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Knowledge to Wisdom

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***Contact Us***
Editor, Journal of Indian Research
Mewar University
Sector-4C, Vasundhara, Delhi-Gzb. Link Road, Ghaziabad-201012 (U.P.)
Phone : 0120-4758300
E-mail: jir@mewaruniversity.org, Website : http://mujournal.mewaruniversity.in

***Abstracts and Indexing***
https://nkrc.niscair.res.in
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***Design & Production***
Samvad Media Pvt. Ltd.
E-mail:media.samvad@gmail.com
Ph: 011-23517803

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# CHAIRPERSON'S MESSAGE

It is heartening to see the timely completion of second volume of the Journal of Indian Research. Bringing out a quality journal is a stupendous task. This has been made possible by the efforts of the Editorial team, the officials of the Research Department and support from the academic community.

With the dawn of the New Year, there is palpable hope in the air. Indian economy is growing fast and expected to beat China in the growth rate. The new government has launched '*Make in India'* campaign to boost manufacturing sector and generate employment for our youth. The objectives of the campaign can be accomplished only when we have a huge pool of engineers and scientists. We cannot catch up the West or China in the old economies. To leapfrog these nations require creating new technology and spur in innovation. Our universities need to become the centres for excellence and innovation. This will require massive investment in the research and development. The research journals are the site where ideas can collide and coalesce. Maintaining high standard and disseminating new ideas is a daunting task. Publications commence with indomitable spirit. But, most of these die down due to lack of constant financial support.

I would take this opportunity to seek help from the government bodies to support publications with clean record and regular periodicity for at least two years. The corporate sector ought to invest a part of their CSR commitments in supporting R & D and their publication in universities.

Last year, we decided to publish a special issue on the Himalayas. That was instantly noticed by the policy makers and research scholars. In the next volume, we intend to bring out a special issue on governance. We expect the list of contributors to expand further. I will also request the institutions to subscribe to the journal so that more and more students, teachers and researchers get benefitted.

In the current issue, we are publishing a magnificent philosophical enquiry by Professor Sthaneshwar Timalsina upon Indigenous Epistemology. He has argued to deploy Indian categories of thinking like *paśyantī* and *pratibhā* to address the global issues. Only by diving into our own ocean of wisdom and allowing the same to fuse with the wisdom emanating from different directions, we can induce revolution in Indian thinking. We look forward to chisel our effort further towards achieving this higher end!

**Dr. Ashok Kumar Gadiya**

# EDITORIAL

*Journal of Indian Research* reaches another point of no return. Our effort to promote new thinking based upon indigenous lines is bearing fruitful result. At the same time, with the change in the political dispensation, there is upsurge of claimants for indigenization of knowledge. Science and history are the new battlegrounds. But, there is an urgent need for academia to rise above the ideological divide and defend their niche. Sacrificing the arduous quest for wisdom in favour of ephemeral fame will dissipate the vigour of knowledge tradition of our civilization.

Empiricism and critical rationality is being marauded by the power of faith. Epics and myths are under threat of extinction with the effort of historicization by the crafty crypto-thinkers. In fact, chronology itself faces the gravest threat of being reduced into abracadabra for the next generation. The paradoxical movement is all couched up under the garb of "decolonization of mind". The scholarship will lose wherewithal to sail in the vast ocean of wisdom if we do not resurrect the serious philosophical inquiry into mode of our thinking. We need to rescue knowledge traditions from both extremes: proponents of indigenized knowledge and votaries of western knowledge - as-universal knowledge.

Professor Sthaneshwar Timalsina has done yeoman service by bringing in the perspective of middle path by juxtaposing Bhartrihari and Abhinavagupta on one hand and Plato , Heidegger to Derrida and Caputo, on the other. This issue of the JIR is publishing his elaborate philosophical enquiry, *"Indigenous Epistemology and Placing the Cultural self in Crisis: A New Hermeneutic Model for Cultural Studies"*. He argues for 'fusion of horizons', a symposium of mutual understanding which requires prior dissolution of the differences and breaking apart of the 'epistemic shells'.

In fact, fusion is inherent in South Asian cognitive DNA. A singular thing that is identified with Indian civilization is the contribution of the 'Yoga' to the world civilization. Recent decision by the world body, United Nations to commemorate 21st June as the International Yoga Day every year has been supported by 170 member states. Yoga (योग) is the art of joining, the breaking apart of the boundary between the world of immanence and transcendence. The etymological root of the term is 'yuj' (युज) or to join. Yoga is not merely the physical and mental exercise to attain balance and equanimity or to join mind and action. It is the paradigm for fusion of horizons. Similar idea permeated other religions of Indic tradition and the last major sect that arose before India was colonized by western invaders, was the Kalachakra Buddhism. In Kalachakra, an attempt was made for a grand synthesis of all the major Indic sects and they came up with a beautiful seed syllable for their sect- *Evam* (एवं). *Evam* is '*and*', joining together. Under this category, one can join anything and everything. The cosmogram of Kalachakra Tantra that symbolizes the seed syllable or the Ten Powerful One consists of the Lantsa character for E(ए) on the left and VAM(वं) on the right , representing the ultimate fusion of emptiness (E/ए) and bliss (VAM/ वं). The two parts of Evam contain within themselves the grand idea of fusion of wisdom (प्रज्ञा) and method (उपाय). This is the most sublime and secular formulation for 'fusion of horizons'.

It is another matter that our sub-continent is facing the politics of divisiveness of all kinds. Dr. C.P. Singh et *al.* have traced one of the origin of politics of divisive identities to the census started by the British administrators in their paper, "*Colonial Agenda of Census in India*". British used the census to create new identities and divisions in society to counter the emerging nationalism. Their basic purpose of dividing the people on sectarian lines was meant to pursue their policy of divide and rule so that they could perpetuate their colonial rule in India. The British administrators encouraged divisive policies rooted in census data and findings to institutionalize the divisions amongst the people in India. From Michel Foucault to Benedict Anderson and Sudipto Kaviraj, all of them have argued how the colonial forms of knowledge like enumeration and the statistics (science of state) transform the fuzzy boundaries into frigid boundaries and cause the rise of politics of identities. Modern knowledge tradition does discourage the fluidity of self and 'fusion of horizons'.


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Our administrators are also responsible for falling into the trap of the statistics as panacea for ills of governance. They discourage the indigenous categories at the altar of data and tables. India launched the National Population Policy decades back in 1976. But, two-child policy could not permeate the masses. In spite of mass advertisement, public announcements, workshops and literature dissemination, the policy failed to appeal popular imagination. Rather there was a popular backlash forcing the retreat of the state. What went wrong? Population policy was couched in the western epistemic framework which prioritizes empiricism and hence the science of state viz. statistics. The government went on flaunting the ill-effects if the population continued to rise. Ironically, in spite of constant effort by the state to slow down the population figure, now the population is touching the unbelievable 1.3 billion mark and we might surpass China within a decade. Imagine if the government contextualized the policy in the cultural root and deployed indigenous narrative, the policy might have been effective. The State could have used the epic Ramayana and argued how the hero, Rama had the first child only after 14 years of marriage. Buddha had the only child after 13 years of marriage. This could have been effective in communicating how our civilizational heroes lived and discouraged bearing many children.

In recent times, we are witnessing massive campaign against non-vegetarianism. The votaries of vegetarianism drool over paranoia when they demand blanket ban against even consumption of eggs. Seeds of new fragmentation are being sown in Indian society. There are political movements picking up against cow slaughter and pink revolution in India. But, by tying up the consumption of egg with the cattle slaughter is problematic. Meat consumption is bad, is being justified by referring to some obscure research in the West. It is as if the results in western societies bear the sole stamp of authority. There is total absence of indigenous categories in the whole discourse. The problem exists in India; the understanding ought to be premised over the Indian categories of thinking.

Few weeks ago, I was attending a panel discussion over "Buddhism and Vegetarianism". The speakers were unanimous in reducing non-vegetarianism as a sin of the worst kind. In fact, one of the speakers mentioned how the stomach becomes graveyard for all sort of dead beings. The audience comprised of people from the Himalayan belt, for whom the non-vegetarianism is a way of life. In cold climates, they require protein-rich source of energy and by asking them to even forego consuming eggs tantamount to disrupting their own life-cycles and cultural ecology itself.

But, is there a way to discourage cattle slaughter and yet not imposing a blanket ban over non-vegetarianism? The answer cannot be convincing if it is coated with the environmental logic and the statistical fallacies. In the Indian context, cow slaughter is a taboo about which there is unanimity among all Indic traditions. Though, the necessity discourages extreme vegetarianism; there cannot be any justification for cattle slaughter in this part of the world. The freedom to satiate gastronomic desire and bodily necessity ought to be balanced so as not to offend the Indic sensibility. In such a puzzling condition, western categories might not offer the solution. But, does Indic thinking has appropriate indigenous categories?

Vasubandhu, the 4$^{th}$ century Mahayana philosopher composed a treatise *Garbhavakrantinirdesa-sutra* (Sutra on Entering the Womb) and described how there are four modes of entering the womb. He describes how embryo grows into foetus through various stages like *kalala, arbula, pesin, ghan* and finally *prasakha* when material organs with support get fully developed. Vasubandhu describes how the fetus in its 28$^{th}$ week of gestation experiences the 'eight disordered conception" and in the 36$^{th}$ week, feels unhappy about being caged in dark womb and wishes to escape. Tibetan yogi, Gampopa (1079-1153 A.D.) describes in the book, *Jewel Ornament of Liberation,* experiences of pain that embryo undergo throughout gestation. It is during the 36$^{th}$ week when foetus wants to escape the dungeon of womb. Similarly, *Garbha-Upanishad* of Krishna-Yajurveda mentions that during the 9$^{th}$ month of gestation, the foetus learns to contemplate over the miseries of human life.

One thing is common among Indic scriptures that it is only during the birth through the womb (*karma-yoni*), that karma-cycle operates. Though, there are two more kinds of wombs- *divya-yoni* and *bhoga-yoni*, karma cycle does

not operate through these. While the various forms of demi-gods and angels which do not have material body are supposed to take birth through *divya- yoni*; animals, insects and such beings at lower level of evolutionary ladder which do not possess discriminatory wisdom are said to be born of the *bhoga-yoni* (enjoyment womb). There is consensus among various sects that the world we live in is full of sorrow. The karma cycle is supposed to operate only when the foetus learns to experience suffering.

It is sin to interrupt the completion of karma-cycle of other beings. Every being must be given fullest opportunity to strive for own escape from the ubiquitous karma-cycle. Since, none of the scripture mentions about operation of karma cycle in beings which are not born of womb, the non-mammals can clearly be excluded from the karma-cycle. There should not be blanket opposition against consumption of fish, chicken and eggs all being *a-yonij* (अयोनिज्). But, what about consumption of red meat? The categorization of non-vegetarians between white meat and red meat- eater can reduce several differences over cattle slaughter.

Human beings survive within an existential band. It appears that existence of beings itself is quantized. Our hearing organs respond to vibrations within a range of 20 Hz-20000 Hz. Similarly, we have a homeostatic temperature. We see within a small visual range. Our gastronomic range should there of be clearly defined. *A-yonij* seems to be a natural category.

We have seen how Indic tradition describes foetus of 36-37$^{th}$ week duration as entering the cycle of karma. Based upon this parameter, we can classify the mammals which can be avoided for the consumption so that they can complete their own karma-cycle. The gestation period of mammals can be classified into two categories: more than 36-37 week duration and less than 36-37 week duration. While camel(406 day), cow(280days), dolphin(276 days), elephant(640 days), giraffe(395-425 days), horse(337 days) will belong to the former category; goat(151 days), kangaroo(40 days), pig(151 days), rabbit(32 days), sheep(148 days), dog(62 days), mouse( 21 days) will belong to the latter category.

Such indigenous knowledge-based modern categorization will come to aid for the people who seek culinary freedom and those who resist cattle slaughter, particularly that of cow and beef.

Our constant endeavour to brood over Indian scriptural knowledge and blend those with the modern knowledge is possible only due to the perennial support of the Chancellor of the Mewar University, his office and the colleagues. We also make an appeal to the scholars to support this risky venture of bringing out a periodical in print without support from the government sectors, by sending serious contemplative studies and methodical empirical results with promising results. The life of a periodical depends upon the paramount mantra of *Evam* (एवं). Only "we" *and* "you", working in tandem can guarantee the survival of ideas.

**– Niraj Kumar**

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**Philosophy**

# INDIGENOUS EPISTEMOLOGY AND PLACING THE CULTURAL SELF IN CRISIS: A NEW HERMENEUTIC MODEL FOR CULTURAL STUDIES

***Sthaneshwar Timalsina****

**ABSTRACT**

*Contemporary studies in Western settings or their replication in non-Western academe has helped the West to impose its categories on the non-West. Western epistemology is still caught up in the binaries. The understanding of a culture is inevitably enigmatic when one's scholarship is situated in the presupposition of a binary that opposes self to other. A culturally conditioned subject wanting to study another culture in itself is problematic. Moreover, the epistemic paradigm that reduces the truth to perspectives and makes all the perspectives equal makes the quest for truth by means of 'studies' irrelevant. By exploring examples from cultural studies where the cultural 'other' is India, the paper argue that those hermeneutic models that are not willing to call into question the subject itself are epistemologically flawed. A necessary 'fusion of horizons' is not possible unless the subjects in dialogue are willing to dissolve their differences or come out of the epistemic shell that defines their selves and differentiates one from the other. A dialogue, ought to be inter-penetrative, wherein both subjects merge in constituting a new paradigm. This can sprout the gaze of a disinterested subject, or that of the witnessing self (sāksin)—through which one ascends by the erasure of one's culturally constructed fictive self.*

*In this exploratory paper seeking non-western epistemological framework to understand truth, Indian concenpt of Paśyantī and pratibhā as described in Bhartrihari's work has been discussed. Paśyantī or self-seeing-speech explains the dialogical nature of reality; while the concept of pratibhā or intuitive or reflexive awareness, a meta-gaze, provides a path towards self-recognition. These concepts can unite the binaries wherein awareness divided into the forms of subject and object dissolves. A hermeneutic shift is required in current scholarship whereby the self is willing to sacrifice its ego-bound identity and penetrate the objects, or experience other subjets the way they would experience themselves. This would not only help us evolve as empathetic beings but would also give us better insight into our own surroundings. The paper appeals for a movement beyond the recognition of cultural differences and seeks to universalize indigenous categories in redressing global problems.*

**Keywords:** Abhinavagupta, Bhartrihari,deconstruction, Derrida, dualistic epistemology, Eurocentrism, fusion of horizons, hermeneutic, Nāgārjuna, Occident, Orient, *paśyantī, pratibhā, pratyabhijñā,* Śankara.

## INTRODUCTION

The field of cultural studies is yet to decisively facilitate its stated aim of providing meaningful and genuine understanding of the so-called 'cultural self' and its myriad cultural transactions. Deconstructive analysis unearths the cultural presuppositions inherent in this field, which is laden with enduring colonial tendencies and biases still prevalent in today's academic discourse. My argument is that the understanding of a culture is inevitably enigmatic

***Professor Sthaneshwar Timalsina** is Professor of Religions of India, Tantra, Religion and the Body at San Diego State University, US. He completed his Acharya (Masters) in Benaras and attained his PhD from Martin Luther University Germany(2004). An erudite Sanskrit scholar, he is an authority on Advaita Vedanta, and best known for his works, *Seeing and Appearance: History of the Advaita Drstisrsti*(2006) as well as *Consciousness in Indian Philosophy: The Advaita Doctrine of 'Awareness Only'*(2008). E-mail: timalsin@mail.sdsu.edu

when one's scholarship is situated in the presupposition of a binary that opposes self to other. Subjects studying other cultures, I argue, better understand and empathize with the subjects of their study when they are willing to sacrifice their own self-constructed cultural otherness. A deeper dialogue, a dialogue embedded at the core of self-experience, I argue, is the hermeneutical key for understanding cultural subjects. This approach of deconstructing the self in an effort to recognize the other, I believe, has a greater potential to bridge abiding differences and heal a multiplicity of culturally wounded subjects. Real cultural dialogue occurs in that 'fusion of horizons' that arises from the bracketing of one's own culturally constructed presuppositions.

**DIFFERENCE AND CULTURE**

While Gadamer, Derrida, and Caputo call into question the subject via their respective hermeneutic approaches, the way that cultural studies have been institutionalized has functioned primarily as an instrument for the subject to interpolate his own preconceptions and misconceptions. As a consequence, a disturbing trend of mis-reading so-called 'marginalized cultures' has cultivated a binary of the culture and its reporter, thereby subverting human experience in the course of its self-objectification. By examining a few historical examples, I analyze in this paper how the construction of cultural selves and particularly the scholar's separation of oneself from the life-events examined, has only furthered cultural misappropriation and turned the field of cultural studies into a hermeneutical battleground. Gadamer, rather than trying to synthesize the perspectives of the self and the other, stresses openness toward the perspective of the 'other.' He is willing to suspend the individual subject's own position, which calls into question what Bakhtin or Caputo have argued in order to maintain difference or assert the irreducibility of the self and the other. By exploring examples from cultural studies where the cultural 'other' is India, I argue that those hermeneutic models that are not willing to call into question the subject itself are epistemologically flawed. A necessary 'fusion of horizons,' a symposium of mutual understanding as it were, is not possible unless the subjects in dialogue are willing to dissolve their differences or come out of the epistemic shell that defines their selves and differentiates one from the other. A dialogue, to me, is inter-penetrative, wherein both subjects merge in constituting a new paradigm. A mere exchange of words cannot be considered a dialogue. Presumed differences, in my understanding, can and often do, stem from misjudgment.

This misunderstanding is not always a cognitive error, but often times, is due to a failure on the part of those engaged in dialogue to put aside their respective epistemological biases. The subjects engaged in this kind of fallacious hermeneutics, in my opinion, can speak but not engage in dialogue. I consider the binary created by these subjects as 'false,' and as long as the cultural selves are not willing to escape their evaluation of others based on faulty parameters, no actual dialogue can occur. I propose in this paper that the construction of the binaries of 'cultural self' and 'the other' has precluded actually knowing other cultural selves or initiating any truly meaningful inter-subjective dialogue. This leads to my proposal that the cultural selves that initiate discourse need to erase their subjective horizon in order to penetrate the realm of the 'other.' This does not preclude subjects from making judgments, but this breach in the horizons of the self and the other will open up a space which can provide a foundation for 'understanding' to occur. As long as the subjects are not willing to relinquish their conceptual boundaries, there is no real 'fusion.' In other words, self-existence is not dependent upon the sustenance of the 'ego,' and when the maintenance of a subjective horizon precludes the possibility of a dialogue, a meta-awareness is required to relinquish subjectivity.

The defining of a culture requires the presence of a cultural other. This 'other' constitutes a difference that allows one culture to identify itself. When different cultures develop a dialogue, numerous binaries can emerge, such as that of insider and outsider, or superior and inferior. Post-colonial studies have deconstructed the settings in which cultures have been studied. This has given a new twist to studying 'other' cultures and has problematized the colonial framework of admiration, adoption, and assimilation, where the eventual outcome of such studies has remained to diminish the cultural other. The question is, can we really know the cultural others that are not our own fabrications? The arguments developed in this paper demand bracketing the self from discourse, placing the subjective horizon in crisis and entering into the realm of other subjects, and in this process, they borrow some premises from classical Sanskrit philosophy. Seeking an even broader horizon, I argue in this paper that human concerns and consciousness cannot be confined to cultures alone, and the advancement of our shared destiny relies

on our ability to develop trans-cultural disciplines rooted in global wisdom, rather than arguing for or against the cultural self. All cultures have the narrative of human survival and possess insights that prepare humanity for further evolution. The crises of global warming or the lack of drinking water, for instance, are common challenges for the entire humanity. Non-violence, along the same lines, is not merely the concern of some Jain monks, but a global need. Our construction of the binaries should not preclude knowledge systems. In this sense, this paper appeals for a movement beyond the recognition of cultural differences.

I understand the consequences of this proposed reading of cultures to be the potential for a transcendence of the binaries of self and other, insider and outsider, in-group and out-group, that characterize and drive much cultural dialogue. Cultural dialogue, like any other form of discourse, does not innately remain fixed to established binaries, but rather shifts according to the dynamic nature of the subjects and interpreters that are always constructing their respective interpretations within and according to their own particular frames of reference. Historically, however, it has been possible for cultures to expand the scope of dialogue and adapt by freeing themselves from the fixed ideological frameworks. The dialogical selves, in this light, embody a 'becoming' that is itself discursive—flux, rather than 'being,' as Heidegger and Caputo would agree. By giving some examples from cultural studies that stem from the faulty parameters of biased subjects, I argue in this paper that cultural dialogue can occur only when the subject's own epistemic horizon is breached, allowing the identified other to engage in dialogue as a conscious subject and not just a mere concept of objectification.

In framing my position, I have drawn from from José Cabezón's (Cabezón 2006, 21-38) insight that cultural studies have not only constructed the binary of the self and the other but also a presumed superiority of the self in relation to other. Erasure of this constructed self and its superiority, I argue in this paper, is a precondition for constructive hermeneutical dialogue. In order to propose an interpretive model that sustains the collapse of this fabricated self, I borrow ideas from Bhartrihari, Śankara, and Abhinavagupta as well. Unlike their Western counterparts, these philosophers recommend an erasure of the ego-self, the self that is culturally constructed, in quest of a higher, purer truth. I propose that 'recognition of truth' is possible only when the dichotomy of subject and object is dismantled and the dialogical subject transforms his horizon, going beyond those restrictive parameters in which the self-produced-by-culture has been defined, and instead experiences the perceived other as the very self to-be-known.

The seeds of my argument can be traced in their seminal form to concepts, terms, and teachings in classical Sanskrit philosophy, particularly the concept of 'intuitive knowledge' (*pratibhā*) and the doctrine of self-recognition (*pratyabhijñā*). Both *pratibhā* and *pratyabhijñā* reference ideas linked to faith in a transcendental truth beyond the fluctuating discursive patterns of dialogical selves. The epistemic framework for recognizing reality, in these parameters, can shift the subjective horizon—just as 'truth' cannot be labelled 'subjective,' it cannot be about 'objective' reality, as the binary of subject and object are innately relational. Both are problematic in recognizing reality. The intuitive stage of *pratibhā* is non-dual in its nature; and, in this self-reflexive awareness, there is no dichotomy of self from other. From within the framework of such a term, one is inclined to seeing the wisdom of seeking that reality that allows for an interpenetration of all epistemic domains. This, to me, is a real dialogue: not to realize that we are utterly different, irreducible, and impenetrable, but that we rest—all and each and every one of us—on the very same foundational reality that expresses itself through us.

This leads us to two different scenarios. In one, the subjects engaged in dialogue are hellbent to preserve their ego-self and muster their rights and explore their strengths. In the other, the subjective domains overlap, and an enterprise that initially stems from the desire to project one's own superiority transforms itself into a hermeneutical pattern of mutual understanding and appreciation. In this age in which the world's citizenry is progressively moving away from classical ethnocentric consciousness and embracing more pluralist values, cultural studies cannot stand alone, isolating itself from real human needs. As a consequence, the project of the 'restoration of ego' will have to collapse and find its home in universal human aspirations. Moving away from fictional self-identity, we scholars can contribute to the larger cause of adaptation by providing cognitive frameworks that facilitate a higher order of self-awareness grounded in values of non-violence.

Bhartrihari introduces the concept of 'self-seeing-speech' (*paśyantī*) that witnesses itself while also seeing entities as if externalized. This is the level of speech wherein the so-called external and internal are commingled.

My proposed model of hermeneutical dialogue involves subjects in this self-seeing stage whereby that which was previously objectified and externalized as 'out there' tranforms into an intimate otherness that is perceived within as one's own self-essence. The intrinsic nature of language as dialogical and the manifestation of reality in dialogue, therfore, can be derived from the concept of *paśyantī*. An epistemology resting on this concept can lay the foundation for a broader discourse on cultures. The concept of *paśyantī* suggests that before a real dialogue, an internal dialogue must occur. The very expression of language presumes this internal dialogue. My argument is that only when this dialogue stems from a common ground, based on truth, can a real conversation with the 'other' have lasting and true value. Such a true dialogue occurs when the internal dialogue of *paśyantī* and the external dialogue with the other comes into union. In plain words, we can hear each other better, if we speak from our hearts. No dialogue is possible in deception. This knowing-of-the-heart is a higher gnosis (*paramajñāna*).

I propose not an abnegation of the 'other,' nor an incorporation of the other within the 'self.' On the contrary, this model suggests the experience of oneness in the intuitive state of *pratibhā,* wherein one breaches his subjective horizon, as if becoming the other. We cannot discover the truth by seeking it within the polarity of the self and the other, as the truth transcends this dichotomy. Only when such an ideological *aporia* is breached, can one see through the eyes of the other and realize the way things are in their respective actualities.

