diverse species on the planet, accounting for 70% of all creatures and they contribute significantly to biological diversity (Sattler et al. 2011, New 2015, Alessa, L., 2016). They rule all conditions except the snowiest and most salty. They are found in variety of habitats, from desert to tropical woodland, and from pools to cascading waterfalls. Insects are associated with both terrestrial and freshwater, including mosses and liverworts. Majority of plants with flowers, and their reproduction is reliant on insect visitors pollinating and thereby reproducing them. Almost all frogs and lizards need insects to survive. About one-third of fish, animals, eat insects but in contrast, about one-third of insects consume other insects. In a nutshell, insects are the bedrock of all land-associated habitats. Additionally, humans cannot exist without them, since almost a third of our food, particularly the most nutritional components,

such as fruit and nuts, are substantially or fully pollinated by insects. From the dawn of civilization, tribal community has played a critical role in conserving insect biodiversity in and around areas of their natural environment (Michael J. Samways, 2018).

The biological roles they serve bring various advantages to tribal inhabitants (Prather 2013; Bennett et al. 2014a; Baldock2015), as well as several negative consequences (Rust et al. 2012; Dunn et al. 2010). Flora and insects often coevolved in near proximity, with certain insect organisms exhibiting a strong degree of specialization (Forister 2012). Plant species also provide tools for insect detritivores, pests, and parasitoids such as fruit, foraging, spawning, oviposition, shelter, and overwintering; indeed, activities that encourage these resources in agro-ecosystems through promoting plant diversity and systemic complexity are critical components of pest management (Landis 2000). Thus, the existence of tribal people maintains the biodiversity of appropriate plant species which can sustain the vital element affecting insect diversity (Aronson 2016).

To introduce value-based insect protection, tribal communities follow certain traditional principles like, insect conservation practices, which seeks to recognize and encourage human local community concern for insects, thus guaranteeing that these insects serve as an essential source fostering human and insect well-being (Simaika et al. 2018).

Since time immemorial, the bee product honey has been used by tribal communities in many Ayurveda formulations. It was also demonstrated by many tribal informants that insects in particular could be used to produce drugs with analgesic, anti-rheumatic, anti-bacterial, immunological, anesthetic, and diuretic properties.(Chakravorty, Jet al 2011).Cultural ethnobiological understanding and the acceptance of insects as food and an important part of indigenous therapies are still known only by indigenous people. Moreover, the medicinal properties of insects are often a tightly held secret that is often handed on orally from generation to generation. This method of information transfer is an age-old tradition and a widely recognized socio-cultural characteristic of the ethnic communities of India.(Yamakawa M: et al 1998).

While insects are most abundant in India, with approximately 645 district tribes and a large percentage of the population living in rural and semi-urban areas, the diversity of insects consumed as food is comparatively lesser, especially in the south and central parts of the country. It's difficult to explain why the condition is as it is; either insects as food are underappreciated, or ethnic people are sacrificing their rituals as a result of legislation

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requiring forest cover conservation and eradicating their extensive indigenous Knowledge of utilizing insects in general, and as food in particular, before any scientific documentation. This tribal culture structure has often fulfilled the dual function of using insects as food (i.e. food items and feed) and conservation (Jharna Chakravorty, 2014).While insects (species and individuals) are abundant in Arunachal Pradesh, groups of the tribal people never capture and eat insects hastily, randomly, or without selection, but rather according to unwritten rules and traditions. Not only do the rituals dictate which organisms may be harvested and used as food, but they often address the insects' medicinal properties (Meyer-Rochow VB, et al. 2008). Some of the taboos among the tribal people such as tiger killing are unlucky; sparrows are symbols of good fortune, etc. also helped in their conservation.

### 3. TRIBES OF SOUTHERN INDIA

The tribal people of South India is remarkable include that they remain uninhabited by modernity; as a result, people possess simplistic preferences yet are devoted to their traditions and beliefs. Dynamic and vibrant, tribal groups are unique in their customs and history.

The biological diversity we see at present is the gift by our decent from thousands of years of evolution. Genetic diversity (diversity between habitat), species diversity (diversity at the species level), and ecological diversity are all used to quantify diversity. The preservation of biological diversity is critical for the survival of humans and other species of life. From their inception, Plants have provided both physical and moral requirements for humans. The relationship has culminated in creating a one-of-a-kind information framework for the use and protection of plant genetic capital (IISE, 2011). The value of plant resources has been taught by cultural diversity in terms of ethnic populations. Understanding native communities about the cultural, moral, social, and economic qualities of plants can be extremely beneficial to humanity as a whole. It can have several dominant genes for the production of crop plants that are widely grown today (Armstrong, S.J et al. 2003). It has the power to supply humans with a slew of new chemicals to tackle a range of human illnesses. Many of these stories from around the globe show how the ethnic experience has aided in the advancement of western society. New medicine for memory retention has been produced and sold from the *B. monnieri*, which has historically been used in India to improve memory capacity (Jogender Mehla 2020). Both of these references specifically demonstrate that cultural complexity is the primary basis of plant utilitarianism. The presence of cultural diversity is inextricably related to biological diversity. Since tribal cultures depend on biological resources for spiritual, religious, and cultural needs, this traditional biodiversity interpretation of native communities are not limited to sustenance. Both of these were viewed as life-sustaining services by tribal groups. As a result, they not only use them but still conserve them. The loss of any of these types of diversity will have a significant impact on humanity. As a result, for meaningful conservation, all biological and cultural diversity can be viewed as a unit (Michelle Cocks 2006). Ravishankar, T, 1990, 1992, 1995 observed the conservation and sustainable use activities of some southern Indian tribal groups in his study, including the Kolams, Paliyars, Gonds, Koyas, Konda Reddys, Malasar, Pardhans, Naikpods, Pulay, Irulas, Malaimalasar, Malayalis, Kadars, Lambadis of Andhra Pradesh and Muthuvans. Southern India is home to a rather diverse ecosystem of fascinating species, due to its tribal residents' use of plants. Most of the plants are used only for one purpose, while there might be future application in other parts of plants. *Brideliaretusa, Canthium doccum, Ficus racemosa, Longifolia ficus, Phyllanera latifolia,* and *Terminalia bellerubarbila* were predominantly used for their edible seeds and fruits. Plant usage may be as well defined by selection. Seventy percent of humanity draws much of their nourishment from only a handful of animals. The tribals in southern India use between 1,500 - 1,000 to 1,500 plant varieties. Because it is hard to name just a few kinds of fruits, they usually consume fruits of various plant species, including Carissa, Cordia, and Memecylon (Xu J. et al. 2019; Ravichandran, L.K., 2019). Tribal groups use resources with caution and ecological competence. For e.g. In Tamil Nadu, "Kadars" pick only matured plants of the Dioscorea for tuber harvesting (Thamizoli P 2015).The production is shared by the whole population, preventing overexploitation. In the off-season, a part of the collection is prepared for consumption. This is a one-of-a-kind demonstration of neighborhood cooperation in plant utilities and resource management (T. Ravishankar 2003).

Tribal citizens in Sathyamangalam, which lies at the crossroads of Tamil Nadu, Karnataka, and Kerala, live a comfortable life with few everyday necessities. For decades, tribal communities residing in and near the forest have participated in hunting and collecting, cultivation, and evolving agriculture. They had gathered food from the forest without endangering it (Arul Actovin C and C. Satheesh Kumar, 2019). Agriculture is the dominant source of production in all of the tribal settlements surveyed. Hill rice and millets such as Tenay, Ragi, Maize, Samai, and Kambu are among the subsistence crops grown by others. Cash crops like pepper and banana are increasingly making their way through several communities. Farming is the main source of production in all of the tribal settlements

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surveyed. Hill rice and millets such as Tenay, Ragi, Maize, Samai, and Kambu are among the subsistence crops grown by others. Cash crops like pepper and banana are increasingly making their way through several settlements (Janetius, S.T., 2017).

However, the genetic material conserved by the tribes up to this stage is under pressure due to the rising population in tribal region. This leads to less interaction among them which directly or indirectly inculcates unhealthy lifestyles among themselves. Outsiders' entrepreneurial behaviors contributed to the overexploitation of wealth that the tribes relied on for survival. Thus, leads to depleting tribal capital that makes them do unnecessary practices for their income, finally resulting in unhealthy tribal attitudes. Traditional cultivars must be conserved by gene bank conservation to avoid genetic erosion since they provide the essential raw material for future crop improvement (Koen Kusters et al. 2004).

## 3.1. North Eastern Tribes:

The Monpa and Shertukpen tribes of Arunachal Pradesh's hilly western regions have ancient religious traditions and a wealth of indigenous Knowledge. Their culture is identical to that of the other tribes in Arunachal Pradesh, but it is unique, strongly related to the climate. Their society is, in reality, strongly dominated by religious beliefs. Traditional cultures' rich information and traditions connected with the usage and protection of livestock, plants, and the environment as a whole have been the social pillars for shared coordination and long-term sustainability of the inhabitants (Ranjay K singh 2013).



**3. Tribes association in Protecting Nature**

India has its own concerns regarding trees, which have major role in the nation since ancient times. After African continent, the second-largest tribal people reside in India (Sreenivasa Rao J, et al 2019).Realizing the tribes' privileges to obtain and distribute small forest products has immense potential for growing the tribes' revenue and raising their quality of life. This direct or indirect means of dependency on the forest for economy would enable them to conserve it. By this way tribes would be released from the clutches of money lenders and small business people who purchase lucrative minor produce from tribes at a discount and earn handsomely. The tribes' wellbeing and welfare metrics would certainly increase as a consequence of the discretionary income. The tribals are widely regarded as the forests and resources guardians (Figure 3).

The tribal people's present way of life is focused on subsistence farming. They also serve as wage workers in the forestry and sylviculture activities of state governments' forest departments (National Portal of India 1951). Their needs and practices have to be documented, so that herbal practioners will have a greater understanding of how these tribes are related to the forest and what their unique practices are! The social and legal facets of the partnership between tribals and the forest should have a strict implication.

It further establishes theat such a partnership has a solid legal framework, because it is largely focused on socio-cultural influences and customs (Wackernagel, M. J. 2005; Philip, H. 2007). The current big concern faced by the aboriginal people is a lack of recognition of their rights. They are unaware of the specific privileges that have been bestowed upon them. The absence of any substantive law that defines tribal interests about environmental protection is the source of this shambles. Tribal people have been worshipping the forest and hilly regions as though it were a deity since the dawn of time and this is one of the key explanations why they defend it from damage as part of their religious obligations. But, owing to the evolving terms, the tribals have been suppressed in numerous forms by many influential factors of society. Consequently, it is important to identify their privileges and pass laws to assist tribal communities in protecting their rights (Narwani, G.S.2004).

Incentives should also be offered to tribal groups that grow conventional cultivars, which produce lower yields than high-yielding varieties. This allows tribals to plant genetically diverse, drought-resistant, and pest-tolerant crops, which will compensate for their poor production (Roos, E., et al. 2018)

Policy choices that could affect the natural equilibrium and nature can be undertaken with the help of indigenous people who reside in the region who may provide realistic feedback. Ethnic people are the ones who struggle the most in any environmental disaster when they

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are at the bottom of the socioeconomic ladder. Biodiversity depletion leads to cultural diversity loss, which is the cradle of awareness about plant beliefs. Ignoring cultural diversity security and the associated traditional ecological consciousness endangers the cause of biodiversity restoration, which is vital for the human planet's survival. The bourgeoisie insists that major MNCs investing in the mineral-based industry in impoverished tribal areas rich in mineral resources would raise foreign exchange revenues and stimulate economic growth, resulting in the development of essential amenities as well as the rapid socio-economic transition of the native community. It was identified that tribals are losing their property in big mining, iron companies, and also with non-tribal externals that coexist in such places. This leads to the migration of tribes to slums for their survival (Meher, R. 2009). It's a generational shift that no one wants to see. Approximately 55% of the nation's tribal community now lives outside of their natural environments. It is well established that tribal community displacement, which is largely motivated by distress, is rising. This process, if stopped and the tribes are allowed to live in their native locations will not only make them survive but also will have bountiful impact in improving environmental conditions in that area. Finally, tribal people should make their strict decision, practices and rules in such a way they never allow any immoral practices to be practiced in their areas. Government has already amended strict Government order (GO) and laws to preserve the tribal communal properties. Investigators should be held accountable to record prospective use of their findings and the inherited ancient traditions. For instance, a biopharmaceutical corporation may use conventional information unearthed by a well-intentioned botanical researcher to develop a "novel" medication (Whitt, L. 2009).

**Conclusion:**

The rich oral literature of India's tribes can be traced back to the nation's literature roots. The majority of Indian tribal groups are culturally close to tribal communities around the world. They exist in naturally integrated communities that are cohesive. In India, the tribal community is considered to be autochthonous to the land. They choose to live in spatial solitude, mostly in woodland regions, which do not often correspond to mainstream culture. They don't seem to care about acquiring money or utilizing labor as a means of accumulating interest and capital. Also, they believe in the human capacity to spell and understand reality, and they embrace a paradigm in which existence, humans, and God are all inextricably bound. They follow their intuition rather than rationality, regard the room around them as religious rather than secular, and have a subjective rather than logical

sense of time. As a result, the world of tribal fantasy is opposed to contemporary Indian society. Indigenous peoples are an essential part of cultural complexity and ecological equilibrium, as well as an evolutionary treasure for scientists researching evolutionary and migratory history. The world owes them the courtesy of allowing them to remain in harmony on sacred lands that they have revered and protected for generations. Although Indigenous peoples strive to advocate for the environment, they cannot do it alone. "We're all in this together. We need the rest of the planet to understand this," "This isn't about Indigenous communities heroically battling and losing our life to defend the earth. This is about all of us coming together through nations, races, and social backgrounds to transform the way our global economy operates.

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# ETHNOBOTANICAL DOCUMENTATION AND QUANTITATIVE STUDY ON INDIGENOUS MEDICINAL PLANTS USED BY KANI TRIBES OF KANYAKUMARI DISTRICT

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**Abstract**

Tribal people value far more than anyone about their forest and environment, because their life and heritage rely on it. They are traditionally the hardest-hitting naturalists and have managed their cultivable lands for several years. The present study is an attempt to document local health traditions of Kanyakumari district. The investigation identified 120 species, distributed in 54 families. 70 plants of ethnomedicinal importance were identified, which have not yet been reported so far from Kanyakumari wild life forest of Southern-Western Ghats. Many participants were approached three times to verify the information provided by informants during data documentation. The data quality was ensured by selecting well-trained 20 practitioners to point out missing information if any and the data is carefully analysed. In total, 120 Medicinal plant species of which Dicot plants constitute 116 species (96.7%) and monocot plant constitutes 4 species (3.3%). Fabaceae with 12 (10.00%) was the most commonly reported family of medicinal plants species. Habit wise study revealed that 40 species (33.33%) were tree, followed by the most widely used life types are herb (36 species) (30%). The most common modes of preparation for treating the ailment was paste (40 preparations) for internal consumptions as well as external application. The oral administration route is recommended for the remedies reported in the recent studies. The highest disease category record was for pulmonary-related problems, Impotence, wound healing, and Pain (1%). Highest use-value is reported for *Azadirachta indica, Ocimum tenuiflorum, Piper nigrum,* and *Phyllanthus amarus.* ICF values for use value by the informants for 25 ailment categories were recorded, and the informants reported eighteen distinct diseases in the investigation. The ICF has a significance range of 0 to 1, with a high value indicating a high degree of informant agreement. Fidelity Level (FL) values estimated that ten medicinal plants that have the relative high healing potential and feed for animals, DCI value ranges from 0.271 to 0.011. The RPL parameters were estimated to identify the medicinal plant resources or twenty four species of which five plant species mentioned by 19 or more informants were classified as common. Out of the 24 species, 23 have ROP values greater than 50, making them the most popular in terms of folk medicinal potential. Five species are recorded as most commonly used with species with ROP = 100. The remaining 19 species have modest clinical impact, as defined by less than eight informants. The therapeutic knowledge documented in this study could be explored in the future for phytochemical and pharmacological investigations that could lead to plant-based nanomedicine, drug development, and production. Secondly, the paper deals with the combination of socio-economic and legal facets of the interaction between tribals and forests.

Keywords: Ethnobotany, kanyakumari, kani tribes, species, informants, quantitative Study

## 1. Introduction

India has its own forest reservations, and they have held a significant role since ancient times. India has the second largest number of indigenous peoples, after Africa. According to the census in 2011, the tribal population in the country is 10.45 crore, which constitutes about 8.08 %. About 87 percent of the Scheduled Tribe population is concentrated in the central belt, which comprises the eight states of Madhya Pradesh, Orissa, Bihar, Maharashtra, Gujarat, Rajasthan, and Andhra Pradesh. Around 3% out of 10%, respectively, live in other states in the north-eastern area. Madhya Pradesh is home to the largest concentration of the country's 1.54 million Scheduled Tribes. (Williams LA 2001; Krippner S, 2003). Tribal people have worshiped the environment from time immemorial, considering it as a heaven, and it is one of the primary reasons, they safeguard it from threats as a matter of religious responsibility, however, as a consequence of these evolving terms, many dominant sectors of civilization have oppressed tribal communities in a number of ways. As a result, now is the time to define tribal sovereignty and pass legislation to assist tribal communities in defending their rights, and respecting the rights of tribal peoples is also the cheapest and fastest way to conserve high biodiversity area (CCRAS, 2019)

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Ethno-medico botany has been playing an important role in human health care since immemorial. Curiosity and activity in ethno-medico botany have exploded in the last few decades. Since its conception, ethno-medico botany study has contributed significantly to our comprehension of conventional subsistence, medicinal expertise, and practice (Thangaraj Francis Xavier et al. 2014). The proliferation in ethno-medico botany literature has been fueled by a growing understanding of the effects of indigenous people's forced migration and or acculturation, the acceptance of indigenous health ideas as a way of preserving ethnic identities, and the quest for novel medical therapies and technologies (Schmidt et al. 2009) Ethno-Medical practices and local and oral health traditions are prevailing among the ethnic groups and tribal population catering the local health needs of remote tribal pockets (CCRAS, 2019). However, reliable scientific evidence for the use of ethnomedicinal plants is scarce. A recent experiment demonstrated that plants have enormous potential for researchers evaluating conventional arguments for the manufacture of new drugs (Ananda R Josh, et al. 2000). Additionally, there has been an increase in global participation in herbal medicine. Ethnobotanical studies have recently gained popularity as a means of examining conventional information, especially in the majority of developing countries Ragupathy S et al. 2008). Thus, it is essential to collect ethnobotanical data and record all conventional expertise that has acquired significance in drug production. (Chah, KF et al. 2006) Traditional medicinal plants are critical in primary health care and disease management (WHO 2019). According to the World Health Organization, up to 80% of the world's population relies on conventional medicine for their primary healthcare needs (WHO 2019). Economic gains accumulate from the production of indigenous drugs and the usage of medicinal plants to cure a variety of diseases. Tribal cultures also established their own distinct system of naming medicinal plants and administering them to various diseases (Chopra RN et al. 1986; Kadhirvel K, et al.2010)

In India, there are over 53 million tribal people who live in 550 villages comprised of 227 ethnic groups. They live in about 5,000 forested settlements or are nomadic in the forest. Each tribal culture maintains its own distinct social and cultural identity (Ramachandran VS et al. 1981). Kani is a tribal community in India that primarily inhabits the woods along the Kerala–Tamil Nadu boundary, which is situated in the southernmost portion of the Western Ghats. They possess extensive knowledge of herbal medicine for a variety of diseases. (Viswanathan MB et al. 2004; Augustine J et al. 2004; Sivadasan M; Prakash JW et al. 2008)

By keeping the importance of ethno-medico botanical studies in the field of health care needs and drug discovery, the present study dealt with the quantitative research and documentation of ethno-medico botanical knowledge of Kani tribes in Kanyakumari district of Tamil Nadu.

## 2. Materials and Methods
### 2.1 Study area and informants

The forests of Kanyakumari district in Tamil Nadu are located at the southernmost point of the Western Ghats, occupying at 5 forest ranges: Azhagiyapandipuram, Boothapandi, Kaliyal range, Kulasekaram, and Vellimalai with rich vegetation and occupy almost 3500 sq km. Geographically, it is located between $77^o$ $15^'$ and $77^o$ $36^'$ E longitudes and $8^o$ $03^'$ and $8^o$ $35^'$ N latitudes. Such forest regions are described by various folding and extends that engulf short, narrow valleys and vary in elevation from 50 to 1868 metres altitude includes Kodayaru (1100 m), Thadagamalai (1300 m), Keeriparai (1450 m), Olakaiaruvi (1640 m) and Vanathiparai (1750 m). Medico-Ethnobotanical surveys were conducted from various Kani tribes in different settlements at Aralvaimozhi, Kalikesam, Keeriparai, Kiliviyaru, Kodithurai, Maramalai, Marunthuvalmalai, Olakaiaruvi, Vanathiparai, Veerapuli of Kanyakumari district in Tamil Nadu. Twenty informants in particular were chosen on the basis of their gender, indigenous expertise about medicinal plants, and their informed consent. Eighty percent of the twenty informants were female, which was achieved intentionally to ascertain the position of females in traditional medicine.

### 2.3 Ethno-Medicobotanical Survey

Ethno-Medicobotanical survey was carried out from various Kani tribes by following the methodology of Jain (1981) through interview, with a questionnaire to record the medical knowledge of the plants. Ethno-Medicobotanical information on medicinal values, local name(s), and plant parts used, the process of preparation, the type of administration, the dosages, and the mode of application were all recorded properly (Jain SK, 1981). During the visit, local names and medicinal uses of plant species used by tribal communities were noted, which was later confirmed with the help of literature. The data were cross checked with them by repeated interview for authenticity and confirmation of medicinal usages.

### 2.4 Collection and Identification of Plants

The plants used by Kani tribes for several human ailments were identified by using various Flora (Gamble JS 1935; Mathew 1983; Manickam VS et al. 2004), and their nomenclature were confirmed by Flora (Nair NC, et al. 1983; Henry AN et al. 1989; Henry AN et al. 1987) and botanical websites (www.theplantlist.org; www.IPNI.org). Herbarium specimens for the all the ethnobotanical plants were collected by the standard method (Jain SK, et al. 1976) and the herbarium specimens for all the plant species were documented and deposited at Guru Nanak Research Institute (GRI), Guru Nanak College, Chennai for reference.

### 2.5 Quantitative Analysis

The Usage value (UV), Informant consensus factor (ICF), Fidelity level (FL), Disease-consensus index (DCI), Relative popularity level (RPL), and Rank order priority (ROP) were used to evaluate ethno-medicobotanical data. Finally, the results is visualized using graphs and charts

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### 2.5.1 Use Value (UV)

The usage value (UV) of a plant species indicates its relative significance in terms of its applications.

It was calculated as

$$UVc = \Sigma U / ns$$

where U is the count of all usage citations made by all informants for a particular species divided by the total number of informants (ns) (Phillips O, et al. 1993a; Phillips O, et al. 1993b; Andrade-Cetto A et al. 2011).

### 2.5.2 Informant consensus factor (ICF)

The informant consensus factor (ICF) was used to determine the ethnobotanical significance of the collected plant species and to assess the degree of agreement between informants' additional information about various ailments.

It was calculated as

$$ICF = (Nur - Nt) / (Nur - 1)$$

where Nur denotes the number of times an ailment was listed in each column and Nt denotes the number of plant species mentioned. (Trotter RT et al. 1986)

### 2.5.3 Fidelity level (FL)

The fidelity amount was measured as

$$FL = Np / N \times 100$$

It was used to measure the percentage of informants claiming to use the same plant for the same reason.

Np denotes the number of informants who discussed a particular plant species used to treat unique illnesses and N denotes the total number of informants who used the plant as medication to treat any specified ailment. (Adolfo Andrade Cetto et al. 2006)

### 2.5.4 Disease-Consensus Index (DCI)

Disease-Consensus Index (DCI) was used to know the common plant to treat the single chronic disease (Friedman J et al. 1986). DCI calculation has a set of questions to be answered by the informant, these questions will include the knowledge and personal experience on the specific species to treat a disease.

The DCI was calculated as follows:

$$DCI = \left\{ \sum_{i=1}^{\infty} \left( \frac{Vxi}{Cc} \right) mVx \right\} Pm^{-0.1}$$

thus x was an species, Vxi is the sum of individual values acquired for one species in the same population and evaluates plant knowledge and number of mentions, mVx is the statistical mean of the individual values for one plant and evaluates plant knowledge, and correlation coefficient is Cc, that calculates the overall number of informants that can refer to a plant and evaluates the number of times the plant has been listed. Cc also applies to the number of individuals who were consulted. Finally, the estimate was split by 100, yielding values ranging from 0.01 to 1.

### 2.5.5 Relative popularity level (RPL)

A report of the total number of diseases treated by a single medicinal plant as stated by the total number of informants for that disease (Friedman J, et al. 1986; Mohammed saleem Ali-shtayeh et al. 2000), this can be used as a corrective factor for FL. Additionally, a correction scale is used to count medicinal plants that are both common and controversial. The amount of uses per plant rises linearly with the number of informants is believed to be between 0 and 1, with 1 indicating complete popularity of a plant for a specific ailment and "0" indicating no ailment treated by the particular medicinal plant, which means "1" indicates complete popularity of plant and "0" indicates unknown plant.

### 2.5.6 Rank Order Priority (ROP)

Rank Order Priority (ROP) is a corrective metric that is used to rank plant species with varying FL and RPL values appropriately (Friedman J, et al. 1986; Mohammed saleem Ali-shtayeh et al. 2000). A plant species' Rank Order Priority (ROP) can be determined as

$$ROP = FL \times RP.$$

Where FL denotes the degree of fidelity.

RP = Relative Popularity; the number of times a species is cited divided by the number of times the most commonly listed species is cited.

### 3. Results and Discussion

The medico-ethnobotanical data's on medicinal plants used to treat various ailments observed in the region is shown in Table 1.

### 3.1 Medico-Ethnobotanical documentation

### 3.1.1 Taxonomy and plant life form

In the present study, 120 Medico-ethnobotanical plant taxa belonged to 54 families, 109 genera, 120 species were recorded (Table 1) and of which, 116 plants (96.7 %) were dicots and 4 plants (3.3 %) were monocots. Among familywise distribution, Fabaceae was dominant family represented by 12 species (10%) followed by Mimosaceae and Solanaceae by 6 species each (5%), Apocynaceae, Caesalpiniaceae, Euphorbiaceae and Rutaceae by 5 species each (4.17%), Asteraceae and Cucurbitaceae by 4 species each (3.33%), Anacardiaceae, Combretaceae, Malvaceae, Meliaceae, Myrtaceae, Rubiaceae and Verbenaceae by 3 species each (2.50%), Acanthaceae, Amaranthaceae, Asclepiadaceae, Cleomaceae, Convolvulaceae, Lamiaceae, Liliaceae and Moracaeae and Sapindaceae by 2 species each (1.67%) and the remaining 29 families was described by a single species (0.8%) respectively (Table 2). Among generic wise distribution, the genus *Solanum* L., has been the predominant genus, with four species (3.33%) subsequently by *Acacia* Mart., *Senna* Mill. and *Terminalia* L., by 4 species each (2.5%), *Cleome* L. and *Ficus* L., by 2 species each and the remaining 103 genera typified by single species each (0.8%) correspondingly. Among plant life forms, trees were the dominant life form represents by 38 species (33.33 %) followed by herbs (30 % with 35 species), shrubs (25.83 % with 31 species), climbing herbs (10 % with 11 species) and climbing shrubs (08.3 % with 5 species) respectively (Fig.2).

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### 3.1.2 Plant parts used, Mode of preparation and Mode of administration

Within the plant parts used medicinally, leaves contributed 42.22 % followed by stem (4.53 %), fruit (11.3%) whole plant parts (9.05 %), seed (7.54%), flowers (6.79 %), stem bark (6.03 %), latex (5.27%), root (3.77 %), root bark (0.49 %), gum and rhizome (1.51 %) respectively (Fig 3). The mode of preparation of plant materials to cure various ailments fall into nine categories. Among these, the most common mode of preparation was recorded paste as 31.01 %. This was followed by powder (16.28%) decoction (17.05 %), Extract and juice (24.81 %), latex (5.42 %), pills (2.32 %), oil (1.55 %), flower bundle and soaked petals (0.78 %) respectively (Fig. 4). Among the mode of administration, internal uses was recorded as dominant uses with 51.67 % in 62 uses followed by internal mode (40 % in 48 uses) and both internal and external mode (8.33 % in 10 uses) respectively (Fig 5).

### 3.2 Quantitative analysis

3.2.1 Informant consensus factors (ICF)

To determine the informant consensus factor (ICF) in this analysis, the reported human ailments were divided into 24 groups (Table: 4). The ICF values varied between 0 and 1, with a high valve indicating a high degree of informant agreement. The informant consensus factor (ICF) values ranged from 0.57 to 1.0, whereas the lowest values were recorded for Diabetics while highest value (1) was recorded for dengue fever, menstrual disorder, over bleeding followed by stomach pain and indigestion (0.96 each), ulcer, delivery pain and eye pain (0.94 each), venereal disease (0.93), head ache and joint pain (0.92 each), liver disease (0.91) and Impotence (0.9). The ICF (Informant consensus factor) values recorded were vary between 0.72 to 0.89 for fever, hair fall, heart disease, fever, scabies, cold and cough, inflammation, skin disease respectively. Among the most common diseases is fever. Herbal treatment is the first line of protection for the Kani people, which may understand the category's strong Fic importance. (Friedman J, et al. 1986) also reported higher Fic value for Fever. These results suggest that menstrual disturbances, prolonged bleeding, all forms of discomfort, and gastrointestinal disorders are prevalent in the study region. Similar results have been published previously (Ayyanar M et al. 2011; Bradacs G et al. 2011; Leto C, et al. 2013)

However, relative to dermatological ailments (Kadir MF et al. 2012; Singh AG et al. 2012) identified a greater number of species for treating gastrointestinal diseases. The ICF levels for multiple illness types ranged from 0.0 (nervous disorder) to 0.39 (GIT diseases). The average ICF value across all groups was 0.16, consistent with previous Pakistani studies (Abbasi AM et al. 2012; Bibi T, et al. 2014). Once again, this aspect is influenced by the availability of a plant in a study field. Another argument to note is that, since a set of Informant consensus variables was included in the study, this means a greater likelihood of information exchange between informants, which leads to their experience becoming more homogeneous. (Qureshi R, et al. 2010)

### 3.2.2 Use Values (UV)

Out of 24 medicinal plants of interest by informants, eight have great significance. Highest UV values indicates that informants attribute a great significance to frequently used medicinal plants. (Table 3). Low UV plants are not inherently unimportant, since this could mean that conventional awareness of certain plants is at risk of not being spread and may eventually vanish. Therefore, this should be suggested that medicinal plants with the highest UV values be further investigated for phytochemical and pharmacological assessment in order to improve herbal drug medicinal systems. (Medeiros MFT et al. 2011).

### 3.2.3 Fidelity Level (FL)

Additionally, FL values were used to measure the relative curing ability and feed for animals of medicinal plants based on the percentage of informants who decided on their usage for a specific ailment category (Friedman J et al. 1986). The informants suggested a maximum of ten medicinal plants to cure human illnesses and animal nutrition, so they could be more analyzed for bioactivity and therapeutic properties. (See Table 5) Treatments for commonly identified infections clearly have the highest FL values, while species that are less well-suited to treating specific illnesses have poor FL values. In terms of fidelity, a significant proportion of the uses suggested for each species exceeded the overall predicted value (Medeiros MFT et al. 2011; Choudhury PR et al. 2015). A high FL value can indicate a plant's potential resistance to a specific disease. (Yaseen Get al. 2015b).