For example, what does it take to solve the Gaza problem? Are the two parties in war willing to relinquish their Jewish and Muslim identities, and feel for a moment just as human beings, greet each other without threat, without cunning and deception, and initiate a dialogue that does not threaten the existence of one another? If not, no dialogue is ever possible. When cultural, linguistic, geo-political, or any other interests become more important, or when the fictional selves engage in dialogue in order to preserve their ego, there is no letting go of the ego and there is no understanding between the conversing subjects.

As the 'other' is a product of alterity, the arguments derived from *pratibhā* and *paśyantī* demonstrate that the categories of 'self' and 'other' are superimposed onto the ground of pure awareness and are simultaneously arising. This being the case, the quest for the other who is not superimposed is logically impossible. Following the model of *pratibhā*, truth manifests when differences dissolve, as the polarities constructed in cultural settings can manifest only what is relational and not the absolute. This dissolution of difference is not the dissolution of cultural difference, but rather the dismantling of the superimposed dichotomy (Cabezón 2006, 23-24). The contemporary hermeneutics arguing for cultural dialogue seem to have forgotten the greater reality that, while we all stem from particular cultures and speak different languages, our aspirations and ingenuity cannot be confined within these parameters. While all subjects are cultural, speaking reality in their own language, what they express is not just relational. At least, this is the parameter in which the *advaya* epistemology of Dharmakīrti or the *advaita* epistemology of Śankara and Abhinava functions. On the other hand, if 'reality' is culturally constructed, no dialogue is required, as it cannot ever enter the horizon of the other subject. Not only that, it leads to the consequence that the other in a dialogue or the object in the epistemic process of cognition always remains unknown. In either case, to this author the predominant model of hermeneutics based on the dichotomy of subject and object is incapable of addressing true cultural dialogue.

Relying on the above non-dual arguments, my fundamental proposition is that hermeneutical propositions grounded in the dialogical opposition of subject and object are inherently flawed or at least epistemologically limited. My argument for adopting *pratibhā* as the essential ground of cognition is toward the end of demonstrating the validity of the epistemological recognition of non-duality in the process of engaging in cultural dialgogue. I argue that an actual 'experience of reality' does not occur within any epistemic horizon confined by dichotomy. Furthermore, the very premise of the objective gaze is to accept the 'other' as devoid of reflexive self-awareness. Now the question is, how can subjects engage in understanding each other, or breach their respective epistemic horizons in quest of this non-conditional truth? And for this, I would like to engage Śankara's presuppositions for reading Advaita.

Prior to beginning his commentary, Śankara proposes that only select people are authorized to read Vedānta. The four constituents—(1) discriminating wisdom of what is transitory and what is not, (2) having no craving for enjoying the world, (3) having moral qualities and strengths to restrain oneself from physical desires, and (4) the zeal to attain liberation—according to Śankara, are the preconditions for understanding his teachings (*The Brahmasūtra-*

*bhāsya*, I.1.1). What is noteworthy in this itemization of requirements is that our ability to learn something is framed by our intentionality. When Śankara's arguments in this context are engaged, the study cannot be guided by prejudiced concerns, and the subjects both from inside and outside (in the case of cultural discourse) thereby fail to recognize a reality that is beyond the culturally-constructed notions regarding distinctions between 'subject' and its 'object'.[1] This is to argue that 'understanding' as an epistemological category requires the transcendence of frameworks bound to such binaries as subjective and objective, inside and outside, etic and emic, and so on.

In order to demonstrate how intentionality affects understanding, I am offering a few examples of the readings of Indian cultural forms in the contemporary period. Indian philosophy has been studied since its origin with multiple and sometimes contrasting purposes: adherents study one school of thought to imbibe the instructions and apply them in their lives (like people studying and practicing Yoga); opponents of any given school mine its thought in order to refute it and propound their own doctrine (like Dharmakîrti reading Mîmâmsâ and Nyâya philosophies); there are examples of studying another culture with an intent to learn from it and adopt its tenets (as in the case of the emergent philosophical structure with the integration of various yogic systems found in Patañjali's system, or in the writings of Gaudapâda or Sankara). In these modes of cultural dialogue, evident in the classical examples of Hindu-Buddhist-Jain debates over epistemology and metaphysics, self-correction has always remained consequential. Even when there is no erasure of difference, there is a process of refinement through which the 'sacred' voice of the other is heard. Contemporary imperial studies of the marginalized cultures, on the other hand, too often aspire, perhaps at times naïvely, to erase the other. Colonized cultures, in this paradigm, are always 'food' or the primary materials (just like the raw materials in the industrial products) for the sustenance of the imperial machine. These studies, I argue, presuppose a dichotomy prior to engaging in dialogue. In other words, this framework rarely allows for a real dialogue to occur and a real understanding to emerge.

Studying other cultures, in my experience, is most fundamentally about the opportunity and challenge of understanding other people at the level of their fundamental ground. When engaged in this way, cultural studies have the potential to initiate an authentic existential transformation, either in the party that initiates the dialogue or the one that responds. Cultural understanding, therefore, has to be dialogical, as it is about the engagement with, by, and for a plurality of subjects. Only those subjects who truly 'understand' can transform and not those who have been merely 'understood.' That which is merely understood remains confined to the realm of objectivity. From a Vedāntic perspective one could say that the 'understood' being 'objective' remains thereby nothing more than superimposed illusion. Subjects cannot enter a dialogue without recognizing that cultural studies require the epistemic shift out of objectivity into the world of the subject.

My argument is a sub-set of a broader argument regarding the parameters by which India has been read in contemporary times and the problems that such readings have produced. My thesis is that it is the very flawed interpretive approach of such studies that generates the problems arising from such studies.

To clarify my argument I turn again to Śankara's theory of superimposition (*adhyāsa*) whereby reality is not known due to a cognitive error in which the subject is misidentified with the object. Realization of the true nature of things can occur only when a knowing subject is willing and able to escape from this epistemic defect. It is only when one has made such an escape that one is in a position to provide unbiased and valid interpretive reflections on one's own, let alone another's, cultural heritage. In short, cultural dialogue can occur only when subjects are willing to problematize their own cultural horizons; and, they must do so specifically via the perspective they gain by being liberated from those very horizons. In other words, with my thesis I point to the existence of a transcendent gaze—one may call it the gaze of a disinterested subject, or that of the witnessing self (*sāksin*)—through which one ascends by the erasure of one's culturally constructed self as one thereby enters the condition of the relational self that emerges in the binary of being-with-other.

## CULTURAL MONOLOGUES

'Dialogue', by definition, presupposes the existence of two subjects exchanging their perspectives. In cultural dialogue, however, the dominant subject's autonomy in interpreting the subordinated subject results in abnegation of the other's genuine subjectivity. The result is monologue with an imagined subject. In this platform, not only

are the 'other' subjects misunderstood, they are not even brought to the ground of being. While this monological framework has many defects, I argue that it, perhaps paradoxically, nontheless also has the potential to lead to the kind of dialogue I have heretowith claimed it negates.

Here a question arises: are we doomed to live solely in the fictions we tell about ourselves and each other, believing our monologues to be dialogues, or can we actually learn to understand each other, to experience the real object, and to have a real dialogue? Just as human awareness is culturally shaped, my conviction is that we are capable of having real understanding and dialogue. Accordingly, subjects can understand each other, and can transform their perspectives, without one subject destructively subjugating the other subject's epistemic, hence cultural, domain. The transformation of Buddhism in China, the emergence of Tibetan Buddhism, the transformation of Hindu, Buddhist, and Jain philosophies in classical times, all are the result of such dialogue. If we pinpoint a timeframe, we may not find an ideal dialogue occurring even during those historical modes. What we cannot deny, though, is that in this exchange, respective historical instantiations brought about an eventual transformation of cultural understanding that occurred as a consequence of these not-so-perfect dialogues and oftentimes monologues.

In order to demonstrate how the contemporary parameters of cultural studies lack the desired dialogical model, I provide now a few examples from European approaches to the reading of Indian culture. If closely analyzed, these studies can be summed up in three distinct trends: first, upon the premise of inherent dichotomy, then upon similarity, and finally with the premise of inherent categories. As Cabezón has noted, these three trends can be summed up with the statements 'they are not like us,' 'they are like us, but we are rational,' and 'they are like us, but,'; however, as he notes, each of the statements can actually be subsumed within the first as they all arise from the affirmation of inherent dichotomy (Cabezón 2006, 23-24). This first trend of inherent separation is vivid in the Hegelian approach that is alive to this day, although centuries have passed and the language of hermeneutics has changed somewhat since Hegel penned his thoughts. Examining Hegel's approach to history can be described as the doing of a historiography of Eurocentrism. Such a perspective perhaps helps us frame the discourse in (unfortunately common) contexts where 'philosophy' is considered proprietary to the West. When engaging in cultural dialogue by means of this model, there inevitably arises a *faux* 'dialogue' constructed by one party who deems himself more 'rational' to an other who is defined as 'not-like-me'. This model of course keeps in place the necesseary theses and antitheses which are woven together via synthesis.

No doubt, recurrent Indological use of the Hegelian method has helped frame the European perception of what or who India is. Hegel immersed himself in the study of Indian thought, even writing a book on the *Bhagavadgītā*, only to later depict these scriptural depths to be nothing more than an "insanity [found] through opium," (King 1999a, 124)[2] or "an Idealism of imagination, without distinct conceptions," (Hegel 1956, 139) or "a Pantheism, however, of Imagination, not of Thought," (Hegel 1956, 141) and self-realization "a sort of hazy consciousness" (Hegel 1956, 149). In Hegel's perspective, "Hinduism, with a monstrous inconsistency, is also the maddest of polytheisms" (Hegel 1971, 307).[3]

Now, one may wonder, what is the point of this excavation of graves, this unearthing of skeletons? The question is, As long as we do not examine the roots of the problem and cure it at its foundation, how then can we heal our collective cultural body?

A hegemonic cultural tyranny based on subordination is not, of course, a 21st-Century product. Just as in the past, such hegemony bleeds cultures today, and, today as yesterday, civilizations and enthicities are being wiped out, even as you read this next word. The logos of Aryan superiority theory or the related Aryan invasion theory, and many other similar ideas, result in the institutionalization of the superiority of one race over another, giving priviledge to one against the other, and thereby granting power to one at the expense of the other. These are not simply desktop theories obscured in one footnote. These statements are placed centrally to this text as my thesis on transcendece includes this point: these age-old stories of subjugation, ignorance and suffering haunt us to this day, be it in Nepal, Nigeria or even (to bring home the point by example) every major urban center in the United States. Through this gazing into our own histories we may or may not find the same brutalization of 'the past' in today's ethnographic readings, and we may or may not see that this agenda of engaging in dialogue in order to erase the other has remained unchanged. Whatever we find, we will find our truth. Reading Hegel or Max Müller,[4] therefore, is not just to locate the history, but to face the mirror of our collective, culturally-determined selves. In so doing,

we thereby come to the place of transcending that collectivity. I write here not merely on the narrative of India. The field of African studies, for example, bears similar characteristics (Camara 2005, 82-96).

Recognizing reality by analogy, or the method of comparison and contrast, is faulty in the epistemic sense that the thing-in-itself is neither similar nor different from others but is the object itself. This approach cannot give us the knowledge of the thing-in-itself, as the thing known is qualified, realized only in relation to the other. Śankara and particularly Vimuktātman identified an epistemic problem of recognition in terms of identity and difference, the epistemic modes that conclude in comparison or contrast (Timalsina 2009, 85-102). The problem with this mode of comparative study is that it embraces categories of the 'self' and projects them onto the 'other.' The typical argument is that both the cultural constitution of the self and the other are relative, relational, co-arising, and bound to be epistemically faulty. Let me highlight the limits of this approach with two citations from the writings of Max Müller. Regarding the Upanishads, Müller writes,"[I]ts language, no doubt, is less exact than that of an Aristotle, its tenets are vague, and the light which it sheds on the dark depths of human thought resembles more the sheet-lightning of a somber evening, than the bright rays of a cloudless sunrise" (Müller 1926, 300), and regarding Hinduism in general that "it will make us hesitate before we deny to the Aryan nations an instinctive Monotheism" (Müller 1926, 300).

These examples are cited here only to demonstrate how far we have been able to both progress, and regress, in cultivating a real cultural dialogue over the past centuries. However, it is not my contention that these parameters are impossible to overcome. On the contrary, the erasure of the culturally construed subjectivity, I argue, can shape a proper understanding among cultures, allow cultural subjects to be understood, and in turn, have a culturally diverse society engaged in meaningful conversation. This is not an erasure of cultures, as has been the consequence of cultural monologues in the colonial paradigm. If cultural identity is a form of game, I am only cautioning that the players engaged in the game ought to be aware that they are engaged in play.

In too many cases, the existing models of cultural studies, whether comparative in nature or studies on a single topic are bound to fail as they too often stand on the shaky ground of faulty presuppositions. It is not that these studies are by themselves problematic, but rather that the shaping of the discipline itself has been guided by a flawed set of core epistemological values. If the human angsts and fantasies, dreams and memories, are grounded on the single thrust of survival, why then cannot there be universal philosophical quests and responses, rather than the preclusion of the literatures of entire civilizations as so many tragically censored chapters from the book of ethnic studies?

How can the *Mahābhārata* be a concern for understanding only the Indian psyche but the *Illiad* the unquestioned standard for understanding human nature writ large? How can Patañjalian analysis of mind be a mere subject of Indian spirituality and the psychoanalysis of Freud be a universal science? I argue here not against a comparative study. Things or concepts are cognized by comparing or contrasting, and there is nothing intrinsically wrong with that. The only problem is, how can a hermeneutical stage grounded on misconception and institutionalized with the purpose of protecting some and subjugating or even erasing others, ever provide a platform for a meaningful dialogue? Be it the comparative study initiated by William Jones who compares Gautama with Aristotle, Jaimini with Socrates, Vyāsa with Plato, and Kapila with Pythagoras (Sugirtharajah 2003, 15), or that of Max Müller when he compares Vedānta to ancient Greek philosophies, or of Paul Hacker who compares Vedānta to Neo-Platonism and reflects upon Hindu ethics in light of Schopenhauer (Halbfass 1995, 211-226 & 273-318), an ardent desire to overpower and subordinate the other is vivid.[5] Comparison could be one of the superb means of cognition. Even the Naiyāyikas from classical India defended analogy (*upamāna*) as one of the instruments of valid cognition (*pramānas*). If analogy can give valid cognition, why not apply the same method in contemporary times? Comparision can enhance our knowledge only when what we are comparing (the objects) are not the figments of our own imagination, and we are willing to go one step further and erase our ego from the meta-gaze while witnessing the world-events.

There are two sets of arguments that have been developed thus far in this meditation on the limits and possibilities of cultural studies. First, a positive hermeneutics free from an agenda to violate the other[6] can emerge with the premise of the intrinsic value of the 'other.' There is not just a tendency to absorb the Orient in the writings of Whitehead, Alan Watts, or Ken Wilber, but there is also the emergence of a new kind of recognition of the value of reading texts and traditions on their own terms. We may have to wait for the perfect example of this new paradigm, but the samples we have already before, suggest that South Asian studies will not simply remain 'ghetto studies' but

will penetrate the center of our hermeneutical consciousness and thereby reshape various disciplines in the future. It remains critical that the binaries of 'self' and 'other', of 'rational' and 'irrational,' and other such comparisons made to establish rationality, will inevitably reflect problematic hermeneutical assumptions.[7]

The second argument developed in this essay is that the very proposition of recognizing reality within the framework of a binary between the self and other is itself inevitably faulty. All the problems stemming from these models can be resolved if and only if the binary of the subject and object is viewed as subsidiary to reality itself, and is thus an unreliable means of knowledge that leads sometimes closer to knowing the entity but always fails in the end to represent the truth itself. When the yardstick of comparison is based on the self and the other with an underlying conviction that the other is always inferior to the self, there is a violation of the basic norms for cultural dialogue. Just as any Indian can relish *Romeo and Juliet*, emancipating the reader-subject from its original geopolitical boundaries, so can a Western reader enjoy Śākuntala and not locate it only in one cultural setting. Sometimes, we have a surplus of cultural imaginations, and the erasure of the self from discourse will ensure a real aesthetic pleasure or an intellectual insight that the cultural divides do not allow. The real radicality of hermeneutics—borrowing here from Caputo—comes with this erasure of subjectivity. This is not simply about subjects finding reality 'out there' in terms of objects cum objects, but rather in subjects bracketing their own subjectivity and giving space within themselves for the presence of the other.

We see the signs of this cognitive superimposition nearly immediately when we turn to the writings of the leading (mostly European) Indologists. Jacobi, for instance, maintains that there was a 'philosophy' in India and *ānvīksikī* is his applicable term while Hacker rejects this perception (Ganeri 2002, 359), saying that Indians had philosophical thought but did not have a term to denote it. Other Indologists question the application of specific terms such as *darśana* to denote philosophy.[8] What is amusing is that these scholars are looking for a term in India that stands for the dictionary definition of philosophy as it is known in the West. The flaw here is not that these scholars can be superseded by a new scholarship. The problem, rather, lies in Eurocentrism and the so-called 'enlightened' and 'rational' subject reading the subordinated other.

Let me further point out the persistence of this tendency in contemporary scholarship. Halbfass, for instance, writes, "[Systems other than the Western traditions,]... in spite of all analogies, are ultimately not philosophical traditions" (Halbfass 1988, 433). Moreover, he concludes [F]or the time being there is no escape from the global network of "Europeanization" (Halbfass, 441-442). He concludes that "Modern Indian thought finds itself in a historical context created by Europe, and it has difficulties speaking for itself. Even in its self-representation and self-assertion, it speaks to a large extent in a European idiom" (Halbfass, 375).

As one can see, Halbfass's conclusions are not categorically different from what the early Indologists observed. Truth be told, Halbfass is correct in stating that the modern self-discovery of India is first the discovery of the European self in India, rather than finding its own subjectivity. At the culmination of the colonial project, subjects discover their identity not by means of self-recognition but by recognizing the other and construing the self in relation to the other. As one can see, Halbfass first assumes philosophy as categorically European and concludes that the concept of philosophy for Hindus is a tool, not only of "Westernization" but also of self-affirmation against the West (Halbfass 263). Embracing Heidegger's argument, Halbfass claims that there is no escape from Europeanization.[9] That is, the only way non-Europe can have self-reflection and theorization of individual and collective experiences is only through the European gaze. I am not bringing these arguments to critique Halbfass but only to relate the past with the present, the foundation of colonial studies and its culmination. Contemporary epistemologies illustrate that our experience is ecologically grounded, and our cognition is constructed in relation to its surroundings. A rational way to recognize reality begs one to go beyond what is given to experience and seek truth beneath it. Cultural studies, on the contrary, are founded on fictional subjects uncovering the fictional others. As a consequence, we have bracketed human experiences, whether these are secular or religious, and framed them in terms of the other.

This tendency has allowed for the marginalization of the study of philosophy emerging from non-Western cultures. Even when such studies have been generated, the categories explored have typically been shaped by Western hegemonic agendas. And the disciplines that are found more fruitful for the expansion of the Western agenda have remained more prominent in academe than those that have served others' goals. The demise of philology is one such example.[10] Rather than initiating a dialogue, this has consequently resulted in creating a fabricated discourse

with an imagined other.

Now the question remains, is it possible to move beyond appropriation and subordination when reading other cultures? Can cultures be studied and not fancied? These need to be answered, if there is any future to the disciplines that have emerged in our times. Halbfass concludes, "Concerning the semantic relation of *darśana* and 'philosophy' and the applicability of the European word 'philosophy' to the Indian tradition of thought, I agree completely with Mohanty that there is no justification for a puristic and Eurocentric restriction of the scope of philosophy and for an exclusion of India from the historiography of philosophy."[11]

Utilization of such categories differs from merely an unconscious or prejudiced appropriation of knowledge in that there is an awareness of the application of categories, and unease in its lack of congruity. What this means is that human intentionality must be at the center of both judgment and action, and as long as a correction is not made in the basic level of intentionality, then our effort to learn and transform ourselves and the world will result only in cultivating interpretive methods and products that inevitably lead to *duhkha*. A refined and noble intentionality ought to be the foundation of what we learn and what we produce from our learning. I am reading Śankara or Dharmakīrti or Abhinava in this context not to affirm or reject their esoteric wisdom, but only to borrow from a shared epistemology that grounds experience in a cognitive state transcendent to the binary of subject and object. This, I believe, can give a model for an understanding beyond cultural and linguistic constructions. I also argue that this model can help one cultivate awareness by problematizing one's own subjective horizons.

Śankara, for instance, lays out the foundation for studying Vedānta, an argument that can be expanded to make a claim that subjects need to cultivate themselves in order to experience something outside their misconceptions. Additionally, he expects that the subject has control over his personal inclinations and is capable of bracketing himself from the discourse. Reality cannot be experienced, according to Śankara, while preserving the ego. He argues that recognizing the truth leads to a dismantling of ego and thereby a removal of ignorance and its effect, which is the root cause of the the perception of ontological difference between self and other. If applied in the context of cultural studies, Śankara would argue that one cannot make an attempt to know something upon the premise of the self and the other, for when true insight arises, the binary of self and other disappears. This is not just the epistemology of Śankara. Dharmakīrtian epistemology also rests on the assumption that realization in itself is non-dual, only manifest in terms of subject and object due to misconception.

Ideas cannot be the domain of a particular culture, as they have a tendency to be universal. The colonial attitude that human inspiration and ingenuity can be labelled as 'ours' versus 'theirs' fails to acknowledge this universal thrust of the truth. Reality cannot be the victim of violence and subordination, as it is self-aware and self-effulgent. Rather than discovering the truth that embraces all humanity, the colonial tendency has bracketed human angsts and aspirations within time and space or within race and gender, and as a consequence, has engendered misconceptions about the value of cultural studies. This, in my opinion, rests on a faulty epistemology of knowing the other by representing the other. What has been ignored in this epistemic paradigm is a natural process of the fusion of the cognizing subject with what is being cognized, a real fusion of the epistemic horizon. If we read Hegel, Nietzsche, or Whitehead, or from India the thinkers such as Tagore, Aurobindo, or Radhakrishnan, there is a clear flow of ideas from East to West or from West to East. Ideas are like medicine and one should use it based on their efficacy and not on their origins. Too often the ideas we are cultivating through various forms of cultural studies are causing the cultural body to collapse, penetrating to the host-bodies like parasites and consuming their life-energy from within.

The result of this parasitic hermeneutics is little more than the promotion of European ideas to the non-West. I am rather more interested in seeing comparative studies transcend the realm of colonially-produced binaries and authentically engage the actual thoughts of non-colonialist cultures in order to give rise to a nuanced, sophisticated global philosophy, one capable of guiding humanity through the 21st century and beyond.

Heidegger claimed that we cannot escape 'Europeanization.' I ask, Do the studies under the guise of phenomenology serve the same purpose?[12] Mohanty posits: "[O]riginal Vedānta is phenomenological, later Vedānta is metaphysical" (Mohanty 1993, 253). In his opinion, "Vedānta's 'Brahman' is rather the transcendental subjectivity of Kant or Husserl than the all-inclusive Absolute of Hegel or Bradley" (Mohanty 1993, 253). Bina Gupta argues that phenomenology "leads us to a point where linguistic and interpretive differences, though recognized, are

transcended" (Gupta 1998, xii). What we see through these respected scholars is not the tendencies of the West reading the non-West, but rather of the non-West internalizing the West's categories into its own self-understanding. Self-recognition, in these settings, can only be validated by the internalization of foreign categories, and this validating process is not possible without reframing one's mode of thinking within the framework of the other. This, of course, is one, perhaps even clandestine, mechanism of colonialist subjugation.

It would be a mispresentation if I fail to point out that these appropriations have not simply been the servants of colonial agendas. The phenomenological view of Advaita, for instance, could be considered an example of the kind of dialogue I herein promote, even if the resonance of Eurocentrism, with its reframing of Buddhist or Vedanta discourse to suit a particular reading of philosophy in Europe.[13] The truth is that the scholars who have asssigned Indian thought to phenomenology have failed to clarify their position of Vedanta or Buddhism through the means of post-phenomenological reflection. I ask this, Can these disciplines be reduced to a stream of phenomenology? Is this what the 'fusion of horizons' looks like?

The only positive remark I have regarding Indological phenomenology is that it is at least a mimicry or replication of the design of dialogue. When phenomenology does not lead to the reduction of one stream of thought even before the dialogue occurs, then this interpretive trend has the potential to engender new streams of thought and new philosophies for the future. Indological phenomenologists can also compare ideas, not in the sense of identity but as affinity (see, for example, Lusthaus 2002, 13). And if the studies of Indian philosophies are not with an intent to reduce the oriental thoughts to a particular stream of European thinking, or not to appropriate ideas, then this reading in the light of affinity has the potential to facilitate an actual understanding of the non-West.

Working in non-Western philosophy is itself an attempt to defy the parameters of colonial discourse. Heidegger, for instance, claims that 'Western philosophy' is a tautology, because philosophy is 'Western', or even more precisely, 'European.'[14] Rather than opening a dialogue with the non-West, the mainstream West has thus closed herself, engaging in a pseudo-dialogue rather than the quest for an inter-subjective discourse, a real dialogue. As Halbfass argues, this self-enclosed tendency remains problematic. His statement in terms of appropriating Vedānta by measuring its categories in light of Western ideas is remarkable: "[S]uch comparisons which try to demonstrate the superiority of the Vedānta by measuring it against foreign, Western standards also testify to the continuing authority of these standards" (Halbfass 1988, 308).

It needs to be observed that the trend of reading the non-West in order to expand Western ideas, rather than expanding human understanding by going beyond geo-political parameters is not restricted to Western scholars alone. According to J. L. Mehta, "[F]or all non-Western civilizations, Heidegger's thinking brings hope", as he believes that Heidegger is an "untimely *Rishi* in this time of need".[15] Mehta describes the process of realization as not innocently spiritual, but that which involves the growing ascendancy of reason over imagination, of Occident over Orient.[16] What we learn from these examples is that the study of cultures in the platform where a part of humanity is posed as a binary to the other, no real comprehension is possible. This is not the case that the construction of the Orient is not cherished by some in the 'Orient.' The argument is, this encapsulation of human consciousness to some ethnic or geopolitical boundary has only caused in marginalization, subordination, and a consequential displacement.

The writers addressed above are ready to sacrifice several traditions and central components of a particular Indian philosophy in order to appropriate it so that it fits with Western thought, specifically, phenomenology. This is even more vivid if we examine religious studies, with primarily the Protestant categories being framed for comprehending religions. The mechanism in which Christianity functions, such as the beliefs in the Holy Book, a Prophet, Sin and Redemption, just to name a few, becomes the measuring stick for reading other cultures and philosophies within the rubric of religion, be it Jainism or the indigenous traditions.

Contemporary studies in Western settings or their replication in non-Western academe has helped the West to impose its categories on the non-West, as examplified above. Had the beginning been grounded on exploring the parameters of human understanding, cross-cultural studies could have had positive results. Had our concerns been primarily oriented to listen and learn, rather than convince and proselytize, we could have gained ground. What Russell wrote some sixty years ago, "The Western reader wishes to know what influence Greek philosophy had on

Buddhism, the more so as Buddhist art suffered a powerful Hellenic influence,"[17] is what remains as the guiding principle for cultural studies even today. The foundation for studies of the non-West has been so sancrosanct, and the building blocks just the walls of deception, that squeezing the truth out of these studies is harder than quenching thirst by pressing sand.

What we learn from these historical observations is that cultural studies have emerged in faulty parameters. A lack of awareness of this flawed paradigm leads not just to the subversion of cultural categories or the displacement of indigenous perspectives, but it also threatens the very life of the cultures being studied. This, however, is not an argument that a genuine quest for knowledge is not possible. It is only that the faulty epistemology cannot lead to knowing the truth. A correct approach, I argue in the following lines, stems from dismantling the superimposed binaries. Plain and simple, it is not necessary for a reader to affirm his Western identity when reading the non-West, and vice versa. It is detrimental to experiencing reality, being empathically connected to human experiences, when the subjects create walls to shield themselves from what is being read. Rather than appropriating oneself as a reporter, the correct approach for scholars is to empathize with the way it feels to undergo the depicted circumstances, or to transform one's own experiencial horizon.

Several proposals have emerged in this perplexing hermeneutic ground. The solipsistic model of the impossibility of knowing the other's being, the proposed sympathetic gaze towards the other, the 'fusion of horizon' applied in a different context where 'self' and 'other' can have a dialogue, all have their limitations. A real recognition of the other comes at the time when the self is already transformed. The binary of self and other, a cognitive barrier that keeps the experiencing subject aloof from the life-events that he studies, is not one of the hermeneutic models that deserves a rescue. Putting the subject in crisis, as Caputo would say, is what allows the truth to unfold. When an ethnographer brackets his own subjectivity from the gaze, the anxieties or joys of the subjects he is studying become his own anxiety and joy. If understanding something is not about appropriating something, there is a future for these studies and also hope for the discipline of the Humanities. It is better to have a sip of tea and feel its bitterness than to observe a tea ceremony and write one million reports.

## DISMANTLING THE BINARIES

The argument of this paper is that when we really desire to understand what a thing, person, or culture is in its respective, solitary actuality, then we have to be willing to penetrate beneath the sphere of ego and dismantle those fictitious identities that reside in unilateral systems of discourse. Education is transformational in the sense that we become what we know. Moreover, what it is that we know through the educational process is via the system of signs that are encoded into our consciousness during the period educational training. In the west, such knowledge has long-since been grounded in dualistic epistemic presuppositions. What this has meant is that the majority of Indologists have tended to view 'India' through a pre-coded consciousness capable of engaging the world through the lens of 'A' and 'Not-A.' True understanding requires a meta-gaze that gives a direct encounter with the truth and not some intervening fiction.

Following the dualistic epistemology applied in cultural studies, understanding stems from the recognition that 'I' can never know the mental state of the other, and in this sense, the other is doomed to be represented. What is ignored through such an assumption is that 'self' is irreducibly relational, constructed in dialogue with the other. Therefore, the genuine consideration of other selves is as crucial to constructing the self as is the self required for the recognition of the other. It is given that the 'other' is not experienced the same way as is the self: "[T]his is exactly this not-knowability that constitutes the other as such. The other's appearing as other is constituted by non-appearing" (Caputo 2000, 41). What has been problematic, though, is the construction of a too-often *duhkha*-engendering hermeneutic breach between those studying and those being studied. Gadamar appeals for putting one's own horizon at risk, while the aforementioned tendencies reject even the engagement of the other horizon. According to Caputo, Derrida himself demands the same. Caputo writes, "[P]utting one's own meaning and self at risk, indeed one's own home, is the only way to let the other come, but one would let the other break into what is our 'own', which means that for Derrida the other would breach, not fuse with our horizons" (Caputo 2000, 42).

This is not about re-presenting the other. It is not even about presenting that other. This is about experiencing

the pure being, the being shared by the self and the other. Recognizing reality does not constitute a polarity. It is this fabrication of the polar opposites that constitutes the epistemic problem. As I have stated in the beginning of this paper, this is due, not to some lack in the structure of hermeneutics, but the shortcomings of its practitioners. The solution is simple: Instead of observing how the witch-doctors in Indonesia or India perform healing rituals, give some medicine to the ailing patients, save some lives, and experience for once that you are just another fellow human being. You will feel even better if you do not trade your medicine for the faith of the native.

Proposing to place the cultural self into crisis, Blanchot states:

"We must give up trying to know those to whom we are linked by something essential; by this I mean we must greet them in the relation with the unknown in which they greet us as well, in our estrangement" (Blanchot 1997, 291)

Just as there is nothing mystical in Blanchot's call for questioning the subject, we can read Nāgārjuna, Śankara or Abhinava the same way. The project of cultural studies cannot be founded upon the premise of subverting indigenous worldviews, converting the natives to the mainstream religious practices, insubordinating native experience, and imposing Western beliefs and values. This can be achieved only when a scholar is willing to relinquish his own perspectives and presuppositions when studying a foreign culture.

The discourse that is possible from the ground of 'not-knowability' not only presupposes the existence of the other, but also expects an acknowledgement that the 'other' is capable of speaking for himself. Caputo writes, "From the depths of a 'common strangeness' we concede that we do not know each other, and that, because of this, we can only speak *to* each other, not *about* each other" (Caputo 2000, 60).

One can argue, what kind of dialogue will this initiate if the very self itself is brought into crisis? The response is simple: it is not a total abnegation of the center of experience, but of its presuppositions with regard to both the self and the other. To condition reality by power, arguing that there is no truth but conditions constituted by power, is tantamount to blocking the sunlight and saying that there is no sunrise. We can sit together and read Hegel and Śankara, or read Augustine and Abhinava, and not reduce their thoughts to a specific culture and time. Rather than anthropologizing the thoughts of Gandhi, we could have implemented them to resolve the Gaza problem. Bracketing human experiences to a particular culture and using them as ethnographic examples, the major premise of ethnic studies, should not come at the cost of our univesal human nature.

Two premises make these studies irrelevant: one, a culturally conditioned subject wanting to study another culture in itself is problematic; and two, the epistemic paradigm that reduces the truth to perspectives and makes all the perspectives equal makes the quest for truth by means of 'studies' irrelevant. As I have argued above, the real conversation is embedded with the self, an intrinsic nature of being, and this is expressed in terms of *paśyantī* that confirms the internal dialogue that is a requirement for an external conversation. *Paśyantī* explains the dialogical nature of reality. Along the same lines, the concept of *pratibhā* or intuitive or reflexive awareness, a meta-gaze, also gives us a path. Coward explains *pratibhā* as "unitary intuition" (Coward 1976, 43), interpreting it as "the intuitive flashlike understanding of the sentence-meaning as a whole" (Coward 1976, 44). This, according to Bhartrihari, is the state in which meaning can be revealed. The concept of *pratibhā* explains that recognition of the reality occurs in the ground where the dichotomy has been dissolved. The concept of *paśyantī* describes the level of awareness where "the limiting forms of manifested speech have been transcended and the final omniscient vision is achieved" (Coward 1976, 47). Recognition, following both of these concepts, is a process that unites the binaries wherein awareness divided into the forms of subject and object dissolves. This coincides with the way that language manifests from a unitary self-awareness to the ground of word and meaning.

The hermeneutic models that rest on difference or identity are thus both faulty. Truth is not experienced in relation: it is the manifestation of the thing-in-itself, the pure being. This manifestation is conditioned every time it is cognized in relation. This relational representation of the truth has epistemic limitations and what we have seen in the modes of Indian studies are just examples to demonstrate how the epistemic ground of recognizing something by maintaining difference is flawed. In essence, a hermeneutic shift is required whereby the self is willing to sacrifice its ego-bound identity and penetrate the objects, or experience other subjets the way they would experience themselves. This would not only help us evolve as empathetic beings but would also give us better insight into our own surroundings.

**NOTES**

1. With this, I am deviating from the model of hermeneutics of the 'care for the other.' There are several writings along these lines. I am directly referring to Abeysekara 2004, 973-1001.
2. The statement of Zaehner that Indian philosophy is 'platonic madness and ecstasy' resonates Hegel's statement (See Ganeri 2002, 376).
3. Hegel goes further: "Deceit and cunning are the fundamental characteristics of the Hindoo. Cheating, stealing, robbing, murdering are with him habitual . . . the Brahmins are especially immoral" (Hegel 1956, 158).
4. For Max Müller, Vedanta remains the primitive religion of the Brahmans. See Müller 1926. One can also note the subtitle of Müller's text, '*So Far as it Illustrates the Primitive Religion of the Brahmans.'* He says with regard to the Vedic literature that it is "full of the most artificial conceptions, the lucubrations rather of conceited dreamers than of simple and original thinkers" (1926, 299).
5. Müller compares Greek *logos* with Vedāntic 'name' and 'form' and the Vedāntic *sat* with '*substentia*' of Spinoza. See Müller 1911.
6. The argument is, cross-cultural studies have been initiated with intents to uproot the cultures being studied. For discussion, see Dallmayr 1996, 107.
7. For a discussion on rationality in Indian thought, see Ganeri 2009.
8. The comparative approach to early studies is explicit in Müller 1998.
9. For an analysis of the Indological studies of Hacker and Halbfass, see Franco and Preisendanz 1997.
10. This has been observed in Frauwallner 1973, xlvii.
11. Halbfass in Franco and Preisandanz 1997, 307. For problematizing the category of 'Indology,' see ibid. 156, 165, 306. The issue of translating philosophical categories is further problematic. For some examples, see Ingalls 1951; Matilal 1984, 231-252; Matilal 1985, 319-332, 356-57; Potter 1991; Halbfass 1992.
12. For a select examples of the phenomenological approach to Indian philosophies, see Sinha 1983; Gupta 1998; and Lusthaus 2002.
13. "These 'translations' or 'substitutions' should not be taken as a claim that Yogācāra as such and Phenomenology are interchangeable or nearly reducible to each other, such that one entire system, or even a constellation of concepts and terms from one system can be carried over into the other painlessly and without shedding a drop of doctrinal blood" (Lusthaus 2002, 12).
14. 'The often-heard expression 'Western-European philosophy' is, in truth, a tautology. Why? Because philosophy is Greek in nature; Greek, in this instance, means that in origin the nature of philosophy is of such a kind that it first laid claim to the Greek world (*Griechentum*), and only it, in order to unfold'. Martin Heidegger, quoted in King 1999b, 27.
15. Quoted in Dallmayr 1996, 92.
16. Ibid, 95.
17. Bertrand Russell in a review of Radhakrishnan's first volume of *Indian Philosophy.* Quoted in Ganeri 2002, 433.

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**History**

# COLONIAL AGENDA OF CENSUS IN INDIA

***Dr. Chander Pal Singh****
***Dr. Pradeep Kumar*****

**ABSTRACT**

*Indian census have been the basis of partition of India (1947), linguistic reorganization of the states (1956), identification of the scheduled castes and the scheduled tribes (1935) and later the 'other backward castes' by the Mandal Commission. Indian census has origins in the colonial past originally established with a view to strengthen British control over Indian colony rather than to improve the administration. British used the census to create new identities and divisions in society to counter the emerging nationalism. Their basic purpose of dividing the people on sectarian lines was meant to pursue their policy of divide and rule so that they could perpetuate their colonial rule in India. The British administrators encouraged divisive policies rooted in census data and findings to institutionalize the divisions amongst the people in India*

**Keywords:** British India, caste, census, depressed classes, enumeration, religion, Risely.

## INTRODUCTION

The Indian census, decennial in nature and a gigantic nationwide administrative exercise, is not a mere head count but has far-reaching political, economic and social implications which go much beyond demographic data. Census figures have been the basis of partition of India (1947), linguistic reorganization of the states (1956), identification of the scheduled castes and the scheduled tribes (1935) and later the '*other backward castes'* by the Mandal Commission.

Like most of the institutions in modern India, census too has origins in the colonial past originally established with a view to strengthen British control over her colony rather than to improve the administration. British used the innocuous looking census to create new identities and divisions in society to counter the emerging nationalism. Though the tide of nationalism could not be stopped from ousting British from India, still the disintegrating tendencies sowed through instruments like census have and are still taking their toll as shown by the recent clamor for a 'caste census'.

## EARLY HISTORY OF CENSUS IN BRITISH INDIA

Census started in Britain in 1801. Soon after, British Parliament expressed their wish to start census operations in their largest colony, India. From 1801 census of Banaras till 1850, about 30 minor censuses were conducted on regional basis with the purpose of collecting information for tax fixation and collection, preparing rolls of males eligible for army recruitment, social and geographical conditions. In 1849, provinces were ordered to forward population figures every five yearly period. Under this scheme censuses were held in North West province (1852-53, 1865), Madras (1851-52, 1855-56, 1861-62, 1865-66), Punjab (1855), Baroda (1855), Mysore (1855), Hyderabad (1855), and Central Provinces (1865).

In 1856, Court of Directors directed the East India Company to hold regular decennial censuses on all-India basis (*Court Despatch*, 1856). But due to the outburst of Revolt of 1857 the scheme was postponed. Decennial

***Dr. Chander Pal Singh** is Assistant Professor(History) at Mewar University, Gangrar, Chittorgarh, Rajasthan. He is author of several books.
****Dr. Pradeep Kumar** is Deputy Director, Mewar University, Gangrar, Chittorgarh, Rajasthan.

scheme was revived in 1871. But the censuses conducted were not held simultaneously (Bengal: 1866; Madras: 1871-72; Bombay: 1871, NWP: 1872; Kochin: 1875). Also the classification and categorization was not uniform in different provinces due to which information collected could not be correlated. These lacunae were corrected in 1881, and from then onwards, decennial census is being regularly held in India.

## COLONIAL NATURE OF CENSUS IN BRITISH INDIA

Indian census had its precedent in the British Census but the objectives were completely different in the colony. The census in Britain was primarily concerned with demographic and economic issues, while, from its very beginning, the Indian census's perspective was ethnic and racial. Indian census machinery was most concerned about collecting information about caste, race, religion and sects. Information gathered from this perspective helped the British to project Indian society as separable social groups with no unifying principle. Thus the census which had started as a quest for information soon became an instrument of the imperial policy. It reflected the official mind because information from the census became the basis of government policies. Census represented the British approach towards Indian social diversity as well as emerging national consciousness.

After the great rebellion of 1857, great fear of the British was the possibility of various sections of Indian society coming together again. But the fact that they had been able to quell the revolt with the help of Indians motivated them to identify potential divisions in the Indian society. For example, high castes who had supplied the rebellious troops needed to be counterbalanced by patronizing the relatively backward communities. In the following decades, the Empire embarked on large scale information gathering projects to understand the complexities of Indian society through such means as Census surveys, Gazetteers, and Ethnographic Surveys. Moreover 'the census existed not merely as a passive recorder of data but as a catalyst for change as it both described and altered its environment.'

The process of categorization and classification of social categories into religions, sects, castes, and tribes led to the beginning of formation of new identities resulting in far-reaching consequences. Census became the medium of introducing new groups like Sikhs, depressed classes, anti-Brahmanism, and tribes. By giving a numerical attribute to the relative size, material conditions, literacy, occupation etc, the census projected different social and religious categories in a competitive and comparative light. As a result, communal feelings flared up. Caste consciousness, which should have mitigated due to the growth of education and the introduction of new means of transport and communication, was heightened. Census sought to transform the caste from a collaborative and complementary phenomenon into a competitive phenomenon. Also the census stereotyped the perceptions of colonial administrator-scholars like W.W. Hunter, Alfred Lyall, H.H. Risely, about the Indian society by accepting them as gospel truths and by imparting them an empirical shape.

Census categorization and enumeration played a key role when representational politics of a selective kind was introduced through constitutional reforms, culminating in separate communal electorates in 1909. Census identified new categories and interests. Constitutional reforms provided them political identity. Thus within the framework of representative politics, British were able to institutionalize divisive forces which were later incorporated into body politic of the political system of independent India.

## CASTE-BASED ENUMERATION

Pre-1857 British understanding about the caste was derived from Missionaries and Orientalist scholars. While the former saw it as barbaric and later regarded it in appreciative terms, the sources of knowledge of both groups were ancient scriptures. Castes were seen as static, following separate social rules and enjoying fixed categories. 1857 revolt showed that British had not understood Indian society properly. Hence in place of scriptural, empirical approach was adopted.

Caste enumeration started in 1871 census but was found to be very confusing. W.C. Plowden, Census Commissioner of N.W.P. (1872) remarked: "The whole question of caste is so confused, and the difficulty of securing correct returns on this subject is so great, that I hope on another occasion no attempt will be made to obtain information as to the castes and tribe of the population." But in 1881, in spite of the practical problems involved,

Plowden, now the Census Commissioner of India, laid down a plan for further research into the large caste units (with population more than 100000). An attempt was also made initially to classify the castes on the basis of social position but was later abandoned on account of great difficulty of the criteria to be adopted. But still many petitions were received from representatives of different castes and we see for the first time the phenomenon of caste associations emerged.

Census 1891 is significant as race (Aryan and non-Aryan) was regarded as the basis of the caste system. This census hence signaled the adoption of 19th century race theories. J.A. Baines, the Census Commissioner, explicitly declared that social system of India was antipathetic to the formation of an idea of nationality: "It is well to begin by clearing out of the way the nation that in the Indian population there is any of the cohesive elements that is implied in the term nationality. There is, indeed, an influence peculiar to the country, but it is averse to nationality, and tends rather towards detachment without independence." It is hardly accidental that Baines was writing these words a few years after the formation of Indian National Congress.

Assumption of racial basis of the diversity of Indian social life and caste as antidote to nationalism found its full fledged expression under H.H. Risely, the Census Commissioner of 1901Census. Risely had been conducting ethnographical studies since 1886. Using anthropometrical methods, he attempted to prove the biracial theory of Indian castes. His objective was to separate the lower castes (non-Aryan origins) from the upper castes (of Aryan origins), in another sense, to arbitrarily detach the lower castes from the general body of the Hindu society. Risely was a vigorous proponent of the notion that castes can perpetuate the colonial rule in India: "So long as a regime of caste persists, it is difficult to see how the sentiment of unity and solidarity can perpetuate and inspire all classes of the community." In the 1901 Census, Risely classified the castes on the basis of social precedence, leading to intense social tensions among various castes. Numerous caste Associations were formed; each asking for a higher place in the caste hierarchy published in the Census reports. Census was thus stereotyping a social structure in which actually, continuous positional changes were taking place and which were in a state of dynamic equilibrium.

Risely justified despotic rule in a caste- based society. He wrote, "Anarchy is the peculiar peril of a society that is organized on the basis of caste, and the dread of anarchy lead to monarchy as the strongest defense against it." Regarding the future of Indian democracy, he prophesied, "Caste would provide the party in power, the party that had spoils to divide."

During the official discussions leading to Minto-Morely Reforms of 1909, Risely (now Home Secretary) was arguing against territorial representation and parliamentary form of government for India. He insisted on a representation of communities and interests in place of territorial representation in keeping with the structure of Indian society as he saw it. He took up the side of Muslim League which was formed with the express purpose of preventing the Hindu majority in future legislature. Risely successfully opposed Secretary of State Morley's proposal of 'territorial representation by means of electoral colleges' and was able to convince the decisions makers that 'separate electorate' would serve the imperial purpose.

Census introduced a central polarization into higher caste and lower caste. By 1911, lowest castes were termed as 'depressed classes'. An attempt was made in 1910 to enumerate them separately from Hindus but was withdrawn due to stiff protest by nationalists. Two-fold objective behind this move was to reduce the number of Hindus and to politicize a dichotomy between caste Hindus and untouchables. British achieved their objectives in the later censuses and caused further fragmentation of Indian society. 'Depressed classes' included 'untouchable castes', 'animist castes or tribes', 'aboriginal and hill tribes' and 'criminal castes'. Since 1936, they are called Scheduled Castes and Scheduled Tribes. Question of including or excluding untouchables in Hindu category originated in 1868 Punjab Census report. In 1872, Bengal Census Commissioner Mr. Braverly remarked: "It is difficult to say where the line should be drawn which is to separate up pure Hindoos from the low castes which have adopted some or other form of Hindooism..."

## RELIGION

Census reports provided a new conceptualization of religion as a community, an aggregate of individuals united by a formal definition and given characteristics based on collected data. Religion as fundamental category provided

ample opportunity on further classification along economic and demographic lines which led to competition among followers of different religions for jobs and opportunities. The act of defining and categorizing, though necessary for the purpose of census administration, was designed in such a way as to hurt and divide the Hinduism which was emerging as the bulwark of nationalism. Hinduism with its immense inbuilt diversity could not be treated at par with book- based religions such as Islam and Christianity.

J.A. Bains, Census Commissioner for 1891 census defined Hinduism as "the large residuum that is not Sikh, or Jain or Buddhist, or professionally Animist, or included in any of the foreign religions such as Islam, Mazdaism, Christianity, or Herbruism". Bains further concluded that "Thus limited, a more applicable title for it would be Brahmanism" A decade earlier Ibbetson in Punjab Census report had declared: "All natives who are not Musalmans, Christian, Jains, Sikhs, or Buddhists, are Hindus." Gradually, different belief systems in the Hinduism were given separate identities.

Sikhs were given separate religious identity in 1868 Census. In 1855 Census, they were enumerated as Hindus. Jains and Buddhists were separated in 1871. In 1869 NWP Census, they were placed in the Hindu category. Sects were projected as different from the mother religion. Arya Samaj in 1881 was treated as sect but treated as separate religious category in 1891. Brahmons and Kabir Panthis in 1871 as Hindus, but in 1881 as separate religions. Subsequently, in the various censuses, the number of religions was as follows: 1871 Census: 5 religious categories, 1881 Census: 15 religious categories, 1891: 9 religious categories, 1901: 10 religious categories. A new category, 'animist', introduced in 1891, was derived from Dr. Tiller's research in America on Hawaiian tribes published in 1889. This category was continuously expanded to include forest and hill tribes to be counted outside the definition of Hinduism. Thus, religious enumeration of people eventually paved the way for the colonial government to introduce various sets of divisions and cleavages in the Hindu society.

## CONCLUSION

The colonial census policy in India has truly been a policy of enumeration of natives more for their discomfiture than good. In the form of census operations, the British thought of digging deeper into the realms of Indian social system in order to find newer and unconventional methods of driving cleavages among the people in such a way that they remain a fragmented force. Thus, their basic purpose of dividing the people on sectarian lines may prove to be the best support for their policy of divide and rule so that they could perpetuate their rule in India without any obstacles or problem. In this regard, as and when the thrust of national movement gained strength, the colonial masters started taking more and more recourse to divisive policies rooted in census data and findings to institutionalize the divisions amongst the people in India.