### 3.2.4 Disease-Consensus Index (DCI)

In the present analyses, DCI value ranged from 0.271 to 0.011. The maximum DCI values was found in *Tibulus terrestris* (0.122), *Syzygium cumini* ( 0.121), *Piper nigrum* (0.132), *Phyllanthus amarus* (0.116), *Gymnema sylvestre* (0.106), followed by *Ocimum tenuiflorum* (0.271), Ficus bengalensis ( 0.212), *Azadirachta indica* (0.264) and finally *Justicia adhatoda* (0.264), the rest of the 15 use value plant have low value observed ranges from 0.086 to 0.011 (Table 3). Disease-Consensus Index has been carried out to know and evaluate the disease consensus data gathered from informants in order to determine the efficacy of different conventional treatments of various ailments (Yaseen G, et al. 2015b; Cruz EC, et al. 2015). DCI is a prevalent method to identify the species curing value for various ailments, so that particular species with higher value can be chosen for further research (Andrade-Cetto A et al. 2011).

It is also observes that the Medicinal plant which have more use value has equivalent DCI value, So from this we can come to an understanding that the same plants can be further available for the same treatment that are prevalent in the society (Cruz EC et al. 2015).

### 3.2.5 Relative Popularity Level (RPL)

Within our 20 informants mentioned 38 plant species for various disease groups, 24 of which are listed in Table 3. These 24 species received additional

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recognition from informants and are thus included for further discussion. The total amount of uses cited by 16 or more informants does not rise as the number of informants increases. 15 plant species were classified as unpopular because fewer than 11 informants mentioned them, whereas 5 plant species were classified as popular because 19 or more informants noted them. The dividing line between common and controversial groups is when the total amount of uses per plant stops to rise as the number of informants increases. *Azadirachta indica* (Meliaceae), *Ocimum americanum* (Lamiaceae), *Piper nigrum* (Piperaceae), *Tribulus terrestris* (Zygophyllaceae), and *Withania*

*somnifera* (Solanaceae) have been the most frequently used plant species with a 1.0 RPL value (Table 3). The other 19 medicinal plants had a lower RPL value (1.0). The widespread popularity of these medicinal plant species is a result of their efficacy, implying that native communities are well versed in their use as herbal remedies. According to ethnomedicinal studies, certain plant species with low RFC values, similar to those found in the current study (Mahmood A, et al. 2013).

### 3.2.6 Rank Order Priority (ROP)

Twenty two species has ROP scores of 50 or more which represent the highest rank order priority among medicinal species investigated, among which *Justicia adhatoda, Gymnema Sylvestre, Ocimum tenuiflorum, Piper nigrum* and *Withania somnifera* were broadly applied species with ROP = 100 (Table 3), likely an indigenous medicinal property resources studies from Hafizabad district, Punjab showed the same *Withania somnifera* has a widely utilised species value (ROP = 100) (Umair M, et al. 2017). Of the 24 species only *Argemone mexicana, Phyllanthus amarus* and *Tribulus terrestris* attained ROP distribution of 92, 93, 99 respectively. This is possibly attributed to declining popularity of medicinal medicines among the local populations of the sample region (Umair M, et al. 2017). Likewise different categories based on the internal or external uses are studied with the highly ranking plant species with ROP values that were embodied by 21 species which has most therapeutic effects into several distinct ailments (Al-Qura`n S, 2006).



**Fig1. Map of the Study area, Kanyakumari**
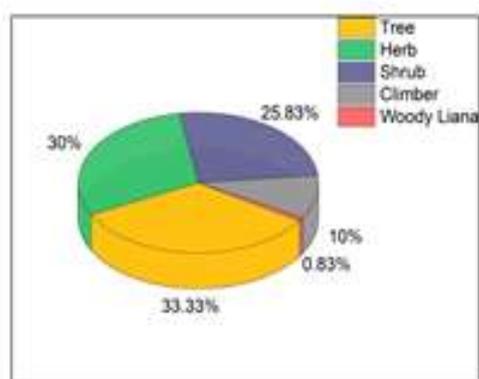


**Fig 2. Habit wise classification of plants**
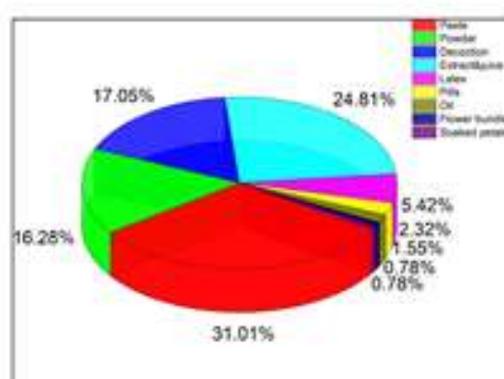


**Fig 3. Percentage of Plant parts used**

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## Table – 1. List of Plants, Part used, Disease cured, Mode of application, Life Form, Preparation and Status

| S.No | Botanical Name / Family Name | Family | Parts Used | Disease Cured | Mode of Application | Habit | Preparation |
|------|------------------------------|--------|------------|---------------|---------------------|-------|-------------|
| 1. | Abrus precatorius L. | Fabaceae | S | Swelling | External | Climbing | P |
| 2. | Abutilon indicum (L.) | Malvaceae | L | Venereal | Internal | Shrub | P |
| 3. | Acacia nilotica (L.) | Mimosaceae | S | Dental care, | Internal | Tree | P |
| 4. | Acacia mearnsii DC. | Mimosaceae | L | Skin disease | External | Shrub | P |
| 5. | Acacia sinuata (Lour.) | Mimosaceae | F | Hair fall | External | Shrub | P |
| 6. | Acalypha indica L. | Euphorbiacea | L | Scabies | External | Herb | P |
| 7. | Achyranthes aspera L. | Amaranthace | L | Cut injuries | External | Herb | P |
| 8. | Aerva lanata (L.) A. | Amaranthace | W | Kidney stone | Internal | Herb | D |
| 9. | Alangium salviifolium | Alangiaceae | S | Chronic | Internal | Tree | D |
| 10. | Albizia amara (Roxb.) | Mimosaceae | L | Skin diseases | External/ | Tree | P |
| 11. | Aloe vera (L.) Burm.f. | Liliaceae | L | Stomach | External/ | Herb | J |
| 12. | Anacardium | Anacardiacea | L | Foot crake | External | Tree | L |
| 13. | Andrographis | Acanthaceae | W | Dengue | Internal | Herb | D |
| 14. | Anthocephalus | Rubiaceae | F | Abortifacient | Internal | Tree | D |
| 15. | Argemone mexicana L. | Papaveraceae | W | Jaundice | Internal | Herb | J |
| 16. | Asclepias curussavica | Asclepiadace | L | Asthma, | External | Shrub | L |
| 17. | Atalantia monophylla | Rutaceae | L | Cold, | Internal | Tree | D |
| 18. | Azadirachta indica A. | Meliaceae | S | Scabies | External/ | Tree | P |
| 19. | Bauhinia purpurea | Caesalpiniace | F | Hair growth | External | Tree | J |
| 20. | Begonia malabarica | Begoniaceae | L | Skin diseases | External | Herb | P |
| 21. | Biophytum sensitivum | Oxalidaceae | L | Venereal | Internal | Herb | P |
| 22. | Brassica juncea (L.) | Brassicaceae | S | Cough | Internal | Herb | D |
| 23. | Butea monosperma | Fabaceae | F | Joint pain | External | Tree | J |
| 24. | Caesalpinia bonduc | Fabaceae | S | Monaural | Internal | Climbing | Pi |
| 25. | Cajanus cajan (L.) | Fabaceae | L | Asthma | Inhaled | Herb | P |
| 26. | Calophyllum | Clusiaceae | S | Hair fall, | External / | Tree | P |
| 27. | Calotropis gigantea | Asclepiadace | L | Scorpion | External | Shrub | L |
| 28. | Canna indica L. | Cannaceae | R | Insect bite | External | Herb | P |
| 29. | Capparis parviflora | Capparaceae | L | Hip pain | External | Shrub | P |
| 30. | Cardiospermum | Sapindaceae | L | Asthma | Internal | Climbing | E |
| 31. | Carica papaya L. | Caricaceae | L | Abortifacient | Internal | Tree | L |
| 32. | Senna alata (L.) Roxb. | Caesalpiniace | L | Skin diseases | External | Shrub | P |
| 33. | Cassia fistula L. | Caesalpiniace | F | Diabetic | Internal | Tree | D |
| 34. | Senna occidentalis (L.) | Caesalpiniace | S | Stomach | Internal | Herb | D |
| 35. | Senna tora (L.) Roxb. | Caesalpiniace | L | Mate | Internal | Herb | Pi |
| 36. | Catharanthus roseus | Apocynaceae | W | Skin disease, | Internal, | Herb | P |
| 37. | Catunaregam spinosa | Rubiaceae | F | Leach Bite | External | Tree | P |
| 38. | Celastrus paniculatus | Celastraceae | S | Nervous | Internal | Shrub | P |
| 39. | Cipadessa baccifera | Meliaceae | L | Poison Bite | Internal | Tree | D |
| 40. | Cissus quadrangularis | Vitaceae | S | Indigestion | Internal | Climbing | P |
| 41. | Citrullus colocynthis | Cucurbitacea | R | Jaundice | Internal | Herb | P |
| 42. | Citrus aurantifolia | Rutaceae | F | Indigestion | Internal | Shrub | J |
| 43. | Cleome monophylla L. | Cleomaceae | L | Head Ache | External | Herb | J |
| 44. | Cleome viscosa L. | Cleomaceae | L | Head Ache- | External | Herb | P |
| 45. | Clitoria ternatea L. | Fabaceae | R | Rheumatic | External | Climbing | P |
| 46. | Coccinia grandis (L.) J. | Cucurbitacea | W | Diabetic, | Internal | Climbing | D |
| 47. | Cuscuta reflexa Roxb. | Convolvulace | W | Jaundice | Internal | Climbing | J |
| 48. | Datura metel L. | Solanaceae | L | Tumour, | External | Shrub | P |
| 49. | Dodonaea viscosa (L.) | Sapindaceae | L | Swelling | External | Shrub | E |
| 50. | Eclipta prostrata (L.) L. | Asteraceae | L | Hair Falling | External | Herb | E |
| 51. | Erythrina variegata L. | Fabaceae | S | Menstrual | Internal | Tree | D |

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| 52. | Eucalyptus tereticornis | Myrtaceae | L | Pain, | External | Tree | E |
| 53. | Euphorbia hirta L. | Euphorbiacea | L | Skin Disease | External | Herb | P |
| 54. | Evolvulus alsinoides | Convolvulace | W | Scabies | External | Herb | P |
| 55. | Ficus benghalensis L. | Moracaeae | B | Diabetic, | External/ | Tree | D |
| 56. | Ficus religiosa L. | Moracaeae | L | Chest Pain | Internal | Tree | P |
| 57. | Gloriosa superba L. | Liliaceae | R | Joint Pain | External | Climbing | P |
| 58. | Helicteres isora L. | Sterculiaceae | F | Hair Growth | External | Shrub | E |
| 59. | Hibiscus rosa-sinensis | Malvaceae | L | Heart | Internal | Shrub | P |
| 60. | Hybanthus | Violaceae | W | Sexual | Internal | Herb | P |
| 61. | Jasminum | Oleaceae | F | Milk | External | Climbing | F |
| 62. | Jatropha curcas L. | Euphorbiacea | L | Tooth Ache | External | Shrub | L |
| 63. | Justicia adhatoda L. | Acanthaceae | L | Cough, Cold | Internal | Shrub | J |
| 64. | Lantana camara L. | Verbenaceae | L | Wound | External | Shrub | P |
| 65. | Lawsonia inermis L. | Lythraceae | L | Skin | External | Shrub | P |
| 66. | Leucas aspera (Willd.) | Lamiaceae | L | Nostril | Internal | Herb | E |
| 67. | Mangifera indica L. | Anacardiacea | S | Delivery | Internal | Tree | D |
| 68. | Melia azedarach L. | Meliaceae | L | Sperm | External/ | Tree | E |
| 69. | Magnolia champaca | Magnoliaceae | L | Eye infection | Internal | Tree | J |
| 70. | Mimosa pudica L. | Mimosaceae | L | Wound | External | Herb | P |
| 71. | Mimusops elengi L. | Sapotaceae | S | Improve | Internal | Tree | D |
| 72. | Momordica charantia | Cucurbitacea | F | Blood | Internal | Climbing | J |
| 73. | Moringa oleifera Lam. | Moringaceae | G | Piles | Internal | Tree | P |
| 74. | Mucuna pruriens (L.) | Fabaceae | S | Sexual | Internal | Climbing | Pi |
| 75. | Mukia madraspatana | Cucurbitacea | L | Cold, Cough | Internal | Climbing | J |
| 76. | Murraya koneigii (L.) | Rutaceae | L | Eye infection | Internal | Shrub | P |
| 77. | Naravelia zeylanica | Ranunculacea | L | Cold and | External | Shrub | E |
| 78. | Nelumbium speciosum | Nymphaeacea | F | Heart | Internal | Herb | P |
| 79. | Nerium oleander L. | Apocynaceae | R | Leprosy, | External | Shrub | P |
| 80. | Ocimum americanum | Lamiaceae | L | Cough and | Internal | Herb | E |
| 81. | Opuntia stricta (Haw.) | Cactaceae | S | Ulcers | Internal | Shrub | J |
| 82. | Phoenix sylvestris (L.) | Arecaceae | S | Aphrodisiac | Internal | Tree | P |
| 83. | Phyllanthus amarus | Euphorbiacea | W | Liver | Internal | Herb | E |
| 84. | Pithecellobium dulce | Mimosaceae | L | Leprosy, | External | Tree | P |
| 85. | Plantago ovata Forssk | Plantaginacea | L | Prevent | Internal | Herb | E |
| 86. | Plumbago zeylanica L. | Plumbaginace | R | Wound | External | Shrub | P |
| 87. | Plumeria rubra L. | Apocynaceae | L | Diabetic | External | Tree | P |
| 88. | Pongamia pinnata (L.) | Fabaceae | S | Skin diseases | External | Tree | O |
| 89. | Psidium gujava L. | Myrtaceae | F | Alcoholic | Internal | Tree | J |
| 90. | Pterocarpus marsupium | Fabaceae | G | Diabetic, | Internal | Tree | E |
| 91. | Punica granatum L. | Punicaceae | F | Cardiac | Internal/ | Shrub | J |
| 92. | Rauvolfia serpentina | Apocynaceae | R | Blood | Internal | Herb | D |
| 93. | Ricinus communis L. | Euphorbiacea | L | Constipation | Internal | Shrub | J |
| 94. | Rubia cordifolia L. | Rubiaceae | W | Blood | Internal | Climbing | D |
| 95. | Rubus ellipticus Smith | Rosaceae | L | Swelling | External | Shrub | P |
| 96. | Ruta graveolens L. | Rutaceae | L | Joint pain | External | Shrub | E |
| 97. | Semecarpus | Anacardiacea | F | Chroniic | External | Tree | O |
| 98. | Sesbania grandiflora | Fabaceae | L | Ulcers | Internal/ | Shrub | E |
| 99. | Sida cordifolia L. | Malvaceae | L | Fever | Internal | Herb | D |
| 100. | Solanum nigrum L. | Solanaceae | L | Ulcer | Internal | Herb | E |
| 101. | Solanum torvum Sw | Solanaceae | F | Asthma | Internal | Shrub | P |
| 102. | Solanum trilobatum L. | Solanaceae | L | Cough and | Internal | Climbing | D |
| 103. | Solanum virginianum | Solanaceae | S | Gum | External | Herb | P |
| 104. | Sphaeranthus indicus | Asteraceae | W | Migraine | External | Herb | E |
| 105. | Syzygium cumini (L.) | Myrtaceae | S | Diabetic | Internal | Tree | D |
| 106. | Tamarindus indica L. | Fabaceae | S | Piles, Insect | Internal/ | Tree | P |
| 107. | Tectona grandis L. f. | Verbenaceae | S | Scabies | External | Tree | P |

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| 108. | Tephrosia purpuria | Fabaceae | R | Delivery | Internal | Herb | P |
|---|---|---|---|---|---|---|---|
| 109. | Terminalia arjuna | Combretacea | S | Heart | Internal | Tree | D |
| 110. | Terminalia bellirica | Combretacea | F | Sexual | Internal | Tree | P |
| 111. | Terminalia chebula | Combretacea | F | Sexual | Internal | Tree | P |
| 112. | Tinospora cordifolia | Menispermac | F | Jaundice | Internal | Climbing | J |
| 113. | Toddalia asiatica (L.) | Rutaceae | S | Stomach | Internal | Shrub | P |
| 114. | Tribulus terrestris L. | Zygophyllace | W | Fever, Head | External | Herb | P |
| 115. | Tridax procumbens L. | Asteraceae | L | Cut injuries | External | Herb | P |
| 116. | Vernonia cinerea (L.) | Asteraceae | L | Wound | External | Herb | P |
| 117. | Vitex negundo L. | Verbenaceae | L | Body pain | External | Shrub | E |
| 118. | Withania somnifera | Solanaceae | R | Nervous | Internal | Shrub | P |
| 119. | Wrightia tinctoria R. | Apocynaceae | L | Skin | External | Tree | L |
| 120. | Ziziphus jujuba Mill. | Rhamnaceae | F | Reduce body | Internal | Tree | S |

C-Common, R-Rare, CU-Cultivated, V-Vulnerable, S-Sporadic

| | **Table 2. The diversity of MP species and their families in the study area** | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No | Family name | No. of species | Percent (%) | S.No | Family name | No.of species | Percent (%) |
| 1 | Fabaceae | 12 | 10.00 | 28 | Begoniaceae | 1 | 0.83 |
| 2 | Mimosaceae | 6 | 5.00 | 29 | Brassicaceae | 1 | 0.83 |
| 3 | Solanaceae | 6 | 5.00 | 30 | Cactaceae | 1 | 0.83 |
| 4 | Apocynaceae | 5 | 4.17 | 31 | Canaceae | 1 | 0.83 |
| 5 | Caesalpiniaceae | 5 | 4.17 | 32 | Capparaceae | 1 | 0.83 |
| 6 | Euphorbiaceae | 5 | 4.17 | 33 | Caricaceae | 1 | 0.83 |
| 7 | Rutaceae | 5 | 4.17 | 34 | Celastraceae | 1 | 0.83 |
| 8 | Asteraceae | 4 | 3.33 | 35 | Clusiaceae | 1 | 0.83 |
| 9 | Cucurbitaceae | 4 | 3.33 | 36 | Lythraceae | 1 | 0.83 |
| 10 | Anacardiaceae | 3 | 2.50 | 37 | Magnoliaceae | 1 | 0.83 |
| 11 | Combretaceae | 3 | 2.50 | 38 | Menispermaceae | 1 | 0.83 |
| 12 | Malvaceae | 3 | 2.50 | 39 | Moringaceae | 1 | 0.83 |
| 13 | Meliaceae | 3 | 2.50 | 40 | Nymphaeaceae | 1 | 0.83 |
| 14 | Myrtaceae | 3 | 2.50 | 41 | Oleaceae | 1 | 0.83 |
| 15 | Rubiaceae | 3 | 2.50 | 42 | Oxalidaceae | 1 | 0.83 |
| 16 | Verbenaceae | 3 | 2.50 | 43 | Papaveraceae | 1 | 0.83 |
| 17 | Acanthaceae | 2 | 1.67 | 44 | Plantaginaceae | 1 | 0.83 |
| 18 | Amaranthaceae | 2 | 1.67 | 45 | Plumbaginaceae | 1 | 0.83 |
| 19 | Asclepiadaceae | 2 | 1.67 | 46 | Punicaceae | 1 | 0.83 |
| 20 | Cleomaceae | 2 | 1.67 | 47 | Ranunculaceae | 1 | 0.83 |
| 21 | Convolvulaceae | 2 | 1.67 | 48 | Rhamnaceae | 1 | 0.83 |
| 22 | Lamiaceae | 2 | 1.67 | 49 | Rosaceae | 1 | 0.83 |
| 23 | Liliaceae | 2 | 1.67 | 50 | Sapotaceae | 1 | 0.83 |
| 24 | Moracaeae | 2 | 1.67 | 51 | Sterculiaceae | 1 | 0.83 |
| 25 | Sapindaceae | 2 | 1.67 | 52 | Violaceae | 1 | 0.83 |
| 26 | Alangiaceae | 1 | 0.83 | 53 | Vitaceae | 1 | 0.83 |
| 27 | Arecaceae | 1 | 0.83 | 54 | Zygophyllaceae | 1 | 0.83 |

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| S. no. | Name of medicinal plant | Number of citation by informants | Total number of informants | UV index | Disease-Consensus Index DCI | RPL | ROP |
|---|---|---|---|---|---|---|---|
| | | | | | Table: 3 Highly utilized species of the study are along with UV, DCI, RPL and ROP. | | |
| 1 | Abrus precatorius | 12 | 20 | 0.6 | 0.063 | 0.72 | 89 |
| 2 | Acacia nilotica | 14 | 20 | 0.7 | 0.072 | 0.77 | 42 |
| 3 | Achyranthes aspera | 14 | 20 | 0.7 | 0.072 | 0.97 | 89 |
| 4 | Justicia adhatoda | 16 | 20 | 0.8 | 0.264 | 0.99 | 100 |
| 5 | Argemone mexicana | 12 | 20 | 0.6 | 0.032 | 0.63 | 92 |
| 6 | Azadirachta  indica | 20 | 20 | 1 | 0.238 | 1 | 89 |
| 7 | Senna alata | 14 | 20 | 0.7 | 0.086 | 0.72 | 65 |
| 8 | Cassia auriculata | 15 | 20 | 0.75 | 0.076 | 0.73 | 67 |
| 9 | Eclipta prostrata | 14 | 20 | 0.7 | 0.073 | 0.81 | 56 |
| 10 | Ficus bengalensis | 17 | 20 | 0.85 | 0.212 | 0.76 | 78 |
| 11 | Gymnema sylvester | 12 | 20 | 0.6 | 0.106 | 0.98 | 100 |
| 12 | Lawsonia inermis | 16 | 20 | 0.8 | 0.041 | 0.71 | 65 |
| 13 | Naravelia zeylanica | 16 | 20 | 0.8 | 0.014 | 0.87 | 77 |
| 14 | Ocimum tenuiflorum | 20 | 20 | 1 | 0.271 | 1 | 100 |
| 15 | Phyllanthus amarus | 20 | 20 | 1 | 0.116 | 0.98 | 93 |
| 16 | Piper nigrum | 20 | 20 | 1 | 0.132 | 1 | 100 |
| 17 | Pongamia pinnata | 20 | 20 | 1 | 0.012 | 0.73 | 85 |
| 18 | Santalum album | 14 | 20 | 0.7 | 0.015 | 0.73 | 34 |
| 19 | Strychnos nux-vomica | 17 | 20 | 0.85 | 0.012 | 0.98 | 85 |
| 20 | Syzygium cumini | 16 | 20 | 0.8 | 0.121 | 0.97 | 77 |
| 21 | Tribulus terrestris | 20 | 20 | 1 | 0.122 | 1 | 99 |
| 22 | Vitex negundo | 16 | 20 | 0.8 | 0.0231 | 0.79 | 72 |
| 23 | Withania somnifera | 17 | 20 | 0.85 | 0.011 | 1 | 100 |
| 24 | Zizyphus jujube | 20 | 20 | 1 | 0.011 | 0.87 | 61 |

**Table 4. Informant consensus factor (ICF) for different ailment categories**

| S.No. | Ailment | Number of taxa (Nt) | Number of use reports (Nur) | ICF |
|---|---|---|---|---|
| 1 | Infection and Inflammation | 8 | 24 | 0.69 |
| 2 | Venereal diseases | 2 | 16 | 0.933 |
| 3 | Hair fall | 4 | 29 | 0.89 |
| 4 | Fever | 4 | 29 | 0.89 |
| 5 | Skin diseases | 11 | 26 | 0.72 |
| 6 | Stomach pain | 2 | 26 | 0.96 |
| 7 | Dengue fever | 1 | 12 | 1 |
| 8 | Cold and Cough | 6 | 28 | 0.81 |
| 9 | Scabies | 4 | 23 | 0.86 |
| 10 | Asthma | 4 | 22 | 0.85 |
| 11 | Poison bite | 6 | 27 | 0.8 |
| 12 | Impotence | 3 | 21 | 0.9 |
| 13 | Indigestion | 2 | 26 | 0.96 |
| 14 | Jaundice | 5 | 27 | 0.84 |
| 15 | Head ache | 3 | 27 | 0.92 |
| 16 | Diabetics | 9 | 20 | 0.57 |
| 17 | Menstrual disorder | 1 | 19 | 1 |
| 18 | Joint pain | 3 | 26 | 0.92 |
| 19 | Heart disease | 3 | 17 | 0.87 |
| 20 | Over bleeding | 1 | 15 | 1 |
| 21 | Liver disease | 2 | 13 | 0.91 |
| 22 | Ulcers | 2 | 19 | 0.94 |
| 23 | Delivery pain | 2 | 19 | 0.94 |
| 24 | Eye infection | 2 | 18 | 0.94 |

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**Table 5. Fidelity Level (FL) of medicinal plants for human, livestock and both ailments**

| S. no. | Ailment Treated | Local name of medicinal plant | Place of collection | Name of medicinal plant | Human | Live Stock | Both | FL |
|---|---|---|---|---|:---:|:---:|:---:|---|
| 1 | Swelling | Kundumani | Kiliviyaru | Abrus precatorius | ✓ | | | 3 |
| 2 | Dental care, Liver strength | Karuvelam | Aralvaimozhi | Acacia nilotica | | | ✓ | 3.5 |
| 3 | Scabies, Cut injuries | Nayarivi | Kodithuraui | Achyranthes aspera | ✓ | | | 3.5 |
| 4 | Cough, Asthma | Adatodai | Kiliviyaru | Adhatoda zeylanica | | | ✓ | 4 |
| 5 | Jaundice | Bramadand | Veerapuli | Argemone Mexicana | ✓ | | | 3 |
| 6 | Intestinal worms, stomach upset, loss of appetite | Veppai | Kiliviyaru, Veerapuli, Kodithurai | Azadirachta indica | ✓ | | | 5 |
| 7 | Skin diseases | Seemaiagathi | Pechiparai | Cassia alata | ✓ | | | 3.5 |
| 8 | Diabetes | Aavaram | Kanikudiyaruppu | Cassia auriculata | | | ✓ | 3.75 |
| 9 | Hair Falling | Karisilanganni | Kodithuraui | Eclipta prostrata | ✓ | | | 3.5 |
| 10 | Diarrhoae | Ala | Kiliviyaru, Veerapuli, Kodithurai | Ficus bengalensis | | | ✓ | 4.25 |
| 11 | Diabetics | cirukurinca | Kiliviyaru | Gymnema sylvestre | ✓ | | | 3 |
| 12 | Skin Diseases (Foot Crake) | Marudhani | Vanathiparai | Lawsonia inermis | | | ✓ | 4 |
| 13 | Cold and Cough | Mookkurinjaan | Konjur | Naravelia zeylanica | ✓ | | | 4 |
| 14 | Cough and Cold | Tulsi | Vanathiparai, Konjur, Kalikesam | Ocimum tenuiflorum | ✓ | | | 5 |
| 15 | Liver disease | Kezhanelli | Pechiparai | Phyllanthus amarus | ✓ | | | 5 |
| 16 | Improve appetite | Kurumilagu | Maramalai | Piper nigrum | ✓ | | | 5 |
| 17 | Skin diseases, (Eczema) | Pungan | Marunthuvazhalmalai | Pongamia pinnata | | | ✓ | 5 |
| 18 | Bronchitis, skin disorders | Santhanam | Olakaiaruvi | Santalum album | | | ✓ | 3.5 |
| 19 | Migraine headache | Yetti | Kodayaru | Strychnos nux-vomica | ✓ | | | 4.25 |
| 20 | Diabetic | Nagamaram | Marunthuvalmalai | Syzygium cumini | | | ✓ | 4 |
| 21 | Fever, Head ache | Nerunji Mull | Vanathiparai | Tribulus terrestris | ✓ | | | 5 |
| 22 | Body pain | KarruNochi | Konjur | Vitex negundo | | | ✓ | 4 |
| 23 | Nervous weakness | Amukura | Keeriparai | Withania somnifera | ✓ | | | 4.25 |
| 24 | Appetite stimulant, digestive aid | Ilandai | Maramalai | Zizyphus jujube | ✓ | | | 5 |
| 25 | Cut injuries | Aruvamukupoondu | Maramalai | Tridax procumbens | | | ✓ | 5 |

## Conclusion

This study summarized the ethnobotanical uses of indigenous plants found in Kanyakumari district, which offered a wealth of knowledge about the Kani tribes' usage of herbal remedies in the district's rural forest areas. This research discovered that the most commonly abused plants were contained in the Fabaceae, Mimosaceae, Solanaceae, and Rutaceae plant families. The present study's habit-based classification showed that trees are the most commonly utilised life type, accompanied by herbs. The usage of ethnomedicinal plants by tribes for a number of diseases shows undeniably good and effective among the

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Kanyakumari tribes. The methods for using ethnobotanically significant plants differed according to the disease's origin. Additionally, this study demonstrates that conventional healers address both human and animal health concerns. The significance of a species for a given reason and the groups that were more relevant to the beneficiaries were calculated through the computation of numerical indices of UV, FL, and ICF, which revealed a greater variety of medicinal species that are still used by indigenous people in the study site to treat different ailments. Increased FL would allow for further ethnopharmacological research in the quest for possible new drugs. From the RPL value, it is clear that medicinal plant species have a strong indication for treating specific ailments, and the final conclusion is that these common plants should be seen as a starting point for future research into their capacity for treating a variety of serious ailments. It is to be understood that the experience and skills of vaidhyars and medicine men about the preparation of medication therapies may be patented, as this skill is known to be extremely rare. However, conventional treatment awareness must be popularised among rural citizens, since there are few health care centres accessible in remote villages. The investigation of Kani tribes' cultural use of traditional medicines would aid in the preservation of this priceless heritage. Additionally, ethnobotanical evidence is critical for conservation managers and policymakers to ensure the long-term viability of medicinal plant populations that are threatened by overexploitation.

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# GREENWASHING – A COMPULSORY PUSH ON THE ECO BUTTON

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## ABSTRACT

"Green" has gained popularity all around the world. Since the idea is still in its infancy, further academic research is required. Many businesses now use green marketing techniques to demonstrate that their products and services are environmentally beneficial. However, a passive presentation of the same may take advantage of consumers and the environment. This paper makes an effort to clarify the idea of "greenwashing," which is a risky form of eyewash. The same types, methods, and causes are also highlighted, offering consumers and businesses the required recommendations. The firms are not the only ones to blame. In this sense, the government, NGOs, consumers, and other parties should all exercise caution.

**Keywords: Greenwashing, Green Marketing, Deceptive Presentation, Eyewash.**

## INTRODUCTION

Ongoing complaints against organizations follow greenwashing. Greenwashing is a problem since it is simple to "paint" things as being more sustainable than they actually are, which leads to ongoing charges against organizations. Using the word "green" to represent something that is environmentally friendly while "whitewashing" its shortcomings is known as "greenwashing."The businesses dishonestly spread statements about environmental awareness. Greenwashing harms the company's brand and reputation, which may happen both purposefully and accidentally. The public is misled into thinking that a company's aims, processes, policies, technology, and other operations are environmentally friendly.

## OBJECTIVES

- To create awareness among the consumers as well as the public about the concept of greenwashing.
- To explore its impact on products.
- To provide necessary suggestions and solutions to companies and consumers.

## RESEARCH METHODOLOGY

Since this is an exploratory study, the technique relied on secondary data. The information was gathered from a variety of sources that were published including books, periodicals, newspapers, essays, research papers, newspapers, and websites. They were carefully examined and the data needed for this paper only was collected from them.