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**Political Geography**

# GEOGRAPHICAL IMPORTANCE AND DOMINANCE OF SOUTH AFRICA IN SOUTHERN AFRICAN DEVELOPMENT COMMUNITY (SADC)

***Gayettri Dixit****

**ABSTRACT**

*South Africa is socially and economically most developed country in the African continent especially in the financial services, transport, infrastructure, manufacturing, agriculture and technological research. South Africa joined the Southern African Development Coordination Conference (SADCC) as founding member in 1980 . South Africa has greater control over the economies of neighboring countries in the SADC and also exercises hegemony within the region. It has demonstrated the main critical dimensions attributable to hegemon states, for instance, that of military, economic status, technology and infrastructure. The present study has argued that South Africa's hegemony is increasingly becoming benign rather than belligerent since the prevailing circumstances do not warrant the existence of the latter. The involvement of South Africa in the structures and its pioneering leadership inhibit the potential to exhibit the gross hegemonic behaviour. The paper argues evolution of South Africa into a benign hegemon within the SADC .*

**Keywords:** Export, hegemonic behaviour , Southern African Development Community(SADC).

## INTRODUCTION

To understand the importance and dominance of South Africa in SADC, it is essential to discuss the geographical location of South Africa which puts the country geo-politically in an advantageous position as compared to the other countries belonging to the same regional grouping. The Republic of South Africa is situated at the southern tip of the African continent. It occupies the area stretching from the Limpopo River in the north to Cape Agulhas in the south. South Africa stretches latitudinally between 22ºS-35ºS and longitudinally between17ºE-33ºE.[1] To the north, South Africa has common boundaries with Namibia to the north-west, The Republic of Botswana and Zimbabwe to the north, while the Republic of Mozambique and The Kingdom of Swaziland lie to the north-east. The Kingdom of Lesotho is the only country in African continent which is completely enclosed or surrounded by South African territory, lying within the eastern part of the Republic. The Tropic of Capricorn passes as far as latitude 34º51′S. The Republic covers a total area of 1,219,080 square kilometer (470,689 Square Miles).[2] The country's coastline covers some 2,968 kilometers. The southernmost point of Africa is Cape Agulhas, located in the Western Cape Province about 100 mi (161 km) southeast of the Cape of Good Hope in South Africa.[3]

South Africa's location has had a great influence on many aspects of its geography and development. Major resources of South Africa are mining, agriculture, food stuffing and energy. South Africa holds the world's largest reserves of manganese ores, chromium, platinum group metals, vanadium, gold and Alumina-Silicates. Mining is the single most important source of foreign exchange earnings and it provides more than 25% of all income earned by South Africa. In South Africa, the growth in real value-added by the mining sector decelerated steadily from 4% in 2003 to 2.75% in 2004 and 2.5 % in 2005. The downward trend in annual growth in the real value-added by the

***Dr. Gayettri Dixit** is a Doctoral Scholar at the Centre for African Studies, Jawaharlal Nehru University, New Delhi-110067. E-Mail: gayettridixit@gmail.com

mining sector reflected the lower output of gold and subdued growth in diamond, coal and platinum production.[4] The Witwatersrand Basin hosts considerable portion of the world's gold reserves, as well as uranium and silver. It yields around 96% of South Africa's gold output. The Bushveld Complex in the North West and Mpumalanga province contains more than half of the world's chrome ore and platinum group metals. It also contains ores of vanadium, iron, titanium, copper, nickel and fluorspar. The Transvaal System contains more than 80% of the world's manganese ores and also hosts large amounts of iron ore, while Mpumalanga and KwaZulu-provinces has extensive coal and anthracite deposits.[5] South Africa's diverse climate permits the cultivation of a wide range of crops, even though only 13% of the land surface is suitable for arable farming, owing largely to inadequate or erratic rainfall, and only 11% of the total land area, or 132,000 sq km. is under major crops. South Africa has a dual agricultural economy: a well-developed commercial sector and a predominantly subsistence-oriented sector in the traditionally settled rural areas. In monetary terms, agriculture's share in the economy has long since been outstripped by those of the mining and secondary industry. Corn, wheat, sugarcane, fruits, vegetables; beef, poultry, mutton, wool, dairy products etc. are major agriculture products of South Africa.

**Table 1 :GDP by kind of economic activity at current prices, South Africa, Million rand, 1980-2011**

| **Industrial Activity** | **YEAR** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** |
| Agriculture | 39 490 | 37 402 | 45 351 | 53 833 | 60 547 | 63 655 | 58 644 | 63 984 |
| Mining and Quarrying | 91 198 | 105 992 | 132 301 | 156 970 | 196 525 | 196 521 | 227 117 | 260 381 |
| Manufacturing | 243 967 | 259 101 | 274 502 | 304 438 | 340 623 | 331 702 | 332 470 | 357 756 |
| Electricity, Gas and Water | 30 176 | 33 010 | 36 946 | 41 783 | 45 902 | 60 402 | 71 403 | 78 532 |
| Construction | 32 039 | 38 558 | 46 158 | 56 908 | 72 221 | 86 522 | 102 801 | 120 420 |
| Wholesale and Retail Trade, Restaurants & hotels | 176 445 | 195 012 | 215 831 | 238 910 | 271 489 | 298 511 | 342 750 | 386 430 |
| Transport and Communication | 124 786 | 139 472 | 153 775 | 164 467 | 189 782 | 199 276 | 203 673 | 220 060 |
| Finance, Insurance, Real Estate and Business Activities | 261 285 | 295 504 | 339 311 | 405 520 | 438 629 | 464 846 | 522 048 | 565 224 |
| General Government Services | 190 563 | 208 561 | 230 116 | 259 802 | 298 704 | 338 903 | 385 307 | 434 224 |
| Other Services | 80 651 | 88 455 | 98 028 | 109 445 | 118 785 | 134 174 | 166 277 | 183 493 |
| **GDP at Factor Cost/Basic Prices** | **12,70,600** | **14,01,067** | **15,72,319** | **17,92,076** | **20,33,207** | **21,74,512** | **24,12,490** | **26,70,504** |
| Net Taxes on products | 144 673 | 170 015 | 195 103 | 224 109 | 229 295 | 223 643 | 248 944 | 293 757 |
| **GDP at Market/Purchasers Prices** | **1 415 273** | **1 571 082** | **1 767 422** | **2 016 185** | **2 262 502** | **2 398 155** | **2 661 434** | **2 964 261** |
| **(Source**: National Statistics Office, South Africa, September 2012) | | | | | | | | |

## SOUTH AFRICA'S RELATION WITH THE SADC COUNTRIES

South Africa is socially and economically most developed country in the African continent especially in the financial services, transport, infrastructure, manufacturing, agriculture and technological research. South Africa has greater control over the economies of neighboring countries, which includes the movement of travelers and freight. Over 62% transit traffic from land locked countries moves through SADC ports. The consequence of transport dependency for the SADC is more crucial than those of trade dependency. South Africa's mineral resources are outstanding in their quality, quantity and variety as compared to all other countries' natural resources.

A numbers of SADC countries share South Africa's transport network, manufacturing industry, labour market, scientific and technical expertise, as well as their capital resources.[6] Geographical location of southern region of South Africa is more sustainable for transportation infrastructure and it is well-developed and supports both domestic and regional needs. Long distance between harbors and inland urban centers necessitate a well-developed transport system. The country's transport system provides a reliable bulk trade link with the outside world for at least six land-locked countries in the region with other countries of the world. These are Botswana, Lesotho, Malawi, Swaziland, Zambia and Zimbabwe which make use of South Africa's transport system. The country's coastline covers some 2,968 kilometers of the subcontinent and has six major ports. Major shipping lanes pass along the South African coastline in the South Atlantic and Indian oceans. Approximately 96 % of the country's exports are conveyed by sea, and the seven commercial ports are the conduits for trade between South Africa and its southern African partners as well as hubs for traffic to and fro Europe, Asia, the Americas and the east and west coasts of Africa.[7]

The sub continental railway system is largely an extension of the South African grid. There are also pipe-lines conveying liquid cargo from Durban in South Africa and Beira in Mozambique to the interior. South African Airways (SAA) provide air services for the transportation of passengers, mainland cargo between the main business centers and SADC countries.[8] South Africa has the highest population growth rate in the world (3.1% a year) and the lowest average rate of economic development. Hundreds of migrant workers make their way to South Africa every year mainly from Lesotho, Mozambique, Malawi, Botswana, and Swaziland. In recent years more than 1.2 million migrant workers and daily commuters from neighbouring countries were legally employed in South Africa at any one time. Thousands more are unconventionally employed or self-employed in South Africa.[9] South Africa's national power utility, Eskom, provides more than 50% of the electricity generated on the entire continent of Africa and export electricity to all neighbouring countries. South Africa is a natural partner for power utilities in Southern and Central Africa in the establishment and operation of a power grid which will allow optimal utilization of the rich energy sources of the subcontinent through the import and export of electricity. Bulk supply agreement with utilities in Botswana, Lesotho, Mozambique, Namibia, Swaziland and Zimbabwe incorporate the principles of independent action, underpinned by coordinated planning of expansion and cooperation for the benefit of the entire region.[10] The largest water supply scheme ever undertaken in Africa is the Lesotho Highlands Water Project- a joint venture of the South African and Lesotho governments. The project will also be a source of electricity for Lesotho, which stands to benefit from income generated through the transfer of its surplus water to South Africa.[11] South Africa plays a significant role in supplying energy, relief aid, transport, communications and outward investment on the SADC country. South Africa's industrial production growth is well above the average for developing markets. South Africa's manufacturing and technological research and quality standards are world-renowned. The country has developed a number of leading technologies, particularly in the fields of energy and fuels, steel production, deep-level mining, telecommunications and information technology.

## DOMINANCE OF SOUTH AFRICA IN SADC

South Africa's dominant position in the region arises from the size, experiences and operational capability of its security force. The economic superiority is another reason for its dominant position in the Southern African region. There is no doubt that membership of South Africa in SADC is giving a major boost to regional integration efforts by enhancing the regional market. The most important factor determining the nature of Southern African regionalism is South Africa's absolute dominance of the region and how to manage that dominance. Typically, in South Africa exists a core area that serves as the hub for the activities of the functional region, which is united by lines of communication to lesser nodes of activity located in the hinterland. The core area generally dominates the hierarchy of nodes. Southern Africa may be viewed as a functional region defined by a rail transport system that extends from Cape Town as far north as Zaire.[12]

The spatial configuration of development of South Africa established by a particular blend of colonialism, capitalism and apartheid destabilization is characterized by intense inequality. In 1998, 73 % of the total GDP of SADC was produced in South Africa. Not surprisingly, therefore, South Africa dominates completely intra-regional trade. As a result of the Republic's relatively sophisticated manufacturing sector, it is in a very good position to export a wide variety of consumer and producer goods to a region that, with the exception of Zimbabwe, lacks

a developed industrial economy. Southern Africa's striking inequalities and South Africa's hegemonic position within the sub-continent highlight the need for regional integration to incorporate some form of redistributive and compensatory mechanism that favour the least developed. Clearly, the potential for conflict between those forces advocating affirmative action assisting underdeveloped countries and those advocating open regionalism based on comparative advantage is considerable.[13] South Africa has demonstrated a willingness to invest in the economies of other countries. The first, non-uniform trade regulations in the SADC countries in many cases proved to be a main stumbling obstruction for increased intra-regional trade. Second, the poor transport infrastructure in the region nullified the geographical benefits of the region. Third, the poor communication infrastructure is again a draw back and is affecting trade relations in the SADC region.[14]

## GEOPOLITICAL STRATEGY OF SOUTH AFRICA TOWARDS SADC

After the collapse of apartheid, South Africa wants to continue to hold a dominant position in the external trade of several Southern African countries. In the mid-1980s, trade with South Africa accounted for over 90% of the imports of Swaziland and Lesotho and more than 35% of their exports. South Africa was also the largest trading partner of Namibia, Zimbabwe and Botswana. The imposition of economic sanctions against South Africa had no effect on trade within SACU.[15] Post-apartheid South Africa involved in SADC, because South Africa wanted to explore its market in SADC and also wanted to secure its regional security and economic integration like SADC institution. Therefore, South Africa became member of SADC . In 1985, trade flows between South Africa and the SADC countries exceeded intra-SADC transactions by 4:1. It is estimated that in 1990, SADC members sent 30 % of their imports sourced in the Republic of South Africa. SADC members in SACU, the BLS countries and Namibia, make up a large proportion of this percentage. The SADC's export of merchandise and services to SADC destinations more than doubled between 1984 and 1987, underlining the importance of SADC market for South Africa's manufacturing industry. The constraints acting against any increase in regional trade are a lack of tradable goods and services, similarity, if not uniformity, of products and serious payment and foreign exchange problem in most SADC member states.[16] Although these relations came under strain during the period of conflict in the 1980s, the essential regionality of Southern Africa has remained intact. The programmes and policies of the SADC, as it then was, while aiming to reduce dependence on South Africa, "were premised on strengthening co-operation among member states, and the degree to which ties with South Africa were reduced was actually very modest."[17] The second reality is that Southern African regional economy is characterized by acute structural imbalances and great unevenness and disparities.

**Before Joining SADC:** In the beginning of the 1990s South Africa remained an important trading partner for all SADCC states except Angola and Tanzania. According to the Development Bank of South Africa (1990), South African imports dominated the markets of Lesotho and Swaziland (both 90 per cent) and Namibia (75 per cent), and were the single most important source of Malawi, Zambia and Zimbabwe. SADCC was not able to reduce its dependence on South Africa. In addition, Pretoria's policy of regional destabilization enforced SADCC's dependence on South Africa.[18] The SADCC being a new organization almost immediately faced opposition from various quarters. The greatest opposition came from the white minority regime of South Africa. This was quite expected because the white regime could not relish the idea of the black state of the Southern Africa trying to free themselves from its economic clutches.

Moreover, the establishment of the SADCC sought to nullify the efforts of the white minority regime of South Africa to launch arrival organization, the Constellation of Southern African States (CONSAS) which would have fortified the dependency relations between the black states and South Africa. Enraged by the establishment of the SADCC, South Africa launched a devastating campaign of military aggressions and economic and political destabilization in the region, targeted mainly at the region's transport facilities. South African troops occupied Southern Angola. South Africa encouraged, armed and supported rebel movements in Angola, Mozambique and elsewhere in the region; South African commandos were active in a terror campaign of murder and destruction in the neighbouring countries.[19] As in trade relations, the SADCC states depend on South African investment in mining, manufacturing, distribution and tourism. In alliance with foreign capital, South African companies are involved in mining and manufacturing in Botswana, Lesotho, Malawi, Zambia and Zimbabwe. Of all the areas of SADCC's

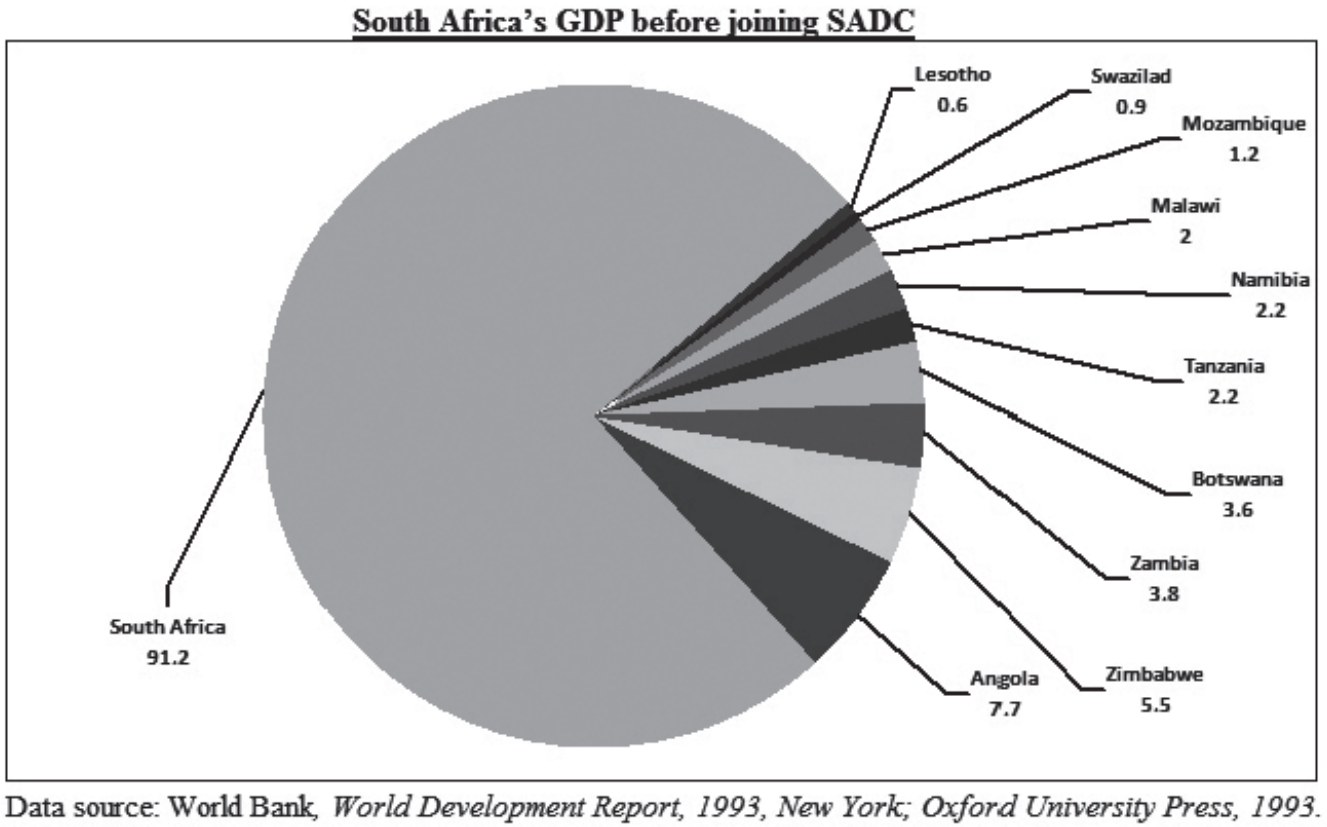


**Figure 1: GDP of South Africa prior to joining SADC**

dependence on South Africa, transport and communications is the most significant. The extent of dependence on the South African Transport Service (SATS) is underscored by the fact that six of the nine states- Botswana, Lesotho, Swaziland, Zambia and Zimbabwe - are landlocked; only Tanzania, Angola and Mozambique had usable port and harbor facilities. South Africa has 75% of the sub-continental rail network and the most efficient ports.[20] The chart shows the extent of South Africa's domination of the SADC economy. South Africa has the greatest share of Gross Domestic Product (GDP) within the SADC, surpassing 91% of the total regional GDP. South Africa has been successful in maintaining this status quo due to its protectionist policies.

In certain quarters, it was suggested that SADCC would be irrelevant after apartheid, and that South Africa, once politically acceptable, would assume the role of regional power to dominate, lead and give assistance to the rest of the region. In the latter connection, there were even suggestions that cooperating partners might then disengage from Southern Africa, in deference to South Africa playing the role of regional donor.[21]

**After Joining SADC:** When South Africa was in the process of joining SADC, then South Africa's GDP was estimated at 91.2 bn U.S. dollars but the combined GDPs of SADC member countries was only expected to be 29.7 bn U.S. dollars, which had no match to South African economy.[22] Moreover, South Africa's GDP is almost four times the size of the SADC's and its total imports and exports are about three times the value of the combined trade of its neighbours. While South Africa's technical and financial expertise may prove beneficial, it is exactly this economic supremacy that frightens a number of the neighbouring states. However, a third view held by the ANC assumes that South Africa will exercise restraint and sensitivity in its relations with its neighbours, if only to avoid accusations that the new government, like its predecessor, is bent on dominating the region by virtue of its superior economic and political muscle.[23] Nelson Mandela formulated the vision for the post-apartheid nation in following words:

*"Southern Africa will… only prosper if the principles of equity, mutual benefit and peaceful cooperation are the tents that inform its future. Reconstruction cannot be imposed on the region by external forces or unilaterally by ourselves as the region's most powerful state. It must be the collective enterprise of Southern Africa's people. Democratic South Africa will, therefore, resist any pressure or temptation to pursue its own interests at the expense of the sub-continent".*[24]

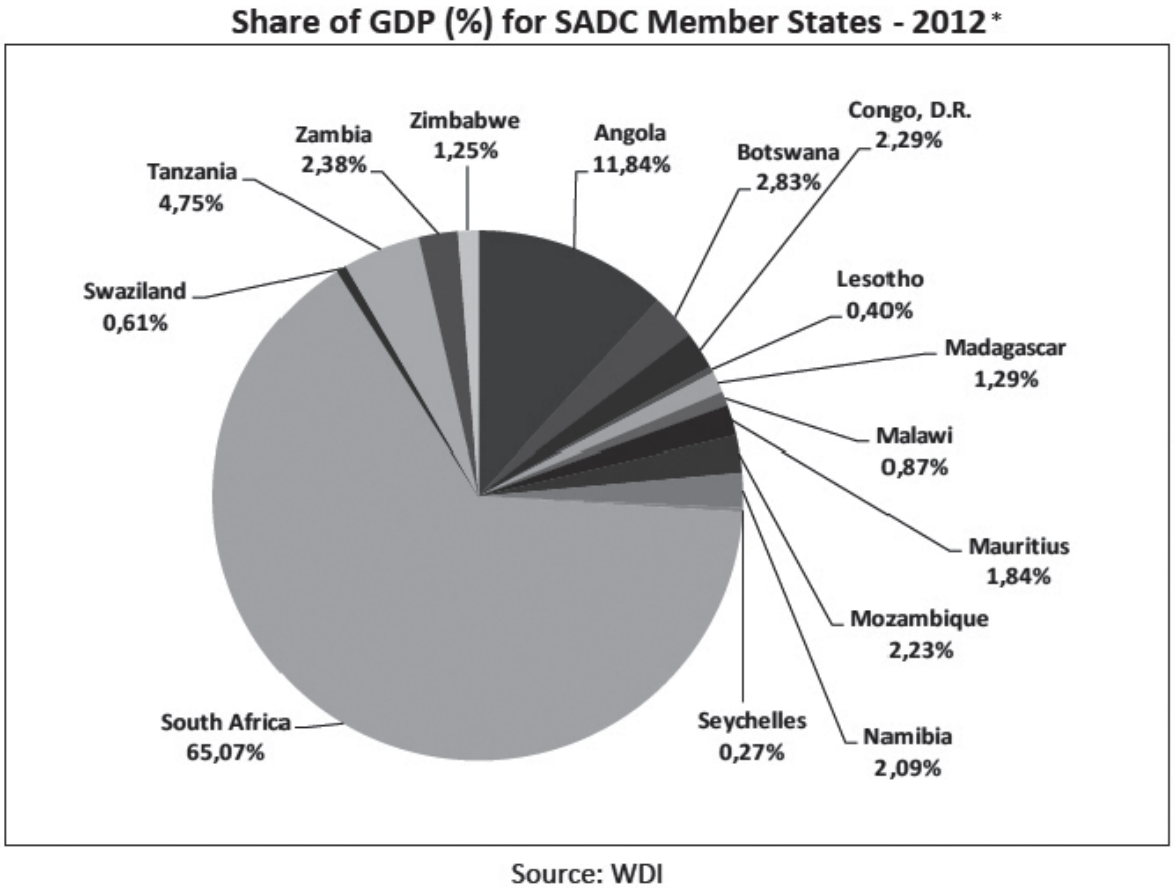


**Figure 2: GDP share of SADC countries**

The premier position of South Africa in the region gives it a dominant role in controlling the structures of regional finance and credit. In Zimbabwe, for example, an estimated 25-30% of privately owned capital stock is reckoned to be South African, although there has been a small reduction since 1990. It is estimated that South Africans own approximately 40% of registered industrial enterprises in Botswana. In Zambia, South Africa owns key mining engineering firms and dominates the freight and forwarding business through-out the region. Political normalization in the wake of the demise of apartheid has led to a rapid increase in exports to the region, but imports from the region remain low to negligible, widening the gap in visible exports between South Africa and its neighbours.[25] South African exports to SADC countries, are mainly value-added goods, that increased by 30% between 1996 and 1997 and the figures are higher than exports to the European Union, traditionally the country's biggest trading partner. Yet import from SADC neighbours accounted for only 5% of South African imports,[26] during the same period, a clearly untenable situation in view of the fact that the benefits of the economic interaction accrue mostly to South Africa, reinforcing historical asymmetries and distrust of the country. After joining SADC, South Africa changed its strategy towards the whole region. Study of the SADC is essential to understand the vital and multiple interests of South Africa in the region.

**SADC: Genesis**

The Southern African Development Coordination Conference (SADCC) was established in Lusaka in 1980 following the adoption of Lusaka Declaration-Southern Africa Towards Economic Liberation. The basic aim of SADCC was to reduce its members' economic dependence on apartheid South Africa and to promote regional economic development. SADCC's original strategy was to concentrate on promoting co-operation in the field of infrastructure, so that the SADCC members did not depend on South Africa's transport and port facilities. The SADCC was formed on 1st April 1980 soon after the Lusaka Declaration was adopted. Over the years, SADCC failed in its endeavour to promote meaningful progress towards regional economic integration. SADCC's integrative strategy deliberately avoided competition, duplication and free market strategies in favour of project co-ordinate regional integration and, in so doing; it totally rejected the neo-classical open regionalism model.[27] In 1989, the Summit of Heads of State and Government meeting in Harare, Zimbabwe, decided that the SADCC should be formalised to give it an appropriate legal status taking into account the need to replace the Memorandum of Understanding with an Agreement, Charter or Treaty. After four years of preparatory work and consultations, a strong consensus evolved indicating that member states wanted the mandate and mission of the SADCC to focus on concerted efforts towards deeper regional co-operation, beyond mere coordination of development projects for equitable integration of their economies. On 17 August 1992, the Head of State and Government met in the capital of Nambia, Windhoek and signed a Declaration and Treaty establishing the Southern Africa Development Community (SADC). Whereas the old SADCC sought to coordinate the economies of member states, the new SADC, on the other hand, seeks to integrate them into a single whole.[28] It is important to remember, however, that South Africa's ability to co-ordinate, for example, regional transport and power networks, and even security action is substantially greater than the expertise in the neighbouring states and in SADC. This could severely undermine the rationale of the Development Community in a post-apartheid region. After all, in 1987, for example, all SADCC members had greater trade with South Africa than with their partners combined, and total SADCC trade with the Republic was roughly six times higher than all intra-SADCC trade.[29] The membership and purpose of SADCC/SADC could be further destabilized if, as is suggested in some quarters, Lesotho and Swaziland opted for closer economic incorporation with a 'new' South Africa.[30] In January 1993, the SADC adopted a framework and strategy for integration and timetable for Community building and the major aim of SADC is to attain the main objectives of SADC.[31] In August 1996, South Africa signed a regional trade protocol agreement with its SADC partners. The agreement was ratified in December 1999, and implementation began in September 2000. It provided duty-free treatment for 85% of trade in 2008 and aimed for 100% by 2012. Now fifteen member states of SADC include, interalia; Angola, Botswana, Democratic Republic of the Congo, Lesotho, Madagascar , Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

South Africa is the largest and the most developed country in the region both in terms of population and the size of the economy. Its economy is sophisticated and diversified, dominating the region as a source of imports and some capital and less as a destination of the region's exports. In the South African case, the country was already a key economic player in the regional economy before formal membership of the SADC. South African investment in other countries are slowly picking up. With regard to regional trade, South Africa was and remains the main origin of imports for seven SADC countries (Botswana, Lesotho, Malawi, Namibia, Swaziland, Zambia and Zimbabwe), while it is the main destination for export from three SADC countries (Lesotho, Swaziland and Zimbabwe). Other benefits from South Africa's entry into the SADC include economies of scale and access to the countries' modern infrastructure such as sea ports especially Durban, which has begun to facilitate the regional movement of goods.[32] There is no doubt that membership of South Africa will give a major boost to regional integration efforts by enlarging the regional market and bringing the not inconsiderable strength and capacities of the South African economy. However, the membership of South Africa will not resolve the dependency relationship which the old SADCC sought to redress, in fact, aggravates the already sharp economic disparities among the member states.[33] South Africa has taken a leading role in the region to address such issues as closer collaboration and economic integration. These include the establishment of a free trade area in the region, the development of basic infrastructure, the development of human resources and the creation of the necessary capacity to drive this complicated process forward, as well as the urgent need for peace, democracy and good governance to be established throughout the region.[34]


**Figure 3**: **Member states of SADC**

South Africa uses its dominance in SADC region for its own national security, and to protect market for their manufactured material and to source natural resources. South Africa wants to continue holding a dominant share in the external trade of several Southern African countries.[35] As a member of SADC, South Africa's focus is on regional stability and co-operation for the socio-economic development of the Southern African region. South Africa's interest and objectives in the Southern African region are guided by the existence of strong linkages between the domestic and regional economy.[36] South African manufactured goods are substantially cheaper and more suited to regional markets than similar ones from the industrial West, and another factor complementing the interdependent relationship is the ability of African countries to supply South Africa competitively and appropriately of their products so that the regional countries are also attracted towards South Africa. South Africa's economy is still largely reliant on the export of primary and intermediate commodities to industrialized countries. However, manufactured goods account for about 70 % of South Africa's exports to whole Africa. Imports mainly consist of capital goods, raw materials, semi-manufactured goods (approximately 76 % of total trade imports) and consumer commodities. South Africa maintains formal trade relations with various countries by means of treaties, trade agreements, and membership in international trade institutions, trade between South Africa and other SADC countries. South Africa exports mainly high value-added manufactured goods but imports largely low value primary commodities. The government's key policy objective is to strengthen trade and investment linkages between South Africa and the other SADC countries.[37] The most important SADC purchaser of South African exports is Zimbabwe, followed by

Mozambique, Zambia, Mauritius, Malawi, Angola, and Tanzania. Zimbabwe is also the largest source of imports, followed by Malawi, Angola, Zambia and Mozambique. The member states of the SADC are negotiating a Free Trade Agreement (FTA) to strengthen trade, investment, and industrial linkages within the region. (See South Africa's export and import from SADC countries in Table 2 and Table 3.)

**Table 2: South Africa's Exports to SADC Countries (average growth rate 1999-2003)**

| **Product** | **% growth** | **Exports 2003 (R-million)** |
|---|---|---|
| Pearls, precious stones, metals, coins, etc | 97.7 | 121 |
| Works of art, collectors pieces and antiques | 56.7 | 5 |
| Cereals | 46.5 | 1,014 |
| Umbrellas, walking-sticks, seat-sticks, whips, etc | 45.7 | 7 |
| Oil seed, oleagic fruits, grain, seed, fruit, etc. | 43.2 | 134 |
| Cotton | 38.2 | 168 |
| Ships, boats and other floating structures | 37.3 | 38 |
| Edible fruit, nuts, peel of citrus fruit, melons | 34.5 | 256 |
| Beverages, spirits and vinegar | 33.5 | 945 |
| hides and skins (other than fur skins) and leather | 29.3 | 4 |
| Essential oils, perfumes, cosmetics, toiletries | 29.1 | 350 |
| Live animals | 28.6 | 62 |
| Lac, gums, resins, vegetable saps and extracts | 27.6 | 13 |
| Impregnated, coated or laminated textile fabric | 26.4 | 4 |
| Printed books, newspapers, pictures etc | 26.4 | 68 |
| Nickel and articles thereof | 25.8 | 154 |
| Lead and articles thereof | 24.5 | 1 |
| Articles of leather, animal gut, harness, travel goods | 23.0 | 11 |
| Silk | 22.6 | 16 |
| Manufactures of plaiting material, basketwork, etc. | 21.7 | 2 |
| **Total Exports to SADC** | **13.1** | |

***Source*****:** Trade and Industrial Policy Strategies (TIPS)

The fastest growing imports from SADC towards South Africa are a mixed bag, mainly consisting of basic processed goods and some agricultural commodities.

**Table 3: South Africa's Imports from the SADC Countries (average growth rate 1999-2003)**

| **Product** | **% growth** | **Imports 2003 (R-million)** |
|---|---|---|
| Ores, slag and ash | 261.8 | 1,061 |
| Sugars and sugar confectionery | 146.0 | 98 |
| Wool, animal hair, horsehair yarn and fabric thereof | 136.6 | 6 |
| Works of art, collectors pieces and antiques | 122.5 | 148 |
| Lac, gums, resins, vegetable saps and extracts | 91.2 | 1 |
| Aircraft, spacecraft, and parts thereof | 85.6 | 156 |
| Manmade filaments | 77.5 | 6 |
| Carpets and other textile floor coverings | 71.3 | 1 |
| Zinc and articles thereof | 70.4 | 31 |
| Manmade staple fibres | 66.2 | 10 |
| Bird skin, feathers, artificial flowers, human hair | 64.4 | 0 |
| Beverages, spirits and vinegar | 63.0 | 14 |
| Meat, fish and seafood food preparations | 60.6 | 22 |
| Animal, vegetable fats and oils, cleavage products, etc. | 60.0 | 14 |
| Umbrellas, walking-sticks, seat-sticks, whips, etc. | 60.0 | 0 |
| Cereal, flour, starch, milk preparations and products | 57.9 | 11 |
| Railway, tramway locomotives, rolling stock, equipment | 55.3 | 9 |
| Impregnated, coated or laminated textile fabric | 48.8 | 2 |
| Optical, photo, technical, medical, etc apparatus | 44.3 | 105 |
| Pulp of wood, fibrous cellulose material, waste etc | 40.8 | 1 |
| **Imports from SADC** | **19.6** | |

***Source:*** Trade and Industrial Policy Strategies (TIPS)

## CONCLUSION

South Africa is the largest and most developed country in the region, both in terms of population and size of economy. South Africa is the regional power of Southern Africa and holds the key to the political and economic future of the region. South Africa's military supremacy in the region is overwhelming and its economy dominates those of its regional neighbours. It is the region's leading source of capital, management, technology, agriculture and manufactured goods, employment and internal market. Its transport infrastructure binds the region into functional unit. South Africa continues to use this interdependence to its geopolitical advantages. South Africa has successfully pursued a regional foreign policy of destabilization designed to maintain the dependence of regional states and keep potentially hostile Governments off balance. The elements most crucial to the determination of South Africa's regional power are geographical and economic in nature. The region of South Africa is united by its transport infrastructure. It is a transport network which carries trade and economic benefits across state boundaries to bind the region together in the performance of the transport function. Its economy is also the most sophisticated and diversified, dominating the region as a source of imports and capital and less as a destination of the region's exports. The motivations for South Africa to preserve its dominance of the region are national security, new market for its manufactured commodities, regional security and for exploitation of natural resources. The SADC countries have

manpower and raw material but they don't have technical know-how, and Capital. But, in the era of globalization, each and every state is inter-connected. That is why it is in the interest of South Africa to ensure regional peace, security and economic integration in the region.

Of paramount importance are the existing contradictions within South Africa. This imposes some limitations for South Africa's role within the region. Therefore, this expected role will take place within the ambit of national versus regional priorities. For instance, poverty and high unemployment rate in South Africa requires the immediate government attention. South Africa is a hegemon within the region due to its overarching economic dominance of the region. It has evaluated this conception by making reference to miscellaneous definitions of the understanding of hegemony. In terms of practical evidence, South Africa fits quite into this categorisation within the region. It has demonstrated the main critical dimensions attributable to hegemon states, for instance, that of military, economic status, technology and infrastructure. The present study has argued that South Africa's hegemony is increasingly becoming subtler rather than vigorous since the prevailing circumstances do not warrant the existence of the latter. The involvement of South Africa in the structures and its pioneering leadership inhibit the potential to exhibit the gross hegemonic behaviour. Therefore, it is concluded that South Africa is a benevolent hegemon since it has the moral obligation to assist the region to achieve its own economic development. This role is, therefore, advantageous to the political, economic and social well being of South Africa since it cannot escape the challenges of the region and the continent.

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**Economics**

# ECONOMIC CONDITIONS OF THE MIGRANT WORKERS IN KERALA: A STUDY IN THE TRIVANDRUM DISTRICT

***Dilip Saikia****

**ABSTRACT**

*In recent years, Kerala has been experiencing a large influx of migrant workers from different parts of India. Higher wages, large employment opportunities and shortages of local labourers make Kerala a lucrative job market for workers from outside the State. The purpose of this paper is to examine the characteristics and economic condition of the migrant workers in Kerala. Based on data from a sample survey of 166 migrant workers, carried out during September-October, 2008 in the Trivandrum district of Kerala, this paper analyses the migrant's demographic and household details, reasons for migration, sources of information, living conditions, occupational pattern, wage and income, consumption and savings, and remittances, etc.*

**Keywords:** Consumption expenditure**,** internal migration, Kerala, network, reason for migration, remittances.

## INTRODUCTION

Kerala, widely known for exporting labour to the Gulf countries (Kannan and Hari, 2002; Rajan and James, 2007; Zachariah et al., 2000, 2001; Zachariah and Rajan, 2004, 2007, 2008), has now been witnessing large influx of migrant labour from different parts of the country (Surabhi and Kumar, 2007). The *Kerala Migration Survey 2007*, conducted by Centre for Development Studies, Trivandrum, estimates that about 18.5 lakh Keralites was living abroad and total remittances to Kerala was about Rs. 24.53 thousand crores, which was about 20.2 percent of Net State Domestic Product (NSDP) of the State (Zachariah and Rajan, 2008). While the outmigration of labour from the State has a number of positive effects on the socio-economic arena and labour market of Kerala economy,[1] the large scale out-migration of labour has created severe scarcity of semi-skilled and un-skilled workers in almost all spheres of the State. At the same time, the real estate and construction sector boom in Kerala has led to huge demand for certain categories of workers such as carpenters, welders, plumbers, drivers, electrician, motor mechanics and other craftsman. This has led to an inevitable rise in the wage rate in the State,[2] which turned Kerala into a lucrative job market for workers hailing from various parts of India, mostly from Assam, West Bengal, Bihar, Orissa, Jharkhand, Chhattisgarh, Andhra Pradesh and Tamil Nadu, and from nearby countries like Nepal and Bangladesh. Today, the presence of migrant workers in Kerala's labour market is so visible that language spoken in many of the large-scale construction sites is often not Malayalam, but Tamil, Hindi, Bengali, Assamese or Nepali.

Available data shows massive inflow of migrants from other states into Kerala. As per the Census 2001, total number of migrants (by place of birth) from other States in Kerala recorded at 4.13 lakh, which was 1.3 percent of Kerala's total population. The National Sample Survey (NSS) data on Migration in India, which defines migration on the basis of last place of residence and thus differs from Census data, shows that total number of migrants in Kerala numbered 10.05 lakh in 1999-2000 and 10.69 lakh in 2007-08 (NSSO, 2010). These migrant workers, which include unskilled and semi-skilled workers like carpenters, masons, mechanics, electricians and barbers, etc., are mostly employed in the informal sectors such as construction, hotels and restaurants, business, small manufacturing units, and more recently in the farm sector too. As such, the migrant workers have become the backbone of Kerala's

***Dilip Saikia** is a Assistant Professor at Department of Commerce, Darrang College**,** Tezpur, Assam, Pin-784001, India. E-mail: dilip.gu@gmail.com

growing economy and without them the wheel of the State economy would not move.

The migration of labourer has a far-reaching impact − both direct and indirect − on the migrant's household as well as at both origin and destination economy.[3] Remittances send by the migrants have direct effect on livelihoods of the migrant's family by significantly improving their consumption pattern, increasing savings and investment, improving standard of living, reducing poverty and providing a social security mechanism for poor households, etc.; together with reduced unemployment rate in the native economy.

Against this backdrop, this paper examines the characteristics and economic condition of migrant workers in the Trivandrum district of Kerala. More precisely the major objectives of the study are:

a) To analyse the characteristics and economic conditions of migrant workers in Trivandrum district of Kerala.

b) To investigate the sources and reasons of migration to Kerala.

c) To examine the flow of remittances and its impact on local economy.

The rest of the paper is organised in the following sections. The next section describes the data used in this paper, followed by the findings of the study. The last section concludes our discussion.

## DATA AND METHODOLOGY

The data used in this paper is based on a primary survey on the migrant workers in the Trivandrum district of Kerala (India), which has been carried out during September-October, 2008. We have selected the Trivandrum district for our survey, keeping the fact in mind that it is the capital city of the State of Kerala, and as per the Census 2001, it accommodates about 11.77 percent of total in-migrants in Kerala, which is the third highest among the districts of Kerala.[4] A major problem faced during the survey was to find out the migrant workers in the district. For this, we have taken the help of the local people to find out the places where the migrant workers have been working and the places where they have been staying. Finally, data has been collected by visiting both the places − working sites and residence − whichever found convenient. Information has been collected on various migration particulars such as migrant's demographic and household details, the reasons of migration, sources of information, living conditions, past and present occupational pattern, wage and income level, consumption and savings pattern, remittances, etc. Information has been recorded for the previous one week as well as for the previous month from the date of the survey, wherever necessary. A total of 166 migrant workers have been interviewed by using a pre-tested semi-structured questionnaire.

## FINDINGS OF THE STUDY

### Age-Sex Composition of Sample Migrants

The sample is comprised of relatively young migrant workers. The average age of the migrants is 26.42 years, with about 25.3 percent of migrants below 20 years and another 32.5 percent are between 21-25 years (Table 1). All the sample migrants are male.

**Table 1: Age Composition of the Sample Migrants**

| Age Group | Frequency | Percent |
|---|---|---|
| 15-20 years | 42 | 25.3 |
| 21-25 years | 54 | 32.5 |
| 26-30 years | 33 | 19.9 |
| 31-35 years | 14 | 8.4 |
| 36-40 years | 12 | 7.2 |
| 41 years and above | 11 | 6.6 |
| Total | 166 | 100.0 |

**Educational Level**

About 16.3 percent of respondents have no formal education, 29.5 percent have primary education and 53.6 percent have secondary education and one respondent has graduation degree (Table 2).

**Table 2: Educational Level of the Migrants**

| Level of Schooling | Frequency | Percent |
|---|---|---|
| No formal schooling | 27 | 16.3 |
| Primary education | 49 | 29.5 |
| Secondary education | 89 | 53.6 |
| Graduation | 1 | 0.6 |
| Total | 166 | 100.0 |

**Religion and Caste**

The social group composition reveals that Schedule Caste (SC) migrants dominate the sample. About 47 percent of respondents belong to SC category, whereas General, OBC and Schedule Tribes (ST) account for 7.2 percent, 7.8 percent and 6.0 percent, respectively. About 96.4 percent of respondents are Hindu and the remaining 3.6 percent are Muslim.

**Table 3: Distribution of Migrants by Castes Groups**

| Category | Frequency | Percent |
|---|---|---|
| Schedule Caste | 78 | 47.0 |
| Schedule Tribes | 10 | 6.0 |
| OBC | 13 | 7.8 |
| General | 12 | 7.2 |
| Don't Know | 53 | 31.9 |
| Total | 166 | 100.0 |

**Marital Status and Family Size**

About two-third of the respondents are unmarried, while 34.9 percent are married, one worker is widowed and another one is separated. The average family size is 5 persons. More than three fourth of the respondents have a relatively smaller family size of below 6 persons.

**Table 4: Distribution of Migrants by Marital Status**

| Category | Frequency | Percent |
|---|---|---|
| Never married | 106 | 63.9 |
| Currently married | 58 | 34.9 |
| Widowed | 1 | 0.6 |
| Separated | 1 | 0.6 |
| Total | 166 | 100 |

**Table 5: Distribution of Migrants by Family size**

| No. of household members | Frequency | Percent |
|---|---|---|
| 1-3 | 25 | 15.10 |
| 4 - 6 | 104 | 62.70 |
| 7 - 8 | 29 | 17.40 |
| 9 & more | 8 | 4.80 |
| Total | 166 | 100.00 |

**Earning Members and Dependents in the Family**

Looking at the earning member in the family (excluding the respondent), about 24 percent of the respondents have no earning member, 58.4 percent have less than two earning members, and 16.87 percent have more than three earning members in their family (Table 6). About 53.6 percent of the respondents have no dependent children (below age 14 years) at home, whereas about 13.3 percent have one, 20.5 percent have two and 12.60 percent have more than 3 dependent children at home (Table 7). For 84 percent of the respondents, the respondent is the only migrant in the family, while the remaining 16 percent have at least one migrant in the family. When the respondents were asked whether they want any other member of their family to migrate with them, about 88 percent said no.

**Table 6: Distribution of Migrants by Number of Earning Member in the Family**

| No. of Earning Member | Frequency | Percent |
|---|---|---|
| 0 | 41 | 24.7 |
| 1-2 | 97 | 58.4 |
| 3-4 | 24 | 14.5 |
| More than 4 | 4 | 2.4 |
| Total | 166 | 100.0 |

**Table 7: Distribution of Migrants by the number of Dependent Children**

| No. of Dependent Children | Frequency | Percent |
|---|---|---|
| 0 | 89 | 53.6 |
| 1 | 22 | 13.3 |
| 2 | 34 | 20.5 |
| 3 & above | 21 | 12.7 |
| Total | 166 | 100.0 |

**Place of Origin**

Table 8 provides the details about the native State of the migrants. Migrants from West Bengal constitute more than half (58 percent) of the sample, while another 37.3 percent of respondents are from Assam. Thus, about 95 percent of the migrants are from West Bengal and Assam, while Andhra Pradesh, Utter Pradesh, Tamil Nadu and Orissa each have two migrants in our sample. This, however, does not imply that the migrant workers in Trivandrum are dominated by workers from West Bengal and Assam. The concentration of migrants from West Bengal and Assam in our sample is high possibly due to the reason that the area that we surveyed was dominated by migrants from these two States. This is not surprising, because migrants from the same place prefer to stay in the same locality.

**Table 8: State of Origin of the Migrants**

| States | Frequency | Percent |
|---|---|---|
| West Bengal | 96 | 57.8 |
| Assam | 62 | 37.3 |
| Andhra Pradesh | 2 | 1.2 |
| Uttar Pradesh | 2 | 1.2 |
| Tamil Nadu | 2 | 1.2 |
| Orissa | 2 | 1.2 |
| Total | 166 | 100.0 |

**Networking**

The migrant workers have come to Kerala on their own without the help of formal agents. The informal network plays important role in migration of workers to Kerala. All the respondents migrated to Kerala through information and help from their friends/relatives (58 percent) and acquaintances (41 percent) who have already migrated to Kerala (Figure 1).

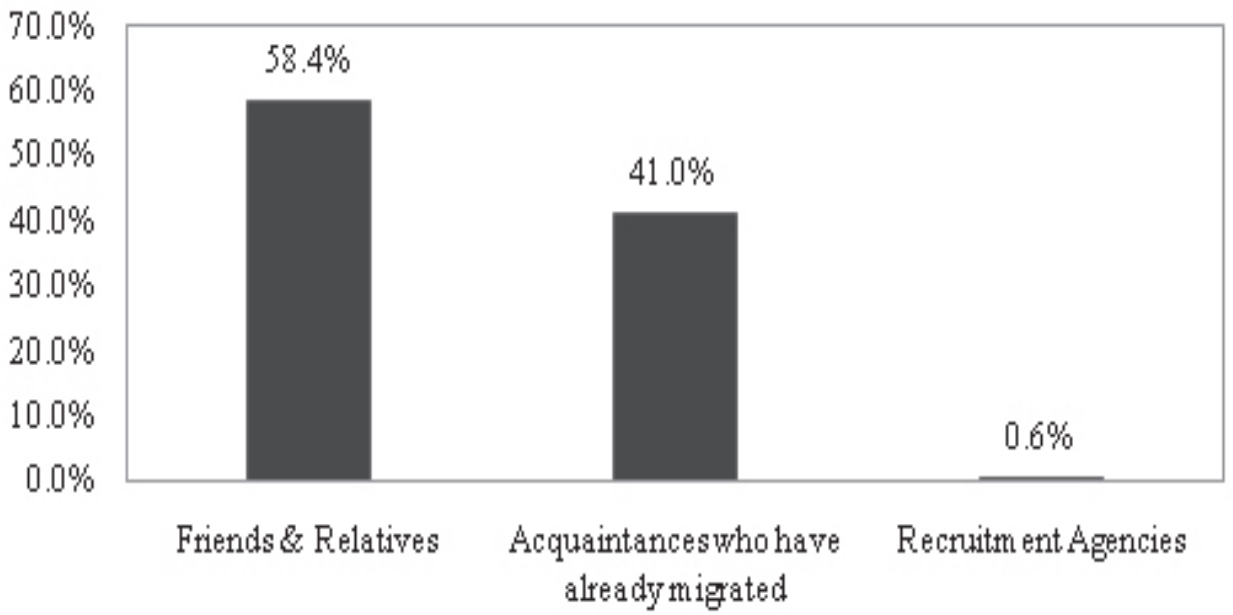


**Figure 1: Source of Information of Migration Opportunities**

**Number of Years Living in Kerala**

About two third of respondents migrated to Kerala for the first time, whereas the rest had prior migration experience to States like Karnataka, Delhi, Rajasthan, Gujarat, Goa and Jammu & Kashmir. Two respondents had also been to other countries like Nepal and Bhutan. About two third of the respondents first migrated after 2006, 23.49 percent had first migrated in between 2001-2005 and 11.43 percent had first migrated before 2000 (Table 9).

**Table 9: Year of First Migration**

| Year | Frequency | Percent |
|---|---|---|
| 1990-1995 | 6 | 3.6 |
| 1996-2000 | 13 | 7.8 |
| 2001-2005 | 39 | 23.5 |
| after 2006 | 108 | 65.1 |
| Total | 166 | 100.0 |

Table 10 reports the number of years that the respondents have been living in Kerala. About 50 percent respondents have migrated to Kerala within one year, 28 percent migrated within 2-3 years, 17.5 percent migrated within 4-8 years and 4.2 percent migrated before 9 years. However, those who have migrated to Kerala long back have not entirely been in Trivandrum, but they also moved to other districts of Kerala such as Ernakulam, Idukki, Palakkad, Kasargod, Kollam, Aleppey, etc. for work.