## REVIEW OF LITERATURE

The term "greenwashing" originated from "whitewashing", first used by American environmentalist Jay Westerveld in 1986. This misleading form of advertising aims to promote the environmental attributes of the organization's products, goals, or policies. Some companies use greenwashing to mislead consumers with environmental protection concepts, causing consumers to buy their goods and services, thereby increasing their overall product revenues (Kahle & Gurel-Atay, 2015; Mayrand & Trottier, 2011).

Although greenwashing was proposed in the 1980s, its usage is still increasing. This might be due to the increasing demand for green products (Dahl, 2010).

Greenwashing behavior is a kind of "creative reputation management" in which the company conceals deviation and authenticity (Laufer, 2003)

## HISTORY OF GREENWASHING

New York environmentalist Jay Westerveld coined the term Greenwashing in a 1986 essay about the hotel industry's practice of placing notices in bedrooms promoting the reuse of towels to save the environment. He noted that often little or no effort was made towards reducing energy waste although towel reuse saved them only laundry costs. He concluded that often the real aim was to escalate profit and labeled this and other profitable – but – ineffective "environmentally-conscientious" acts as greenwashing.

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## SEVEN SINS OF GREENWASHING

Greenwashing is an unsupported claim to deceive consumers believe that a firm's products or services are environmentally friendly and have a greater positive environmental impact than what it is.

TerraChoice researchers visited big-box retailers in USA,Canada,Australia and UK to research 4996 products that were claimed to be green. Over 98% of the products were greenwashed and categorized under seven sins.

### • Sin of Hidden Trade-off

It is predicted on categorizing a product as green based on narrow attributes. A product that purports to be made of recycled materials is the best example. Paper harvesting may appear sustainable if we ignore the manufacturing process which uses a lot of energy ,pollutes the environment and uses harmful chemicals despite coming from a responsibly harvested forest.

### • Sin of No-proof

Any environmental claim that cannot be backed by factual evidence or a trustworthy third-party certification commits this sin. One of the simplest greenwashing techniques is to provide no proof to back up a claim. Companies may claim to sell environmentally friendly items,but they have no true knowledge of the raw materials,supply chain or manufacturing technique used.For example,an electric bulb is marketed as being energy efficient like giving 3 or 4 or 5 stars for energy saving purpose without any details like how much amount of energy (ampere or units) will be saved.

### • Sin of Vagueness

A claim that is inadequately defined which is misunderstood by intended consumers.The tagline"All Natural" or "100% Natural" brings this confusion as they are not always "green". Example-Uranium,Mercury etc are hazardous even though naturally available.

### • Sin of Irrelevance

Sin committed when an environmental claim is true but actually unimportant or unhelpful when the consumers look for truly greener items.When a product is charged high for "CFC-free" while failing to disclose the fact that they were already prohibited by law falls under this sin.

### • Sin of Lesser of Two Evils

Is it true that organic cigarettes are "green"and herbicides are "environmentally friendly?Labelling such products as "green(er)" serves only to seek attention away from their inherent flaws.When firms assertions are technically true but purposely distract the consumers from greater health hazards,it is called the lesser of two evils sin.

### • Sin of Fibbing

Making environmental claims that are bluntly false infers committing the sin of fibbing.The majority includes the misrepresentation of an independent authority's certification.

Volkswagen's emissions cheating strategy is one of the most well-known real life examples.The automaker installed a software in vehicles to circumvent emissions testing methods, allowing dirty,non compliant vehicles to pass regulatory inspections.

### • Sin of Worshipping False Labels

False labels are badges,certificates and honors that have no true meaning.This is created to deceive buyers thinking that the product has gone through a valid green screening process.The common example is the brands paying periodicals to write favourable reviews of their products which is really not.

## FINDINGS

After the research process,the Terrachoice researchers released the type of sin with the percentage of sin committed on the products that were claimed green.

| Type of Sin | % of Sin committed on Products |
|---|---|
| Sin of Hidden Trade-Off | 73 |
| Sin of No Proof | 59 |
| Sin of Vagueness | 56 |
| Sin of Worshipping False Labels | 24 |
| Sin of Irrelevance | 8 |
| Sin of Lesser of Two Evils | 4 |
| Sin of Fibbing | 0.4 |

## SUGGESTIONS AND RECOMMENDATIONS

### I. TO COMPANIES

### • Walk your Green Talk

Product's benefits can be first allowed to convey the audience that it is environmentally friendly followed with the statement of how and why it is correct.This not only attracts consumers but also explores the morality of a firm.

### • Be Transparent

The customers can be informed unambiguously the environmental benefits he is sure to enjoy either with or without paying anything extra.They can be provided with transparent information they want about the product at any point of time.

### • Don't Mislead

Consumers may claim to understand what buzzwords like "recyclable" and "bio-degradable" mean,but they can be easily misled putting naive sustainable marketers at risk by using plain,fluffy and straightforward language.For better understanding, the product can be indicated with the percentage recycled and biodegraded.

### • Enlist the support of third parties

The credibility of third parties such as NGO's,government and environmental organizations can be attached during the

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environmental communication with proper evidence and acknowledgement.

- **Promote responsible consumption**

Companies can encourage customers to use only what is necessary and intentionally make them reduce waste so that resources can be saved from the customers side too.

## II. TO CONSUMERS

- When companies tend to sell their goods through large scale advertisement stating "green",unearth the attributes they are intentionally hiding.

- Be suspicious on all environmental claims

- Examine the factory's environmental history to determine if they are really concerned about the environment and its products.

- Consumers can look out for poor use of scientific facts and terminologies such as sustainable technology,emission offsetting,etc.

- Consumers can differentiate what is right(Green) and what is wrong(Greenwashing) and select the products through their own instincts.

- Check to see if any third-party recommendations are available. If so, check their websites and the products they have approved.

## CONCLUSIONS

Even while it might often be obvious and simple to recognize, the phrase "greenwashing" has lost a lot of its meaning in the current economic climate. The pressure on companies to become "green" leads them to look for green assurances even while they have little to no. Customers have developed to choose green products over conventional ones. When consumers see "green" labels on items, they have confidence in them and buy them without hesitation. In order to promote sustainable growth, businesses must refrain from misleading consumers through disingenuous marketing and deliver the goods honestly. On the other side, the government must step forward to introduce this idea and make the public aware through extensive advertising, awareness initiatives and ongoing campaigns.

## RECENT  GREENWASHING SPOTTED COMPANIES

- **HSBC:** Misleading Climate Ads (2022)
- **Innocent:** Insincere TV advertisements (2022) – Bottled Drink
- **Keurig:** Misleading recycling claims (2022) – Coffee Capsules
- **Unilever:** Fake Plastic promises (2022)
- **Adidas:** Logo embraced as End Plastic Waste (2021)
- **Coca-Cola:**False representation of   recyclable product (2021)
- **H&M:** Insincere sustainable fashion claims (2021)

- **Hefty Recycling Bags:** False representation of the product (2021)
- **Ryanair:** False low-emissions claims (2020) - Airways
- **Quorn:** Unverifiable carbon-footprint claims (2020) –Food Concern
- **Shell:** Gaslighting of the general public (2020)
- **Ikea:** Accredited illegal logging (2020) –Furniture
- **Windex:** Misleading plastic packing claims (2019) –Glass cleaner
- **BP:** Misleading Ads of Low – Carbon Energy (2019)
- **Nestle:**Miseading  recyclable and reusable packing claims (2018)
- **McDonald's:**Launch of Net Zero Carbon emission Restaurant (2018)
- **Volkswagen:** False emission test claims (2015)

## WEBSITES TO  RECOGNIZE GREENWASHING

Greenpeace.org
greenwashingindex.com
stopgreenwash.org
corpwatch.org
thesietch.org
indiaenvironmentportal.org.in.

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# A Study of Problems Faced by Married Working Women in the Current Scenario

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**ABSTRACT**

**With all family members present at home during the lockdown, it has proven to be exceedingly difficult for all women, whether working professionals or stay-at-home moms. This has increased their workload significantly and required more care and attention than usual. Conventional gender roles, which classify males as "breadwinners" and women as "carers," became more apparent, furthering the domestication of both sexes. Housewives faced difficulties, but with "work from home," even professionals faced difficulties. With the worry about job loss and salary reductions, working women face a significant increase in domestic responsibilities, making them more vulnerable in both private and public settings. (Sanjay and Manjesh, 2020)**

**The present study aims to predict the factor of the problem which affects women during the lock down. The samples of 60 married working women were surveyed. The random sampling method is used to survey the population in Chennai. Stress was assessed using ISMA. A structured questionnaire was framed and used to predict the problem which is faced by married working women in the current scenario of Lockdown. The statistical tool used in this study is Regression analysis to predict the factors of the problem which affects and stress married working women. The study revealed that Stress is significantly predicated by Dual work pressure which a has significant value of 0.000, which is less than the acceptable value of 0.05. Hence Null Hypothesis is rejected (0.000 < 0.05)**

Keywords: lockdown, stress, women,

## INTRODUCTION

In India, women perform more unpaid and unrecognized domestic labor. Being socially isolated at home could provide an opportunity to comprehend better and distribute chores.

Whether there is a conflict, an economic downturn, or a disease outbreak, an increase in maltreatment is a pattern that frequently occurs in these situations. The quarantine regulations, however, provide a serious obstacle. Everyone finds it tough to be confined to their homes, but it is a nightmare for female victims of gender-based abuse. Their numbers are likely to increase as the pandemic spreads, affecting women's physical and mental health and their capacity to contribute to the social and economic recovery.

How are you doing right now? When asked this topic, many people would simply roll their eyes, while others would share their experiences with juggling work and housework. Yes, the pandemic and the ongoing lockdown have forced us to confront some harsh truths about life. However, one particularly unpleasant reality has only lightly tarnished the surface of our otherwise happy existence: while the stress in our lives is increasing at an incredible rate, one gender is feeling the strain more than the other. Sneha Agarwal, an IT worker in her mid-twenties, was thinking positively when the government imposed a statewide lockdown. She had only recently gotten married, in September, so she welcomed any chance to spend time with her busy husband. She thought that working from home would be enjoyable. She was unfortunately unaware of what lay ahead. Her frail shoulder bore most of the domestic duties in the absence of the support staff, which consisted of a cook and two maids. Because she needed to prepare breakfast and tidy the house before starting her office duties at 9 am, her day began early, practically at 6 am. She would prepare lunch about midday, leaving her office work unattended, and since she didn't have time for a leisurely meal, she would eat whatever she could fit in between online meetings and presentations. She used to appreciate her husband's requests for sex, but now she cringed when she tried to get some sleep at night. After twenty days, she lost it and sought assistance from a counseling psychologist because she could not bear the pressure. This study attempted to foresee the difficulties that married working women might experience during a lockdown.

## REVIEW OF LITERATURE

- Women in India perform a disproportionate amount of unpaid and unrecognized domestic labor as noted by Divya J Shekhar in 2020.
- The COVID-19 pandemic and the subsequent quarantine regulations pose a serious obstacle for female victims of gender-based abuse, as their numbers are likely to increase, affecting their physical and mental health, as well as their ability to

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contribute to the social and economic recovery, as noted by The Tribune in 2020.

- The COVID-19 pandemic and subsequent lockdowns have led to increased stress for many people, with one gender feeling the strain more than the other, as noted by Rupamudra Kataki in 2020.

# OBJECTIVES OF MARRIED WORKING WOMEN

## 1. Salary reduction

A domestic maid in South Mumbai named Sapna finds herself in a comparable predicament. A few weeks before to the 21-day lockout, her husband, a driver, lost his job. She and her elderly mother-in-law also share a modest kholi in Dadar. Sapna continued to cook and clean dishes at the homes she works at for two days after Prime Minister Narendra Modi enforced the Janata Curfew on March 22 out of concern that her employers would withhold her pay. Once it was confirmed that she would receive full payment, she felt relieved, but the future's uncertainty scares her. She has no idea when her husband will get a new job, and managing the household on a shoestring budget will be difficult.

## 2. Losing a job

Chawla sees the pandemic as a setback for those women who have battled societal and cultural prejudices in order to find employment. Women are three times more likely than men to be unemployed, and this is likely to continue. If a woman finds herself handling the majority of the household duties during the lockdown, "established gender roles will start to take shape again or increase even further." Everyone in the job market is being impacted by the economic downtrend. But, because of the inequality that still exists in the workplace, women are more likely to experience the agony of job loss and income reductions. Almost 122 million Indians lost their employment in April, according to estimates from the Centre for Monitoring Indian Economy.

Three-fourths of them were wage workers and small business owners. The majority of women would be affected since they work in low-wage occupations including domestic help, temporary labor, and small-scale businesses without benefits or job security. (Sanjay and Manjesh, 2020)

The impact on female occupations is clearly apparent across the United States. According to the most recent unemployment statistics, women held 55% of the 20.5 million jobs that were lost last month. According to the nonprofit media organization The Fuller Project, between March and April 11, the proportion of women filing all unemployment claims ranged from 53% in Wyoming to as high as 67% in Alabama.

## 3. Combined work pressure

Working from home is now accepted as the new standard. This new normal has brought forth additional issues but can undoubtedly help stop the unique coronavirus from spreading. Women having to balance work at home and work at the office at the same time is one of the major issues. Women who work from home are under more pressure to juggle family responsibilities and professional obligations. There will undoubtedly be stress as a result of the excessive workload, lack of focus, lack of family support for equal distribution of the work, in-laws' criticism of the work, inadequate rest, and other factors.

## 4. Financial strain

Women frequently opt for part-time jobs or leave the workforce altogether as a result of the stress of unpaid work. According to the survey, women are frequently criticised for how well they handle home duties, which is also a "trigger for violence against women." The research claims that the widespread closure of firms and sectors caused by Covid-19 has had a negative economic impact on communities, particularly on already vulnerable population groups. Women are overrepresented in low-paying, part-time, informal jobs that offer little to no social safety or financial security. It is more difficult for individuals to flee abusive relationships when they lose their money. (Prem Chowdhry, 2020)

## 5. Spouse-related issue

The vulnerability of women is not just mitigated by increased employment at home and job loss anxiety. Domestic violence also has another component, which has become more prevalent under lockdown. According to data from the National Commission on Women, domestic abuse cases have risen since the time before the lockdown, which prompted the Delhi High Court to order the Center and the Delhi government to attend high-level meetings to discuss ways to reduce violence against women. Around May 3, booze stores began to open, which led to an upsurge in domestic violence incidents. Between March 25 and May 5, Ghaziabad recorded 291 occurrences of domestic abuse; between May 5 and May 15, the number rose to 342 cases.

In Noida, there was a similar pattern of an increase in domestic violence instances that were reported. The reported incidence of domestic violence would have followed a similar pattern in other cities. Due to the restriction of living in one-room homes, as well as the dread of being overheard by an abusive husband, a woman is unable to raise her voice through a helpline.

Whether there is a conflict, an economic downturn, or a disease outbreak, an increase in maltreatment is a pattern that frequently occurs in these situations. The quarantine regulations, however, provide a particularly serious obstacle. Everyone finds it tough to be quarantined at home due to the coronavirus, but for female victims of gender-based violence, it turns into a true nightmare. Their numbers are likely to increase as the Covid-19 pandemic spreads, having a variety of negative effects on women's wellness, sexual and reproductive health, mental health, and their capacity to

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contribute to the regrowth of society and the economy. (Antonio Guterres, 2020)

## 6. Dealing with youngsters

Children's inability to go to school worsens the issue because there is no other place for them to go. Despite her children's distractions, a mother works from home. To work with children who are constantly dependent on their mothers for even the most basic necessities is truly a pipe dream. The responsibility of managing youngsters who are locked away 24 hours a day puts a lot of pressure on women. A woman is in a demanding circumstance where she must manage her work and children while competing for the winning prize.

## 7. A conflict with the in-laws

She hopes the lockdown doesn't make things worse. "My mother-in-law does not enjoy him doing housework, although he [the husband] will occasionally help me if I ask him to. I end up doing everything, so," explains Sapna, 30. I'll have to make due with what I've got. The fiercest critics and fault-finders in the household are the in-laws, who intentionally abuse the daughter-in-law by pointing out flaws in her husband's work.

## 8. A lack of family backing

The worst days for married women who work are lockdown periods when they have to manage everything as if they have ten hands. Two ladies often assist Sunanda Aggarwal*, 50, an office assistant at the government's Industrial Training Institute (ITI) in Beawar, Rajasthan, with household duties. Due to Beawar's water shortage, the domestic staff also washes all of the laundry by hand. Agarwal spends her day performing all of the household duties by herself because she works from home during the nationwide shutdown to prevent the coronavirus from spreading. Her son, a 26-year-old aspiring chartered accountant, spends time video chatting pals, streaming movies, and generally being uninterested while her husband, a local retailer, is out playing cards at a neighbor's house.

## 9. Psychiatric problems

According to a recent survey by a sleep solutions business based in Bengaluru, 67% of Indians experience sleep deprivation during lockdowns. "Women who work experience mental irritability since they are unable to obtain enough sleep because of domestic responsibilities and work commitments. There has been a lot of stress and anxiety. Awatramani continued, "Some of the typical problems that all women suffer during the lockdown are health difficulties, sleep patterns alteration, irritation, pressure, guilt, fear, and worry. This is also causing conflicts and fighting within relationships."

## 10. A fear of pandemic illness

Feelings of claustrophobia can frequently result from close closeness. At the moment, quantity time does not equal quality time. Nothing but duties, housework, and childcare will probably not make for very happy family relationships.

Women who work at home have had enough of the arguments and criticism. Many couples are at their wit's end after spending so much time together. The prospect of pandemic illness increases the likelihood that women will commit suicide.

The State Crime Records Bureau reports that 2,358 Pocso instances were reported in 2019, followed by molestation of women (803), cruelty by husbands and relatives (781), kidnapping and kidnapping combined account for 78.2% of crime against women, and rape accounted for 6.1% of crime against women.

The staff at Chennai's 35 all-female police stations kept a close check on their main targets—those who commit crimes against women and children—despite the Covid pandemic. These female police officers registered more than 450 instances from January to August under the Pocso Act and for harassing women, and they detained 465 suspects as part of their contribution to Covid control. According to the Pocso Act, 13% of cases involved abuse by husbands and family members. (Times of India, 2020)

## METHOD

### Objectives

The objective of this study is to identify the problem which is most affecting the married working women during lockdown period.

### Hypothesis

1. There will be no significant relationship between salary reduction, job loss, dual work pressure, financial pressure, problem with spouse, handling children, relationship problem with in-laws, lack of family support, psychological issues and phobia towards pandemic disease of married working women.

2. There will be no prediction of stress of married working women due to reduction in salary, loss of job, dual work pressure, financial pressure, problem with spouse, handling children, relationship problem with in laws, lack of family support, psychological issues and phobia towards pandemic disease of married women.

### Research Design

Random sampling method is used to survey the population.

### Sample

The samples of 60 married working women were surveyed in Chennai.

### Assessment tool

The ISMA (International stress management Association, UK) stress questionnaire assessed stress. Structured questionnaire was framed and used to predict the problem which is faced by married working women in the current scenario of Lockdown. It is a survey study. Likert's scale was used for measurement of questionnaire.

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**STATISTICAL ANALYSIS**

Correlation and Regression analysis was used to assess the association and predict the factors affecting the most married working women.

**RESULT AND DISCUSSION**

**Table 1- showing the Pearson Correlation Coefficient of Factors of the problem faced by married working women**

|     | S | RS | LJ | D P | F P | P S | HC | RI | LF | Psy | Pho |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| **S** | 1.00 | -.40 | -.04 | -.07 | -.15 | .12 | -.19 | -.59 | -.52 | -.36 | .26 |
| **RS** | -.40 | 1.00 | -.51 | .46 | .55 | -.30 | .14 | .39 | .32 | .25 | .28 |
| **LJ** | -.04 | -.51 | 1.00 | -.11 | -.22 | .33 | -.07 | -.28 | -.37 | .06 | -.38 |
| **DP** | -.07 | .46 | -.11 | 1.00 | .56 | -.05 | .31 | .05 | .12 | .35 | .26 |
| **FP** | -.15 | .55 | -.22 | .56 | 1.00 | -.03 | .23 | -.16 | -.32 | .58 | .60 |
| **PS** | .12 | -.30 | .33 | -.05 | -.03 | 1.00 | .40 | -.15 | -.23 | .25 | -.18 |
| **H C** | -.19 | .14 | -.07 | .31 | .23 | .40 | 1.00 | .29 | .17 | .63 | .36 |
| **RI** | -.59 | .39 | -.28 | .05 | -.16 | -.15 | .26 | 1.00 | .81 | .09 | -.40 |
| **LF** | -.52 | .32 | -.38 | .12 | -.32 | -.23 | .17 | .81 | 1.00 | .06 | -.32 |
| **Psy** | -.37 | .26 | .07 | .35 | .58 | .25 | .63 | .09 | .06 | 1.00 | .50 |
| **Pho** | .26 | .28 | -.38 | .26 | .60 | -.18 | .36 | -.40 | -.32 | .50 | 1.00 |

S- Stress, RS-Reduction in Salary, LJ- Loss of Job, DP-Dual work Pressure, FP-Financial Pressure, PS-Problem with Spouse, HC-Handling Children, RI-Relationship problem with In- laws, LF-Lack of Family support, Psy-Psychological issues, Pho-Phobia towards pandemic disease

Strong Correlation exist between the variable

- FP and RS, DP, Psy, Pho;
- Psy and HC, Pho
- LF and RI,
- Pho and Psy.

Hence, the null hypothesis is rejected and the above factors have a significant relationship.

**Table 2-Multiple linear regression analyses for associations of factors namely, Reduction in salary, Loss of job, Dual work pressure, Financial pressure, Problem with spouse, Handling children, Relationship problem with in laws, Lack of family support, Psychological issues, Phobia towards pandemic disease and Stress (60)**

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-----|-----|-----|-----|
| 1 | .881[a] | .775 | .730 | 1.63404 |

a. Predictors: (Constant), Phobia towards pandemic disease, Problem with spouse , Dual work pressure, Loss of Job, Handling Children, Reduction in salary, Psychological issues, Financial pressure, Relationship problem with in laws, Lack of family support

b. Dependent Variable: stress

For further examination, a number that is taken is more than 0. The R-value represents the correlation between the dependent and independent variables.The value in this instance is.881, which is favoura ble .R-square displays the overall variation for the dependent variable that the independent factors may account for. A number higher than 0.5 indicates that the model can identify the relationship. The value in this instance is.775, which is favourable.

In multiple regression, adjusted R-square demonstrates the generalisation of the results, or the variance of the sample results from the population. A minimal difference between R-square and Adjusted R-square must exist. In this instance, the value is.730, which is close to.775, making it acceptable. As a result, the model summary table is enough.

**ANOVA[a]**

| Model | Sum of Squares | df | Mean Square | F | Sig. |
|-------|-----|-----|-----|-----|-----|
| **Regression** | 451.765 | 10 | 45.177 | 16.919 | .000[b] |
| **Residual** | 130.835 | 49 | 2.670 | | |

a. Dependent Variable: stress

b. Predictors: (Constant),

Phobia towards pandemic disease, Problem with spouse , Dual work pressure, Loss of Job, Handling Children, Reduction in salary, Psychological issues, Financial pressure, Relationship problem with in laws, Lack of family support

- P-value/Sig value: Typically, the study's significance level is set at the 5% level or the 95% confidence interval. Consequently, the p-value

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must be lower than 0.05. It is.000 in the table above. The outcome is significant as a result.

- F-ratio: After accounting for the model's inherent inaccuracy, it shows an improvement in the variable's prediction when the model is fitted. A value for the F-ratio yield efficient model is larger than 1. The value in the table above is 16.919, which is good.

These findings suggest that the null hypothesis may be rejected in further analysis because the p-value of the ANOVA table is below the acceptable significance level.

**Coefficients$^a$**

|  | Unstandardized Coefficients B | Unstandardized Coefficients | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|
| (Constant) | 10.293 | 6.766 |  | 1.521 | .135 |
| **Reduction in salary** | -.983 | .392 | -.321 | -2.508 | .015 |
| **Loss of Job** | -.259 | .485 | -.109 | -.535 | .595 |
| **Dual work pressure** | 3.287 | .744 | .508 | 4.418 | .000 |
| **Financial pressure** | -2.023 | .819 | -.589 | -2.471 | .017 |
| **Problem with spouse** | 2.083 | .624 | .501 | 3.340 | .002 |
| **Handling Children** | -2.036 | .634 | -.465 | -3.213 | .002 |
| **Relationship problem with in laws** | 1.198 | .509 | .454 | 2.352 | .023 |
| **Lack of family support** | -1.664 | .830 | -.519 | -2.005 | .051 |
| **Psychological issues** | -1.088 | .569 | -.482 | -1.911 | .062 |
| **Phobia towards pandemic disease** | 2.988 | .826 | 1.042 | 3.616 | .001 |

- Dependent Variable: stress     **Interpretation of coefficients table**

| Independent Variable | Sig value | Hypothesis Testing Result at 95% confidence interval | Interpretation |
|---|---|---|---|
| **Reduction in salary** | .015 | Null Hypothesis rejected (0.015 < 0.05) | The substantial change in stress brought on by the pay drop caused by the Sig. value is 0.015, which is lower than the permitted threshold of 0.05. |
| **Loss of Job** | .595 | Null Hypothesis not rejected (0.595 > 0.05) | Stress levels haven't changed much as a result of job loss. This is due to the Sig. value being 0.595, which exceeds the 0.05 allowed limit. |
| **Dual work pressure** | .000 | Null Hypothesis rejected (0.000 < 0.05) | Dual work pressure caused a significant shift in stress that is less than the allowed value of 0.05, at 0.000. |
| **Financial pressure** | .017 | Null Hypothesis rejected (0.017 < 0.05) | The substantial change in financial stress as a result of the Sig. value is 0.017, which is lower than the desirable value of 0.05. |
| **Problem with spouse** | .002 | Null Hypothesis rejected (0.002< 0.05) | Because of the Sig. value, there has been a major shift in stress that is less than the allowed value of 0.05 and is caused by a spouse-related issue. |
| **Handling Children** | .002 | Null Hypothesis rejected (0.002< 0.05) | The Sig. value results in a significant change in stress related to handling children of 0.002, which is less than the permitted limit of 0.05. |

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| Relationship problem with in laws | .023 | Null Hypothesis rejected (0.023< 0.05) | The significant change in stress as a result of the relationship issue with the in-laws as a result of the Sig. value is 0.023, which is lower than the desirable |
| Lack of family support | .051 | Null Hypothesis not rejected (0.51 > 0.05) | Stress hasn't changed much because of the lack of family support. This is due to the Sig. value being 0.51, which exceeds the permitted limit of 0.05. |
| Psychological issues | .062 | Null Hypothesis not rejected (0.062 > 0.05) | Stress hasn't changed much because of psychological problems. This is due to the Sig. value being greater than the 0.05 allowed limit at 0.062. |
| Phobia towards pandemic disease | .001 | Null Hypothesis rejected (0.001 < 0.05) | The Sig. value causes a substantial shift in stress related to phobia of pandemic sickness of 0.001, which is less than the permitted value of 0.05. |

Therefore, the analysis suggests that Dual work pressure has a significant positive relationship with stress. Hence Dual work Pressure is the highest predictor of Stress.

**Residuals Statistics**

| | Minimum | Maximum | Mean | Std. Deviation | N |
|---|---|---|---|---|---|
| **Predicted Value** | 14.9342 | 23.9748 | 19.7000 | 2.76714 | 60 |
| **Residual** | -6.66546 | 3.33454 | .00000 | 1.48914 | 60 |
| **Std. Predicted Value** | -1.722 | 1.545 | .000 | 1.000 | 60 |
| **Std. Residual** | -4.079 | 2.041 | .000 | .911 | 60 |

a. Dependent Variable: stress

**Charts**
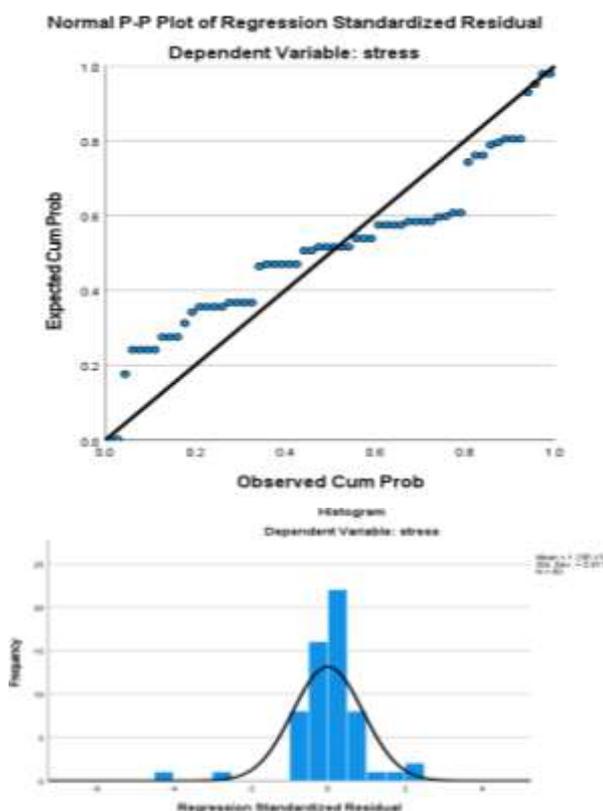




The charts represent the residual statistics of the mean and Standard deviation of variables.

**CONCLUSION**

Regardless of her busy schedule at home or at work, a woman should retain her space for her health and pleasure to preserve her unique nature. Without going overboard with the idea that "without her, nothing would happen at home and others will suffer without her assistance," women should identify their boundaries about what to do and what tasks others should perform. She continued by saying that rather than being spoon-fed and forced to give up their way of life, women should learn how to delegate their work to others and be responsible for managing the home on their own. (Counsellor and psychotherapist, Dr. Valarmathy R. Selvakumar, 2020, Times of India)

"Adult males have never performed unpaid care work in their life, making it exceedingly difficult to modify their behavior, but talking to them is crucial. Now is the moment to instruct and enlist the assistance of young boys and girls by assisting them in realizing the amount of work that has to be done at home, according to Bhogal.

The definition of change differs for each one of us. For stay-at-home parents and homemakers, it has been a complete shift. They have gone from having the home entirely to themselves to now dealing with meddling from other members of the family. Thus recommends finding a corner for yourself, where you can stay busy in some way, while others are around. "Make some time for yourself, and even if you do nothing for 15 minutes, it can leave you feeling refreshed. There is no single, one–size–fits–all solution. You have to carve out your own space at home and define the boundaries. Work at improving communication.

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These are stressful times for everyone. So be patient and considerate. Introspect and perhaps draw up a list of your priorities.

Thus, use patience and consideration. Think about your situation and perhaps make a list of your priorities. Examine your emotional health and concentrate on steadiness. Freely express yourself, but avoid focusing on your partner's flaws. Focus on working together to develop solutions instead. More stuff would be beneficial. Establish a new habit and fully commit to it. Engage in regular exercise to release happy hormones, meditation, singing, poetry reading, or any other activity you truly enjoy, for a period of time each day. (Times of India, 2020)

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**A STUDY OF PROBLEMS FACED BY MARRIED WORKING WOMEN IN THE CURRENT SCENARIO**

# A Study on Job Migration of Age-Old Private Security Guards in Chennai City

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## ABSTRACT

**They are identifying the factors which influence the respondent to migrate to the private security guards jobs at the age of 45years and above. In ancient days only wealthy people used to have private security guards to safeguard them from every possible threat, harm etc., in modern society, peoples collectively started to employ private security guards for their protection besides public protection they get from the Governments. As the population grows rapidly the needs of the people also grow proportionately. But, the governments may not be able to fulfil all the requirements of people. This led to socio-economic problems in the society and in turn created the need for private security guards in every society. As the need for private security guards increases daily in different walks of life, the types of services they offer also vary with various fields. From the findings the respondents have migrated to private security guard job from other form of private jobs because of family commitments, getting older, no support, for self earning, family compulsion and no pension. Private security agencies may come forward to give employment opportunity to youth.**

**Keywords: Job Migration, Private Security Guards, Age old Private Security Guards, Previous occupational status.**

## INTRODUCTION

A private security guard is a person who is hired either by a private organization or by a Government to protect the employers' interests like people, property, equipment etc., from various hazards like fire, theft, robbery, abuse, misuse etc.; Private Security Guards thwart loss to both men and property through either by manual vigilance or through electronic eyes like CCTV camera etc., In emergencies, they alert all the concerned and ensure either no damage or least possible damage to the interests of their employer.