**Table 10: Number of years living in Kerala**

| Years | Frequency | Percent |
|---|---|---|
| 0-1 year | 82 | 49.4 |
| 2-3 years | 48 | 28.9 |
| 4-8 years | 29 | 17.5 |
| 9 years & above | 7 | 4.2 |
| Total | 166 | 100.0 |

**Reasons of Migration**

The major reasons of migration are the poor economic condition and low wages in native region. About 76 percent respondents reported the reason of migration as getting employment/better employment, another 46 percent reported as meeting household expenditure and 33.73 percent reported as accumulation of savings (Table 11). The other reasons mentioned were repayment of debts, financing education of dependents and marriage of dependents, etc. This suggests that migration mostly occurs for the creation of outside support system for livelihood. Further, dominance of economic reasons also suggests that it is primarily the differences in economic opportunities between different States that pushed for migration of workers to other States.

**Table 11: Reasons of Migration**

| Reasons of Migration | Frequency | Percent |
|---|---|---|
| Get employment/better employment | 126 | 75.9 |
| Meeting household expenditure | 77 | 46.4 |
| Accumulate savings | 56 | 33.7 |
| Repayment of debt | 12 | 7.2 |
| Marriage & Financing education of the dependents | 14 | 8.4 |
| Purchase of land/ Construction of house | 1 | 0.6 |
| Total | 166 | 100.0 |
| *Note*: The summation is higher than the reported total because of multiple responses. | | |

When asked about the specific reasons for migrating to Kerala, about 90 percent respondents reported that they migrated to Kerala specifically because of higher wage rate in Kerala, whereas 12.65 percent reported availability of work and another 7.83 percent reported better working condition in Kerala as the main reasons for migration to Kerala (Table 12). A few respondents, who have prior experience of migration to other places, reported that they consider Kerala as a more secure place than other places.

**Table 12: Major Reasons of Migration to Kerala**

| **Reasons of Migration to Kerala** | **Frequency** | **Percent** |
|---|---|---|
| High wage rate | 150 | 90.4 |
| Availability of work | 21 | 12.7 |
| Better Working condition | 13 | 7.8 |
| Accumulation of Savings & repayment of debt | 6 | 3.6 |
| Relatives and Acquaintances working in Kerala | 10 | 6.0 |
| Others | 6 | 3.6 |
| Total | 166 | 100.0 |
| *Note*: The summation is higher than the reported total because of multiple responses. | | |

**Occupation – Before and After Migration**

Before migration to Kerala, about 12.7 percent of the respondents were unemployed and another 4.2 percent were students, whereas about 36 percent were employed in the informal sector, 27 percent were self-employed in agriculture and 20 percent were self-employed in the non-agricultural sector (Table 13). However, there has been barely any improvement in the nature of works even after the migration. Almost all the respondents are engaged in temporary work. None of the respondents have registered to any employment agency. Instead, they have engaged in some kind of informal agreement with contractors in various construction sites. About 90.4 percent respondents are engaged in such work agreements. The remaining 9.6 percent of respondents, who are working independently, either went to different work places in search of work or used to stand in some market places from where somebody picked them up for work. It is found that about 12.65 percent respondents are working as mason and another 71 percent are working as helper to mason in various construction sites. The other activities that the respondents were engaged are bricks maker, casual laborer, carpenter & painting, truck helper, etc. (Table 14).

**Table 13: Primary Occupation of the Migrants before Migration**

| **Category** | **Frequency** | **Percent** |
|---|---|---|
| Students | 7 | 4.2 |
| Unemployed | 21 | 12.7 |
| Employed in informal sector | 60 | 36.1 |
| Self-employed in agriculture | 45 | 27.1 |
| Self-employed in non-agricultural sector | 33 | 19.9 |
| Total | 166 | 100.0 |

**Table 14: Type of Activity of the Migrants after Migration**

| Category | Frequency | Percent |
|---|---|---|
| Bricks maker | 8 | 4.8 |
| Contraction mason | 21 | 12.7 |
| Construction helper | 118 | 71.1 |
| Casual labor | 10 | 6.0 |
| Truck helper | 4 | 2.4 |
| Carpenter & Painting | 5 | 3.0 |
| Total | 166 | 100.0 |

**Skill Level – Before and After Migration**

Of the workers who were employed before migration to Kerala, only about one fourth of them were engaged in activities where some kind of skill is required. Before migration about 74.7 percent respondents were engaged in unskilled activities, 10.8 percent were engaged in semi-skilled activities and 14.5 percent were engaged in skilled activities (Table 15). After migration, about 70.4 percent respondents were engaged in unskilled activities, while about 15 percent respondents were engaged in semi-skilled and skilled activities each (Table 15). Looking at the mobility of the skill level after migration, it is noticed that out of the 20 respondents engaged in skilled activities before migration, 10 are still working in skilled activities, but 2 of them are working in the semi-skilled and 6 are working in the unskilled activities (Table 16). It implies that of the skilled workers before migration 50 percent have moved downward in skill level after migration. Similarly, out of the 15 respondents engaged in semi-skilled activities before migration, 7 are still working in the semi-skilled activities, one moved upward to skilled activities, but the remaining 7 moved downward to unskilled activities after migration. Again, out of the 103 respondents engaged in unskilled activities before migration, 9 moved upward to skilled activities, 12 moved upward to the semi-skilled activities, while the remaining 82 are still working in the unskilled activities after migration. Of the 28 respondents who were unemployed and students before migration, 22 are working in the unskilled activities, 2 in the semi-skilled activities and 4 are working in the skilled activities. Thus, there are both upward and downward mobility of the workers in nature of work they engaged after migration. However, a larger proportion of workers in each type of skill level remained in the same skill level after migration.

**Table 15: Skill Level - Before and After Migration**

| Category | Before Migration | | After Migration | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Unskilled work | 103 | 74.7 | 117 | 70.4 |
| Semi-skilled work | 15 | 10.8 | 25 | 15.1 |
| Skilled work | 20 | 14.5 | 24 | 14.5 |
| Total | 138 | 100.0 | 166 | 100.0 |

**Table 16: Migrants by Skill Level before and after Migration**

| Skill Level before Migration | Skill Level after Migration | | | Total |
|---|---|---|---|---|
| | Skilled | Semi-skilled | Unskilled | |
| Unemployed & Students | 4 (14.3) | 2 (7.1) | 22 (78.6) | 28 (100.0) |
| Skilled | 10 (50.0) | 4 (20.0) | 6 (30.0) | 20 (100.0) |
| Semi skilled | 1 (6.7) | 7 (46.7) | 7 (46.7) | 15 (100.0) |
| Unskilled | 9 (8.7) | 12 (11.7) | 82 (79.6) | 103 (100.0) |
| Total | 24 (14.5) | 25 (15.1) | 117 (70.5) | 166 (100.0) |
| Note: Figures within the bracket shows the row percentage. | | | | |

**Wages and Income Level of the Migrants**

After migration, the migrants received an average daily wage of about Rs. 232, with maximum of Rs. 350 and minimum of Rs. 100. This was three to four times higher than the wage rates in the native places of the migrants. The average number of working days for the migrants is 24 days per month, with maximum of 30 days and minimum of 15 days per month. Since most of the respondents are engaged in temporary activities, the mode of payment for about 72 percent respondents is daily basis and for another 21 percent is weekly basis.

The income level of the migrants before migration is reported in Table 17. Before migration about 13.7 percent respondents have monthly income less than Rs. 1000 and for another 36 percent monthly income was less than Rs. 2000. For 42.4 percent respondents, the monthly income was between Rs. 2000-3499, whereas only for 8 percent the monthly income was more than Rs. 3500 before migration.

The average monthly income of the workers after migration is found to be Rs. 6000. For more than two third of respondents, the monthly income is more than Rs. 5000 after migration as against only 2.2 percent before migration. Only about 3.6 percent respondents earned less than Rs. 3500 per month, but higher than Rs. 2000 (Table 17).

**Table 17: Monthly Income of the Migrants**

| Category | Before Migration | | After Migration | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Rs. 999 & below | 19 | 13.7 | 0 | 0.0 |
| Rs. 1000-1999 | 50 | 36.0 | 0 | 0.0 |
| Rs. 2000-3499 | 59 | 42.4 | 6 | 3.6 |
| Rs. 3500-4999 | 8 | 5.8 | 46 | 27.7 |
| Rs. 5000-6999 | 3 | 2.2 | 92 | 55.4 |
| Rs. 7000 & above | 0 | 0.0 | 22 | 13.3 |
| Total | 138* | 100.0 | 166 | 100.0 |
| *Note*: * The total is 138 in this case because 28 workers were either student or unemployed, and hence, they had no income. | | | | |

A comparison of the income level before and after migration is worthwhile at this point to infer whether migration really makes difference in the financial well being of the migrants. However, such a comparison is difficult as information on income before migration is not available for all the respondents,[5] and as some respondents had migrated more than 15-17 years earlier, so comparing their income at that time with current income without adjustment of the price level is difficult. Despite this limitation, a close look at the income levels before and after

migration (Table 17) reveals that there has been a shift from the low-income brackets to the high-income brackets after migration. Thus, it can be inferred that migration really improved the financial position of the respondents.

**Living Conditions**

Notwithstanding a reasonably good level of income after migration; most of the respondents are living in deplorable conditions. About 44 percent of the respondents reside at the working sites and the remaining 56 percent reside in poor rented houses with single room shared by many. About 91.6 percent of the respondents live with other migrants and cook together, while only 8.4 percent stays alone (Figure 2). In most of the cases there is no provision of hygienic sanitation and safe drinking water.

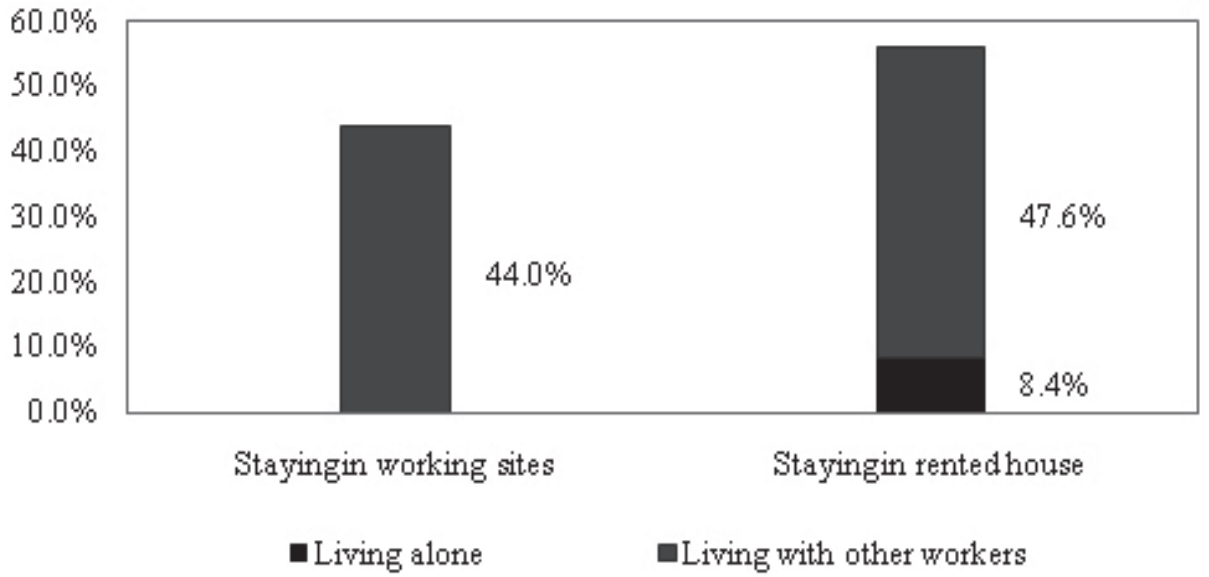


**Figure 2: Living Conditions of the Migrants**

**Consumption Expenditure**

The average monthly expenditure of the respondents is Rs. 2160. For 18.1 percent respondents, the average monthly expenditure is less than Rs. 1500, while for 54.8 percent it ranges between Rs. 1501-2500 and for 11.4 percent it is more than Rs. 3000 (Table 18). The average monthly food expenditure is Rs. 1290 and non- food expenditure is Rs. 870. The amount and component food expenditure is found to be more or less same for all the respondents. This is mainly because of the fact that more than 90 percent respondents stayed and cooked together. But, the non-food expenditure varies from person to person. The coefficient of variation of food expenditure is found to be 0.21, whereas it is 0.79 in case of non-food expenditure.

**Table 18: Monthly Expenditure of the Migrants**

| Expenditure Level (Rs.) | Frequency | Percent |
|---|---|---|
| Less than Rs. 1500 | 30 | 18.1 |
| Rs. 1501- 2000 | 52 | 31.3 |
| Rs. 2001- 2500 | 39 | 23.5 |
| Rs. 2501- 3000 | 26 | 15.7 |
| Rs. 3001 & above | 19 | 11.4 |
| Total | 166 | 100.0 |

**Savings and Investments**

The savings habit among the migrant workers is very small. More than 73 percent of the respondents do not have any savings in Kerala− whatever they can save from their income they sent them to home. Of the 27 percent who have some amount of savings in Kerala − either in bank or chitty/kuris − for about 13.86 percent total savings is less than Rs. 3000, for 7.23 percent it is between Rs. 3000-5000 and for 3.6 percent more than Rs. 10000. Similarly, the respondents hardly invest their money in Kerala. Only 5 out of 166 respondents have invested their money either in buying land, construction of house, or starting business.

**Possession of Consumer Durables**

Regarding the possession of consumer durables, about 21 percent respondents have mobile phone, while 5.42 percent have TV (in the group) and 1.8 percent have music player in Trivandrum (Table 19).

**Table 19: Possession of Consumer Durables**

| Consumer Durables | Frequency | Percent |
|---|---|---|
| No | 119 | 71.7 |
| Mobile phone | 35 | 21.1 |
| TV (in the group) | 9 | 5.4 |
| Music player | 3 | 1.8 |
| Total | 166 | 100.0 |

**Remittances**

Remittances link migration and development of backward region from where migration does take place. Migration can have a direct effect on peoples' livelihoods, to the extent that migrants send money to their families to sustain livelihoods and social relations. It is by the remittances that migration acts as a social security mechanism for the poor households left back. We found that the average remittance sent by the migrants is Rs. 2541 per migrant in the last month and Rs. 26328 per migrant in the preceding year. About one fourth respondents did not send money to home in the last month, whereas 28.31 percent respondents sent between Rs. 1000-2000, 24.7 percent respondents sent between Rs. 2001-3500 and about one fifth respondents sent more than Rs. 3500 in the last month (Table 20).

**Table 20: Remittances Sent to Home in the Last Month**

| Amount (Rs.) | Frequency | Percent |
|---|---|---|
| Not send yet | 42 | 25.3 |
| Rs. 1000-2000 | 47 | 28.3 |
| Rs. 2001-3500 | 41 | 24.7 |
| Rs. 3501-6000 | 30 | 18.1 |
| Rs. 6001 & above | 6 | 3.6 |
| Total | 166 | 100.0 |

We also look at the frequency of sending remittances, as it influences the spending of remittances. About 22.29 percent respondents sent remittances monthly and another 42.77 percent respondents sent remittances at an interval of 2-3 months, whereas 12 percent respondents sent once in a year and 14.46 percent have never sent money to home (Table 21).[6] About 58 percent of the respondents sent money through bank accounts of family members and friends/relatives, 26.8 percent sent by money order and post office, and 15.2 percent sent through fellow migrant workers who are in Trivandrum (Table 22).

**Table 21: Frequency of Sending Remittances to Home**

| **Frequency** | **Frequency** | **Percent** |
|---|---|---|
| Monthly | 37 | 22.3 |
| Once in 2-3 months | 71 | 42.8 |
| Once in 3-4 months | 14 | 8.4 |
| Once in a year | 6 | 3.6 |
| Only once after migration | 14 | 8.4 |
| Not sent yet | 24 | 14.5 |
| Total | 166 | 100.0 |

**Table 22: Mode of Sending Remittances**

| | **Frequency** | **Percent** |
|---|---|---|
| Bank Account | 80 | 58.0 |
| Money Order | 31 | 22.5 |
| Post Office | 6 | 4.3 |
| Through fellow migrant workers | 21 | 15.2 |
| Total | 138 | 100.0 |

The developmental potential of remittances can be accessed through investment out of remittances. If remittances are used for productive purposes then it will lead to economic well-being of the family as well as the region. About 80 percent respondents reported that remittances are mainly used for meeting household expenditure. However, some respondents also reported regular investment in agriculture, education of dependent, buying land & building house (Table 23).

**Table 23: Areas of Spending Remittances**

| **Area of Spending** | **Frequency** | **Percent** |
|---|---|---|
| Household expenditure | 132 | 79.4 |
| Expenditure in agriculture | 8 | 4.8 |
| Expenditure in education of dependent | 14 | 8.4 |
| Repayment of debt | 11 | 6.6 |
| Marriage and other Social functions | 3 | 1.8 |
| Buying land and building house | 6 | 3.6 |
| Saving and others | 4 | 2.4 |
| Don’t know | 10 | 6.0 |
| Total | 166 | 100.0 |
| *Note*: The summation is higher than the reported total because of multiple responses. | | |

## CONCLUSION

The objective of this paper is to analyze the characteristics and economic conditions of migrant workers in the Trivandrum district of Kerala .The analysis is based on data from a sample survey of 166 migrant workers in the Trivandrum district, which was carried out during September-October, 2008. A relatively younger bunch of unskilled and semi-skilled migrant workers, with different educational level and diverse socio-economic background, mostly from the far-flung states of West Bengal and Assam constituted the sample migrants in our study. The major reason for migration of these workers is the poor economic condition, lack of sufficient employment opportunities and low wages in their native place; whereas higher wages, availability of work and better working condition are reported as the major reasons for migration to Kerala. Informal network through friends/relatives and acquaintances who have already migrated to Kerala plays important role in migration of workers to Kerala.

It is found that the nature of employment of the workers has barely changed even after migration. Almost all the migrants are engaged in temporary work and none of them have registered in any employment agency, rather they have made some kind of informal contract with contractors/employers. More than two thirds of the migrants are employed in various menial works such as construction helper, bricks maker, casual laborer, carpenter, truck helper, etc.

The migrants earn a sufficiently higher wage in Kerala, which is, in some cases, more than three-four times higher than the wages in their native places. Although the income level of the migrants has increased, but most of them are living in deplorable conditions. Almost all the migrants used to stay together with other migrants − either at the work sites or rented houses− with one room shared by many and no provision of hygiene, sanitation and safe drinking water. Since, almost all migrants stay and cook together, food expenditure is found to be more or less same for all of them, but the non-food expenditure varies from person to person. The savings and investment habit among the migrants is found to be very poor. The average remittance send by the migrants was Rs. 26328 per migrant in the preceding year. A larger proportion of these remittances are used for meeting household expenditure, very little is invested in agriculture, education of dependent or buying land and building house.

## NOTES

1. The most prominent positive impacts of labour outmigration on Kerala economy are contribution to State income; increasing consumption, savings and investment; enhancing the quality of life and contribution to a high human development; reducing poverty and relative deprivation, etc. The major impact on the labour market is the reduction of unemployment through migration of unemployed youths and non-agricultural labourer. (See Kannan and Hari, 2002; Rajan and James, 2007; Zachariah et al., 2000, 2001; Zachariah and Rajan, 2004, 2007, 2008 for further discussion on this).
2. At the time of survey, the wage rate in Kerala was highest among the States in India. The daily wage of construction workers in Kerala was pegged between Rs. 250-350 in 2001, as against Rs. 71 in West Bengal, Rs. 55 in Tripura and Rs. 47 in Madhya Pradesh. (Source: http://labourbureau.nic.in/WRI-2003-04 percent-20Tables.htm).
3. For a detail discussion on this, see Zachariah *et al*. (2000, 2001), Zachariah and Rajan (2007) and Kannan and Hari (2002), among others.
4. As per Census 2001, only two districts, namely Ernakulam and Idukki, received more inflow of migrants (13.56 percent and 12.85 percent respectively) than Trivandrum district.
5. This is because some respondents reported their income level before migration as ‘subsistence income from agriculture’.
6. In order to find out why the 24 migrants (14.46 percent) had not sent money to home, we cross-classified migrants with respect to the frequency of sending money and the instance of migration in Kerala, which shows that the migrants who had not sent money to home had very recently (within 1-3 months) migrated to Kerala, and therefore, they were not able to accumulate sufficient money to send home.

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**Economics**

# INDEBTEDNESS AMONG KONDA REDDY TRIBAL HOUSEHOLDS IN KHAMMAM DISTRICT OF TELANGANA

***Gummadi Naresh****

**ABSTRACT**

*The State of Telangana known for its rigorous implementation of economic reforms, and the spate of farmers' suicides since the latter half of the nineties provides compelling evidence to the prevalence of crisis in agriculture. The main objective of the study is to examine the magnitude; extent and structure of overall indebtedness position among the Konda Reddy households in Khammam district and identify the factors affecting their indebtedness. The paper suggests certain recommendations to improve the institutional agricultural credit system and to regularize and continuously monitor the functioning of non-institutional sources of finance.*

**Keywords:** Indebtedness, Khammam, Konda Reddy, Telangana.

## INTRODUCTION

Konda Reddy tribal people are economically poorest people in the belt comprising Telangana and Andhra Pradesh. They inhabit on the banks situated on either side of the river Godavari in the hilly and forest tracts of East and West Godavari and Khammam districts of Telangana. Their mother tongue is Telugu, and these people are recognized as a Primitive Tribal Group (PGTs). They are primarily shifting cultivators and largely depends on flora and fauna, bamboo collection of forest and prepare the bamboo mat, bamboo baskets to sell in the local markets for their livelihood. They collect and sell non –timber forest produce like tamarind, adda leaves, myrobolan, broomsticks, and bamboo, etc. They cultivate largely jowar, which is their staple food. They also grow ragi, red gram, bajra, beans, paddy and pulses, etc., to supplement their meager income. These people live below the poverty line. The primitive tribal people face many problems in handicrafts, agriculture, issue of financial assistance, forest produce collection and other. One of the main economic problems of the tribe is indebtedness. 67 per cent Konda Reddy households are indebted in the study area. Indebtedness is one of the biggest and most serious problems in the study area. Indebtedness is a significant obstacle for rural development. It is an indicator of the weak financial infrastructure of our country in the rural areas.

## PROFILE OF THE STUDY AREA

Khammam district has the largest concentration of tribal population in Telangana. The district has Scheduled Tribes population of 5,58,958 which is about 13.24% of the total tribal population of the state. Out of the total 46 mandals, about 29 mandals are populated by tribal groups like Koyas, Lambadi and Konda Reddy and about 2 mandals are partially populated by tribes. Primitive Tribal Group (PGTs) Konda Reddy are highly concentrated in V.R.Puram mandal. There is hundred per cent Konda Reddy population in villages of Darapalle and Tekuluru.

***Gummadi Naresh** is an ICSSR Doctoral Fellow , Department of Economics, Osmania University, Hyderabad, Telangana. E-mail: gummadinareshphd77@gmail.com.

## PROFILE OF THE DARAPALLE VILLAGE

Darapalle is a small village/hamlet in VR Puram mandal in Khammam District of Telangana. It comes under Darapalle Panchayath. It is located 146 km towards east from Khammam district headquarters. Darapalle is surrounded by Kunavaram mandal towards west, Velairpad mandal towards South, Vemsoor mandal towards South, and Kukkunur mandal towards west. Bhadrachalam, Manuguru, Kothagudem, Kovvur are the nearby cities to Darapalle. Total area of Darapalle is 65 hectares.

## PROFILE OF THE TEKULURU VILLAGE

Tekuluru is a small village/hamlet in VR Puram mandal in Khammam District of Telangana. It comes under Tekuluru Panchayath. It is located 146 km towards east from Khammam district head quarters. Bhadrachalam, Manuguru, Kothagudem, Kovvur are the nearby cities to Tekuluru. Total area of Tekuluru is 324 hectares.

## OBJECTIVES OF THE STUDY

- To examine the magnitude, extent and structure of indebtedness among tribal households in the study area.
- To bring into light the traditional money lending agencies.
- To identify the factors causing indebtedness among tribal and obtain their suggestion for improving their standard of living.

## HYPOTHESES

- There is a positive correlation between the size of the household and the extent of the indebtedness.
- There is a positive correlation between the size of the landholding and the extent of the indebtedness.
- Purpose-wise distribution of indebted households for agricultural operations alone is more as compared to others purposes.

## METHODOLOGY

*Data Collection:* This study is based on both primary and secondary sources of data collected from each household, relating to various parameters of social status and financial status, through well designed and structured questionnaire and interview. The required secondary data was also collected through books and various official reports; Articles published in different journals, various seminars and conference papers and, local collectorate office, ITDA , CESS , State level office reports etc.

*Analytical Framework:* To meet the set objectives of the present investigation, as far as possible, simple tables and averages have been used to present the findings of the study. Graphs have also been used.

*Sample Size:* In the present study, we have taken 50 sample respondents from each village selected randomly; making a total of 100 from this mandal.

*Period of the Study:* Survey of the study was conducted during the months of March to June 2014, and the study analysis was done during July-December, 2014.