Private security guards are hired by various organisations from Governments, Business Organizations, Non-Profit Organizations like Charitable Trusts, Temples, Churches, Residential Condominiums and so on. Depending upon the nature of work place, their roles vary

accordingly. Private security guards are usually given uniform to emphasize their legal authority to safeguard property. Security guards who are involved in protecting people of a country from external aggression are categorized as "Armed forces" and those who protect public from internal calamites are categorized as "Police forces" and all other security guards are called Private Security Guards.

Private Security Guards field is rapidly growing worldwide, especially in India and in fact, it is the second largest sector after the agricultural sector in providing jobs to the people in India. As a result, the Government of India has recognized this sector and formulated rules, regulations and guidelines under the Private Security Agencies Act 2005.

## THE THREE PRIMARY ROLES AND RESPONSIBILITIES OF PRIVATE SECURITY GUARDS

i. **Protect -** One of the primary roles of private security guards is to safeguard people, property, money, and other belongings of their clients/employers.

ii. **Prevention -** The saying "Prevention is better than cure" is most appropriate and applicable to the private security guards as preventing every possible untoward incident or crime or offence by expecting the unexpected and by observing their surroundings keenly for any subtle change from the routine and get ready to pull out all stops.

iii. **Observe and Report - Private** security guards are primarily responsible for observing routines and report all those that are not in line with the routine and suspicious. In most of the crime/offence scenes, private security guards are either victims or attenders or eyewitnesses of the situation and as soon as the police reach the site of crime/offence, they get necessary, essential and first-hand

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information of the premises and of the crime/offence from the guards on watch.

## JOB MIGRATION MEANING

Job migration means relocation of an individual from one employer to another to better his/her social and material conditions and to improve the prospect not only for themselves but also for their family members and it should happen without any external compulsion.

## 1.4. REVIEW OF LITERATURE

**Brown, S.C.** investigated stress in security guards in the University of Witwatersrand campus. Conclusions of investigation were as follows i) Personal stress causing factors were the major contributors towards stress in security guards. ii) Money related stressors were exhibited as the most critical stressor. Job related stressors did not affect the subjects as personal stressors did and more than fifty percent of the respondents experienced work as a helping tool against stress. Respondents acknowledged social and physical symptoms of stress over psychological symptoms. **Markey, M., Maher, C.G., Wong, T., & Collins, K.** reported that older workers had greater rate of injury and were less physically active than younger workers. It was proved in the study that proper training to the older workers proved to be beneficial to improve their physical fitness and ability to perform physically demanding works. **Mariwo, T.** suggested that below par payment, non-payment, lengthy working hours and poor working conditions were to be addressed immediately to achieve Decent Work Country Program (DWCP). Also suggested the government to monitor and take stern action against all those dubious security agencies who failed to pay the private security guards. In spite of the difficulties faced by this sector, author lauded the best practices adopted by some of the security companies.

## 1.5. OBJECTIVES OF THE STUDY

- ➤ To identify the factors which influence respondents to migrate to private security guards job.
- ➤ To understand the reasons why private security guard jobs are a popular option for individuals who have migrated from other private sectors, own tiny businesses, and labor jobs.
- ➤ To investigate the potential of private security agencies to provide employment opportunities to the youth and to identify effective strategies to attract and retain talent in the industry.
- ➤ To explore ways private security agencies can improve remuneration and other monetary benefits for their employees to increase job satisfaction and retention rates.
- ➤

## 1.6. RESEARCH METHODOLOGY

For this study, both primary and secondary data have been collected. Primary data have been collected from age old private security guards in Chennai city through personal interview. The researcher visited different regions in Chennai city namely Northern, Central and Southern regions. Quota sampling method has been adopted for the

| Name of the Factor | No. of Samples | No. of Items | Cronbach's Alpha |
|---|---|---|---|
| Job Migration | 50 | 17 | 0.736 |

research study.

**Table: 1.1 RELIABILITY TEST**
**Source: Primary Data**

Reliability analysis was measured with the help of numerically coded data (used Likert scale questions) that revealed particular factors chosen for the study. The main aim of conducting reliability analysis is to ascertain with consistency of selected factors for the present study. If the Cronbach's alpha reliability score is 0.70 or more, then the scale's reliability is reasonably fit and it is assumed that the questionnaire is reliable.

## 1.7. PREVIOUS OCCUPATIONAL STATUS OF AGE OLD PRIVATE SECURITY GUARDS

Previous occupational status of age old private security guards (AOPSGs) viz., existing private security guard, ex-serviceman, engaged in own business, farmer, private sector employee, labourer, government employee and others. Previous occupational status and socioeconomic status of age old private security guards are analysed in table 1.2. Out of 600 age-old private security guards under previous occupational caption, 46 percent are from private sector employees belonging to the age group of 46-50 years, 27 percent of private security guards continued to be private security guards belong to 51-55 years. Among age group of 56-60 years, 51 percent are from own business and age among group of above 60 years, 22 percent are from government employees and others. Among male respondents, 25 percent are from own business and 22 percent are from private sector employees. Among female respondents, 61 percent are from private sector employees. Among married respondents, 26 percent are from own business and 26 percent are from private sector employees. Among category single, 28 percent are from private sector employees.

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Among no formal education group of respondents, 48 percent are from labourers. Among the school level, 30 percent are from private sector employees and 29 percent from own business and at college level, 57 per cent are from private sector employees. Among income group of up to Rs.5000, 20 percent are from own business and 20 percent are from farmers. Among income group of Rs.5001-Rs.10000, 28 percent are from private sector employees, 24 percent are from labourers and 23 percent are from own business. Among income group of Rs.10001-Rs.15000, 32 percent are from own business and 30 percent are from private sector employees. Among income group of above Rs.15000, 28 percent continue to be in the private security guard and 23 percent are from own business. It is found that 27 percent are from private sector employees, 25 percent are from own business and 18 percent are from labourers.

**Table: 1.2 Age Old Private Security Guards Previous Occupational Status**

| Socio-demographic | | Previous Occupational Status | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Existing Private Security Guard | Ex-Serviceman | Own Business | Farmer | Private Sector Employee | Labourer | Govt. Employee & Others | |
| Age in years | 46-50 | 1 (1) | 3 (2) | 34 (20) | 18 (11) | 76 (46) | 33 (20) | 0 (0) | 165 (100) |
| | 51-55 | 45 (27) | 6 (4) | 18 (11) | 19 (11) | 41 (25) | 33 (20) | 3 (2) | 165 (100) |
| | 56-60 | 19 (12) | 3 (2) | 80 (51) | 12 (7) | 20 (13) | 23 (15) | 0 (0) | 157 (100) |
| | Above 60 | 10 (9) | 7 (6) | 19 (17) | 12 (11) | 22 (19) | 18 (16) | 25 (22) | 113 (100) |
| Gender | Male | 71 (13) | 18 (3) | 133 (25) | 61 (12) | 118 (22) | 104 (20) | 28 (5) | 533 (100) |
| | Female | 4 (6) | 1 (1) | 18 (27) | 0 (0) | 41 (61) | 3 (5) | 0 (0) | 67 (100) |
| Marital Status | Married | 66 (13) | 16 (3) | 134 (26) | 51 (10) | 137 (26) | 92 (18) | 24 (4) | 520 (100) |
| | Single | 9 (11) | 3 (4) | 17 (21) | 10 (12) | 22 (28) | 15 (19) | 4 (5) | 80 (100) |
| Education Level | No Formal Education | 18 (14) | 0 (0) | 18 (14) | 22 (17) | 5 (4) | 61 (48) | 4 (3) | 128 (100) |
| | School Level | 57 (13) | 13 (3) | 127 (29) | 38 (9) | 132 (30) | 46 (11) | 20 (5) | 433 (100) |
| | College Level | 0 (0) | 6 (15) | 6 (15) | 1 (3) | 22 (57) | 0 (0) | 4 (10) | 39 (100) |
| Monthly Income | Up to Rs.5,000 | 5 (14) | 0 (0) | 7 (20) | 7 (20) | 4 (11) | 11 (31) | 1 (3) | 35 (100) |
| | Rs.5,001-Rs.10,000 | 28 (8) | 3 (1) | 83 (23) | 42 (11) | 101 (28) | 87 (24) | 20 (5) | 364 (100) |
| | Rs.10,001-Rs.15,000 | 30 (19) | 7 (5) | 51 (32) | 10 (6) | 48 (30) | 7 (5) | 5 (3) | 158 (100) |
| | Above Rs.15,000 | 12 (28) | 9 (21) | 10 (23) | 2 (5) | 6 (13) | 2 (5) | 2 (5) | 43 (100) |
| Total | | 75 (12) | 19 (3) | 151 (25) | 61 (10) | 159 (27) | 107 (18) | 28 (5) | 600 (100) |

**Source: Primary data. Note: Figures in parentheses ( ) denote percentage.**

**1.8. MEAN RANK TOWARDS FACTORS OF JOB MIGRATION OF AGE-OLD PRIVATE SECURITY GUARDS**

**Table: 1.3**

**Friedman Test - Factors of Job Migration of Age-Old Private Security Guards**

| Factors of Job Migration | Mean Rank | Chi-Square value | P value |
|---|---|---|---|
| No rain for agriculture / Loss in Agriculture | 5.40 | | |
| Loss in Own Business | 7.42 | | |
| No Regular Job | 11.15 | | |
| Low Income | 10.67 | 3361.493 | <0.001** |
| Need for Self Earning | 12.03 | | |
| Family Compulsion | 11.23 | | |
| No support | 11.60 | | |

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| | |
|---|---|
| Loan Burden | 8.47 |
| Family Commitments | 12.55 |
| Separated from Family | 4.84 |
| No Pension | 12.53 |
| Getting Older | 11.48 |
| Earning for Medical Expense | 6.42 |
| Avoid ill Health | 7.81 |
| Friends/Relatives are Working | 6.68 |
| Near to Residence | 7.34 |

**Source: Primary Data**

There is no significant difference among mean rank towards factors of job migration of age-old private security guards.

Result of

$H_0$ is rejected, there is significant difference among mean rank towards factors of job migration of age old private security guards.

Significant difference among mean rank towards factors of job migration are analysed and the pertaining hypothesis tested with Friedman test in table 1.3. Since P value is less than 0.01, null hypothesis is rejected at 1% level of significance. Hence it is concluded that there is significant difference among mean rank near towards factors of job migration of age old private security guards. Family commitment (12.55), no pension (12.53) and need for self earning (12.03) received highest mean rank followed by no support (11.60), getting older (11.48), family compulsion (11.23) and no regular job (11.15). Separated from family (4.84) is with the least mean rank. It is found that family commitment, no pension and need for self earning received the highest mean rank followed by no support, getting older, family compulsion and no regular job. Separated from family is with the least mean rank.

## 1.9. CONCLUSION

A major chunk of employees migrating to private security guards are from other private sectors, own tiny businesses and laborers. Many private security guards entered into private security jobs above 45 years of age. So, the researcher conducted the survey from the age group of 46 and above and so they belong to the category of age old private security guards by the operational definition. Respondents have migrated to private security guard jobs from other form of private jobs because of family commitments, getting older, no support, for self earning, family compulsion and no pension. Private security agencies may come forward to give youth employment opportunities and also consider the good remuneration and other monetary benefits to their employees.

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# HR Analytics and Organizational Sustainability: A Conceptual Study with Special Reference to Small and Medium Size Enterprise

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*Abstract*

**Technology now influences every aspect of life, and its impact on business is remarkably significant. Whether small or large, organizations should learn how to use technology proactively to take their business to the next level. The organization's most important asset has always been its human resources. Employees should be considered as resources to gain a competitive advantage, and organizations can succeed in a hostile market by coordinating human resource functions with key technological inventions. Since the inception of HRM, it has been considered as a qualitative discipline. The concept of HR analytics is a way that we have successfully developed to add a numerical component to HRM. This study's focus on HR Analytics is one of many cutting-edge ideas that make up the theory of HR Quantification. This article is designed in the style of a concept note and briefly discusses the features of HR Analytics to meet the strategic and operational needs of business organizations. The study explores the overview of human resources (HR) analytics and how it can be used to improve organizational sustainability. HR analytics can assist in identifying and preventing employee issues and in managing employee engagement. In addition, The study discusses the definitions, relationship and impact of HR analytics on Organizational Sustainability.**

**Key Words: Human Resource Management, Artificial Intelligence, HR Analytics, Organizational**

## Introduction

The future of every organization relies on how effectively human resources are managed. The human resource industry is preparing to encounter a significant upheaval. The difficulty of managing human resources has increased. The ubiquity of mobile, social, and personalization technology has elevated the standard for employee experience. The convergence of technology and human resources increases an organization's capacity to function longer while meeting its stakeholders' needs.

In recent years, the field of HRM faces a paradigm shift into data science. As a result HR analytics has grown in popularity as a tool for managing employee performance and improving organizational efficiency. HR analytics can help organizations identify and address employee issues early, and improve employee engagement and morale. HR analytics is a field that helps organizations to understand and manage the human resources within their organization.

Organizations can use these tools to identify and address problems before they become larger and more difficult to manage. HR professionals can identify trends and patterns through data analysis and make informed decisions supporting organizational sustainability. Organizational sustainability is the ability of an organization to operate over a long period of time while meeting its goals and objectives By improving organizational sustainability, HR analytics can help to ensure a strong future for the organization.

II.     **Review of Literature.**

**Evolution of HR Analytics**

The concept of HR analytics has evolved over the years to become a more sophisticated way of managing human resources. The early days of HR analytics were focused on tracking employee data such as demographics, performance, and disciplinary information. Over time, HR analytics has evolved to encompass several other areas, such as employee engagement, compensation and benefits, and workforce planning.

There are several different types of HR analytics tools, each of which can provide unique benefits. Some of the most common HR analytics tools include:

● **Employee tracking systems (ETS)** - ETSs collect employee data, such as employee name, contact information, and job title. ETSs can also track employee mobility, performance, and attendance.

● **Personality assessments** -Personality assessments can help organizations identify employees' personality traits and strengths. This information can help organizations identify and address issues early, and improve employee morale and engagement

● **Workplace surveys** - Workplace surveys are useful instruments for HR analytics. Workplace surveys can help organizations collect data on employee attitudes, opinions, and satisfaction with their job. This information can help organizations identify and address issues early, and improve employee morale and engagement.

●**Employee data warehouses** - Employee data warehouses can help organizations track employee data in a centralized location. This data can be used to identify and address issues early, and improve employee morale and engagement. These are a key component of HR analytics.

● **HRIS (Human Resource Information System):** A system that tracks employee data, including HR information, performance reviews, and employee complaints.

**Strategic Human Resource Management**

HR analytics is a subset of strategic human resource management that focuses on the use of data analytics to improve decision-making and performance in HR. HR analytics can be used to improve decision-making and performance in several areas. For example, it can help managers identify and address recruitment and retention challenges, identify and reward effective employees, and identify and prevent workplace misconduct.

**Small and Medium Scale Enterprise**

Small and medium enterprises (SMEs) are a key engine of the Indian economy. They account for over 60% of the country's GDP and employ over 60% of the workforce. However, the sector faces several challenges, including a lack of access to funding and skilled professionals. In 2013, the government announced a series of initiatives to support and develop SMEs. Launching the Small Business Development Bank of India (SBDB), establishing a unified online portal for small businesses, and launching a venture capital fund for SMEs helped overcome many struggles.

The era of Digitisation, new technologies, and artificial intelligence demand organizations new ways of working with a different skill set to accomplish strategic objectives, that is where the need for HR analytics boomed. Analytics is an essential tool for small and medium enterprises (SMEs) as well to improve their performance and understand their customers. When human resource training is objectively aimed at the excellence and growth of organizations (Nzari, 2017). Hela Chalutz (2019) study results indicate that workforce planning and recruitment and selection are two HR tasks that yield the highest ROI

III. **Objectives of the study**

- To assess the effectiveness of using HR Analytics in improving the organizational sustainability of SMEs.
- To identify potential problems in the workplace that can be addressed through HR Analytics.
- To evaluate the impact of HR Analytics on employee productivity, satisfaction, communication, coordination, and engagement.
- To analyze the statistical models and methodologies used in HR Analytics for deriving new insights and making smarter decisions in HR.
- To explore the strategic value of HR Analytics in enhancing the overall strategic direction of the organization.

IV. **Methodology**

It is qualitative research that is concentrated on secondary data. The researcher tried to find out the Implementation guidelines for HR analytics and its impact on Organizational sustainability concerning SMEs. Data for the study was gathered from articles, Books, the internet, theses, and databases.

This research paper explores HR analytics' impact on organizational performance. Specifically, we will focus on the following questions:
1. To discuss the benefits of using HR analytics in SME
2. To chalk out the challenges of using HR analytics
3. To identify the most important factors to consider when implementing HR analytics in SME

IV. **Conceptual Framework**

HR analytics is a data-driven approach to managing people at workplace.It is also called people analytics, talent analytics. It brings data-driven decisions, creating a business case for HR intervention. It shifts the traditional HR functions from operational to tactical function. HR analytics is the scientific solution enabling organizations to make significant human capital and strategic business decisions and thereby gain a competitive advantage.

This conceptual note aims to provide an overview of human resources (HR) analytics and how it can be used to improve organizational sustainability. The main focus of HR analytics in case of SME lies in the areas mentioned above.

**The Key area is as follows:**

Workforce planning is the process of planning the size, composition, and posture of the workforce. HR analytics can help SMEs to identify and address issues early, measure progress and success, and provide optimized strategies. Performance management is the process of managing employees' performances and developing their skills. HR analytics helps SMEs identify performance gaps and work to help address them, using the data that analytics offers.

Compensation is allocating rewards and punishments to employees for their performance. It involves analyzing and understanding the current distribution of salaries, deciding on pay levels, fixing pay rates, and developing and operating grade-based pay structures.

**Antecedents and Consequences of HR Analytics**

The research also chalks out the antecedents and Consequences of HR analytics concerning SMEs. There are several potential benefits to using HR analytics, including: -
- improving employee satisfaction and retention
- identifying and preventing discrimination and harassment
- detecting and preventing fraud -enhancing communication and team coordination
- improving employee productivity and performance.
- However, there are also potential consequences of HR analytics, including:
- risking privacy and confidentiality
- causing data quality issues
- increasing data management and storage requirements
- resulting in increased costs and time pressures.

**How does HR analytics work?**

It collects, analyzes, and interprets data to help understand and improve employee satisfaction, recruitment, retention, and performance.

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Descriptive analytics, made up of observations and reports, are important as they consist of observing the workplace to gain initial insight into what is happening.

Diagnostic analytics takes the observations to the next level to understand why and what is the cause. It may be clear that employees are unhappy, but it is important to find out why. Predictive analytics is used less than others, but is where organizations can predict ways of improving the situation and attempt them. Prescriptive analytics is the final step where it considers the cause of the issue and uses the data to prescribe what needs to be done to fix it. Prescriptive analytics relies on the other three forms of analytics to get the best outcome.

## V. Discussion and Findings

Simply reporting data is not anymore sufficient, in the data-driven economy. With the disruption of business models across all industries, the talent acquisition game has changed and with the impact of technological change on work, the need for a continuous learning culture has never been more urgent.

### HR Analytics Use Cases of Leading Organisation

Walmart is an American multinational retailer that owns and operates several supermarket chains all over the world. They have developed an "analytical engine" to anticipate who will leave their employment with the use of HR analytics. This predictive analysis decreased the cost of labor turnover.

**Experian**: Experian experienced a problem with employee attrition. The business was dealing with turnover rates that were 3-4% greater than they desired. They could estimate flight risk using a predictive model with 200 attributes, such as team size and structure, supervisor performance, and commuting time. It is called predictive "workforce analytics".

**Nielsen:** In 2015, Nielsen developed a comparable forecasting model. Only 20 factors, including age, gender, tenure, and manager rating, were included in the first predictive model. A noteworthy outcome was that the corporation could relocate 40% of the workforce to a new position by approaching the individuals with the highest flight risk over the following six months.

Transport company in Zimbabwe: In Zimbabwe, excellent research was done on the effects of comprehensive hiring assessments. A local transportation company wants to lower the expense of their drivers' (Road Traffic accidents)RTAs. These accidents not only jeopardised the lives of those involved, they also caused huge material damages

A nearby firm looked into the possibility of using psychometric tests to identify drivers who were more likely than others to be involved in auto accidents. These elements might be utilized as selection criteria for new hires if they could be identified. They discovered a number of very useful insights. First of all, it turned out that a popular Defensive Driving Certificate (DDC) that drivers had to get, had no impact on their likelihood to be involved in an accident.

The HR analytics solution HCL Technologies uses employs a smart neural network engine that uses processing and semantic analysis. The solution offers crucial skill gap insights that support talent transformation analytics. that

20% of labor demand can be satisfied by reskilling the existing employees.

**Clarks:** The shoe company Clarks investigated the connection between engagement and financial results. The organization investigated the benefits of engagement and whether those benefits would decrease with increasing levels because it had already recorded higher-than-average levels of engagement. The report stated that the findings demonstrated that there was a relationship. Engagement boosts organizational performance. In Clark's case, every 1% (percentage point) improvement in engagement leads to an improvement of 0.4% (percentage point) in business performance. To make an actionable claim over this, another study was conducted by analyzing 100 traits of best-performing stores. They identify store size and tenure of the store manager significantly impact employee performance and engagement. Hence they arrived at the conclusion that the frequent switching of store managers leads to poor performance of the store. In addition, they created an engagement toolkit that managers can use to improve performance.

**Cisco:** Cisco has used demographic information to identify the most suitable locations for new offices. By combining different data, such as current office space utilization rates, the cost and availability of critical personnel, and the accessibility of university graduates, they were able to develop in markets where fewer larger competitors were vying for the same talent. In addition, when selecting a new office, Cisco used this same data to find locations where employees with relevant qualifications were available and abundant.

Benefits of using HR analytics in support of organizational sustainability

The following are some benefits of using HR analytics to support organizational sustainability:

- HR analytics can help identify and track employee engagement and satisfaction, which can help improve morale and employee productivity.
- HR analytics can help identify and track employee recruitment and retention, which can help improve organizational sustainability.
- HR analytics can help identify and track employee performance, which can help improve organizational efficiency and effectiveness.
- HR analytics can help identify and track employee misconduct and illegal behavior, which can help improve organizational safety and security.
- HR analytics can help identify and track employee benefits and rewards, which can help improve organizational competitiveness and efficiency.

Challenges and risks associated with using HR analytics in support of organizational sustainability

Many challenges and risks are associated with using HR analytics in support of organizational sustainability. Chief among these are the potential for data misinterpretation and the risk of false conclusions being drawn from the data. Additionally, analytics can be used to identify and target wasteful or inefficiencies within an organization, but can also lead to the dismissal of employees who are seen as obstacles to efficiency.

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The risks and challenges associated with using HR analytics in support of organizational sustainability can be broadly categorized into two main areas: data quality and data accuracy.

Data quality can be affected by several factors, including inaccuracies in the data collected, poor quality data entry, and incorrect or outdated data. Inaccuracies in data can lead to inaccurate analyses and ineffective decision-making, ultimately leading to organizational sustainability challenges.

Data accuracy can also be a challenge, especially if the data is gathered from different sources and is not always consistent. Inaccurate data can lead to incorrect assumptions and inaccurate analyses, which can ultimately lead to inaccurate decisions and outcomes. Another risk associated with using HR analytics in support of organizational sustainability is the risk of data theft. If unauthorized individuals gain access to the data being used in the analysis, they could use this information to vulnerabilities in the organization or undermine the employees' privacy. Finally, the risk of data misinterpretation can also be a concern. If the data is misinterpreted, this could lead to inaccurate decision-making and potentially harmful outcomes.

## VI. Suggestions of the study

**Prerequisites to implement HR Analytics in SME**

There are several ways to implement hr analytics in an SME:

1. **Clear organizational objectives:** The HR analytics process should be driven by clear organizational objectives and a strategy for achieving those objectives. These objectives should be specific, measurable, achievable, relevant and time-bound.

2. **Good data:** An HR analytics initiative requires good data to succeed. HR analytics projects should start by assessing the quality of the available data, as well as which additional data points may be needed to achieve the desired objectives.

3. **Effective tools:** HR analytics requires effective tools and systems to collect, store, and analyze data. These tools should provide deep insights into the organization's people and processes.

4. **Dedicated resources:** SMEs should ensure they have dedicated resources, such as a project manager or analyst, to manage the project. This resource should have the necessary knowledge and skills to ensure the project is successful.

5. **Change management:** Change management is essential to any successful HR analytics project. SMEs should ensure they have a plan in place to ensure the project is communicated correctly and adopted across the organization.

**HR Analytics software**

1. Use HR analytics software to track employee performance and behavior. This can help you identify and address customer needs, identify opportunities, and predict future customer behavior.

2. Use HR analytics to understand customer needs and preferences. This can help you identify and address customer needs, identify opportunities, and predict future customer behavior.

3. Use HR analytics to understand customer behavior in order to identify and respond to customer needs. This can help you identify and address customer needs, identify opportunities, and predict future customer behavior.

## VII. Conclusion

The study highly recommends that the Organizational sustainability of SMEs can be improved by using HR Analytics to identify and address potential problems in the workplace. HR Analytics can also help organizations identify areas where they need to improve their policies and practices in order to improve employee productivity and satisfaction. The outcome of HR analytics can vary depending on the specific implementation and use case. Typical outcomes include improved employee productivity, better communication and coordination, and increased employee engagement. This study concludes that HR analytics provides a data-driven framework for solving workforce problems through analyzing data with a combination of software and methodologies that applies statistical models and derives new insights for smarter decisions while enhancing the strategic value of HR.

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# Problems and Prospects of Women Entrepreneurs with Respect to Coimbatore City

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## ABSTRACT

As Coimbatore is considered the Manchester of South India, the scope for women entrepreneurs and their economic activities are also wider. This article try to study the real time problems and Prospectus of the Women businesswoman concerning Coimbatore city with the following as the objectives which is to study the socio-economic background of the women entrepreneurs and transmit them to the success and shortfall of their business endeavors, to detail the tribulations & challenge faced by the women entrepreneurs, from their perspective, to analyze the wide range of factors that have promoted the rise of women free enterprise in recent years and the obstacle they face. And to make an overall assessment of their problems and make policy suggestions. The study employed both primary and secondary data. Simple Random Sampling technique is adopted .The statistical tools employed are Descriptive analysis, Weighted average and Garratt ranking. The result of the study states that there is a short of vigilance ,dominance by the Society, lack of financial support and moral support, Inadequate professional training ,difficulties in availing government loans etc should be concentrated by the government and the has to render hands in all aspects.

Keywords :Women Entrepreneur ,Societal dominance, Financial support

## INTRODUCTION

Women shape a momentous creature source of the land. They should be taken as an important instrument for the development and growth of economy of every nation. Women's category in Indian society has distorted from point to point. Women position has always considered hence women have been regarded a symbol of power, acquaintance and possessions. Practically, during various periods certain changes were visible from the archaeological remnants. Consequently women entrepreneur act as a incredible position into the country's development .Women entrepreneur is allowed to essential encouragement who hold to focused and skilled people. The want to provide suitable state of affairs for free enterprise is fundamentally significant. Advantageous behavior may be urbanized by means of guidance. To alterour nation's societal and fiscal structure and strengthen the underprivileged sector of the culture like women, better importance is required on industrialized growth. Man power includes both men and women, of operational era comprise the major strength of profitable progress of an accomplishment. Women shape a vital section of the work strength, and their monetary role cannot exist cut off from the frame of progress. The position and level of assimilation of women in economic development is constantly a marker of women's financial autonomy and communal condition. Employment provides financially viable autonomy to women. In addition, women contain and turn into an central ingredient of the present culture. Women should enhancement the returns of the folks through no matter what expertise she has acquired. The current inflationary pressure deserves women to join the male members of the family for securing considerable source of revenue. Therefore these articles aim to study the troubles and diagnosis of women entrepreneurs in the society concerning Coimbatore city.

## REVIEW OF LITERATURE

Sapna Manshani and Anjna Dubey (2017) carried out a study on "Start-up Women in Start-up India: A study of Women Entrepreneurs in India". The main objectives is to locate the role of women in financial growth, the factor encourage women to turn out to be thriving entrepreneurs and the challenge face through them. The methodology used in the article is to analyze the secondary data collected from published reports of NASSCOM, census surveys etc. The findings of the study show that if the yearly development of the financial system might acquire a further of 2.4% but pro-growth and pro-gender policy are implemented. Further the study suggests that innovative thinking and risk taking are the requisites for success of women entrepreneurs.

Dr.B.Ramesh (2018) conducted a study on "Problems and Prospective of Women Entrepreneurship in India". The main objective of the article was to comprehend the women entrepreneurship in India, to recognize the harms of women entrepreneurs in India and to make an appraisal of the society help women entrepreneurship in India. The method adopted in the study was widespread study of secondary data collected from a variety of books. The findings of the study revealed that the women entrepreneurs addressed the problems arising from like be deficient in of financial support, culture, communal barrier, lawful official procedure, far above the ground outlay of manufacture, male conquered culture, limited managerial ability, lack of self-confidence etc. Further there are various factors like haul and drive factor, which are pressure women entrepreneurs. Regime has taken various steps for the upliftment of women entrepreneurs throughout successive five year plans. Women have the possible and purpose to involve, support and take charge of their individual endeavor in a exceptionally efficient method, suitable hold and support as of the people, family unit, control preserve and formulate these women entrepreneur a part of conventional of countrywide financial system and they know how to donate to the economy improvement of India.

Akhila Pai. H (2018) studied "Digital Startups and Women Entrepreneurship: A Study on Status of Women Entrepreneurs in India". The main objectives of the study are to recognize the purpose feature so as to encourage women on the road to put up and doing digital startups, to list out successful women entrepreneurs of digital startups in India and on the road to seriously scrutinize the most important issue and challenge face by women in digital marketplace .The method adopted in the study is solely based on secondary data collected through literature survey, journals, newspapers, websites and published articles relating to this topic. The findings of the study are optimistic about the success of the 'Start-up India' operation by Prime Minister of India. This have float quite a few scheme designed for create industrial alertness, direction and skillfulness progress program for women. This study notices that as the atmosphere is shifting exceptionally rapidly, investors begin investing in woman headship, and their input in monetary expansion is also being acknowledged and raised at an extensive velocity.

S.Soniya, S.Sudhamathi (2019) conducted a study on "Digital Marketing of Women Fashion Products towards Entrepreneurs perspective in Chennai city". The most crucial objective of the study was to know the conceptual framework of digital marketing, to make the entrepreneurs opinion towards digital marketing and suggest to pick up the services rendered to entrepreneurs. The methodology adopted in the study was accepted out through the intention document the knowledge and opinion of entrepreneurs towards digital marketing in Chennai city. The study's findings show how entrepreneurs' educational qualifications influence their views and outlook on digital marketing. The entrepreneurs feel that while promoting the products in websites they consider the consumers approach and preference. They also opine that through improving their advertisements they could get better the income edge of the industry.

5.Dr. K. Pushpam and Dr. S.Thirumal (2020) conducted a study on "The role of Women Entrepreneurship in Digital Commerce". Core objectives are to examine the role and achievement of women entrepreneurs and e-commerce sector and headed for explore the kinds of challenge face by women entrepreneurs inside the industry and Commerce sector. The methodology adopted in the study is based on both primary and secondary data collected through interviews schedule and literature survey journals and research papers. The findings of this study show that a majority of women entrepreneurs are in the age category of 31 to 40 time and find that nearly every one of the women entrepreneurs express the predicament of raise sufficient capital. They suffer because funds are not easily available in the required quantum and at the time of need.

Bhavna Vijay, Parul Shah, Mihir shah and Ankit Parmar (2021) conducted "A study on Female Entrepreneurship and start-up". The main objectives of the study are to learn about the reason for early a business to consider the cost of the administration business, to explore the a variety of preparations, project, and organization concerned in promoting womanly entrepreneurship in new-fangled businesses and to inspect the noteworthy troubles face through feminine business visionary in innovative business. The method adopted in the study is based on the information collected from websites, periodicals, magazines, government publications, books, and research papers, among other sources. The findings of the study approaches aimed at retain additional women in management and respected position are important, because they strength of character support women in gaining proficiency and in sequence, allow them to establish their business.

## OBJECTIVES OF THE STUDY

1. To study the socio-economic background of the woman entrepreneurs and relate them to the success and shortfalls of their business endeavours.
2. To detail the troubles & challenge face by the women entrepreneurs, from their perspective.
3. To analyze the wide range of factors that have promoted the rise of women entrepreneurship in recent years and the hurdles they face.
4. To make an overall assessment of their problems and make policy suggestions.

## RESEARCH METHODOLOGY

**Sample size:** To undertake this study, a sample of 120 women entrepreneurs in Coimbatore city have been selected as respondents included from both urban and rural areas

Source of Data

**Primary Data:** It refers to the actual facts gather through the investigator himself. This explore uses primary data for the do research work. A pre tested survey was administered to the respondents with the question.

**Secondary Data:** Secondary data was composed from a variety of books, websites, and magazines.

**Sample Technique:** The study adopts a simple random sampling technique.

**Area of the study:** The study is with the most regard to Coimbatore, a city in India

**Tools Used For Analysis:** The collected information were analyze and obtainable in the outline of tables to go well with the study and also to interpret the results. Simple Percentage analysis and weighted average was used in this study.

## Results and Findings of the Study

### Table 1 Shows the Demographic profile of the respondents

| Demographic profile | No. of Respondents | Percentage (%) |
|---|---|---|
| Age (In Years) | | |
| 21-30 years | 55 | 45.8 |
| 31-40 years | 31 | 25.8 |
| 41-50 years | 32 | 26.7 |
| 51 years above | 2 | 1.7 |
| Marital Status | | |
| Married | 69 | 57.5 |
| Unmarried | 48 | 40 |
| Divorced | 2 | 1.7 |
| Widow | 1 | 0.8 |
| Educational Qualification | | |
| School Level | 4 | 3.3 |
| Diploma | 7 | 5.8 |
| Under Graduate | 69 | 57.5 |
| Post Graduate | 37 | 30.8 |
| Not Educated | 3 | 2.5 |
| Type of the family | | |
| Nuclear Family | 87 | 72.5 |
| Joint Family | 33 | 27.5 |
| First-generation women Entrepreneur | | |
| Yes | 79 | 65.8 |
| No | 41 | 34.2 |

**Source: Primary Data**

**INTERPRETATION**: From the above table:1, it is concluded that the majority of respondents are 21 to 30 years (45.8), majority of respondents are married (57.5%), the majority of respondents are undergraduates (57.5%), majority of respondents belong to the nuclear family (72.5%), and majority of respondents are first generation entrepreneurs (65.8%).

**Table 2 Showing the challenges faced while procuring Raw material**

| Challenges Of Raw Materials | Strongly Agree | Agree | Neutral | Disagree | Strongly Agree | Total | Weighted Average |
|---|---|---|---|---|---|---|---|
| High Material Cost | 26 | 42 | 46 | 4 | 2 | 120 | 3.71 |
| | 130 | 168 | 138 | 8 | 2 | 446 | |
| Less Quality | 15 | 33 | 47 | 14 | 11 | 120 | 3.22 |
| | 75 | 132 | 141 | 28 | 11 | 387 | |
| High Middlemen Charges | 16 | 32 | 44 | 17 | 11 | 120 | 3.20 |
| | 80 | 128 | 132 | 34 | 11 | 385 | |
| Heavy Competition | 48 | 29 | 35 | 7 | 1 | 120 | 3.96 |
| | 240 | 116 | 105 | 14 | 1 | 476 | |
| Strict Govt. Policies | 10 | 22 | 49 | 24 | 15 | 120 | 2.9 |
| | 50 | 88 | 147 | 48 | 15 | 348 | |
| Middlemen Interference Is High | 23 | 28 | 44 | 14 | 11 | 120 | 3.31 |
| | 115 | 112 | 132 | 28 | 11 | 398 | |

**Source: Primary data**

**Interpretation:** From the above table 2, heavy competition (3.96) has got high weight age, followed by High material cost (3.71) and next comes the middlemen interference (3.31). Less quality of raw materials follows (3.22), and then comes high middlemen charges (3.20) and strict govt. policies (2.9) in the order. Majority of the respondents were facing problems in purchase of raw material due to heavy competition.

**Table 3 Showing Various Challenges While Starting the Business**

| Challenges | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Lack of Experiencece | 12 | 21 | 27 | 15 | 18 | 4 | 3 | 9 | 11 | 120 |
| | 10% | 17.5% | 22.5% | 12.5% | 15% | 3.3% | 2.5% | 7.5% | 9.2% | |
| Lack ofFamily Support | 47 | 17 | 24 | 12 | 2 | 3 | 4 | 2 | 9 | 120 |
| | 39.2% | 14.2% | 20% | 10% | 1.7% | 2.5% | 3.3% | 1.6% | 7.5% | |
| Lack of Decision Making Skills | 15 | 24 | 26 | 15 | 18 | 7 | 4 | 6 | 5 | 120 |
| | 12.5% | 20% | 21.7% | 12.5% | 15% | 5.8% | 3.3% | 5% | 4.2% | |
| Lack of Marketingg | 13 | 17 | 27 | 14 | 25 | 7 | 7 | 3 | 7 | 120 |
| | 10.8% | 14.2% | 22.5% | 11.7% | 20.8% | 5.8% | 5.8% | 2.5% | 5.8% | |
| Lack ofFinance | 37 | 18 | 23 | 11 | 17 | 5 | 2 | 3 | 4 | 120 |
| | 30.8% | 15% | 19.2% | 9.2% | 14.2% | 4.2% | 1.6% | 2.5% | 3.3% | |
| Lack ofSkilledLabor | 25 | 17 | 27 | 12 | 14 | 9 | 4 | 4 | 8 | 120 |
| | 20.8% | 14.2% | 22.5% | 10% | 11.7% | 7.5% | 3.3% | 3.3% | 6.7% | |
| Lack of Motivationon | 32 | 19 | 21 | 12 | 11 | 14 | 7 | 2 | 2 | 120 |
| | 26.7% | 15.8% | 17.5% | 10% | 9.1% | 11.7% | 5.8% | 1.7% | 1.7% | |
| Lack ofTraining | 10 | 21 | 27 | 13 | 25 | 6 | 9 | 4 | 5 | 120 |
| | 8.4% | 17.5% | 22.5% | 10.8% | 20.8% | 5% | 7.5% | 3.3% | 4.2% | |
| Lack of Government Assistance | 46 | 18 | 18 | 14 | 5 | 4 | 5 | 4 | 6 | 120 |
| | 38.3% | 15% | 15% | 11.7% | 4.2% | 3.3% | 4.2% | 3.3% | 5% | |

**Source:** Primary data

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## Table 4. Showing their Preference for the Factors

| S.NO. | FACTORS | 1 | 2 | 3 | TOTAL |
|-------|---------|---|---|---|-------|
| 1. | Awareness about various Govt.agencies | 48 (40%) | 43 (35.8%) | 29 (24.2%) | 120 |
| 2. | Awareness aboutvarious Govt. Schemes | 45 (37.5%) | 45 (37.5%) | 30 (25%) | 120 |
| 3. | Problems of Shortage of Funds | 37 (30.8%) | 53 (44.2%) | 30 (25%) | 120 |
| 4. | Problems of Obtaining Loans from Financial Inst. | 39 (32.5%) | 58 (48.3%) | 23 (19.2%) | 120 |
| 5. | Problems of High Interest Rate | 50 (41.7%) | 40 (33.3%) | 30 (25%) | 120 |
| 6. | Problems in getting Govt. Aids, if any | 53 (44.2%) | 36 (30%) | 31 (25.8%) | 120 |

**Source:** Primary data

**Interpretation:** From Table 3, (22.5%) of the respondents moderately felt that lack of their experience is one of the major difficulties they faced at the start of their business, but (2.5%) of them don't find it a big deal. They might contain as a stepping stone on the way to grow and expand in their industry. Table shows majority (85%) lack family support and only (15%) have their family by their side to support them. The table clearly shows that almost (67%) of the respondents felt they lack decision-making skills, but 18% disagreed with this and the remaining (15%) remained neutral. From table, almost (60%) respondents, agree that they lack in marketing skills, (19%) don't agree with this and remaining (21%) stays neutral, neither agree fully nor disagree that they lack in marketing. Also from the table majority felt lack of finance is the major challenge they face and (30.83%) responded the extreme lack of finance, a major challenge. More than (65%) of the respondents felt a lack of skilled labor pose a major problem in their business venture. It is evident that they lack motivation and nearly (70%) faces this as a very big challenge. Nearly (21%) of the respondents stay neutral regarding the lack of training, It is clearly seen that majority of the respondents (80%) felt that they lack in the governmental assistance (majority 38.83% rated 1 for this category as an extreme major challenge in their business).Hence, the lack of family support with 85%, stand first in the major challenges faced by the entrepreneurs, next comes, Governmental assistance with (80%) in the order. Then comes lack of finance with (75%) and lack of motivation with almost (70%).

This is followed by decision making skills with (67%) and then comes lack of experience with (62%).

## Table 5 Shows the Challenges Faced While Selling the Products in the Domestic Market and in Foreign Market

| Challenges of marketing In Domestic/ International Market | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree | Total | Weighted Average |
|---|---|---|---|---|---|---|---|
| Heavy Competition | 51 | 34 | 32 | 2 | 1 | 120 | 4.1 |
| | 255 | 136 | 96 | 4 | 1 | 492 | |
| Competitive Pricing | 45 | 44 | 26 | 4 | - | 120 | 4.06 |
| | 225 | 176 | 78 | 8 | 0 | 487 | |
| Intermediaries | 13 | 34 | 49 | 12 | 12 | 120 | 3.2 |
| | 65 | 136 | 147 | 24 | 12 | 384 | |
| Continuous Availability | 30 | 33 | 46 | 10 | 1 | 120 | 3.67 |
| | 150 | 132 | 138 | 20 | 1 | 441 | |
| On time Shipment | 33 | 34 | 42 | 9 | 2 | 120 | 3.72 |
| | 165 | 136 | 126 | 18 | 2 | 447 | |
| High Expectations | 32 | 31 | 53 | 1 | 3 | 120 | 3.73 |
| | 160 | 124 | 159 | 2 | 3 | 448 | |
| Mode of Payment | 27 | 35 | 44 | 8 | 6 | 120 | 3.74 |
| | 135 | 140 | 132 | 16 | 6 | 429 | |
| On Time Delivery | 37 | 29 | 48 | 6 | - | 120 | 3.80 |
| | 185 | 116 | 144 | 12 | 0 | 457 | |

Source: Primary data

## Interpretation

From the table 4.17, nearly (40%) don't have awareness about various government agencies and financial institutions. Only (24.2%) have awareness on this. Remaining (35.8%) stay neutral in this regard. Only (25%) have awareness about various government schemes and (70%) of the remaining respondents has been equally divided into the other two categories, as (37.5%) don't have any awareness regarding the various schemes and the balance (37.5%) stay neutral in this category. Majority (44.2%) of the respondents are neutral in the problems of shortage of funds. (30.8%) don't have any problems with

shortage of funds and the balance (25%) face problems with shortage of funds. Only (32.5%) don't find it difficult to obtain loans from financial institutions and (48.3%) of them stay neutral in this category. Only a minimum (19.2%) find it difficult. Majority of almost (42%) of the respondents don't think the high rate of interest a major problem and only (25%) finds it a problem. The same is the case of problems in getting government aids

## Interpretation

From the above table 5 , among the survey responses, heavy competition (4.1) has got more weight age, followed by competitive pricing (4.06), one time delivery (3.80), mode of payment(3.74), high expectations (3.73), on time shipment (3.72), continuous availability (3.67) and last comes intermediaries with 3.2 weighted mean. Majority of the respondents were facing challenges in marketing due to heavy competition.

## SUGGESTIONS

1. In the study area, school level educated women entrepreneurs are the low level investors in business. Hence the government should make aware of them about the access to the government credit schemes exclusively meant for industrial investment by the way of conducting the awareness generation programmes.

2. There is a need to increase the managerial efficiency of the primary level educated women entrepreneurs. In this connection, the District Industry Centers should identify and invite primary level educated women entrepreneurs with a view to conduct the training programme on managerial skills.

3. The women entrepreneurs of Coimbatore city should be made aware of various government schemes on financial assistance. In this connection, the District Industry Centre should conduct the training programmes about the ways and means of getting benefits from the government schemes.

4. Some of the women entrepreneurs feel difficulty in availing benefits from the government. Hence the government should reduce the formalities in granting financial assistance under industrial development programmes.

5. Professional training helps women entrepreneurs to enhance their business in every field. The Government should set up a training centre for women entrepreneurs to improve their technical knowledge and creativity in the business.

## CONCLUSION

It could be observed from the result of the study so as to women entrepreneurs have on track their business on the base of availability of economic benefits, access to raw materials and infrastructure facilities, inducing socio cultural factors, personal and family necessity and availability of sources of investment in Coimbatore city. The women entrepreneurs differ significantly in their various types of motives behind the establishment of business according to their educational status and age category. This study brings to attention on women entrepreneurs level of investment, type of business and place of conducting the business and this study highlights the variation among the women entrepreneurs in their business investment and operational behavior. It could be noted that women entrepreneur from, high level educated group, and young age group have shown better performance in their managerial practices than their counterparts. This study brings to attention on economic presentation of women in business. It also highlights various problems faced by women entrepreneurs and measures to overcome such problems as per the views of the women entrepreneurs in Coimbatore city. The Women entrepreneurs are gaining greater control over their income and resources. Personally they are perceiving self-confidence, recognition within the family and respect in society. As far as society empowerment of women entrepreneurs is concerned, they are now becoming a part of decision making within the family. Women entrepreneurs were quite conscious about the legal and permissible rights which have been given to them by the constitution and the government of India. Women entrepreneurs in Coimbatore city look for a lot of troubles in running their business, but that does not stop them from growing their business. They were encouraged by many influencing factors to start and run their business. But the most important influencing factor for them was to enjoy a better and secure life, by their self-aspiration, enhanced social status and personal goals.

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# BLOCKCHAIN AND AI: UNLOCKING THE POTENTIAL OF MODERN STOCK MARKETS

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**ABSTRACT:**

**Blockchain is a distributed ledger technology that offers advantages such as transparency, immutability and security. Blockchain technology has grown in popularity in recent years, especially in the financial sector, due to its potential to revolutionize many aspects of the industry. One area where the blockchain technology could have the biggest impact is in the stock market. The integration of blockchain and artificial intelligence (AI) technologies has the potential to revolutionize modern stock markets.**

**This paper aims to explore the use of blockchain technology in the stock market, specifically in the areas of settlement, voting and governance, transaction/ trade execution, and post-trade processing. Further, the usage of cryptocurrencies that use the blockchain technology and various other technologies, playing a significant role in the Stock Market are also analysed, thus establishing a relationship between the IT and financial sector. This paper provides an overview of the potential benefits and challenges of combining blockchain and AI in stock markets, including increased efficiency, reduced costs, improved security, and better decision-making. We analyse current use cases of blockchain and AI in stock market and cryptocurrency trading. By examining the synergies between these two technologies, this paper aims to provide a comprehensive understanding of how they can unlock the potential of modern stock markets.**

**KEYWORDS: Blockchain technology, Stock market, Cryptocurrencies, Artificial Intelligence, Smart contracts.**

## INTRODUCTION:

Blockchain technology is a distributed ledger technology that has received a lot of attention in the recent years. Its ability to provide transparent and secure services has led to the numerous applications of it in various industries that include Banking and Finance, Healthcare, Real Estate, Software security, Supply chains, etc.,.

One of the areas where blockchain technology can have a significant impact is in the stock markets. Stock markets are complex systems that involve many intermediaries, including brokers, clearinghouses, and depositories. However, these intermediaries can be expensive, slow and error-prone, making them an obstacle to the stock market's operations.

The use of blockchain technology in stock markets can reduce inefficiencies, increase transparency, and mitigate risks and collectively helps in overcoming these obstacles. The emergence of blockchain and artificial intelligence (AI) has introduced new possibilities for modernizing stock markets. Blockchain technology offers transparency, security, and immutability in record-keeping, while AI provides intelligent decision-making capabilities. By combining these two technologies, we can unlock the potential of modern stock markets, making them more efficient, cost-effective, and secure. This paper aims to explore the potential of blockchain and AI in stock markets, including the benefits and challenges of their integration, current use cases, and future possibilities. By analysing the synergies between these two technologies, we hope to shed light on their transformative role in the stock market landscape.

## REVIEW OF LITERATURE:

Blockchain technology has received a lot of attention in the recent years due to its ability to provide transparent and secure services which has led to the numerous applications of it in various industries. This Review of Literature aims to examine the existing research on the use of blockchain in the stock markets. Blockchain technology has the potential to improve the efficiency, transparency and security of the stock market. Many researchers have

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investigated the potential application of blockchain technology in the stock market.

**Nir Kshetri (2018)** examined how blockchain technology can help overcome the challenges of the current settlement system in the stock market. The author highlighted the potential benefits of blockchain technology, including reduced settlement time, cost and risk. The paper also discusses the challenges of implementing blockchain, such as change-resistance and regulatory barriers.

The **Li et al. (2018)** paper describes a blockchain based stock trading system that uses smart contracts to execute trades and settlement processes. The paper highlights the benefits of using blockchain and smart contracts for stock trading, including increased efficiency, transparency and security. Overall, the paper presents a novel and promising application of blockchain and smart contracts in the stock trading industry and highlights the potential benefits to both the investors and the brokers.

The **Singh et al. (2018)** paper explores how blockchain technology can be applied to the issuance of Asset-Backed Securities (ABS). The paper highlights the limitations and challenges of the traditional ABS market, such as lack of transparency, huge costs and inefficient processes. The authors propose the development of a blockchain based platform that uses smart contracts to automate and streamline the ABS issuing process, and provide increased transparency, efficiency and security. However, as with any emerging technology, challenges and limitations still need to be overcome to gain widespread adoption.

Overall, existing research suggests that blockchain technology could have a powerful impact on the stock market. The technology can improve the stock market's efficiency, transparency and security, thereby benefitting both the investors and the companies. However, more research is needed to fully explore blockchain technology's potential in the stock markets. Future research should focus on practical blockchain based systems that stock exchanges and other market participants can adopt.

**STATEMENT OF PROBLEM:**

The traditional stock market infrastructure relies on centralized databases and intermediaries for the recording, management, and settlement of transactions. This system can lead to issues such as delayed settlement times, inaccurate record-keeping and increased risk of fraud and errors. The use of blockchain technology can address these challenges by providing a decentralized, tamper-proof, and transparent ledger that facilitates faster and more efficient transactions. At the same time, AI can leverage the vast amounts of data available in the stock market to improve

decision-making, risk management, and portfolio optimization.

The research paper aims to investigate the potential of combining blockchain technology and artificial intelligence (AI) in stock markets, and their impact on improving transparency, security, and efficiency. While blockchain and AI have been identified as transformative technologies that can revolutionize various industries, their potential in the context of stock markets remains largely unexplored.

**OBJECTIVES OF THE STUDY:**

- **T**o analyse the potential of combining blockchain technology and artificial intelligence (AI) in improving the financial aspects of stock markets, including transparency, security, and efficiency.
- To examine both the financial & technical aspects of implementing blockchain technology and AI in stock markets.
- To explore the current usage of blockchain based platforms in stock markets.
- To evaluate the impact of the combination of AI and blockchain technology and its application in the stock markets
- To inspect AI based cryptocurrencies and their functions.

By achieving these objectives, the research paper can comprehensively analyse the potential of combining blockchain technology and AI in stock markets, addressing both the financial and technical aspects.

**AN OVERVIEW OF THE IMPACT OF BLOCKCHAIN TECHNOLOGY ON STOCK MARKETS - A FINANCIAL PERSPECTIVE:**

The application of blockchain technology in stock markets can have a significant impact on various processes involved in stock trading. Few major significant impacts of blockchain technology on the stock market are explained as follows.

**SETTLEMENT:**

One area where blockchain technology could have a significant impact is settlement. Traditional stock market settlements can take time to complete, as transactions need to go through various intermediaries for verification and settlement. Currently in India, stock settlements take T+1(trade plus one) day. Earlier, stock trades were settled within two days of the actual transaction (T+2). This potentially causes significant risks and costs for market participants. Blockchain technology can reduce settlement time to minutes by providing real-time settlement through smart contracts. Smart contracts are automated systems that work within the terms of a contract when certain

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conditions are met. By using smart contracts, stock settlements can be automated and executed in real time, reducing settlement time and associated costs.

Blockchain technology enables peer-to-peer transactions, eliminating the need for intermediaries, thus, reducing settlement period to almost real-time.

**VOTING AND GOVERNANCE:**

Blockchain-based platforms can help vote in company matters like elections and other major business decisions. The voting process can be automated using smart contracts, ensuring the results' accuracy and transparency. This helps increase shareholder participation and engagement and reduces the risk of errors and fraud.

Blockchain technology can also enable the shareholders to vote by proxy, which means that their voting rights can be delegated to another party. This helps increase shareholder participation in voting, especially for those unable to attend shareholder meetings. Blockchain technology can also help enhance corporate governance's transparency and accountability by using these blockchain-based platforms to record governance decisions so that the shareholders can access all these information real time, allowing the company to be held accountable for its decisions.

**TRANSACTION EXECUTION AND POST-TRADE PROCESSING:**

Blockchain technology greatly helps in trade execution by largely reducing settlement time to almost real-time without the help of intermediaries like clearinghouses and custodian banks. It can provide increased transparency in post-trade processing by allowing all parties in a trade to have access to the same information at the same time.

Blockchain technology can also help in managing the data in post-trade processing by ensuring the secure and accurate trade data in a decentralised network, thus increasing the efficiency by streamlining data management processes. Thus, the use of blockchain technology can help reduce costs, increase efficiency and improve transparency and accuracy in transaction execution and post-trade processing.

**BLOCKCHAIN BASED PLATFORMS CURRENTLY USED IN STOCK MARKETS:**

Various stock exchanges around the world are currently using blockchain based platforms. Here's an overview of some of the most notable ones:

- Nasdaq Linq is a platform launched in 2015, that uses blockchain technology to issue and trade shares of private companies. The platform allows the issuance, transfer and settlement of shares, thereby reducing the time and cost associated with traditional private market transactions.

- Hong Kong Exchanges and Clearing Limited (HKEX) has launched a platform called "Stock Connect" which is powered by blockchain technology that enables cross border trading between Hong Kong and mainland China. This platform enables investors to trade stocks that are listed on the Shanghai and Shenzhen stock exchanges.

- The Australian Securities Exchanges (ASX) is currently developing a blockchain based platform to replace its existing system for settlement and clearing for equity trades. The platform is called CHESS, which stands for Clearing House Electronic Subregister System which is expected to improve efficiency, reduce costs, and enhance transparency and security.

- The London Stock Exchanges Group (LSEG) launched a blockchain based platform called "Turquoise Plato" which allows the market participants to anonymously execute block trades in equity. This platform aims at improving efficiency and reducing trading costs.

**BLOCKCHAIN TECHNOLOGY AND ITS COMBINATION WITH AI – A TECHNICAL PERSPECTIVE:**

This part explores the technical aspects of impact of cryptocurrencies, and the combination of artificial intelligence and blockchain technology and reviews the AI based cryptocurrencies currently in use.

**CRYPTOCURRENCIES AND THEIR RELATIONSHIP WITH BLOCKCHAIN AND OTHER BOOMING TECHNOLOGIES**

Cryptocurrencies play a very vital role in the usage of blockchain technology in the stock market. They can be categorised on the basis of multiple factors such as:

- **Decentralisation**: Cryptocurrencies are digital currencies that are not controlled by any central or intermediate authority. This makes it decentralized by nature which thus makes it a natural fit for blockchain technology which also follows a similar decentralized mechanism. Intermediates such as banks can be completely eliminated eventually increasing transparency for users and reducing costs.

- **Smart Contracts:** These are kinds of self-executing contracts where the terms of agreements are written into code. Cryptocurrencies enable the usage of such smart contracts which can automate the settlement process without the necessity for human intervention. This can greatly save time, reduce costs and increase the efficiency in the stock market.

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- **Partial Ownership**: Cryptocurrencies allows the fractional ownership of securities, increasing the ease of access and reducing hindrances for investors entering the market. Instead of buying or selling whole shares, investors can thus buy or sell portions of securities in the form of digital assets. This also inculcates a sense of democracy in the stock market.

- **Security:** Cryptocurrencies use various technologies and algorithms which can provide high security level while making stock market transactions. Transactions on the blockchain use cryptographic algorithms that use a unique secure hash algorithm for encryption and decryption, making it difficult for hackers and fraudsters to tamper with the data. This minimizes risks of frauds and market manipulation by increasing the transparency of the transactions being made and increasing the accountability of users.

- **Faster transactions-** Fast and seamless settlements are one of the most notable advantages of using cryptocurrencies in the stock market. Traditional settlements can take days whereas cryptocurrencies such as Bitcoins, Ethereum etc., can perform transactions in minutes or even seconds. This increases the liquidity in the markets and reduces the risks and threats associated.

- Thus, with the increasing usage of the blockchain technology in the stock market, the role of digital assets in the form of cryptocurrencies will continue to grow rapidly and play a pivotal role in shaping the stock market's future.

## COMBINING AI & BLOCKCHAIN:

Artificial Intelligence has been one of the most booming technologies in the IT industry and with the latest constantly involving technologies like chatbots it has become a revolution with leading companies ready to invest millions. AI is the kind of technology that can help in solving complex problems and helps in decision making by leveraging data more efficiently. AI constantly continues to evolve and the latest innovation that is in progress is the combined use of AI and blockchain technology which could become the most powerful tool in providing security , preventing frauds and analyses patterns in the blockchain data, detecting suspicious activities. This could provide more security for various kinds of activities performed using the blockchain technology and could potentially prevent money laundering as well. Artificial intelligence works on behavioural patterns and predictive analysis. This could prove to be effective in cryptocurrencies that use blockchain technology. This is because the results of such

analysis could be an immensely productive way to analyse market prices and trends.

One of the major problems associated with cryptocurrencies today is the volatility of using various cryptocurrencies for transactions. Though there is transparency of data being stored in ledgers using blockchain, there is still a lack of security and 0.34% of the transactions still result in crimes. This technology issue can also be partially resolved by using AI in smart contracts which in turn can ensure that transactions comply with predefined rules.

However, AI cryptocurrencies are entirely different from other cryptocurrencies, and the primary differentiating factor is the presence of built-in AI technology in these coins.

The volatile nature of cryptocurrencies where the values are unpredictable make it difficult for users to make informed investment decisions while trading. This is where technologies like Artificial Intelligence and Machine Language are being incorporated with existing Blockchain technology, to give insights into market trends and provide platforms for transparent, seamless transactions, AI based cryptocurrencies leverage the AI technology to provide advanced real time features that tend to benefit traders who want to maximize their returns and minimize their risk exposure.

At present humans are the ones who're making investment decisions. Using AI, better investment decisions can be made by combining computer knowledge with human experience. Various AI algorithms will also come in handy while managing crypto assets and performing trading. This makes it susceptible to attacks that compromise with the security. Blockchain ensures the exchange of coins without a third party's involvement, making transactions private and transparent. Presented below are the different types of AI based cryptocurrencies that are most popularly used.

## AI Based cryptocurrencies include:

**NUMERAI (NMR) -** This cryptocurrency is built on the ethereum blockchain and payments can be made on its platform. It provides two applications-

Numerai Tournament, a weekly competition, rewards participants who submit predictive algorithms to accurately predict market trends in the fintech industry. Winners get rewarded in NMR tokens.

Signal Tournament where participants are rewarded in NMR tokens for predicting market trends using technical indicators.

Numerai also uses Machine Learning algorithms in addition to AI. It is a decentralised hedge fund where data

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scientists use machine learning models to trade using cryptocurrencies. In addition to the predictive models that are used as mentioned above, other tools to develop and test models are also provided to data scientists using this platform. They receive rewards in the form of cryptocurrencies, provided that their models function well.

**OCEAN PROTOCOL**- This contains an open source platform that easily enables transacting data for both customers and sellers. It also consists of a database that can store large amounts of data related to the transactions. The protocol enables the creation and management of data using such database systems. It consists of Open Vertical which enables private and public data access. It also ensures privacy by making the users aware of whom their data is accessible to. It also works on a predictive model and enables analysing large data sets.

**DEEPBRAIN CHAIN -** It uses blockchain technology using AI in a cost effective manner and employs infinite scalability. It is one of the most affordable AI cryptocurrencies available in the market. A privacy layer present protects sensitive data. Many large companies have used this platform to create cloud based games in the past.

**FETCH.AI (FET) - This** kind of cryptocurrency works with very limited human interference. It makes use of machine learning algorithms for its functioning on a decentralised network. Users can thus interact and negotiate over this decentralised network with digital assets and make use of data services. It consists of a Native Token that incentivises network users, facilitates transactions and rewards data miners for block validation on the blockchain. It takes the technical advancements a notch up by providing an autonomous agent that can be used in supply chain management, smart homes and other sectors.

**SingularityNET (AGIX) -** It is another open source platform that enables developers to incentivize the AI services on a distributed network. It makes use of Ethereum blockchain and tokenizes incentives to cooperate with the clients who are a part of the network. SingualrityNET provides insights about potential risks and market trends using AI algorithms that match buyers and sellers. Just like any other mode of payment AI based cryptocurrencies can also have their own set of cons in the stock market. Some set of challenges include:

The lack of user privacy because all the data need to be trained and risk of hacking of AI algorithms can result in biased, inaccurate predictions. The lack of clarity in regulating cryptocurrencies makes their business adoption a burden. This can also result in legal implications.

**CONCLUSION:**

In conclusion, blockchain technology has the potential to revolutionize the stock market by increasing transparency, security, and efficiency. By using blockchain-based systems, stock market transactions can become more secure and cost-effective, reducing the risk of fraud and errors. Furthermore, combining blockchain technology with AI can result in more intelligent, autonomous, and decentralized decision-making processes, which can enhance the accuracy and efficiency of stock market operations. Additionally, AI-based cryptocurrencies have the potential to provide new opportunities for investors and traders, while also addressing some of the limitations of traditional cryptocurrencies. As such, the applications of blockchain technology in stock markets are vast and promising, with the potential to transform the industry as we know it. Overall, it is clear that blockchain technology, coupled with AI, has the potential to shape the future of stock market trading, enabling greater efficiency, security, and transparency for all stakeholders involved.