**FARMER WISE INCIDENCE OF INDEBTEDNESS AMONG KONDA REDDY HOUSEHOLDS IN KHAMMAM**

**Table 1: Darapally village Farmer- wise incidence of Indebtedness among tribal households in Khammam (*Major source*)**

| S. No | Source | Farmer wise(Amount in rupees) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Marginal1 | Marginal II | Small 1 | Small II | Other | Total |
| 1 | Landlords outstanding | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Relations Outstanding | 4600 | 1923 | 2647 | 2727 | 0 | 2460 |
| 3 | Moneylenders Outstanding | 0 | 1154 | 588 | 909 | 20000 | 2300 |
| 4 | Cooperative Outstanding | 0 | 0 | 0 | 2727 | 0 | 600 |
| 5 | National Bank Outstanding | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | Dwacra outstanding | 0 | 0 | 0 | 3636 | 0 | 800 |
| 7 | Other Outstanding | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | **Total** | 4600 | 3077 | 3235 | 10000 | 20000 | 6160 |

(**Note**: ≤ 1.5 acre= Marginal Farmers, 1.51 – 2.5 acre = Marginal 2 Farmers, 2.51 – 3.5 acre = Small 1 Farmers, 3.51 – 5 acre = Small2 Farmers, 5.0 acre - ≥ = Others Farmers)

*Source*: Field Data

The analysis too indicates a similar trend. On an average, each farmer household is indebted by an amount of Rs.6160. The indebtedness depends on different source in the study area. Here, there is a positive correlation between size of the land category and amount of indebtedness. Two types of Small farmers have four sources of the credit. As compared to this, Marginal 1 farmers households depends on relations credit source. Marginal 2 farmers households depends on relatives and moneylenders, Small 1 farmer households also depends on same sources. But Small 2 farmer households depends on relatives, moneylenders and cooperative, dwacra sources. According to analysis, large farmers depends only moneylenders source, and they pay high interest rates hence, fluctuations in agriculture returns will lead to more indebtedness among them.

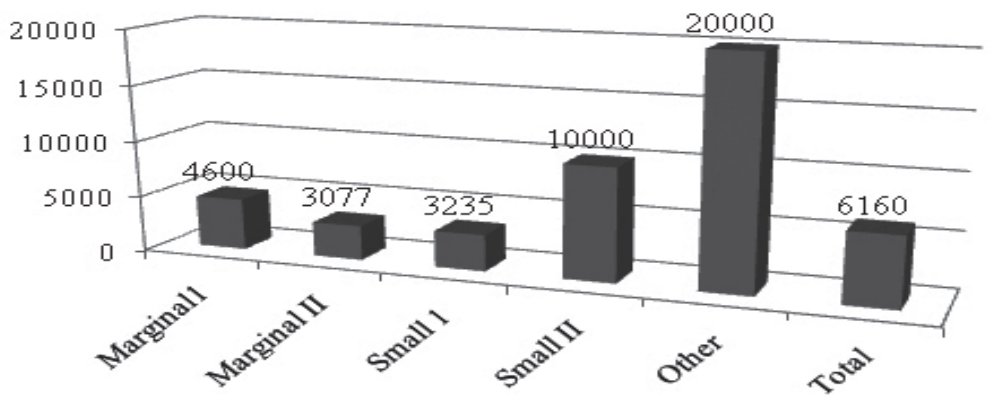


**Figure: Farmer wise incidence of Indebtedness among tribal households in Darapalle village**

(**Note**: ≤ 1.5 acre = Marginal Farmers, 1.51 – 2.5 acre = Marginal 2 Farmers, 2.51 – 3.5 acre = Small 1 Farmers, 3.51 – 5 acre = Small2 Farmers, 5.0 acre - ≥ = Others Farmers)

*Source:* Field Data

Thus, farmer- wise analysis indicates that informal sources are the major source of the finance for the farmers in Khammam district. There is a positive correlation between size of the land holding and outstanding loans. Konda Reddy farmers in Khammam district are more exposed to high cost credit, and informal credit source i.e., relations and moneylenders. Moneylenders are major sources for credit in the study area. They are paying high interest rates. Hence, fluctuations in agriculture returns will lead to more indebtedness. Analysis of the source of indebtedness suggest that at the farmer level, the average outstanding loan is in following order:relations(Rs.2460), moneylenders(Rs.2300), cooperative outstanding (Rs.600), and dwacra (Rs.800).

**Table 2: Farmer wise incidence of Indebtedness among tribal households in Tekuluru village (*Major source*)**

| S. No | Source | Farmer wise | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Marginal1** | **Marginal II** | **Small 1** | **Small II** | **Other** | **Total** |
| 1 | Landlords outstanding | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Relations Outstanding | 5000 | 2200 | 1500 | 2267 | 2168 | 2180 |
| 3 | Moneylenders Outstanding | 5000 | 3400 | 6600 | 5200 | 4056 | 4880 |
| 4 | Cooperative Outstanding | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | National Bank Outstanding | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | Dwacra outstanding | 0 | 0 | 0 | 0 | 1111 | 400 |
| 7 | Other Outstanding | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | **Total** | 10000 | 5600 | 8100 | 7467 | 7333 | 7460 |

(**Note:** ≤ 1.5 acre = Marginal Farmers, 1.51 – 2.5 acre = Marginal 2 Farmers, 2.51 – 3.5 acre = Small 1 Farmers, 3.51 – 5 acre = Small2 Farmers, 5.0 acre ≥ = Others Farmers)

*Source*: Field Data

The average indebtedness in the study area amounts to Rs.7460 for the year 2012-13. The highest indebted farmers are Marginal 1 (Rs.10,000) followed by Small 1 farmers (Rs.8100), Small 2 farmers(Rs.7467), other farmers households (Rs.7333) and Marginal 2 farmers (Rs.5600). Relatives and moneylenders are the major source in the study area. Almost all farmer households depends on informal credit source and they pay high interest rates, hence fluctuations in agriculture returns will lead to more indebtedness.

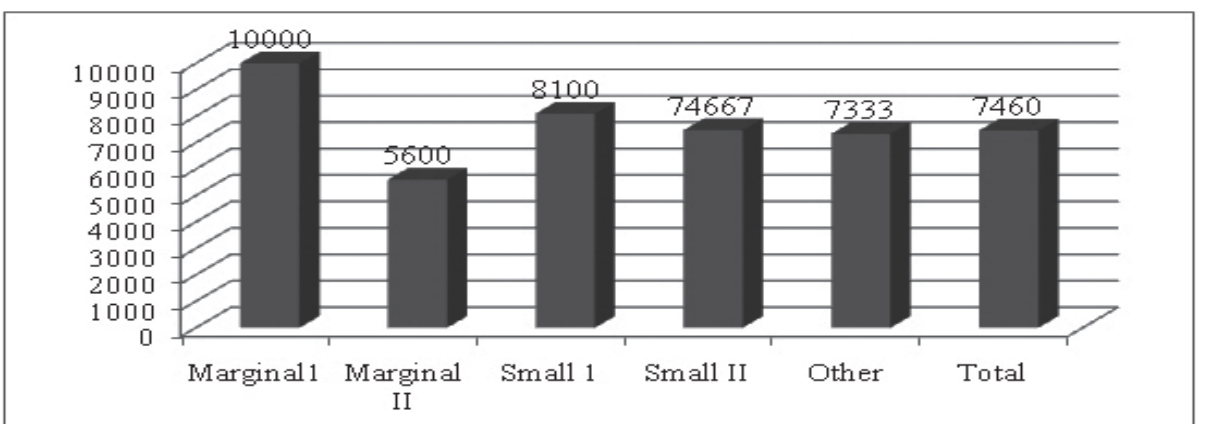


**Figure 2: Farmer wise incidence of Indebtedness among tribal households in Tekuluru village**

(**Note:** ≤ 1.5 acre = Marginal Farmers, 1.51 – 2.5 acre = Marginal 2 Farmers, 2.51 – 3.5 acre = Small 1 Farmers, 3.51 – 5 acre = Small2 Farmers, 5.0 acre ≥ = Others Farmers)

*Source*: Field Data

The data indicates that informal sources are the major source of the finance for the farmers in Khammam district. Konda Reddy farmers in Khammam district are more exposed to high cost credit, and informal credit source i.e. relations and moneylenders. At the farmer level, relations outstanding and moneylenders outstanding are the major source of the credit, accounting for an average of Rs.2180, followed by moneylenders at an average amount of Rs.4880. Similar trend was observed among households of all the other farmers' categories.

## CONCLUSIONS AND SUGGESTIONS

It can be concluded from above analysis that 67 per cent of Konda Reddy farmer household in the sample area of Khammam are indebted and every farm size categories are equally indebted in percentage terms. The amount of indebtedness was higher in Tekuluru .

To improve the economic condition of farmers, following measure are suggested to tackle the situation:

(i) Regularize and continuously monitor the functioning of non-institutional source of finance;

(ii) Strengthen the functioning of cooperatives in the hill areas;

(iii) Improve the functioning and lending procedure of the commercial banks;

(iv) Implement the crop insurance scheme through ITDAs in agency areas;

(v) Organize mass campaign against intoxicants and extravagant expenditure on social festivities.

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**Computer Science**

# DESIGN & DEVELOPMENT OF DISCRETE HMM (DHMM) ISOLATED HINDI SPEECH RECOGNIZER

***Satish Kumar****
***Prof. Jai Prakash*****

**ABSTRACT**

*This paper describes the insight of the design & development of a Proposed Hindi Speech Recognizer based on the discrete hidden Markov model (DHMM). Here we have proposed a new Quantizer which has been used with discrete hidden Markov modeling to get a proposed DHMM Hindi Speech Recognizer. The multidimensional Mel frequency cepstral coefficients(MFCC) speech vectors are converted into discrete symbols through a vector quantizer having size of the codebook as 32 i.e. each observation sequence for every utterance is represented by 32 code vectors or discrete symbols. The proposed design of a vector quantizer goes through various steps such as sorting, partitioning, quantizing and cluster indexing etc. to get an observation sequence. Each observation sequence is segmented into six states & a correct state sequence is found out by Viterbi algorithm. The parameter discrete symbol probability distribution (Emission matrix) and how a discrete symbol moves from one state to another (Transition matrix) are estimated by Baum Welch algorithm which makes use of forward & backward variables. The negative logarithm of probability distribution of discrete symbols in different states is used to find the index of the maximum probability which gives the recognized utterance. The results of the experimentation have shown that Proposed DHMM Speech Recognizer is more powerful and efficient as compared to other Speech Recognizer*

**Keywords:** Baum-Welch, DHMM, Markov model, Speech Recognizer, Viterbi, VQ.

## INTRODUCTION

A discrete HMM Hindi speech recognizer is based on the principle of Markov process which states that "future is independent of past given the present" that is the next output emission of any activity does not depend on the previous or present output. Between the year 1960 to 1970; Baum, Petrie & Egon, worked on probabilistic functions statistical estimation for probabilistic functions of a Markov process & developed the basic theory of hidden Markov Models(HMM) [1] [2] [3]. This theory of HMM was applied to speech recognition for developing isolated word recognizer between the year 1980-1990 by Rabiner, Wilpon, Juang, Levinson & Sondhi [4][5][6]. The design of front end of DHMM Hindi speech recognizer involves capturing raw speech, its digitization and extracting MFCC speech vectors followed by vector quantization to get a sequence of symbols or observation sequence which is used for developing a statistical model such as HMM. In the year 1980, Linde, Buzo & Gray proposed an algorithm for vector quantization (VQ) based on nearest neighbor search and distortion measure [7]. The VQ technique was applied to speech recognition by Soong & Rosenberg, where set of codebooks were generated through the use of spectral property of a speaker [8].The design and development of DHMM for recognizing isolated Hindi words is divided into four sections (1) Front

***Satish Kumar** is a Research Scholar at Mewar University, Gangrar, Chittorgarh, Rajasthan, India. He is working as Lecturer(S.G) at Kasturba Polytechnic for women, Pitampura,New Delhi. E-mail: satish_suryan@yahoo.com
****Prof. Jai Prakash** is a Visiting Professor, Mewar University, Rajasthan, India, E-mail: drjp27@yahoo.co.uk.

End development and design of proposed vector quantizer, (2) Discrete hidden Markov model development.. (3) Architecture of proposed DHMM Hindi speech recognizer,(4) Results of experimentation. The design of proposed VQ method, algorithm, and flow chart is described in detail in Section 1. The development of the HMM model includes calculation of various parameters like, forward variable (α), backward variable (β), gamma (γ), Zie (ξ), and re-estimating the model 'λ' parameters, initial state probability distribution $(\pi_i)$, transition matrix $(a_{ij})$ and observation symbol probability distribution $(b_j(k))$ by using forward & backward algorithms and Baum-Welch algorithm has been described in section 2 of this paper. The Architecture of DHMM Hindi speech recognizer involves its software design & implementation which is described in Section 3. The results and conclusions are discussed in Section 4 and 5.

## 1. FRONT END DEVELOPMENT AND DESIGN OF PROPOSED VECTOR QUANTIZER:

***1.1 Front End Development****:* It includes recording, digitizing the speech signal and converting it into Mel frequency cepstral coefficients (MFCC). The Mel scale is having linear frequency spacing below 1 $KH_Z$ and has logarithmic spacing above 1$KH_Z$. Because of this property these parameters finds application in the speech recognition. The MFCC algorithm has various steps such as pre-emphasizing speech signal, Enframing , windowing , FFT calculation , Mel frequency transformation and finally Discrete cosine transformation (DCT) is performed to get MFCC parameters. The 12 dimensional MFCC vectors are passed through a proposed vector quantizer for the purpose of reducing the data and designing different codebooks described in next Para. The detailed steps of development of front end for Hindi speech recognizer have been described in [9].

***1.2 Proposed Vector Quantizer Design****:*

*i) Codebook Design:* The process of the codebook designing is called training of Codebook. A code book can be designed in various sizes such as K=8, 16, 32, 64, 128 etc. The number of code vectors defines the size of a Codebook. The symbol L or K denotes the size of the code book. The size of a codebook is also defined in terms of L-level Codebook. The partitioning of N dimensional space into L clusters or cells is done. The proposed algorithm for designing a codebook is described below.

*ii) Algorithm:*

*Step 1***:** *Initialization:*

The Mel frequency cepstral coefficients obtained from digitized speech samples are used as

*Initial data set* {C1, C3 …….. $C_n$}, where n is the maximum length of observation sequence.

*Step 2: Sorting:*

The components of data set are arranged in the ascending order of their magnitude value to obtain new data set.

*Step 3***:** *Partitioning:*

The new data set so obtained is partitioned into number of clusters or cells depending upon the size of the codebook.

*Step 4***:** *Quantization:*

Each partition is allotted a quantized value.

*Step 5***:** *Cluster Indexing*

The index value of cluster is allotted to each member of new data set to obtain a symbol sequence or simply the observation sequence.

*Step 6***:** *Termination:*

Finally a sequence of Symbols Called observation sequence is obtained after completion of step 5 and the process is stopped.

**Figure 1** shows the flow chart for designing the proposed vector quantizer.

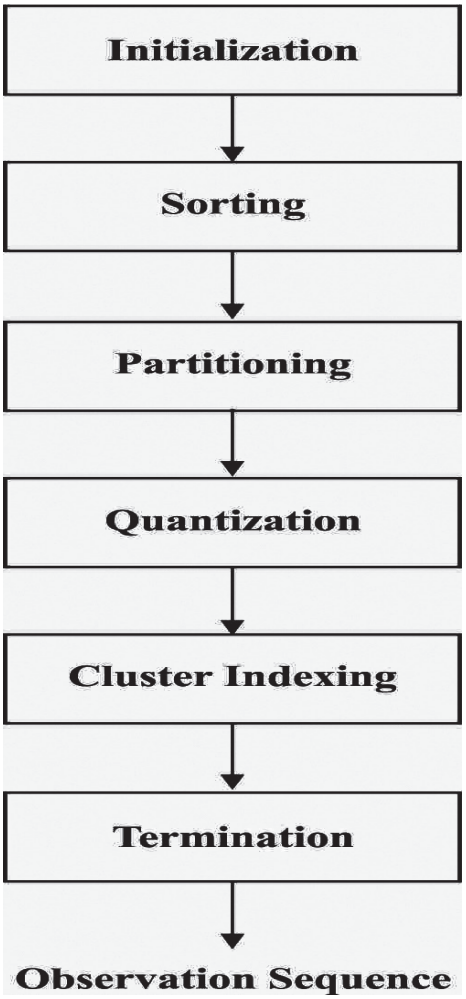


**Figure 1: Flow chart of proposed vector Quantizer**

## 2. DISCRETE HIDDEN MARKOV MODEL DEVELOPMENT

A discrete HMM is characterized by $\lambda = (A, B, \pi)$. Where $A = a_{ij}$ defines the transition matrix that is how a symbol moves from one state $i$ to other state $j$. $B = b_j(k)$ defines the observation symbol probability distribution that is the output emission matrix given by $b_j(k) = P(O_n = V_k / S_n = j)$. *The* $\pi_i = P(S_1 = i)$ defines the initial state distribution. S defines the number of states in the model. M defines the discrete observation symbols per state. For example an observation sequence has series of symbols M=1, 2, 3… 32. Let us assume a *observation Sequence* as*:* 2, 3, 5, 7, 9, 2, 20, 22, 2, 32, 1, 30, 29, 28, 2, 9, 1, 3, 32, 3. Here the observation sequence has length of 20 symbols. From the above sequence, it is inferred that the first symbol is 2 that is the emission or the output of any activity or output symbol is 2 but it is unknown that this output belongs to which state i.e. the state is hidden. Hence the state of any symbol is always unknown in the sequence and the correct sequence of state of symbol is found out by using Viterbi procedure [10].

To develop a discrete HMM, $\lambda = (A, B, \pi)$, three problems are solved out. The first problems is to find out the probability of observation sequence $P(O / \lambda)$ for a given observation sequence $O = (O_1 O_2 ... O_N)$ & model parameter $\lambda = (A, B, \pi)$. The forward and backward procedures are used to obtain the solution to Problem 1. The second problem is to find the optimal state sequence for a given observation sequence $P(O_1, O_2 ... O_N)$ .The solution to Problem 2 is obtained by using Viterbi algorithm. The third problem is to adjust the model parameters in order to maximize the probability of observation sequence $P(O / \lambda)$ . The solution to Problem 3 is obtained by using Baum-Welch algorithm [9][11][12][13].

### *2.1 Forward Algorithm*

Let us define a forward variable $\alpha_n(i)$ and is given by

$$\alpha_n(i) = P(O_1O_2O_3....O_n, S_n = i / \lambda)$$

Where P→ Probability of partial observation sequence or output emission symbol sequence up to instant *n* with.

$S_n$→ State s at time n is equal to i given the model $\lambda$

*Step 1: Initialization*

$$\alpha_1(i) = \pi_i .\ e_i(O_1) \qquad 1 \le i \le S$$

*Step 2: Recursion*

$$\alpha_{n+1}(j) = \left[\sum_{i=1}^{S} \alpha_n(i).a_{ij}\right] e_j(O_{n+1}) \quad 1 \le n \le N-1$$
$$1 \le j \le S$$

*Step 3: Termination*

$$P(O / \lambda) = \sum_{i=1}^{S} \alpha_N(i)$$

Where ( ) shows the joint probabilities of initial observation $O_1$ and State i **.** Figure 2 shows the operational sequences required for finding out the forward variable $\alpha_{n+1}$ which is a recursive process.

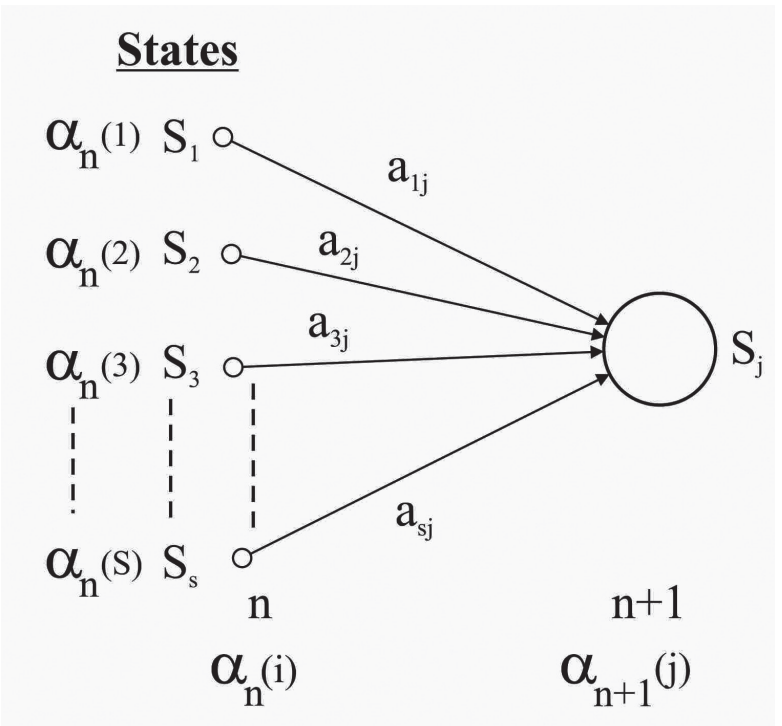


**Figure 2 : Operational sequence for Forward variable (Alpha)**

The probability of observation sequence $\alpha_N(i)$ can be calculated through the termination step 3 by adding all the terminal forward variable $\alpha_N(i)$ .

### *2.2 Backward Algorithm*

Let us define a backward variable $\beta_n(i)$ which is given as

$$\beta_n(i) = P(O_{n+1}O_{n+2}.....O_N \ / S_n = i, \lambda)$$

Where P is the probability of the partial observation Sequence from instant n+1 to end with $S_n \rightarrow$The State at instant n is equal to 1 given the model $\lambda$ .

**Algorithm:**

*Step 1***:** *Initialization*

$$\beta_N(i) = 1 \qquad 1 \le i \le S$$

*Step 2***:** *Recursion*

$$\beta_n(i) = \sum_{j=1}^{S} a_{ij}.\ e_j(O_{n+1})\,\beta_{n+1}(j)$$

Where $n = N-1, N-2.....1, \quad 1 \le i \le S$

Step 3*: Termination*

$$P(O/\lambda = \sum_{i=1}^{S} \pi_i e_i(O_1)\beta_1(i)$$

The backward algorithm is used to find out the value of backward variable $\beta_n(i)$ moving from back to start along the observation sequence. The forward and backward algorithms are used for finding out the optimal state sequence and parameter estimation of HMM respectively. Figure 3 shows the steps required to calculate the backward variable $\beta_n(i)$ .

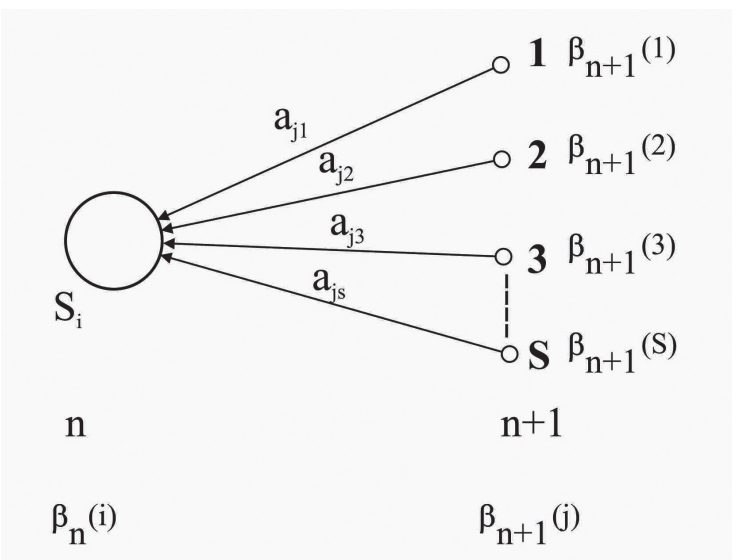


**Figure 3: Operational sequence for calculating Backward variable(Beta)**

### *2.3 Viterbi Algorithm*

It is used to find out the hidden state sequence associated with the given observation sequence. Now it is to be find out using some optimal criteria. The Viterbi algorithm select one state sequence out of various state sequences that has the maximum likelihood for a given observation sequence. Single best state sequence S = ($S_1$ $S_2$ $S_3$… $S_N$) for a given observation sequence O = $O_1$ $O_2$ $O_3$… $O_N$ can be find out by defining a quantity such as $\delta_n(i)$. Let us define the quantity $\delta_n(i)$ given as :

$$\delta_n(i) = \max_{S_1 S_2, \ldots S_{n-1}} P[S_1 S_2 \ldots S_{n-1}, S_n = i, O_1 O_2 \ldots O_n \mid \lambda]$$

Where $\delta_n(i)$ is the maximum probability of state sequences of length n.