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# WANNAPRENEURS TO ENTREPRENEURS: SCRUTINIZING THE REASON BEHIND "WHY NOT" AND "HOW TO"

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**ABSTRACT:** The research article "Wannapreneurs to Entrepreneurs: Scrutinizing the Reason behind the Why Not & How" aims to figure out the fact and reason behind two major interrogations,
•Why and What makes wantrepreneurs stop themselves from being an entrepreneur?
•How to convert wantrepreneurs to functioning active entrepreneurs?
Entrepreneurs who prove to be successful in taking on the risks of a start-up are rewarded with profits, prominence, and continuous extended opportunities. Wannapreneurs talk about managing and organizing the business with considerable initiative and risk but never do it. The upcoming article's objective is to figure out the demotivational factors that stop the thwantrepreneursrs to be functioning as active entrepreneurs and to motivate the intrapreneurs by studying the mantra behind the people who switch from wantrepreneurs to entrepreneurs. The research methodology bought into the study includes a questionnaire survey among wantrepreneurs who wanted to be an entrepreneur and never initiated their business idea as a startup. The collected data from 229 wantrepreneurs from Chennai city is analyzed and interpreted using various statistical tools by SPSS. The obstacles and barriers studied in the research are listed as Discouragement be society & family, Lack of capital funding, Government regulations, Education, skills and training, Business support (networking), Fear of risk, and Competition. The conclusion stated the solution to the objected interrogation "WHY NOT" and "HOW TO" convert wantrepreneurs to active entrepreneurs.
Keywords: Wannapreneurs, Entrepreneurs, Obstacles, Barriers.

## Introduction

Start-up is a company or business unit undertaken by an entrepreneur to seek, develop, and validate a scalable economic model. **Start-ups** face high uncertainty and have high rates of failure, but a minority go on to be successful and influential. Today's young people are more interested in becoming entrepreneurs andcreating their own businesses, but never do **it**. In reality, those individuals wanted to be entrepreneurs but never initiated any progress to be so, from that point they are been tagged as "**Wannapreneurs**". Most of the wantrepreneurs believe the statement from Warby Parker, "A Start-up is a company working to solve a problem where the solution is not obvious and success is not guaranteed". The unguaranteed success factor coins detriment influence and disproving to convert wantrepreneurs to entrepreneurs. It is imperative to analyze the realistic influential factors on "Why wantrepreneurs do not progress themselves as an entrepreneur".

**The objective of the study**

- To figure out the demotivational factors that stop wantrepreneurs to be functioning as active entrepreneurs.
- To motivate wantrepreneurs by reviewing the mantra behind the people who switched from being wantrepreneurs to entrepreneurs.

**1. Research Question**

- Why Wannapreneurs do not become successful active Entrepreneurs?
- How to convert Wannapreneurs to Entrepreneurs?

**2. Data sources**

The study used both primary and secondary data. The primary data was collected directly from respondents. The secondary data was taken from research articles, research blogs, magazines, textbooks, start-up experts and influencing entrepreneur's history.

**3. Sampling size and method**

The analysis of the study was done by having a purposive sampling method for evaluation of Demotivational factors & Obstacles and barriers which initiate their own start up

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unit by wantrepreneurs in the study area. Altogether, 250 questionnaires were distributed, out of which 240 filled responses were gathered, from which 229 were filtered on basis of the wannapreneur's profile. The total of 229 responses is sample size for the findings and analysis of the study.

**Literature Review**
**Life Cycle of Start-ups (Aidin Salamzadeh, 2015):** The start-up differs from other job and complex in nature, start-up have life cycles from their initial stage to successful

business venture. The sequence of stages differs based on the nature of start-up. The life cycle of start-up stages are as follows in the below figure:
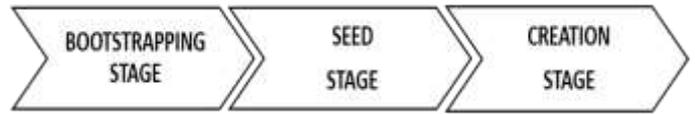


**Source: www.researchgate.net (Aidin Salamzadeh, 2015)**

**Obstacles and Barriers to Start a Business among the wannapreneurs**
**One-sample t-test for Obstacles and Barriers faced by Wannapreneurs**

| Obstacles & Barriers | N | Mean | SD | t | p |
|---|---|---|---|---|---|
| Discouragement by the society & family | 229 | 3.19 | 1.11 | 2.56 | .011* |
| Lack of capital funding | 229 | 3.6 | 0.92 | 9.839 | .000** |
| Government regulations | 229 | 3.41 | 0.852 | 7.366 | .000** |
| Education, skills and training | 229 | 3.35 | 1.072 | 4.931 | .000** |
| Business support (networking) | 229 | 3.63 | 1.003 | 9.557 | .000** |
| Fear of risk | 229 | 3.52 | 0.989 | 8.016 | <0.001** |
| Competition | 229 | 3.49 | 1.209 | 6.177 | <0.001** |

The p-value for Obstacles and Barriers to start a business among the wannapreneurs is <0.01. Therefore, the study confirmed that the wannapreneurs are facing Obstacles and Barriers to start a business and become an entrepreneur.

**The solution to Financial & Government Regulation Barrier:** The study has revealed that financial sources (monetary funding) are the major block among young graduates stepping into society as an entrepreneur. This stumbling block can be cleared by creating an awareness of financial schemes generated by Government banks and financial institutions to promote Entrepreneurship and Startup in order to uphold industrial development. The topmost financial scheme formulated by the Government of India for aspiring people to become Entrepreneurs are Atal Incubation Centre (AIC), NewGen IDEC, MSME Market Development Assistance, The Women Entrepreneurship Platform (WEP) with three aspects listed as Iccha Shakti, Gyaan Shakti, and Karma Shakti, Self-Employment Lending Schemes Credit Line 2 – Micro Financing Scheme, Swarojgar Credit Card, Pradhan Mantri Mudra Yojana, Raw Material Assistance Scheme by NSIC and Venture Capital Scheme for Agri-Business Development by SFAC.

**The solution to the Skill Barrier:** The faculties can cultivate the skills and courage and direct towards business initiatives to reduce the fear of risk, motivate them by adding the history of successful entrepreneurs and add live decisive examples in the lectures of entrepreneurship development classes and by conducting startup development programs, seminars and workshops with the assistance of fruitful entrepreneurs.

**De-motivational Factors Towards the Entrepreneurship among the Different Age Groups of Wannapreneurs**
**ANOVA test for De-motivational Factors towards Entrepreneurship among the different Age groups of Wannapreneurs**
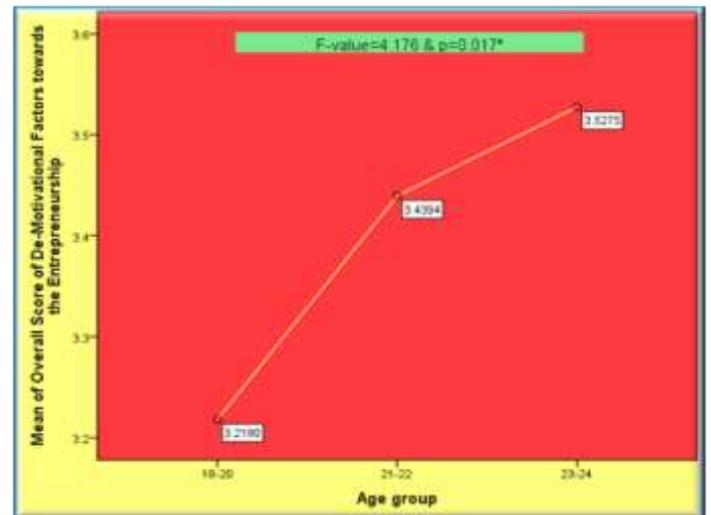


The F & p-value for ANOVA test for De-motivational Factors towards Entrepreneurship among the different Ages of Wannapreneurs is 4.176 & 0.017. The study concluded that there is a significant difference among the age group of Wannapreneurs concerning the de-motivational factors towards Entrepreneurship concerning the commitments they carry.

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## Conclusion:

"Everyone can tell you the risk, An Entrepreneur can see the Reward" – Robert Kiyosaki

Thus, the study states Entrepreneurship is not appreciated by society, Lack of startup funding, Government regulations and Business networking considered as a major stumbling block for success. The solution to the de-motivational fact of bearing risk and financial funding sources is to create awareness of beneficial scheme and policies regulated by Government considering Entrepreneurship as a career decision among youngsters who are the future of economy. Thus, Entrepreneurship and Startup are foreseen as a one-stop solution to unemployment. These disputes in the process of economic development hike the living standard and financial status of whole individuals in the nation. Therefore, the Government policies undergo the barriers faced by the graduates in the process of conversion from Wannapreneurs to Entrepreneurs, by promoting Entrepreneurship careers and a positive mindset towards Startup which bounce advanced aid to the economic growth of the realm.

## Limitation & Scope for Further Research

- A comparative study between Chennai and other parts of cities in Tamil Nadu can throw more light on opportunities to entrepreneurs.
- To analyze the Obstacles and Barriers faced by wantrepreneurs among College Students in the study region, future studies can be done with individuals from other specifications and corporate job seekers.
- The study is from a specific group of students such as Commerce and Business Administration discipline. Further studies can include different categories of students from diverse educational backgrounds and courses.

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# An Analysis of Prevalence and Factors Causing Anaemia Among Children in India

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## Abstract

**This paper discusses the pervasive existence and factors leading to anaemia -– a state of reduced iron content in the red cells at the national level. Taking in to consideration the national level representation health statistics, The National Family Health Survey Report-5, the trend of anaemic status in all states have been analysed. The iron content in the body has to be checked at all stages of life, such as pregnant and lactating mothers, new born babies and children below age five  Anaemia if ignored will lead not only to hazardous health consequences but also leads to an increase in economic burden. Around the globe India is one of the most severely affected countries with high pervasiveness of anaemia.  In this study the optimum levels of haemoglobin for children are discussed to create awareness. Importance is dedicated towards anaemia among children, because they are the future human resource to shoulder the country in all walks of life. Emphasises is also laid  on the health aspect, stating that if health is assumed as secondary, then life becomes sedentary. Therefore creating awareness, rolling down of health schemes, allocation of increased funds towards health industry will pave way to combat the deficiency**

**Key words: _Anaemia, Iron Defici, severity ,Haemoglobin level Children_**

## Materials and Methods:

The report generated by National Family Health Survey -5, was considered

for the study and by adopting descriptive and inferential statistical methods the results were obtained. The result of the analysis indicates demographic and social variables including age, place of residence, religion and educational status play an influencing role towards the severity of anaemia

**Introduction**

Anaemia is a state of disorder where the quantity of red blood cells or the iron concentration within them is lower than normal. Haemoglobin is necessary to transmit oxygen and if there is too few or abnormal red blood cells, or not enough haemoglobin, there will be a decreased capacity of the blood to carry oxygen to the body's tissues. The optimum haemoglobin levels to meet the physiological requirements differs by ageing, gender, and pregnancy status.  Anaemia affects the functional health of children specifically, motor and mental impairment, it leads to decreased work efficiency in adults, poor pregnancy outcome, and health effects on the new born infant.
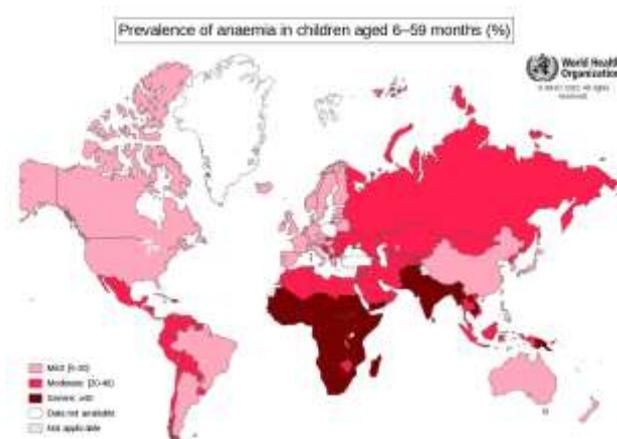


**Source:** World Health Organisation-The Global Health Observatory-Health Data

The World map depicts the pervasive existence of anaemia all over the globe. The shades from light to extreme darks represent the severity of its presence.

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Globally, iron deficiency anaemia has relevant medical and social impacts and this is a severe  severe global public health issue that mainly affects young children and pregnant mothers. World Health Organisation has estimated about  40 per cent in children of age group (6months-59 months) are easy victims of anaemia and in comparison with all the countries, Pervasive existence of anaemia among children in **African Region** accounts to 60.2 per cent . The worldwide frequency of anaemia among children has shown a decrease from 48.0 percent to 39.8 percent from the year 2000 and the trend line is stagnant from 2010. Globally, the prevalence  of anaemia was 30 per cent among women of reproductive age (15-49 years.), which is equivalent to over half a billion women .Pregnant women accounted to 36.5 percent and Non pregnant women constituted 29.6 percent. Since the year 2000, the worldwide pervasive existence of anaemia in women of reproductive age has been stationary, while the prevalence of anaemia in pregnant women has shown a slight declining phase.

**Review of Literature**

**Premanand Bharathi et al (2008)** attempts to study the anaemic condition between pregnant and non-pregnant women aged between 15 to 49 in urban and rural sector of 2016 in India and its relationship with few important economic and bio social factors. The severity was found on the pregnant women than non-pregnant women. Zone wise- State wise distribution of mean Haemoglobin  and percentage distribution of anaemia among women who  are in the family way and non-pregnant women was computed, likewise different levels of anaemia with economic and bio- social factors among pregnant and non-pregnant women was also computed. It is also identified that the degree of prevalence various over different geographical zones and States with in India and it is observed that people residing and Eastern North Eastern Central zones are more prone to anaemia. Education is an important factor in realizing the self-Health Care and is also an important observation that  people  working  in  agriculture  are  more vulnerable to anaemia since they are easily prone to infested with who comes and other parasites

**Rekha Kumar et al (2017)** examines 200 adolescent girls in a tertiary hospital, Bihar to determine the prevalence of iron deficiency and iron deficiency anaemia. The cross sectional study found that 50percent of respondents where anaemia and it is also pointed that Gujarat has a very high percent of anaemia population  when  compared  to  Tamil  Nadu Karnataka West Bengal

**Abhilash Shashidhar Nihar etal (2019)** carries out a cross sectional study among 255 adolescent girls where 48.63percent where identified with anaemia. The mild degree of anaemia was observed in the early adolescent age group and a significant relationship was found between so economics status dietary modification nutritional supplementation and anaemia

**Samuel Scott et al (2022)** attempted to explain the pervasiveness, harshness and burden of anaemia among the adolescent aged 10- 19 in India Comprehensive National Nutrition Survey 2016-18(CNNS) has been used for examining the factors related with anaemia at the national level.  Using Regression technique it is found that iron deficiency showed the strongest Association with anaemia followed by hemoglobinopathies, vitamin A and Zinc deficiency .The study also added that continuous address on iron deficiency is immediately needed to create awareness among the people

**Objectives of the study:**

➢ To outline  the pervasive existence  of anaemia among children aged 6 months -59 months at the national level

➢ To examine the factors causing anaemia among children

In India Anaemia is one of the key health concerns, but still it goes unobserved. **According to the National Family Health Survey Report-5,** Anaemia is a disorder that is marked by low levels of haemoglobin in the blood. Iron is a key component of haemoglobin, and iron deficiency is estimated to be responsible for half of all anaemia globally. Other causes of anaemia include malaria, hookworm and other helminths, other nutritional deficiencies, chronic infections, and genetic conditions .Women of reproductive age and children are vulnerable to this deficiency resulting in high morbidity and maternal deaths, and this in turn hampers the economic growth. Women are easily affected due to their undernourished dietary patterns, lacking iron and also iron loss during menstruation and child births.Iron is very important element of human diet. This is essential for formation of haemoglobin.  Low levels of Haemoglobin cause Iron deficiency anaemia. The red cells comprise haemoglobin. The red cells are vital particles in blood. Iron is a mineral that the body needs for growth and development. The body uses iron to make haemoglobin, a protein in red blood cells that transmits oxygen from the lungs to all parts of the body.

**Iron Deficiency Anaemia (IDA)** continues to be major threat in India. It is estimated that about 20percent of maternal demises are directly correlated to anaemia. The majority of the states (eastern, north-eastern and central) suffer from high anaemia prevalence rate and it increases over time. It is observed that multiple socio-demographic factors ranging from poor economic and educational status, unhygienic rural residence, and increased number of childbearing of women are responsible for anaemia levels among women in India. To overcome this difficulty India should create employment facilities to women and thereby strengthening their financial status which would help them to combat their health related issues. Anaemia in children is alarming, because it damages the cognitive development, growth, and increases illness. *The*

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National Family Health Survey Report(2016) *reveals that,* 67 per cent of Indian children aged 6-59 months have anaemia (haemoglobin levels below 11.0 g/dl), which is higher than National Family Health Survey Report (2021) estimate of 59 per cent

*Anaemia among adults was identified as* 57 percent among women and 25percent of men in the age group of 15-49

**Table:1** Haemoglobin levels in blood amongst **children aged below five years**

| Anaemia status (Severity) | Haemoglobin level in grams/decilitre* |
|---|---|
| Anaemic condition | <11.0 |
| Mild anaemia | 10.0-10.9 |
| Moderate anaemia | 7.0-9.9 |
| Severe anaemia | <7.0 |
| Not an anaemic person | 11.0 or greater |
| *Haemoglobin levels are adjusted for altitude in enumeration areas that are above 1,000 metres | |

Source: National Family Health Survey-Report 2021

Table:1 depicts the severity of iron deficiency mong the children of age 06-59 months. Any level less than 11.0 is considered as anaemic condition. Children under 10.0-10.9 category fall under mild anaemia, 7.0-9.9 grams under moderate and finally below 7grams are severely affected.
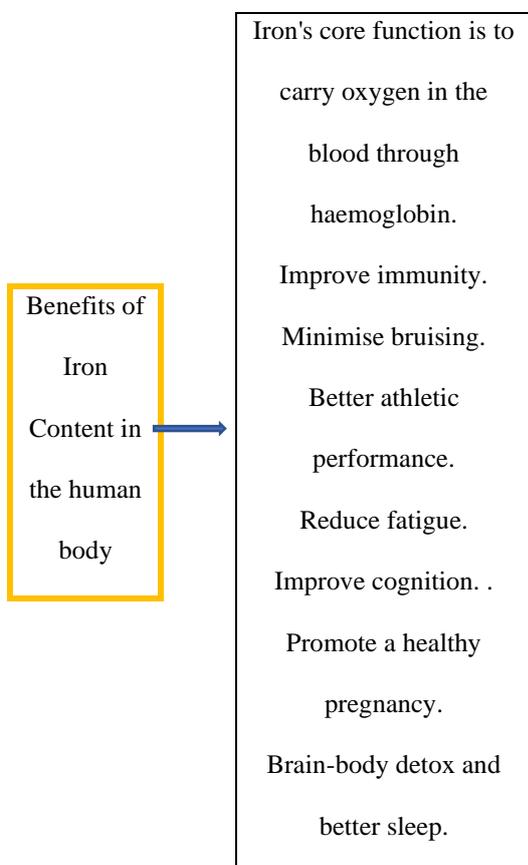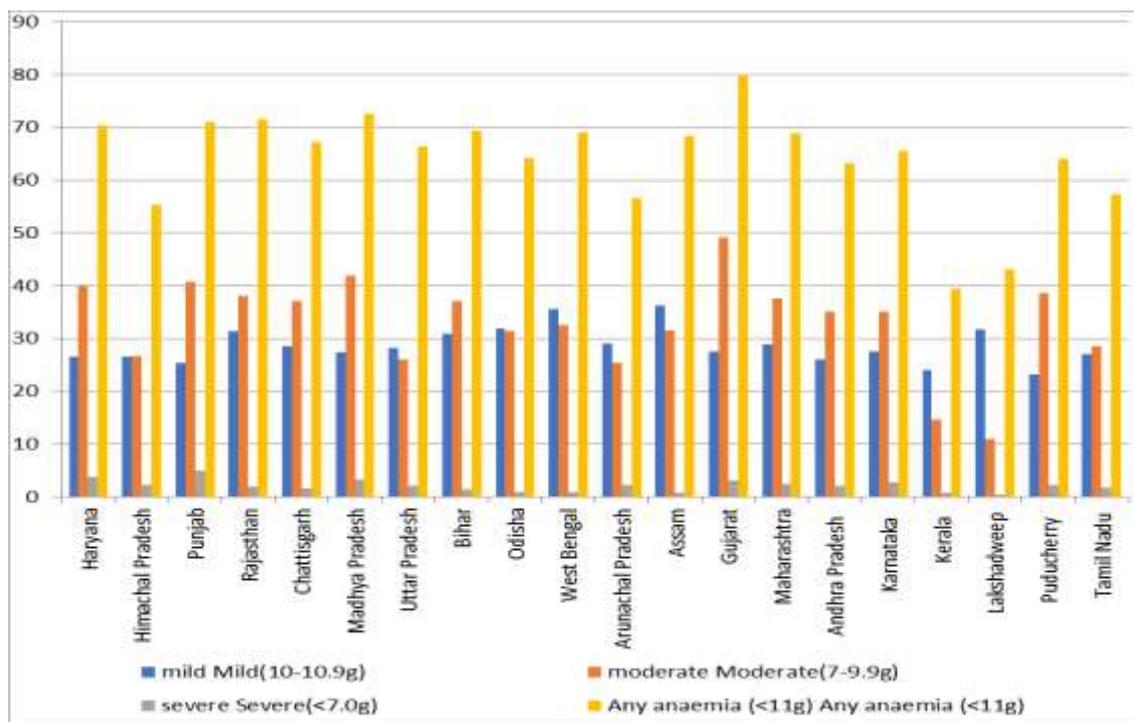
| Benefits of Iron Content in the human body | → | Iron's core function is to carry oxygen in the blood through haemoglobin. Improve immunity. Minimise bruising. Better athletic performance. Reduce fatigue. Improve cognition. . Promote a healthy pregnancy. Brain-body detox and better sleep. |
|---|---|---|

**Table:2** Anaemia status by Haemoglobin levels in the Major States of India

| States | Mild (10-10.9g) | Moderate (7-9.9g) | Severe (<7.0g) | Any anaemia (<11g) |
|---|---|---|---|---|
| Haryana | 26.60 | 40.00 | 3.80 | 70.40 |
| Himachal Pradesh | 26.50 | 26.70 | 2.20 | 55.40 |
| Punjab | 25.30 | 40.80 | 5.00 | 71.10 |
| Rajasthan | 31.40 | 38.00 | 2.00 | **71.50** |
| Chattisgarh | 28.50 | 37.10 | 1.60 | 67.20 |
| Madhya Pradesh | 27.40 | 42.00 | 3.30 | **72.60** |
| Uttar Pradesh | 28.20 | 26.10 | 2.10 | 66.40 |
| Bihar | 30.90 | 37.00 | 1.50 | 69.40 |
| Odisha | 31.90 | 31.40 | 0.90 | 64.20 |
| West Bengal | 35.60 | 32.50 | 0.90 | 69.00 |
| Arunachal Pradesh | 29.00 | 25.30 | 2.20 | 56.60 |
| Assam | 36.20 | 31.50 | 0.80 | 68.40 |
| Gujarat | 27.50 | 49.10 | 3.10 | **79.70** |
| Maharashtra | 28.90 | 37.50 | 2.40 | 68.90 |
| Andhra Pradesh | 26.10 | 35.00 | 2.10 | 63.20 |
| Karnataka | 27.60 | 35.10 | 2.70 | 65.50 |
| Kerala | 24.10 | 14.60 | 0.70 | **39.40** |
| Lakshadweep | 31.80 | 10.90 | 0.50 | 43.10 |
| Puducherry | 23.20 | 38.60 | 2.20 | 64.00 |
| Tamil Nadu | 27.0 | 28.60 | 1.80 | 57.40 |

Source: computed from NFHS (2019-21)

Table: 2 depicts the spread of aneamia(severity) in the states of india.It is evident that the first three highest severity prevails in the state of Gujarat followed byMadhya Pradesh and Rajasthan. On the contrary Kerala has the least percent of anaemia prevalence among children followed by Puducherry.

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Source: computed from NFHS (2019-21)

**Statistical Analysis of Factors associated with the pervasive existence of anaemia among children of age 6-59 months**

**Association among Age and level of Anaemia**

To find out the association among age of the children and level of anaemia, age (in months) and level of anaemia has been considered. The levels are measured in terms of frequency of the respondents chosen by the National Family Health Survey Report-5 and the levels of severity has been grouped as Severe, Moderate and Mild prevalence of anaemia

Chi-Square Test has been carried with the following Null Hypothesis and Alternative Hypothesis:

$H_0$ : There is no association among the age and the level of anaemia among children

$H_1$ : There is an association among the age and the level of anaemia among children

**Table 3:** Association among Age and level of Anaemia

| Age in Months | Anaemia level | | | | Total | Pearson Chi Square Value | p value | Inference |
|---|---|---|---|---|---|---|---|---|
| | Severe | Moderate | Mild | Not anaemic | | | | |
| 15-19 | 124 | 1918 | 1387 | 1862 | 5291 | 430.062 | 0.00** | There is Positive Association among Age and Level of Anaemia in Children |
| 20-24 | 1442 | 20785 | 17200 | 24744 | 64171 | | | |
| 25-29 | 2109 | 27008 | 23233 | 36799 | 89149 | | | |
| 30-34 | 1163 | 12837 | 11135 | 18669 | 43804 | | | |
| 35-39 | 506 | 5038 | 4195 | 7156 | 16895 | | | |
| 40-44 | 135 | 1235 | 954 | 1675 | 3999 | | | |
| 45-49 | 33 | 297 | 246 | 498 | 1074 | | | |
| **Total** | **5512** | **69118** | **58350** | **91403** | **224383** | | | |

**Source:** Computed using National Family Health Survey Report-5(2019-2021)

Note : **\*\*** denotes significant at 1% level

Based on the results arrived, it is found that 25-29 months old children have been severely affected by the deficiency followed by 20-24 months of age. The result of Chi-square

Goodness of fit is shown in Table:3. Since the p value is less than 0.00 the null hypothesis is rejected at 1percent level of significance and concluded that that there is a positive

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association among chronological age and level of anaemia. Therefore we reject the null-hypothesis and accept the alternate hypothesis that age has an impact on the prevalence of anaemia among children.

**Association Among Place of Residence and Level of Anaemia**

To find out the association among place of residence and level of anaemia among children, the frequency of the respondents from rural and urban areas are chosen from the National Family Health Survey and the levels of severity has been grouped as Severe, Moderate and Mild prevalence of anaemia

Chi-Square Test have been carried with the following Null Hypothesis and Alternative Hypothesis:

$H_0$ : There is no association among the place of residence and the level of anaemia among children

$H_1$ : There is an association among the place of residence and the level of anaemia among children

**Table:4** Association among place of residence and level of Anaemia

| Place of Residence | Level of Anaemia | | | Total | Pearson Chi Square Value | p value | Inference |
|---|---|---|---|---|---|---|---|
| | Severe | Moderate | Mild | Not anaemic | | | There is Positive Association among place of residence and Level of Anaemia in Children |
| Urban | 877 | 11814 | 11380 | 20492 | 767.480 | **0.00\*\*** | |
| Rural | 4635 | 57304 | 46970 | **70911** | | | |
| **Total** | **5512** | **69118** | **58350** | **91403** | | | |

**Source:** Compiled from National Family Health Survey2019-2021 Note : **\*\*** denotes significant at 1% level

Based on the Chi-square results arrived, it is found that 25-29 months old children have been severely affected by the deficiency followed by 20-24 months of age. The result of Chi-square Goodness of Fit is shown in Table:4. Since the p value is less than 0.00 the Null hypothesis is rejected at 1percent level of significance and concluded that there is a positive association among place of residence and level of anaemia. Therefore we reject the null-hypothesis and accept the alternate hypothesis and found that there is a positive relationship between the place of residence and level of anaemia among children.

| Table: 5 Association among Religion and level of Anaemia | | | | | | | |
|---|---|---|---|---|---|---|---|
| Religion | Anaemia level | | | | Total | Pearson Chi Square Value | p value | Inference |
| | Severe | Moderate | Mild | Not anaemic | | | |
| Hindu | 4111 | 52857 | 43914 | 64420 | 165302 | 1824.013[a] | 0.00\*\* | There is Positive Association among place of residence and Level of Anaemia in Children |
| Muslim | 751 | 9414 | 7980 | 13319 | 31464 | | | |
| Christian | 340 | 4040 | 4172 | 9965 | 18517 | | | |
| Sikh | 113 | 1268 | 989 | 1464 | 3834 | | | |
| Buddhist / Neo-Buddhist | 136 | 688 | 562 | 854 | 2240 | | | |
| Jain | 1 | 33 | 53 | 86 | 173 | | | |
| Jewish | 0 | 1 | 0 | 0 | 1 | | | |
| Parsi / Zoroastrian | 0 | 3 | 3 | 6 | 12 | | | |
| No religion | 0 | 18 | 13 | 47 | 78 | | | |
| Other | 60 | 796 | 664 | 1242 | 2762 | | | |
| **Total** | **5512** | **69118** | **58350** | **91403** | **224383** | | | |

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Based on the results arrived, the table indicates that, there is no severe anaemic level found among Jains, Jewish, Parsi communities. The number of people who are not anaemic fall under the Hindu Religion when compared to other religions.

The result of Chi-square Goodness of fit is shown above. Since the p value is less than 0.00 the Null hypothesis is rejected at 1percent level of significance and concluded that there is a positive association among Religion and level of anaemia. Therefore we reject the Null-hypothesis and accept the Alternate hypothesis.

To find out whether there exists any association among Education and level of anaemia among children, the frequency of the respondents are chosen from the National Family Health Survey and the levels of severity has been grouped as Severe, Moderate and Mild prevalence of anaemia

Chi-Square Test have been carried with the following Null Hypothesis and Alternative Hypothesis:

$H_0$ : There is no association among Education  and the level of anaemia  among children

$H_1$ : There is an association among Education  and the level of anaemia  among children

| Educational attainment | Anaemia level | | | | Total | Pearson Chi Square Value | p value | Inference |
|---|---|---|---|---|---|---|---|---|
| | Severe | Moderate | Mild | Not anaemic | | | | |
| No education | 1576 | 17300 | 12818 | 17557 | 49251 | 1833.526[a] | .000** | There is Positive Association among Education and Level of Anaemia in Children |
| Incomplete primary | 830 | 9475 | 7517 | 11216 | 29038 | | | |
| Incomplete secondary | 2546 | 33861 | 29254 | 46284 | 111945 | | | |
| Complete secondary | 74 | 1211 | 1017 | 1701 | 4003 | | | |
| Higher Secondary | 486 | 7271 | 7744 | 14645 | 30146 | | | |
| Total | 5512 | 69118 | 58350 | 91403 | 224383 | | | |

**Table:6 Association among Education and level of Anaemia**

**Source:** Compiled from National Family Health Survey Report-5(2019-2021)
Note :  ** denotes significant at 1% level

Based on the results arrived, the Table:6  indicates that, the frequency of the disease decreases with the level of education. The level of severe anaemic reduces from 1576 to 74. Moderate and mild anaemia have also reduced with the increase in education standards. The result of Chi-square Goodness of fit is shown above. Since the p value is less than 0.00 the Null hypothesis is rejected at 5percent level of significance and concluded that there is a positive association among Education and level of anaemia.  Therefore we reject the null-hypothesis and accept the Alternate hypothesis.

**Conclusion**

Anaemia is associated with poor cognitive and motor development in children, and work capacity in adults, affecting the country's economic development.  Unequal income distribution associated with caste issues, and unhealthy hygiene are the foremost reason for anaemia in India. The adverse effects of anaemia may take the forms of decreased productivity among children in future, decreased productivity of adults

The government of India has announced various schemes including Surakshit Matritva Aashwasan (SUMAN), The Anemia Mukt Bharat strategy, 'Pradhan Mantri Poshan Shakti Nirman' scheme (PM Poshan Scheme) , National Food Security Act, 2013 (NFSA).are some of the major health programmes being implemented by the Government of India to bring about substantive change in anaemic conditions.

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**An Analysis of Prevalence and Factors Causing Anaemia Among Children in India**

# Evaluation of Low Code-No Code Development Platforms versus Traditional Development Approaches

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*Abstract:*

**The advantages and disadvantages of low-code and no-code development platforms are compared in this article to more conventional development methodologies. Businesses have had a variety of choices for decades when they needed new information systems. They could hire internal coders to create a new system or buy a system from a third party vendor. This provides a good fit with obligations for company. Today, there is a novel alternative that is becoming more and more popular. Low code/no code (LC/NC) applications are much more affordable than systems created in-house and can effectively meet business requirements. They can also be implemented right away. There aren't many, if any, programming abilities needed.**

*Keywords***: Software development life cycle (SDLC), Low code no code development, No code development, Traditional development.**

## I.INTRODUCTION

### What is a Low Code Development Platform?

Low Code creation is a visual, drag-and-drop application creation method for minimizing manual coding during deployment. These platforms enable individual developers to create sites and applications that require expert expertise only.

1. Computer science or software creation concepts
2. latest software development tools and libraries

Platforms that enable low-code development are called Low Code Development Platforms (LCDP) or Low Code Application Platforms (LCAP).

### What is a no-code development platform?

Code is used to create a no-code platform, just like any other technical tool. The primary advantage is that it adds an abstraction layer so the user can only see the information they need. Using no-code platforms, anyone can convert a simple idea into a functional visual app. Without knowing any code, citizen developers can create web and mobile applications by connecting drag-and-drop application components. If you have a no-code platform on your side, it doesn't matter if you're a professional developer, a citizen developer, a small company owner, a business analyst, or someone without any technical knowledge. You can combine components with APIs on a no-code platform's user-friendly interface to produce useful applications. It does away with the idea of legacy technology from business operations and is usable by non-technical employees.

## II. METHODOLOGY

In this paper, we plan to analyze various aspects of low code/no-code development platforms and compare them with traditional development methods in terms of agility, cost of development, functionality, customization and many other aspects.

The following figure illustrates the various phases of traditional development methodology.



**Figure 1 : SDLC**

Platforms for development with no or little code operate differently. They frequently offer prebuilt components for various purposes, and applications and software are created by integrating and configuring these modules.
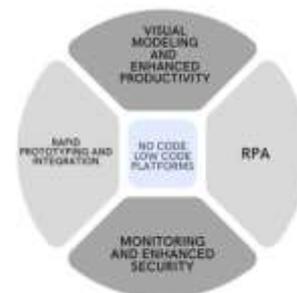


Figure 2: Low Code No Code Platform Overview

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## III. OVERVIEW
### A. Ease of Development
➢ **Traditional Development Platforms**:

A precise, well-established development method is used in traditional app development.

You typically anticipate the application of Agile methodology and DevOps best practices when it comes to computing. The DevOps practices guarantee that your application can be easily managed, updated without a hitch, and released to the public. However, developers must be familiar with the ecosystem, frameworks, technologies, and technology stack a company uses to create a standard app. There is a sizable selection of tools and innovations available. Developers encounter software bugs and mistakes that can be troublesome to fix.

➢ **Low-Code/ No-Code Development Platforms:**

These platforms typically come with small tools, making it easier to create various apps with little difficulty. Application development using the (LC/NC) method is much easier for non-technical staff who lack the necessary knowledge and expertise. For experienced developers, low-code, no-code development has the clear benefit of being quick. Prebuilt modules shorten the time needed to implement application features, freeing up developers' time for tasks that demand more creativity or have higher business priority. Developers can combine a function with an external platform without having to become experts on that external platform by using low-code development.

### B. Cost
➢ **Traditional Development Platforms:**

Businesses must compensate skilled developers experienced with the technology stack to create traditional apps. The conventional method of app development comes with additional costs, such as those for the tools and libraries used for app development, the integration of third-party services, and infrastructure services like servers, data storage, and content development networks. (CDN). Companies should set up these services independently or contract them to cloud services like AWS, GCP, or Azure. Costs will vary based on the scope of the project and specific organizational requirements, but they will still be significantly higher than those low-code no-code platforms.

➢ **Low-code/ No-code Development Platforms:**

Platforms for low-code and no-code development help companies create apps quickly and cheaply for immediate use. An internal staff or software development outsourcing is required for traditional development. With the low-code effect, an organization can employ part-time developers to work on cooperative projects without assembling a team. It also depends on how much the platforms' subscription fees are. Typically, it is much less expensive than hiring experienced developers who expect higher salaries commensurate with their qualifications.

### C. Maintenance
➢ **Traditional Development Platforms:**

For application assistance in traditional development, in-house or outside development teams are necessary. IT teams must update applications created using a conventional methodology to add new features and address bugs. Maintenance may be complex with traditional programming because updates or revisions would need to be implemented by a separate internal or external development team. Additionally, updating software can be a laborious process that requires teams to plan, create, and test changes before informing users of them.

➢ **Low-code/ No-code Development Platforms:**

The prebuilt and pre-tested modules found on no-code platforms make implementing adjustments more accessible and effective. Additionally, there are few chances of matching. Low-code platforms are usually governed and managed by the company that maintains them because they are aPaaS (an application platform as a service). This streamlines the maintenance process because the hosting company, rather than the company promoting the service, oversees all software upgrades and improvements. This benefits companies with weak or non-existent IT departments because it allows them to use well-maintained software without investing in additional resources.

### D. Agility
➢ *Traditional Development Platforms:*

Because they typically feature a complex setup mechanism, traditional development platforms are less agile. Furthermore, accurate implementation of sophisticated coding takes a lot of time to learn.

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➢ *Low-code/ No-code Development Platforms*
Because of their user-friendly design and drag & drop capabilities, these platforms are much easier to use. Contrary to custom development, developing apps or software doesn't necessitate writing code because the necessary methods may be drawn out using simple sketching techniques.

**E.      Reusability/Robust**
➢ *Traditional Development Platforms:*
Code reuse is possible with traditional development. This has a noticeable impact on the condition and maintainability of software products and increases productivity. Reusable components are frequently created using frameworks like AngularJS, React Native, etc. Although low-code systems have reusable components built in, saving time, designing these components to be utilized later takes time. Although traditional programming allows for code reuse, it lacks the low-code/no-code systems' pre-configured modules and app functionalities. For reuse, specific modules and functionality must be made in advance.

➢ **Low-code/ No-code Development Platforms**
Exceptional low-code systems offer OOTB (out-of-the-box) capabilities, eliminating the need to create kernel modules from scratch for apps. Some systems come with prebuilt gist modules like data management and customer service management. Multi-device adaptability is one of the most sought-after features of low-code/no-code platforms. Users can create cross-platform compatible programs that can run on all operating systems and gadgets. Using pre-configured modules and application functionality is another distinctive aspect of low-code development.

**F.      Advantages**
➢ *Traditional Development Platforms:*
**Unlimited Customization and Functionality**: Businesses can change custom code whenever they see fit. Almost any functionality can be implemented, and nearly every integration is doable. You can use any technology, tooling, hosting, and APIs you like when creating a bespoke app as long as it gets the job done and achieves the desired functionality.

**Full Ownership and Control**: Another benefit of conventional development is that you have total control over every facet of the created program. Since businesses choose custom apps, the ASCII text file is their property, giving them total control over the app's architecture, security, and integrability, among

other factors. No restrictions or limitations exist on how developers can write their code or organize their apps.

**Flexibility:** Any language and development environment can create traditional applications.

**Deploy Anywhere**: Applications created using a standard technique are released to the locations developers find most essential to support.

**Complex Functionality and Business Logic:**
It appears that developers are not constrained to using pre-existing features and modules. Compared to low-code/no-code development, this may be the most significant benefit of traditional application development. Low-code/no-code systems are appropriate for small-scale applications except for larger projects requiring scaling and complex custom logic. Conventional application development is the best.

➢ *Low-code/ No-code Development Platforms*

**Economical:** With low-code/no-code, event time and costs are significantly reduced, and businesses don't need to hire as many developers. Also, when using no-code development for your product, you benefit from the flexibility that the Agile methodology offers because these platforms provide version for any changes made to the application.

**Agility:** It enables businesses to move forward and produce modifications more quickly. Because they provide knowledge of configuration-based design, low-code/no-code products demand fewer skills than custom application development.

**Better risk management**: Businesses may swiftly make changes to comply with constantly changing rules using a no-code or low-code approach. Also, compared to conventional development techniques, all setup operations in this situation, including code review, building, and debugging, are significantly faster.

**Enhanced user experience**: Low-code/no-code platforms automate several key user-experience-related transactions. Quick app updates and robust business process features to aid in creating far better apps.

**Increased Productivity**: Low-code/no-code platforms help close the communication gap between IT and business teams, enabling them to address pressing organizational problems. Business organizations can design their applications using this method without dealing with developers. It does away with the need for complicated coding, expanding access to additional team members and boosting productivity.

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**Improved Security:** If a patch or security upgrade is available, the low-code/no-code platforms will automatically install it rather than requiring the developer to enter the code to do so.
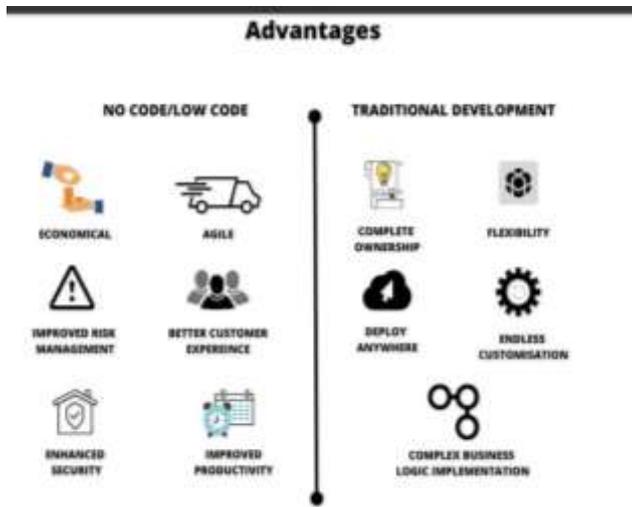


**Figure 3 : Advantages of LCNC Vs Traditional**

**Disadvantages**

**Increased Costs**: There is no getting around the fact that traditional custom programming demands careful budgeting, whether you choose to build yourself, contract out, or utilize a nearby source.

**Time Restrictions**: Human programming takes longer than code automatically generated by low-code/no-code technologies. Traditional application development also requires many time-consuming manual code changes to support various platforms, create sockets, and create other interfaces between services and applications.

**Need for Skilled Resources:** To create a custom application, a large team of developers, QA engineers, designers, and other experts is needed. A task in and of itself may be finding an app developer who will respect your product as their own.

Coding can be challenging to acquire, and it's unlikely that an entrepreneur would have the time to devote to learning the trade to the point where s/he feels confident producing usable apps as and when needed.

**Programming Requirements**: More specialized knowledge of a programming language or development environment is required for traditional application development. Before beginning a conventional application development project,

individuals must receive the necessary training and skill development.

**Time to Market is Relatively Slow**: Compared to no-code programming, custom app development takes longer—anywhere from two months to a year. Even when developers speed up the process using pre-existing components, most of an app is produced manually and takes time.

➢ *Low-code/ No-code Development Platforms*

**Third-Party Reliance**: With a low-code or no-code platform, one would mainly rely on the vendor to reduce risks, secure vulnerabilities, and adjust their update schedule to sync with the vendor.

Low-code/no-code development platforms typically provide businesses with few possibilities for creating customized or customized software applications or solutions.

**Restricted Integration Options**: The range of options available to developers using low-code/no-code development platforms is limited. This could be a significant barrier for organizations relying on older technology to run their daily operations.

**Developer Shortage:** Low-code/no-code development is not an obvious area of expertise, so it might be difficult for businesses to find knowledgeable developers in this field.
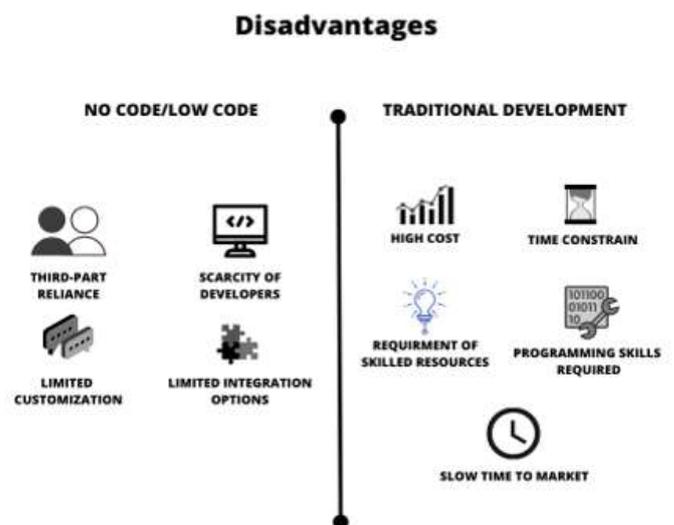


**Figure 4 : Disadvantages of LCNC versus Traditional**

IV      KEY LCNC TRENDS AND THEMES

To determine whether the hype around LCNCs is accurate, the worldwide LCNC market's state and

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prospects are evaluated. Also, a narrowed-down pool of vendors is chosen to compare them to one another.

*A.        Market Growth Indicator*

Per the 2021 Grandview Research [5], the LCNC market is expected to grow at a CAGR of 24.3% from 2021 to 2028 and cross $28B in 2022. By 2028, this is predicted to be a $92.9B industry with close to even split between On-Premise and Cloud based LCNC platforms.
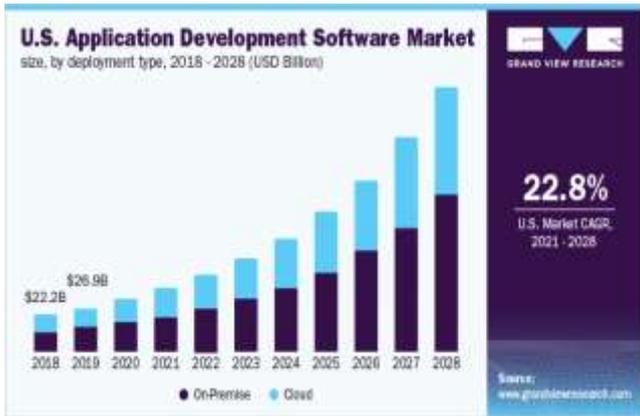


**Figure 5 :   Projected Low-Code Development Platform Market Growth**.

*Comparison of LCNC Growth with Other Leading Technology Trends*

This analysis compares LCNC growth against AI, Blockchain, Edge Computing, and RPA. Also, the comments refer market reports from a typical vendor to ensure research consistency.
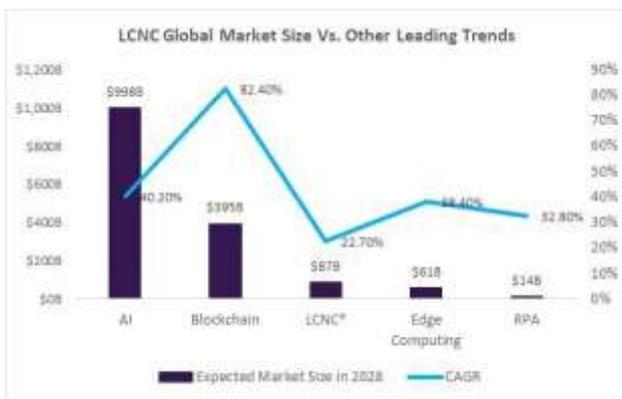


**Figure 6 :  LCNC Global Market Size Vs. Other Leading Trends.**

Even though LCNC has had unheard-of growth, it performs only marginally compared to other top technological trends. Compared to other industries, LCNC's CAGR is the lowest at 22.7%, indicating interaction with other trends, such as the possibility of

AI and RPA platforms eroding some of the company's market capitalization.

**Industry Statistics for the Top LCNC Vendors**

Whereas in theory LCNC can be applied across industries, some have a stronger inclination to benefit from these platforms due to existing legacy technologies that must be integrated with LCNC to develop new applications or their greater desire for innovation. This and the LCNC vendors' emphasis on sales and marketing paint the picture of their industry alignment. The table below is illustrative and based on the general population of evaluations customers have left for these vendors.

| Industry Demographics | | | | |
|---|---|---|---|---|
| | Services | Financial Services | Manufacturing | Healthcare | Other |
| **Appian** | 16% | 40% | 7% | 6% | 31% |
| **Mendix** | 32% | 17% | 20% | 2% | 29% |
| **Microsoft** | 20% | 12% | 20% | 5% | 43% |
| **OutSystems** | 27% | 21% | 10% | 7% | 35% |
| **Pegasystems** | N/A | N/A | N/A | N/A | N/A |
| **Salesforce** | 30% | 15% | 19% | 8% | 28% |
| **ServiceNow** | 25% | 17% | 12% | 12% | 34% |

Indicates vendor with highest demographic focus

**Table 1: Industry Demographics of Leading LCNC Platforms**

| Geographic Demographics | | | |
|---|---|---|---|
| | North America | Europe, Middle East, & Africa | Asia/Pacific | Latin America |
| **Appian** | 49% | 31% | 16% | 4% |
| **Mendix** | 28% | 63% | 7% | 2% |
| **Microsoft** | 37% | 28% | 26% | 9% |
| **OutSystems** | 28% | 50% | 16% | 6% |
| **Pegasystems** | N/A | N/A | N/A | N/A |
| **Salesforce** | 52% | 24% | 16% | 8% |
| **ServiceNow** | 49% | 18% | 25% | 8% |

Indicates vendor with high demographic focus

**Table 2: Geographic Demographics of Leading LCNC Platforms.**

**V   CONCLUSION**

By 2024, 75% of large businesses will be utilizing at least four low-code development tools for citizen development projects and IT application development. This and other patterns covered in this paper indicate that LCNC is more than just a fad; it is firmly established and will soon become the norm for application development. Also, businesses can deploy these LCNC systems for RAD with success using the hybrid Agile paradigm suggested in this study. In order to ensure that the application design, development, and deployment are successful overall, it is also vital to comprehend the complex architecture

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that underpins these platforms and plan for navigating some of the blind spots.

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# RECENT OVERTURES IN RESOURCE OPTIMIZATION TECHNIQUES FOR HIERARCHICAL DISTRIBUTED CLOUD COMPUTING ENVIRONMENT: A COMPREHENSIVE REVIEW

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**Abstract**
**The new paradigm of the Internet of Things (IoT) has escalated into an evolving field of knowledge. IoT systems are objects with transducers; software, computing power, and electronics are built in, as well as the ability to send and receive data. IoT hardware gathers data and sends it to the cloud for analysis. Cloud services include storage, infrastructure and software designed for IoT applications are provided through cloud computing. The amount of data generated by IoT applications also grows as the number of users grows daily, placing strain on the cloud server. It is crucial to balance server load by utilizing various load-balancing methods for effective utilization of cloud services. This research review paper provides thorough analysis of many methods of resource optimization scheduling and allocation of weight compensating methods disseminated in cloud environs suggested in existing research.**
**Keywords: - Internet of Things, Load Balancing, Simulation tools, Cloud Computing, Distributed Cloud.**

## I. INTRODUCTION

Internet of Things (IoT), distributed cloud environs that contribute to understanding its future domain. Device-to-device connectivity, which enables tangible objects to connect across networks, is the basic idea behind the Internet of Things. It has been predicted that there will be a lot more items connected to the internet compared to the number of people, also these devices provide the majority of internet traffic [1]. General architecture of IoT visualized in Figure 1.

Tangible objects include any entity, including people, animals, automobiles, electrical devices, and anything else, with a unique identifier that enables it to connect to the network. Some items contain tiny transducers implanted in them; these detect devices' information from their surroundings are shared using other devices for data analysis. These gadgets make objective judgments based on exploration of data, thus qualifying them as *"smart"* things [2]. IoT is a significant advancement in tools and technology besides a way to healthier approach. This technology enables us to live a lavish lifestyle, helps us make choices quickly, and offers valuable information. There are already several IoT apps on the market. For instance, the smart home system offers customer amenities like protection, accessibility, effectiveness, and energy economy as indicated in Figure 2. Owners may operate their IoT equipment at anytime from anywhere, using mobile apps, which also allow them to manage their home's security by regulating entrance gate and allowing known individuals to enter. IoT is suitable for use in healthcare to monitor the health of elderly persons who are still able to live independently and to offer ongoing medical supervision to chronic patients who live in remote or underserved areas as exhibited in Figure 2. To increase agricultural production, multiple research teams have been developing e-Agriculture applications.
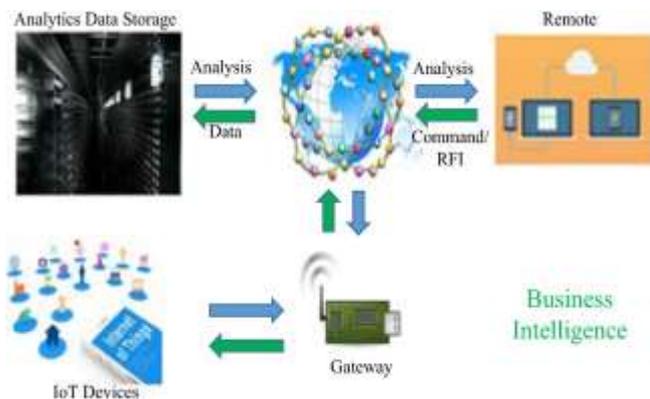


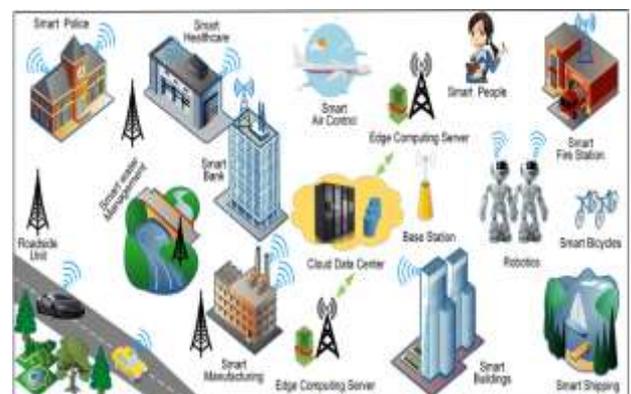**Figure 1: General Architecture of IoT**



**Figure 2: IoT application areas**

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## II. CLOUD COMPUTING

The core of IoT is cloud-based, which is how data gathered through IoT gadgets is processed. The Cloud is characterized as a collection of interconnected, dispersed, concurrent servers housed by several data centers distributed throughout the globe. Infrastructure as Service (IaaS), Platform as Service (PaaS), and software on a subscription basis are three levels that makeup cloud computing services (SaaS) as highlighted in Figure 3.
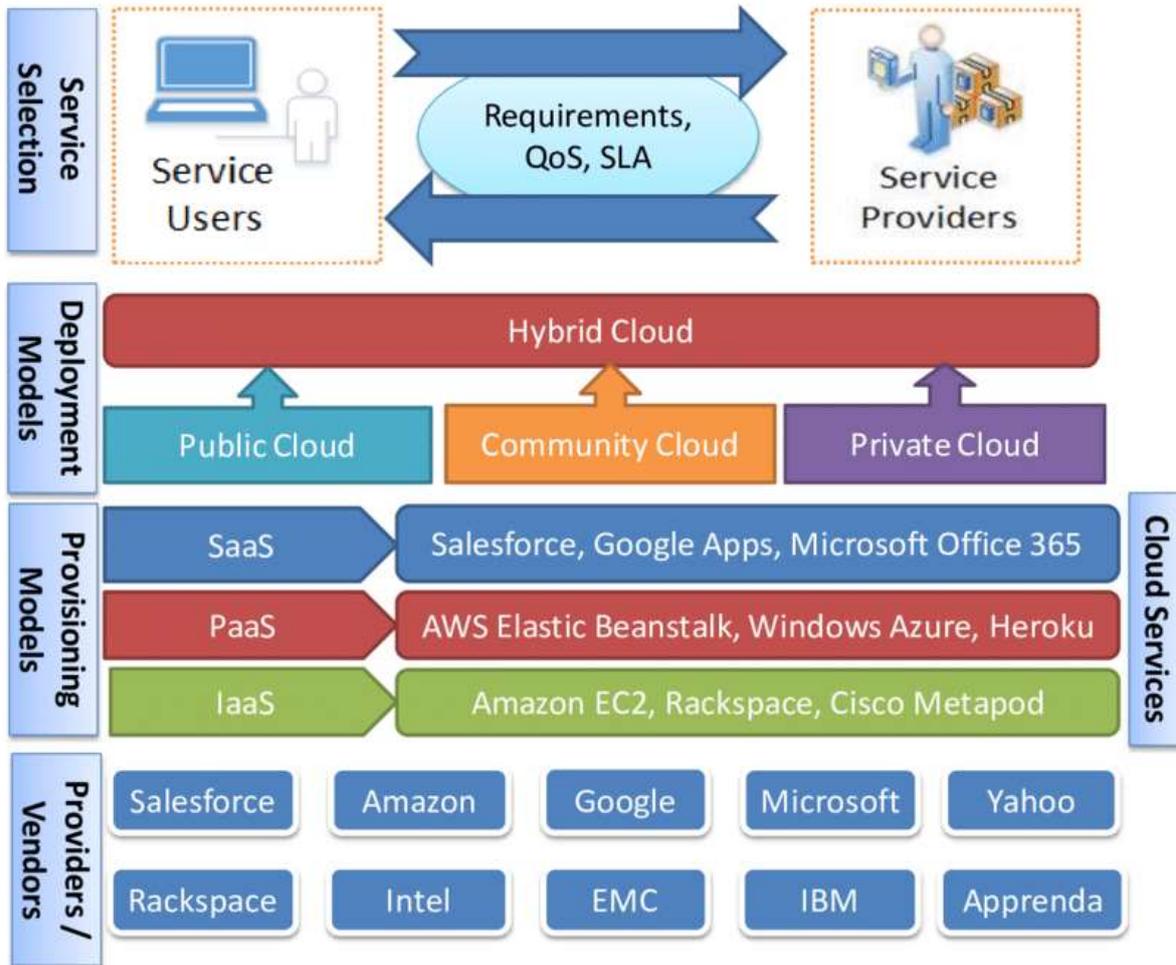


**Figure 3: Cloud Services Infrastructure**

#### a) Infrastructure-as-a-Service (IaaS): -

Infrastructure-as-a-Service allows for instantaneous facility of hosts running a variety of operating systems and unique software stacks. It is regarded as the base layers of cloud services platform. Web services [3] [4] are primarily responsible for providing IaaS services. Amazon Web Services (AWS) IoT offers IaaS offerings for IoT systems. It offers rich as well as comprehensive functionality that aids in the development of IoT elucidations. IoT- Core assists in securely connecting devices to cloud server, and IoT Cloud Management, which registers, arranges, keeps track of, and remotely manages IoT gadgets, are just a few of the IoT services offered by Amazon. IoT Analytics gathers, prepares, enhances, maintains, and examines IoT device data. IoT Greengrass, piece of software that enables safe native computation, communications, and governance, synchronization, and ML inference capabilities on connected devices [5].

#### b) Platform-as-a-Service (PaaS): -

The inner stratum of cloud computing design is called PaaS. PaaS provides a platform for creating and deploying apps to devs. In this case, it is not necessary for creators concerning aware of the processors as well as storage, an application entails. Platform-as-a-Service offered by Microsoft Azure [6], amalgamation of Microsoft governed cloud services under the name Azure Internet of Things (IoT) allows to connect, monitor besides administer billions of IoT gadgets. Platform services offer building blocks aimed at specific and flexible adaptable IoT applications [7].

#### c) Software-as-a-Service (SaaS): -

Outer core of service based software cloud technology is SaaS. Such services accessed to anybody via web interface. As result, users are commencing to use web software and services more frequently than conventional systems. Software that is accessible virtually offers us exact similar features as software installed. Typical desktop programs, such as

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spreadsheets, word processing, are available nowadays as online as services [8] [9]. IoT device SaaS solutions from Oracle are available for tracking taskforces, assets, and manufacturing, among other things. [10].

The main characteristic of cloud model is on-demand accessibility of resources centered on service level agreements. Flexibility is next important factor [11]. The flexibility of cloud computing allows users to modify configurations required. When we make use of resources that are accessible, cloud offers services that demand pay from everyone. In addition to, it consumes layered approach with globally disparate nodes.

In order to handle load globally, just small amount of hosts being utilized. Services of cloud is subject to load multiplicity, including computation (CPU) load, network load, memory load, and others [12]. It is crucial that every hosts have adjusted; they ought to remain neither over-burdened nor under-loaded. Even the amount of Internet of Things gadgets grows, consequently volume of information that devices collect. Techniques for task scheduling implemented to distribute workload among nodes. These techniques assist in distributing workload on hosts according to their capacities to ensure that all available needs met.

The remaining research work is organized as follows: Section2 confers load-balancing algorithms in cloud computing further Section3's relevant research is portrayed. Section4 delineates modeling techniques be used to model IoT infrastructure.

## III. LOAD BALANCING IN CLOUD COMPUTING

Cloud services, constantly managed to exploit assets to its greatest potential. Occasionally, certain nodes experience high load whereas other ones experience low demand or remain idle. Algorithmic approach for balancing load had employed to solve all sorts of issues. By keeping track of heap scheduled on every hosts, these algorithms assist in allocating each work. The load-balancing technique described as "*Cloud load balancing utilizes either real hosts or virtual machines (VMs)*" [12]. Active effort equitably spread among all nodes using this counterbalancing method (VMs/hosts). Load balancing as service (LBaaS), another name for cloud load in task scheduling techniques.

Between two groups of static and dynamic load balancing, multiple sorts about algorithmic strategies are employed in cloud technology. Prior to compiling, static load balancing algorithms distribute jobs among hosts based on algorithm's knowledge of every resource requirements. These standards form basis for task distribution. Static load balancing is appropriate for minor - scale distributed setups with fast internet and negligible network latency. Solutions that come under static category are often ineffective because they only work reliably when nodes consume minimal differences in cloud-load. Since there are 'n' clients on cloud, load remains identical [13].

Energetic optimization techniques function in a virtual environment, continuously gathering data concerning

hosts load. It makes choice towards dividing jobs across nodes in light of that. Similarly, depending on precedence, we assign, reassign, or remove any task from servers. Dynamic Load Balancing Technique aims to shorten runtime also transmission lags into large - scale distributed systems. However, these methods or strategies found to be very effective at evenly distributing load across various provided facilities within cloud environment scheduled towards their nodes [13].

Numerous static, dynamic load-balancing strategies have been put out recent times for distributed cloud computing environments. In [14], thorough analysis conducted regarding several existing algorithms that experts suggested enclosed in this section. In contrast to dynamic load balancing algorithms that operate extremely dispersed settings, static load balancing algorithms operate in smaller scattered surroundings besides less complicated. Static algorithms require sophisticated data, such as length and job count.. Static category includes conventional kinds, while dynamic category constitute heuristic designed techniques.

### a) Static load balancing algorithms

**Round Robin:** To allocate work towards virtualized environment, it employs cyclic process and conventional ways in distributing jobs among networks. If there are 'n' tasks to complete, be divided into stages based on order in which requests arrive. This technique has drawback how some networks with strong computational control stay under loaded despite nodes with low computing power are severely overwhelmed [15].

**Min-min:** Static load balancing method that organizes jobs based on time and duration required by completing them. These jobs chosen initially as well as subsequent jobs indeed chosen within this sequence [16]. They do organized in raising direction of job with minimal period for completion.

**Max-min:** Max-min approach, identical towards Min-min algorithm, instead jobs ordered based on their optimum execution. Jobs are only through the shortest completion time assigned initially, whereas additional jobs are deferred until certain work has been completed [16].

**Opportunistic Load Balancing (OLB):** It keeps all hosts active without taking into account the burden of operation presently operating just on host. Apart from existing job executing upon that site, it assigns additional job haphazardly [17].

**Weighted Round Robin:** It created to address disadvantages of round-robin fashion. It distributes encumbrance to hosts based on their traffic management capabilities. Jobs distributed in terms of load. This method contributes to site's demand and performance maintained. If twin jobs given towards multiple hosts, final work sent to host with larger weightings [18].

**Least Connection:** Results into currently executing jobs, while preceding approaches do not. Additional jobs allocated in order that results inside fewest test runs at this moment [19].

**Weighted Least Connection:** It is a Comparable technique to minimum linking strategy. Based on weighted round robin

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results, heaps consigned to servers disseminated in numeral data in Balanced Minimum Link [20].

### b) Dynamic Load balancing

**Honey bee foraging:** An active approach developed by honeybees; thorough evaluation of activities in how they look for and harvest food conducted. Scout, type of bee that forages intended for nourishment also communicates with others via vibration dance. This provides approximation of quality foods. This approach used in load balancing to notify under loaded and overburdened virtual machines. Tasks from overcrowded devices transferred to under loaded ones. Conversely, jobs as of overcrowded VMs regarded as honeybees. When tasks sent to underutilize VM, jobs besides loads scheduled to its specific VM. Choose VMs scheduled based weight with priority tasks. Whenever a high priority job is sent to another VM, indeed choose a VM with fewest highest - precedence jobs so that work is completed as soon as possible. Because all VMs ordered in ascending order depending on load, job that has withdrawn assigned to least loaded VM. Essentially, jobs are honeybees, and VMs are sources of nutrition. Loading job to VM is analogous to honey bee searching for nectar [21].

**Particle Swarm Optimization (PSO) Technique:** PSO developed by Kennedy and Eberhart, form of meta-heuristics approach. Broad hunt optimization approach is adaptive. PSO method, comparable to former population-based techniques such as GA; however nope explicit reunion regarding population members. Also, adopts model template aimed at communal communication, develops communiqué amongst them. Swarm intelligence optimization strategies are quite comparable to PSO algorithm. It concentrates on lowering request's entire price of processing in cloud server.

**Heuristic Algorithm:** Previous problem-solving approaches were sluggish and incompatible with NP-complete issues. Heuristic methods meant to resolve choice issues as well as issues more quickly and effectively than previous methods. The Traveling Salesmen Issue, an instance schedule places to visit and distance between two cities provided, as well as best answer is to explore each locations while traversing shortest route possible.

**Ant-Colony Optimization algorithm (ACO):** Ant Colony Optimization strategy is a problem-solving approach enthused through ant behaviors by exploring ideal pathways from nestle to food; altogether work also hunt for newfangled nutriment although few ants operate tandemly on transferring nourishment since origin to nest. Numerous research scientists motivated by ant behavior used it to tackle real-world issues in various domains [22]. In this approach, node's design is persisted, besides ant changes node's contents from source to destination.

**K-subset algorithm:** Initial K-subset technique as well as their descendants fail to represent inherent properties of heterogeneous clustering system. Strategies consist of two phases: 1) find 'k' relevant networks, and 2) Pick least loaded one. Each node picked with an equal probability. However, hosts controlled through contemporary weight status, resultant demand response time at network determined

merely by its rank in given sequence, but nope of differential in powers or capacity across sites.

**Genetic Algorithm (GA):** Popular approach for solving NP (Non-polynomial)-complete issues. Genetic algorithm based virtuously on computational intelligence approach. It is portion of heuristic search process. Ordinary development upon human intellect moreover genes drive GA.

**Climbing hill:** Hill climbing is a basic continuous optimization procedure that systematically progresses to optimal result. It chooses increasing value and proceeds to summit or upward. The pinnacle is summit of hilltop or location in which no surrounding value is greater than summit. The method terminates when it hits maximum or halting condition. It may at times arrive to local optimal resolution rather than worldwide optimal. This approach keeps an ordered list with list of VMs and their statuses for task scheduling.

### IV. PROPOSED ALGORITHMS REVIEW

An improved honeybee rooted on weight compensating technique presented by Vasudevan et al., [23] to increase cloud system performance, honeybee algorithm enhanced to shorten makespan and assign resource to task. This computation flaw remain dearth towards quality of service.

Adhikari et al., [24] insinuated job-scheduling load balancing strategy for such IaaS cloud infrastructure is Heuristic-based load-balancing algorithm (HBLBA). There are two phases in process. The need besides kind of VMs determined during initial stage using an effective technique to locate best practical server patterns. Jobs scheduled on virtual machines (VMs) consuming modeling approach in second phase to reduce waiting time. The makespan, waiting time, and resource utilizations of suggested method are comparable to those of two current techniques, min-max and round robin.

A predictive load balancing method for clouds been put forth by Jodayree et al., [25], which aids service quality as well as reduces energy usage towards cloud network load. With proposed C-Rule algorithm, which is rule-based method, they had considered two techniques, round robin versus random. The projection is based on Cicada predictions, which helps cloud service providers arrange available assets for allocation. It aids in development of load balancing algorithms for cloud settings that are quicker and more dependable. In addition, CPU waiting time decreased by suggested method.

Improved Particle Swarm Optimization introduced by Zhu, Yongfei, et al., [26] was widely praised. When compared tored-black tree algorithm, the proposed approach is more effective and has fewer drawbacks. The results show that PSO and enhanced PSO both operate at precisely same speeds. When allegorized to further approaches, it performs task solving and load balancing significantly.

A Bat Algorithm based on bats' usual behavior projected by Sharma et al., [27] study. When bat pursues its prey, it flies erratically by altering its speed and locations in relation to prey's space from itself. Jobs treated as fake bats in proposed algorithm, while virtual machines treated as prey. Response

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times as well as imbalance levels improved. This method's disadvantage is that it offers quick migration and scalability.

A hybrid technique highlighted by Ghumman et al., [28] study by coalescing improved max-min with ant colony algorithms. In order to determine best load balance, improved Max-Min combined with an ant colony to shorten runtime. That cuts back on both operating time and expense.

Dam, Scintami, et al., [29], amalgamated two algorithms— evolutionary method and gravitational emulation local search—to develop hybrid load balancing method (GEL). Whereas GEL explores regionally, GA has a worldwide tendency to issue space, contributing to wider makespan with decreased amount of virtual machines that will not be very effective. The GEL method's flaw is that it never settles on single optimal answer.

An improved K-subset static technique predicted by Tang et al., [30]. It had modelled after k-subset approach that enhances method's versatility, consistency, and accessibility. When compared to original approach, suggested one reduces execution time. They used CloudSim simulator to present better outcomes on paper.

Dasgupta, Kousik, et al., [31] introduced Genetic Algorithm (GA) designed for load balancing technique for cloud environment. The optimization model is dynamic in nature. It makes an effort to do assignment as quickly as possible. GA is soft computing strategy that belongs to category of heuristic search techniques. They had tried to address improper running time allocation, used to generate network congestion.

Stochastic hill climbing method suggested by Mondal et al., [32] for balancing load in cloud. This approach designed around standard hill climbing technique, where it chooses next greatest nearby number and hikes top or at local optimum solution to be reached. When examined alongside two widely applied techniques such as First Come First Search and Round Robin, yields better outcomes.

Technique for rebalancing load on virtual machines in cloud-based computing system portrayed by Hsiao, Hung-Chang, et al., [33]. Use of Hadoop system made for simulation process. To attain optimal throughput, created in dynamic Hadoop Distributed File System (HDFS) environs. Load Balancing Ant Colony Optimization (LBACO) algorithm projected by Li, Kun, et al. [34] reduces makespan, evenly splits workload among all virtual machines, and determines level of unbalance. By means of CloudSim simulator, suggested approach contrasted with First Come First Search algorithm with 500 workloads.

Weighted Signature based Load Balancing (WSLB) technique projected by Ajit. M, and G. Vidya [35] study. This approach point out virtual machines in accordance with weight consignment issue determined for each host in datacenter. Load-balancer, accessible on host with maximum sited with utmost weight consignment factor, then lowermost one, and so on, sends virtual machine-id. The average response time had shortened by means of suggested methodology.

## V. SIMULATION TOOLS FOR IOT

Simulation tools for well-known IoT applications are major big data provenances. IoT tools do typically enabled through clouds, wherein big data manipulation platforms store, manipulate data. Determining operating efficacy towards accompanying big data manipulation is crucial for effectively supporting IoT big data apps and scaling effectiveness of cloud platform. Some of simulation tools mentioned in this section follows:

**IOTSim**: IOTSim is simulation tool for IoT gadgets that uses MapReduce technologies to handle large amounts of information. It requires fewer period as well as resources to operate in cloud computing. It models as well as simulates numerous Internet of Things apps that have been active concurrently in cloud and produces exact outcomes [36].

**MATLAB:** With use of simulation software like MATLAB, IoT apps such as operational optimization, predictive maintenance, supervisory control, also further designed, prototyped, as well as deployed. By means of integrated interfaces to cloud storage, relative and irrelative datasets, and standards, accesses with data preprocessing, streaming towards archived data. They have utilized quickly to create personalized IoT analytics and models. ThingSpeak, an open IoT environment with MATLAB analytics, was introduced to prototype and operationalize smaller-scale systems and explore live data streams.

**CloudSim:** Simulation tool for cloud environment called CloudSim. Simulation engine, cloud platform, and source code layers make up CloudSim architecture. A piece of open source software is CloudSim. It is Java-based and works with both Windows and Linux operating systems. Further simulation tools, such as Cloud Analyst [37], developed just upon CloudSim platform.

**CloudAnalyst:** Tool for visual modelling and simulation of massively scalable applications installed on cloud framework. CloudAnalyst, rooted upon CloudSim, enables description of numerous factors, namely application workloads, user tracking devices (including latitude and longitude), datacenter generation and location, user and datacenter count, and resource count per datacenter. CloudAnalyst engenders reports regarding request-computing time, request-responding time, headed for other parameters using this data. App developers can effectively allocate resources across accessible datacenters, prioritize datacenters to handle particular requests, and reduce operational expenses by using CloudAnalyst [38].

**NetSim:** Network simulator tool used as an IoT system simulator. NetSim tool used to evaluate how well actual apps operate over virtual network. The user can use NetSim to forecast performance of relevant network whether they are constructing brand-new IoT network from scratch or growing with an existing one.

**Iotify:** This simulator tool allows creating cloud-based IoT applications. This program aids consumers in simulating and installing IoT net into their specific implied IoT tools. To find, address problems in advance, releasing finished product generate adaptive movement since number of inferred test platforms for size, resultant besides, security. To examine

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how network delay influences users' system recital as whole, it simulate high data traffic.

## VI. CONCLUSION

IoT device adoption is relatively new phenomenon that is expanding daily. Because they can communicate and make judgements without human involvement, technologies we use every day are growing smarter. The Internet of Things (IoT) helps them accomplish this complete task by giving each physical device unique identification and integrated detectors. An IoT platform is a collective name for location where all these detectors store data they collect. IoT platforms are cloud services that provide standard language and framework so that data do understand besides transferred amongst all detectors.

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# PRAGMATIC APPLICATIONS OF SIGMOID: A NONLINEAR NEURAL NETWORKS ACTIVATION FUNCTION

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**ABSTRACT**

**Neural Networks have become a versatile component in the field of Artificial Intelligence proliferating automation in various fields of the Industry. The resilience and accuracy of a neural network highly rely upon its neuron's activation functions. One such activation function is the Sigmoid, also called the Logistic Function. The study deals with implementing sigmoid functions in Artificial Neural Networks as practical applications under various verticals and comprehensively comparing its performance and efficiency.**
**Keywords:** *Sigmoid Activation Function, ANN, Deep Learning, Applications*

## 1. INTRODUCTION

SIGMOID FUNCTION whose graphs are "S-shaped" curves, appear in many contexts, such as the transfer functions used in many neural networks. Their ubiquity is no accident; these are among the most straightforward nonlinear curves, striking a graceful balance between linear and nonlinear behavior. Grossberg gives an illuminating and pertinent discussion of this point[17].The final stage of a logistic regression model is constantly set to the logistic Function, which allows the model to affair a liability.
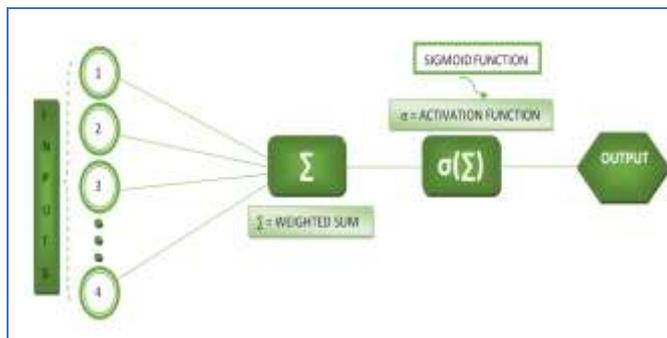


*Fig 1. The three main activation function*

**Sigmoid As An Activation Function In Neural Network**

The Sigmoid Function is used as an Activation Function in a neural network. For example, A weighted sum of inputs passes through an activation function. Still, if every subcaste in the neural network were to contain only weights and impulses, but no activation function, the exclusive network would be original to a single direct combination of weights and impulses. In other words, the formula for the neural network could be factored and simplified down to a simple direct regression model.
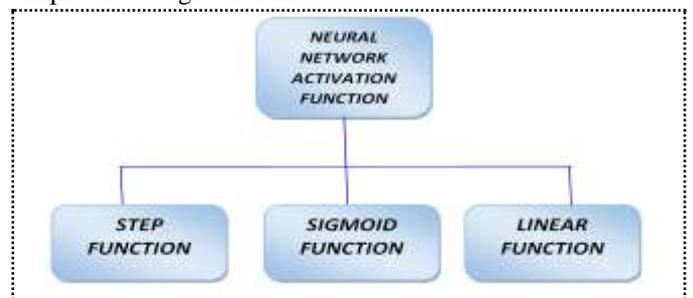


*Fig 2. A Sigmoid unit in neural network*

When an activation function for a neuron is sigmoid then the output will be 0 and 1  also the sigmoid Function is nonlinear, so the output of this Function is also nonlinear of the weighted sum of inputs. The sigmoid Function is also called a squashing function as its sphere is the set of all real figures, and its range is( 0, 1). Hence, if the input to the Function is either a huge negative number or a veritably large positive number, the affair is always between 0 and 1. The same goes for any number between- ∞ and ∞

## 2. LITERATURE SURVEY

This section shows the existing theories and studies prevailing over Deep Learning and Neural Networks based on various sigmoid activation functions.The artificial intelligence capabilities of machinery largely rely on the underlying Machine Learning and Deep Learning Algorithms that have enabled accurate problem-solving and analytical expertise. As inquisitively explained by Christian Janiesch, Patrick Zschech, and Kai Heinrich in their study paper which was released in the year 2021, the efficiency of these algorithms depends on the analytic models that predict the required outcomes. To discuss in detail on Deep Learning, the various architectures used such as Convolutional neural network (CNN), Recurrent neural network (RNN), and Generative adversarial neural network (GAN) play a vital role in choosing the right one for the

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required prediction. Yet another prospectus released in the year 2019 at the MATEC Web of Conferences has analyzed the use of tangent sigmoid activation function for Cardiac activity monitoring and has conveyed the proven competence of MLP-based Neural Networks for the same[1]. In a research paper that was released in the International Journal for Recent Technology and Engineering(IJRTE), the investigations have shown that the deficiencies of Extreme Learning Machines(ELM) such as instability and unreliability of linear functions on irregular data and poor generalization have been significantly overcome by using ELM-S(Extreme Learning Machines with sigmoid activations) [2]. Further stances that support the implementation of the sigmoidal activation function include an appraisal stated by S. Narayan in his paper published in the Information Sciences Journal. The scrutiny has stated that applying the Generalised Sigmoid activation function in the output layer of a back-propagating Neural Network presents optimistic predictions and has produced solutions to problems such as the XOR Problem, IRIS dataset classification problem, etc[3]. These observations and manifestations have fuelled the enthusiasm to know more about the sigmoid activation function and hence in the upcoming sections of this study, we will be looking at the real-time applications of the sigmoid activation function's variants. We will discuss in detail its predictive and forecasting abilities.

## 3. APPLICATIONS OF SIGMOID ACTIVATION FUNCTION

The nonlinearity nature of the sigmoid activation function makes it versatile and appropriate for any obligation with very few modifications and extensions. While the usage of this omnipotent activation function is widespread and enormous in number, we constrained our study to five major sections of use cases of neural networks that work on the sigmoid activation function.
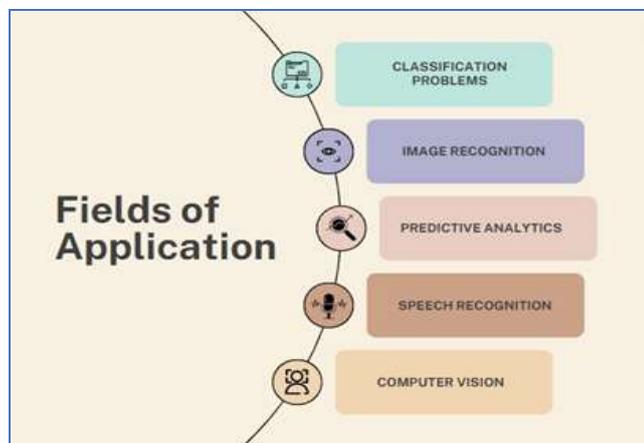


*Fig 3. Fields of Applications illustrated in the study*

These include Classification problems, Image recognition, Speech recognition, Computer vision-based applications, and Predictive Analytics. Each section is explained with the aid of two real-time use cases.

### 3.1 CLASSIFICATION PROBLEMS

Classification is a category of supervised Machine Learning Algorithms that evaluates the input vector into classes of objects based on the categorical output. Classification can be done by the use of various algorithms and for numerous cases. This part will briefly discuss two utility scenarios in which sigmoidal activation functions are used. The first case study [4], exemplifies the use of DL in classifying the radiology imaging of Chest X-rays (CXR) and Computerized Tomography (CT) scans into potential Covid 19 Infection. Selecting to work on the CT screening images, the authors have explained the use of Artificial Convolutional Neural Network that learns to classify from pre-existing images for precise diagnostics using various activation functions such as ReLu, Sigmoid and TanH with 3 optimizers. Keeping the learning rate constant ($10^{-5}$) with each optimizer such as Stochastic Gradient Descent with Momentum (SGDM), Root Mean Square Propagation (RMSprop), and Adaptive Moment (Adam), the study analyses the prediction using models consisting of 8 mini-batch, 16 mini-batch and 32 mini-batch size on the CXR Database[4]. The sigmoid Function gives out 87.33 %, 89.00%, and 85.67% Validation Accuracy respectively for each combination of models. It states the simplicity and its ability to work well on shallow networks. But when compared to Tanh and ReLU, the paper reviews the sigmoid activation function as not very opt for the application due to its inability to perform well when initialized with small weights and its woes of dealing with the vanishing gradient problem. ReLU, on the other hand, outweighed TanH and Sigmoid with increased accuracy and computational speed. Nevertheless, ReLU still suffered from overfitting the Database[4]. The second case study [5], is yet another study that deals with Deep Learning in medical applications which in this case is the classification of brain imaging to diagnose Alzheimer's disease (AD), a progressive brain disease that affects thousands of lives every year. The objective is the accurate MRI-based classification to acceptably detect and diagnose AD through Convolutional Artificial Neural Network (CNN). The paper evaluates the performance of the CNN model using 3 activation functions which are Sigmoid, ReLU and leaky ReLU using 3 pooling-functions: average pooling, max pooling, and stochastic pooling. The sigmoidal activation worked with minimal efficiency because of being saturated when the absolute values of the input were pretty large[5].

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## 3.2 IMAGE RECOGNITION

Image Recognition is the process of detecting an image in a given peripheral. With the increase in data generation and data transfer, the necessity to detect and differentiate between digital images has become vital to manipulate these data into powerful insights. The first use instance of sigmoid activation function in image recognition is stated in the paper [6], which compares the influence of activation function in image recognition through a facial expression recognition method based on a CNN model.The execution of the CNN using sigmoid Function of the JAFFE database has given a decent 96.25% of accuracy with a learning rate of 0.001 and 87.91% of accuracy on the FER2013 Database. The notable comparison in this application is the outweighed performance of sigmoidal over ReLU which contradicts the conclusions of the past two investigations. This is because of the ability of ReLU to go through a severe condition called the phenomenon of neuronal necrosis that occurs when a negative input is given into ReLU whose derivative is a zero[6]. The next use case is the study [7], which focuses on improving the accuracy of predicting and recognizing vegetable through-16 network by adding 5 BN Layers in the fused FC6 and FC7 layers with double dimensions, compares the performance of the model using Sigmoid, TanH and ReLU. When the model was experimented with 3 different activation functions, sigmoid performs with the least accuracy of 27.4% whereas the ReLU exhibits exemplary accuracy of 96.5%. The reason remains the same ability to saturate and produce gradient disappearance [7].

## 3.3 PREDICTIVE ANALYTICS

The process of collecting data from various points and to build a model that aids in predicting the possible future outcomes with analytical parameters is called predictive analytic. We have all been experiencing the information burst in which Big Data has become one of the most famous buzzwords. While Predictive Analytics served as an application of Machine Learning, the enforcement of using PA to generate optimum Business Intelligence is what we term as Business Analytics. Predictive Analytics requires the aid of statistics, forecasting and text mining to provide improvised results[8]. The first use case [9] exhibits the research on implementing a predictive neural network model made of Multi-Layer Perceptron (MLP) that predicts the Daily Outflow from a watershed near Iran. With randomly picked data from a 5-year Database, the study has used The LM algorithm to train the ANN using train and test set. The predictions have shown that traditional tangent sigmoid transfers perform approximately better when compared to the logistic sigmoid activation function. The Correlation and RMSE values of the training and validation sets have fallen in favour of Tangent sigmoid transfer function[9]. The research has also successfully proposed an accurate predictive model using 5 MLP's as an improved alternative to the traditional methods of water outflow prediction. Next comes an interesting investigation [10] whose objective is to propose a Deep Learning model that predicts the performance of a team in the software industry much early to boost efficiency by effective selection. Yet the study has provided a DNN framework that uses binary classification to forecast productivity and has been evaluated using 3 activation functions namely, Sigmoid, ReLu and TanH. The model has been deployed by enabling ReLu and Sigmoid as its activation function and Binary cross-entropy as the lost Function. The Model worked pretty accurately and has shown satisfactory results.

## 3.4 SPEECH RECOGNITION

Automatic Speech recognition, as termed in the reference [11], is the ability of a model to recognize the spoken word, and perceive it to be recognized as inputs for further manipulations that perform a desired action and hence results an output. Speaking is by far the easiest way of communicating with one's environment. Researchers have come up with intuitive speech recognition models that form the basis of the widely used NLP (natural Language Processing) methods. The initial use of circumstance [12] is the implementation of an Encode-Decoder Recurrent Neural Network that translates English to Bangla language.The parsing factors and tokenization of individual characters forms the basis of recognition. The study has illustrated that sigmoid Function has given satisfactory performance for the output layer and the have further moved on to implement sigmoid for the input of activation layer and softmax for the output of the same. The study has successfully implemented a high performance language translator for Bangla [12] . Next use of case [13] is a versatile solution for an ASR to adapt variations. The paper has tried to use 4 ways to create an adaptive ASR amongst which injection of Bias and slope adaptation to classical sigmoid Function has been detailed out. This use case describes the ability of sigmoid activation functions to undergo various modifications and work with increased precision.

## 3.5 COMPUTER VISION

Computer vision is a subset of Artificial Intelligence that enables the qualitative interpretations and understandings of images, videos and other inputs, to generate the manipulated yield that is capable of inducing further actions. One such paper which illustrates the application of CV is [14], which explains the methods and

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uses of Recognizing hand gestures through computer vision. The recognition can be motion, skeleton, depth, 3D Model or colour based. Henceforth, we will be looking into two use cases of CV under which sigmoid activation function plays the transfer roles. The first use case [15], illustrates the execution of a One-shot facial sketch recognition model that is made up of Siamese Convolutional Neural network. The objective of the study is to propose the facial sketch of an image from an observation with high accuracy. Also, the model has been designed to recognize familiar classes through one-shot learning, which makes this study interesting. The CNN has been evaluated using sigmoid, tanh, softplus and softmax activation functions acting in the transfer layer and the observations have shown that sigmoid activation function has gained a 100% accuracy in predicting the sketch of an image under 300 learning iterations. The second case study [16], proposes a framework that implements Motion detection and Tracking application. The main purpose of motion detection is surveillance and security concerns that usually work under the live stream data. The model successfully detected and tracked the 8 video samples which had distortions, high movements and dissimilarities, exhibiting accurate predictions and outputs.

## 5. FUTURE SCOPES

The ability of the sigmoid Function to convert any real number to one between 0 and 1 is advantageous in data science and many other fields: it allows learning non-networks in deep learning as a nonlinear activation function within neurons in artificial neural networks. Linear relationships between data.The sigmoid Function plays the role of an activation function in machine learning, which is used to add nonlinearity to the machine learning model. Basically, the Function decides which value to send as output and which not to send as output.It's the most extensively exercised activation function as it's a nonlinear function. Sigmoid Function transforms the valuations in the range 0 to 1. It can be outlined as $f(x) = 1/e-x$ Sigmoid Function is continuously differentiable and a smooth S-acclimated function. The outgrowth of the Function is $f'(x) = 1-$ sigmoid$(x)$ .

## 6. CONCLUSION

In this article, we discussed the sigmoid Function and its advantages and disadvantages, its working medium, and the core suspicion behind the same with its associated advantages and disadvantages. Knowing these crucial generalities will help one better understand the mathematics behind the Function and will help one answer any affiliated

interview questions efficiently. sigmoid Function is the basic Function in neural networks and is also used in various applications to predict the outcomes . we have just explained the assorted applications of the same.

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**PRAGMATIC APPLICATIONS OF SIGMOID: A NON-LINEAR NEURAL NETWORKS ACTIVATION FUNCTION**

# A STUDY ON STRESS AND ITS IMPACT ON THE ROLE EFFICACY OF SPACECRAFT CONTROLLERS

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## Abstract:

**Stress can be described as a dynamic condition,in which an individual is confronted with an opportunity,a constraint or a demand related. Mission Operations and Health Analysis group is tasked with conducting spacecraft operations through the network of ground stations and other supporting facilities.The spacecraft controllers need utmost attention and vigilant monitoring of satellites without differentiating day and night. The objective is to know why the spacecraft controllers are liable to stress and the stress level in the job environment to determine the impact of stress on the job. Direct interviews were conducted through the Questionnaire, data evaluation, and interpreted the results to compute the Stress level and Role Efficacy.The correlation method was adopted. It was observed that the value of the job stress increases the resulting in decreasing value of Role Efficacy and proved that inverse relationship exists.**
**Keywords: stress, spacecraft, satellite, control**

## Introduction

Stress can be described as a dynamic condition in which an individual is confronted with an opportunity, a constraint, or a demand related to what he or she desires and for which the outcome is perceived to be both uncertain and important. Stress is not necessarily bad in itself while stress is typically discussed in a negative sense, it has also positive value. It can be viewed as a potential opportunity when it offers gain. Researchers and the public alike have used the term stress for both the effects of the and for stressors, which are events or conditions that produce stress. "Stress is the reaction of the mind and body to change". The definition includes all kinds of pleasant, unpleasant, and boring changes. Stress is a response to an event in the environment, not the event itself, any major life changes even a good change can produce a stress response, even pleasurable activities can produce stress, it is not simply nervous tension and is not identical with alarm reactions.

Every human body is under some sort of stress. Stressors as the external demands of life or the internal attitude and thoughts that require us to adapt. Stressors can include traffic jams, pollution in the city, or an angry boss. Stressors can also include the work that never seems to get done. Discovering where stress comes from Emotional stressors include the fears and anxieties with which we

struggle, Interactions with family members can be stressful, and the family structure has been changing. Social stressors involve our interactions with other people, it vary from person to person. What brings relief from stress for one person may contribute stress to for another. Positive stress need to function effectively, it is more important for development it helps to meet new challenges. Negative stress decreases decision-making abilities and also decreases productivity.

## Spacecraft operation and control

Mission Operations and Health Analysis (MOHA) group is responsible for conducting spacecraft operations (low earth-orbiting satellites) through the network of ground stations and other supporting facilities. The activities involve prelaunch simulations, the launch phase, and initial phase operations. The respective spacecraft controllers carry out the normal phase activities from the dedicated mission control Room (DMCR) around the clock. The activities of the spacecraft controller include vigilant health monitoring, looking for anomalies, conducting regular operations for the change of onboard configurations through commanding, payload operations, and recording of spacecraft health status in the identified logs. The orbit determination group determines the orbit followed by the satellites and provides the required, advice to the operation team. Based on this, the controller with the necessary authorization will carry out the orbit maneuvers.

A spacecraft controller is an important mission operations and health analysis group member. The responsibilities of the spacecraft controllers are conducting spacecraft operations flawlessly in round-the-clock shifts, ensuring the normal health of the spacecraft during real-time through spacecraft telemetry data as per the operation guideline document, and executing operations instructions provided by the engineer-in-charge and shift. Reporting of spacecraft anomalies if any and initiations of corrective actions, carrying out offline data analysis, and reporting about problems encountered during the shift to spacecraft operation managers and Engineer-in-charge. Spacecraft

controllers are allowed to handle the spacecraft operations independently, after thorough training and reviews.

During the course of the training, the spacecraft controllers acquire the qualities like perseverance, dedication, alertness, analyzing mind, the discipline of a professional controller, willing to learn always a thorough knowledge of the satellite and its operation.

## Controllers are Liable to Stress

Spacecraft controllers need utmost attention and vigilant monitoring of satellites, without differentiating day and night. They are separated from the mainstream employees and their job does not entertain any company other than the spacecraft, at least during their duty hours. They work against the nature and biological clock as this operation is a continuous process, and they are deprived of normal and public holidays. Since the holidays (weekly half) match neither the mainstream nor their colleagues, the social interactions are at a very low ebb. As the satellite controllers do not follow food timings the food habit becomes irregular. All the good work and sincerity will be blown off if a simple mistake is committed by negligence, which is detrimental to the help of the spacecraft.

While spacecraft controllers attend night shifts, it is quite usual for them to skip sleep after night shifts, due to urgent domestic work that has to be carried out only during the day. Also, the daytime environment is not conducive to having a peaceful sleep. These too add to restlessness and increase stress. Any simple mistake in issuing the instruction to a spacecraft or failing to monitor the spacecraft anomalies which may lead to contingencies. It may lead to the loss of satellites and national prestige. Also, the person's reputation is lost and it is a day dawn process to make a replacement for the loss of spacecraft. This sort of "fear-psychos" causes niggling stress in the spacecraft controllers.

Hence, they continue concentrating on their work, which becomes fodder for stress. The study's objectives are to know why spacecraft controllers are liable to stress, to find out the stress level in the job environment, and to find out the impact of stress on the job.

## Methodology

The research was made at the Direct Mission Control Room (DMCR), ISRO Telemetry Tracking Command Network, Indian Space Research Organisation, Peenya Industrial Estate, Bangalore. The data were collected through primary data through surveys and secondary data through the database. Data collection is very specific in the research, as only respondents have been given the questionnaires. The research has been conducted for the scientist engineer's team. Correlation analysis has been used to describe the degree to which stress level is

linearly related to Role efficacy. It has been observed that an inverse relationship exists when the value of job stress increases, resulting in the decreasing value of Role efficacy and the values of job stress decrease resulting in the increasing value of Role efficacy. The interpretation of a correlation coefficient as a measure of the strength of linear association between two variables is purely mathematical and is completely free from any cause-and-effect implication.

## Conclusion

From the systematic study of the stress pattern in spacecraft controllers, it is found that they are moderately stressed, with a Role efficacy level as high as 87%. This is true for both genders irrespective of their qualification and their experience. The study has pointed toward the various causes of stress among the controllers. To cap it all, the working nature against the biological clock and the utmost attention needed during the satellite passes and also to react without any delay in case of anomalies/contingencies in the spacecraft plays a vital role. Above all, any action/no action by the controller that is detrimental to spacecraft health will bring down their hard-earned image as well as their morale.

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