*Algorithm:*

*Step 1***:** *Initialization At instant n=1*

$$\delta_1(i) = \pi_i . e_i(O_1) \quad 1 \le i \le S$$

$$\psi_1(i) = 0$$

Step 2*: Recursion from instant n = 2*

$$\delta_n(j) = \max_{1 \le i \le S} [\delta_{n-1}(i) a_{ij}] e_j(O_n) \qquad \begin{matrix} 2 \le n \le N \\ 1 \le j \le S \end{matrix}$$

$$\psi_n(j) = \arg\max_{1 \le i \le S} [\delta_{n-1}(i) . a_{ij}] \qquad \begin{matrix} 2 \le n \le N \\ 1 \le j \le S \end{matrix}$$

*Step 3*: *Termination*

$$P^* = \max_{1 \le i \le S} [\delta_N(i)]$$

$$S_N^* = \arg\max_{1 \le i \le S} [\delta_N(i)]$$

*Step 4: Path (State Sequence) backtracking*

$$S_n^* = \psi_{n+1}(S_{n+1}^*)$$

$$n = N-1, N-2 \ldots .1$$

***2.4 Baum-Welch Algorithm****:* This algorithm describes the iterative procedure for re-estimation of various HMM parameters such as $\pi_i$, $a_{ij}$ & $b_j(k)$ . The term re-estimation means finding an iterative and improved value of these parameters as per certain criteria. A criteria normally used for re-calculating these parameters is based on two points (i) when the difference in calculated immediate values of these parameter is less than a threshold

values *e*=0.0001; (ii) If iterations exceeds a defined value. The procedure of recalculating values of these parameters is stopped if the above criterion is met. Now let us define a quantity $\xi_n(i,j)$ which is given as:

$$\xi_n(i,j) = P(S_n = i, S_{n+1} = j \mid O, \lambda)$$

Where $\xi_n(i,j) \rightarrow$ Probability of being in the state $i$ at instant $'n'$ and in state j at instant $n+1$.The sequence of operations required for calculating the term $\xi_n(i,j)$ has been described in the **Figure 4**.

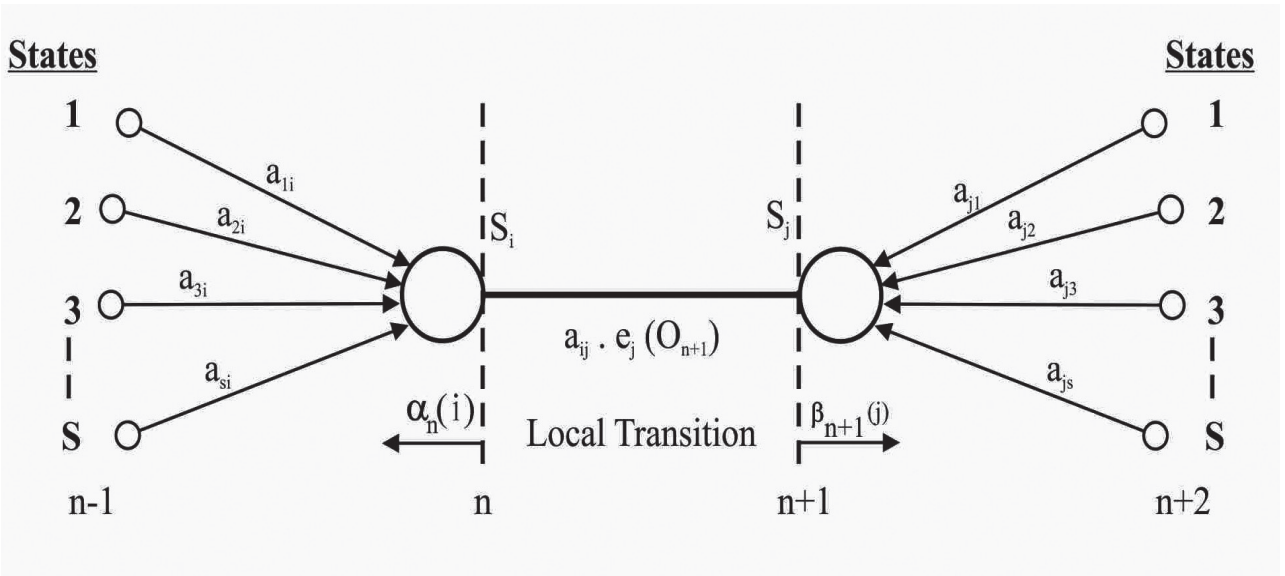


**Figure 4: Operational sequence for calculating Zie**

Now by using the definitions of forward variable $\alpha_n(i)$ & backward variable $\beta_n(i)$ as described earlier and making use of the Figure 3, showing various paths & probabilities the term $\xi_n(i,j)$ can be calculated as follows

$$\xi_n(i,j) = \frac{\alpha_n(i).a_{ij}.e_j(O_{n+1})\beta_{n+1}(j)}{\sum_{i=1}^{s}\sum_{j=1}^{s}\alpha_n(i).a_{ij}.e_j(O_{n+1})\beta_{n+1}(j)}$$

Now let us define a posterior probability variable $\gamma_n(i)$ which is given as below:

$$\gamma_n(i) = P(S_n = i \mid O, \lambda)$$

Where $\gamma_n(i) \rightarrow$ Probability of being in the state $i$ at instant $n$ given the observation sequence and model $\lambda$

Posterior probability variable, gamma, $\gamma_n(i)$ can be calculated by using the definitions of forward & backward variables $\alpha_n(i)$ & $\beta_n(i)$

$$\gamma_n(i) = \frac{\alpha_n(i)\beta_n(i)}{\sum_{j=1}^{s}\alpha_n(i)\beta_n(i)}$$

gamma $\gamma_n(i)$ can be related to zie, $\xi_n(i,j)$ by summing zie over j we get

$$\gamma_n(i) = \sum_{j=1}^{s} \xi_n(i,j)$$

Expected number of transitions from $i$ in the observations sequence O can be calculated by summing gamma, $\gamma_n(i)$ over the time n index

$$\sum_{n=1}^{N-1} \gamma_n(i) = \text{Expected no. of transitions from state } i \text{ in } O.$$

Similarly expected number of transitions from state $i$ to state j in '$O$' can be calculated by summing the term $\xi_n(i,j)$ over the time n index.

$$\sum_{n=1}^{N-1} \xi_n(i,j) = \text{Expected no. of transitions from state } i \text{ to state j in } O.$$

The re-estimation of HMM parameters such as $\pi_i$, A and B is done by using the formula

1. $\overline{\pi}_i = \gamma_1(i) \Rightarrow Expected\ number\ of\ times\ in\ state\ i\ at\ time\ n = 1$

2. $$\overline{a}_{ij} = \frac{\sum_{n=1}^{N-1} \xi_n(i,j)}{\sum_{n=1}^{N-1} \gamma_n(i)} \Rightarrow \frac{Expected\ number\ of\ transitions\ from\ state\ i\ to\ state\ j}{Expected\ number\ of\ transitions\ from\ state\ i}$$

3. $$\overline{b}_{j(k)} = \frac{\sum_{n=1,\ \{such\ that\ O_n = k\}}^{N} \gamma_n(j)}{\sum_{n=1}^{N} \gamma_n(j)} \Rightarrow \frac{Expected\ number\ of\ times\ in\ state\ j\ \&\ observing\ symbol\ k}{Expected\ number\ of\ times\ in\ state\ j}$$

## 3. ARCHITECTURE OF PROPOSED DHMM HINDI SPEECH RECOGNIZER:

A discrete hidden Markov model (DHMM) Hindi Speech Recognizer is based on the principle of discrete time Markov process. A speech signal can be represented by parametric random process is the basic assumption used for designing a DHMM based speech recognizer. The architecture of a proposed discrete HMM Hindi speech Recognizer is shown in Figure 5. The vocabulary size is W=10 words each with K=5 utterances of male and female speaker in the age group of 30-50 years. Here we model each of the word of the vocabulary & prepare a discrete model for each word. Each word is trained with 5 utterances, and then every word utterance is converted into sequence of symbols called observation sequence. An observation sequence is the representation of spectral characteristics of the word and each sequence is derived through the proposed vector quantization process where every MFCC Vectors of each utterance is converted into discrete symbols. The Mel frequency cepstral coefficients (MFCC) are widely used because they represent the best approximation of human ear [14] [15].

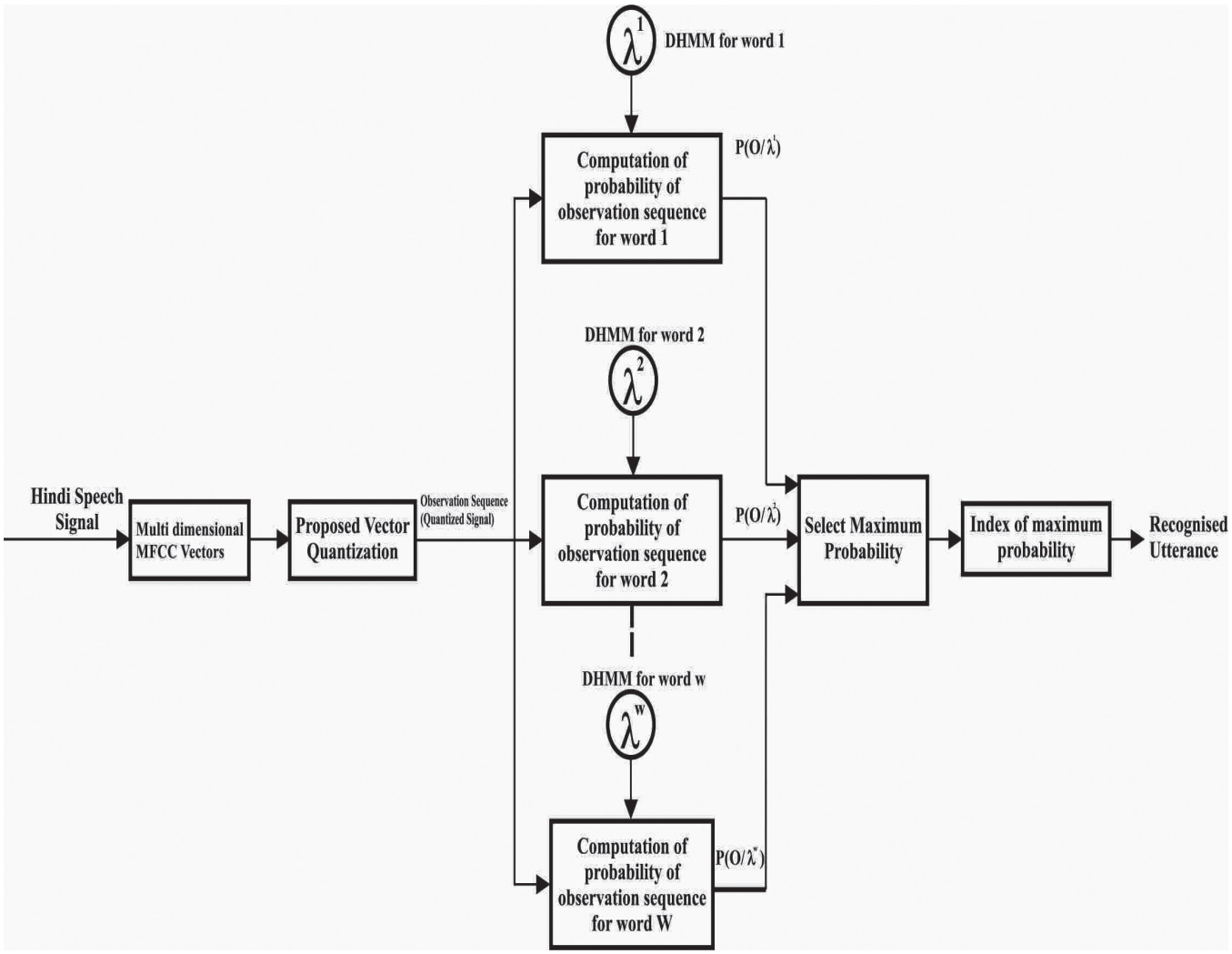


**Figure 5:Proposed DHMM Hindi Speech Recognizer**

We perform the following steps to complete the process of Hindi speech recognition of different words.

1. We build the discrete HMM model for W words of the vocabulary. The model parameters $\lambda = (A, B, \pi)$ are estimated and are used to optimize the probability of the training set observation vectors for W$^{th}$ word.

2. For the recognition of every unknown word the pre-processing as shown in the Figure 5 is carried out. The first step is the feature analysis of the speech signal of every word. Here we use the Mel frequency cepstral coefficients. The second step is vector quantization of the speech vectors to get observation sequence O = ($O_1$ $O_2$ $O_3$… $O_N$). Finally, the calculation is done for probability of observation sequence for every word. i.e. $P(O / \lambda s)$, $1 \le w \le W$ followed by the selection of the word whose model probability is maximum [16].

Recognized word will be given by the index $w^* = \arg\max[P(O / \lambda w)]$ . Generally the $1 \le w \le W$

Probability computation is done through Viterbi algorithm. A software in MATLAB has been designed using proposed VQ techniques described in Section1 and algorithms such as Forward, Backward, Viterbi and Baum -Welch described in Section 2.

## 4. RESULTS OF THE EXPERIMENTATION PERFORMED ON PROPOSED DHMM SPEECH RECOGNIZER

| | **Existing Method** (*using k means of VQ*) | | | | **Proposed Method** (*using proposed VQ*) | | | |
|---|---|---|---|---|---|---|---|---|
| *Words in Data* | *Unknown Word 1* (*Sita)* | | *Unknown Word 2* (*Raam*) | | *Unknown Word 1 (Sita)* | | *Unknown Word 2* (*Raam*) | |
| | Probability Computation | | Probability Computation | | Probability Computation | | Probability Computation | |
| (Index j) | Iteration 1 | Iteration 2 | Iteration 1 | Iteration 2 | Iteration 1 | Iteration 2 | Iteration 1 | Iteration 2 |
| | 1.0e+003 * | 1.0e+003* | 1.0e+003* | 1.0e+003 * | 1.0e+003* | 1.0e+003* | 1.0e+003* | 1.0e+003 * |
| Word1(*Hanuman*) | -2.1801 | **-2.1469** | **-2.8161** | -2.8536 | -2.1654 | -2.1654 | -2.8273 | -2.8273 |
| Word 2(*Kalam*) | **-2.1309** | -2.1883 | -2.8673 | -2.8494 | -2.1777 | -2.1777 | -2.8532 | -2.8532 |
| Word 3(*Kapi*) | -2.1416 | -2.1644 | -2.8302 | -2.8293 | -2.1719 | -2.1719 | -2.8268 | -2.8268 |
| Word 4(*Kitab)* | - 2.1837 | -2.1680 | -2.8887 | -2.8134 | -2.1653 | -2.1653 | -2.8385 | -2.8385 |
| Word 5(*Pen*) | -2.2302 | -2.1523 | -2.8662 | **-2.7963** | -2.1649 | -2.1649 | -2.8258 | -2.8258 |
| Word 6(*Pustak*) | -2.1713 | -2.1950 | -2.8400 | -2.8565 | -2.1676 | -2.1676 | -2.8314 | -2.8314 |
| Word 7(*Raam*) | -2.2058 | -2.2276 | -2.9305 | -2.8684 | -2.1892 | -2.1892 | **-2.7756** | **-2.7756** |
| Word 8(*Ravan*) | -2.2264 | -2.1777 | -2.9396 | -2.8710 | -2.1641 | -2.1641 | -2.8349 | -2.8349 |
| Word 9(*Sita*) | -2.1911 | -2.1806 | -2.8368 | -2.8802 | **-2.1248** | **-2.1248** | -2.8451 | -2.8451 |
| Word 10(*Sugriv*) | -2.1857 | -2.1576 | -2.8953 | -2.8437 | -2.1709 | -2.1709 | -2.8318 | -2.8318 |
| Max Probability index 'j' | **j=2** | **j=1** | **j=1** | **j=5** | **j=9** | **j=9** | **j=7** | **j=7** |
| | *The maximum probability is selected which gives the index of the recognized utterance. The proposed DHMM is trained with 5 utterances of each word and sixth utterance of every word is used as an unknown word during the testing phase**.** | | | | | | | |
| **Recognised word** | ***Kalam*** | ***Hanuman*** | ***Hanuman*** | ***Pen*** | ***Sita*** | ***Sita*** | ***Raam*** | ***Raam*** |
| ***Status of Recognition*** | *Incorrect* | | *Incorrect* | | *Correct* | | *Correct* | |

The interpretation of the above result yields that the proposed technique of Speech recognition is superior and the accuracy is extremely high although the data length used is small. All the test utterances were recognized correctly through proposed method as compared to k-means method for same speaker that is we can say that the system has been designed *Speaker dependent*. It can be made *Speaker independent* by training the system by large number of speaker.

## 5. CONCLUSIONS AND FUTURE DIRECTIONS

The proposed design makes use of code book size of 32 code vectors and 12 dimensional MFCC Speech vectors. The computed probabilities after every iteration comes as a constant value i.e. it does not change with iteration number as compared to k-means of VQ where computed probability values changes after every iteration

because of the use of random selection of Centroids as initial data centers or code vectors. The proposed design is very simple as it involves vector quantization of input speech signal which leads to discrete symbols that are used to develop a statistical model such as HMM. The efficiency of proposed DHMM Hindi Speech Recognizer is better as compared to older methods of VQ such as K-means. The work can be carried out in future direction by using 26 or 39 dimensional MFCC speech vectors and using speaker dependent or independent , continuous density HMM for recognizing the words .

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**Electronics**

# USER AUTHENTICATION WITH FUZZY FUSION OF FACE TECHNIQUES

***Shiv Ratan Singh****
***Jai Prakash*****

**ABSTRACT**

*The vast majority of the successful commercial biometric systems at present depend on fingerprint or face-recognition. Moreover, these biometric indicators complement one another in their strengths and advantages. While fingerprint gives exceptionally high verification precision, these still carry some verification errors. The Face recognition is the second most preferred method with reasonably good accuracy. In this paper, we attempt to integrate the face and fingerprint recognition techniques using fuzzy fusion method. The results presented in the paper are very promising and provide a direction for the future research in the user identification.*

**Keywords:** Biometric, face recognition, Fuzzy Logic, fuzzy fusion, Linear Discriminant Analysis(LDA), Principal Component Analysis(PCA).

## INTRODUCTION

Face recognition technology has become one of the most important biometric technologies, for its non-intrusive nature and its potential applications like personal identification, security access control, surveillance systems, tele-communications, digital libraries, human-computer interaction, military and so on. In past, much research is done for the enhancement of the accuracy of the Face recognition system. In this exercise, the algorithms have become very computationally complex and such algorithms can't be used in real time systems. In this paper, we have shown that using the basic algorithms for the face recognition and then Fuzzy fusion of these methods significantly improves the results. In this work, Face identification techniques: Principal Component Analysis (PCA and linear discriminant analysis (LDA) [4] are discussed and finally fuzzy fusion of these two techniques is done to further improve the results.

## FACE RECOGNITION

It is quite easy to obtain facial images with a couple of inexpensive fixed cameras. Good face recognition algorithms and appropriate preprocessing of the images can compensate for noise and slight variations in orientation, scale and illumination [3].

Face recognition is used for two primary purposes:

1. *Verification* (one-to-one matching): When presented with a face image of an unknown individual along with a claim of identity, making sure whether the individual is who he/she claims to be.

2. *Identification* (one-to-many matching): Given an image of an unknown individual, determining the identity

***Shiv Ratan Singh** is a Lecturer at the Department of ECE Guru Nanak Dev Co-ed Polytechnic, Government of NCT of Delhi. He is also a Research Scholar at Mewar University, Gangrar, Chittorgarh, Rajasthan**.** Email: sratanphd@gmail.com.
****Jai Prakash** is a Visiting faculty at Mewar University Gangrar, Chittorgarh, Rajasthan**.**

of that person by comparing (possibly after encoding) that image with a database of (possibly encoded) images of known individuals [3].

The flow diagram for the face recognition techniques is shown in the Figure 1 given below:

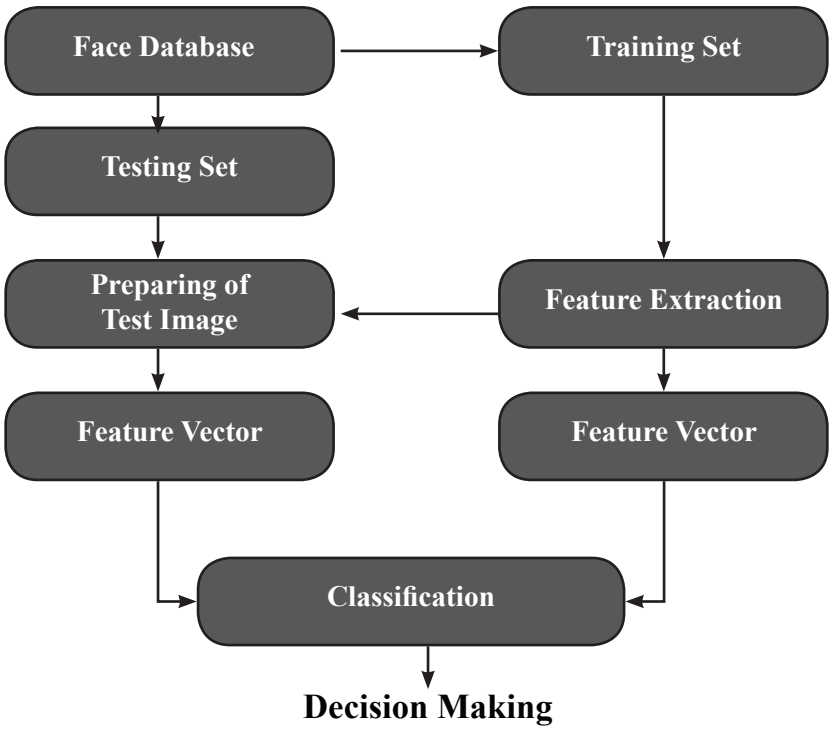


**Figure 1: Flow diagram for the face recognition**

In the face recognition system the flow must be followed. It defines all the required steps in the face recognition system. Figure 1 defines all the required steps, but the most important step is the Feature Extraction which is ultimately used for dimensional reduction as well as for extracting features from input of the system. Extracted features are passed to the last phase that is classification where the identification or verification rate is calculated.

## PRINCIPAL COMPONENT ANALYSIS

A 2-dimension facial image under investigation can be represented as 1- dimension vector by concatenating each row (or column) into a long thin vector [4, 5]. Considering *M vectors* of size *N* (= rows of image × columns of image) a representation, a set of sampled images an be created.

$$x_i = [p_1, p_2 ... p_N]^T \; i = 1 .....M \qquad \textbf{(1)}$$

Where, $p_j$ represents the pixel values.

Let $m = \frac{1}{M}\sum_{i=1}^{M} x_i$ represent the mean image, and let $w_i$ be defined as mean centered image (subtraction of the mean image from each image vector) $w_i = x_i - m$ **(2)**

Our goal is to find a set of $e_i$ 's which have the largest possible projection onto each of the $w_i$ 's. We wish to find

a set of *M* orthonormal vectors $e_i$ for which the quantity $\lambda_i = \frac{1}{M}\sum_{n=1}^{M}\left(e_i^T w_n\right)^2$ is maximized with the orthonormality constraint

$$e_l^T e_k = \delta_{lk} \quad \textbf{(3)}$$

It has been shown that the $e_i$'s and $\lambda_i$'s are given by the eigenvectors and eigenvalues of the covariance matrix $C = WW^T$, where *W* is a matrix composed of the column vectors $w_i$ placed side by side [4]. The size of *C* is $N \times N$ which could be enormous. For example, images of size $64 \times 64$ create the covariance matrix of size $4096 \times 4096$. It is not practical to solve for the eigenvectors of *C* directly. According to a common theorem in linear algebra, the vectors $e_i$ and scalars, $\lambda_i$ can be obtained by solving for the eigenvectors and eigenvalues of the $M \times M$ matrix $W^T W$. Let $d_i$ and $\mu_i$ be the eigenvectors and eigenvalues of $W^T W$ respectively.

$$W^T W d_i = \mu_i d_i \quad \textbf{(4)}$$

By multiplying left to both sides by *W*

$$WW^T W d_i = W \mu_i d_i \quad \textbf{(5)}$$

which means that the first $M-1$ eigenvectors $e_i$ and eigenvalues $\lambda_i$ of $WW^T$ are given by $Wd_i$ and $\mu_i$ respectively. $Wd_i$ needs to be normalized in order to be equal to $e_i$. Since we only sum up a finite number of image vectors, $M$, the rank of the covariance matrix cannot exceed $M-1$ (The -1 come from the subtraction of the mean vector *m*).

The eigenvectors corresponding to nonzero eigenvalues of the covariance matrix produce an orthonormal basis for the subspace within which most image data can be represented with a small amount of error. The sorting of eigenvectors is done according to their corresponding eigenvalues from high to low. The eigenvector corresponding to the largest eigenvalue has the greatest variance in the image [5]. Similarly, the smallest eigenvalue corresponds to the least variance. It is noticeable that the reduced dimensions are first five to ten percent of the total dimensions. A facial image can be projected onto $M'$ $M$ dimensions by computing

$$\Omega = [v_1, v_2 ... v_M]^T \quad \textbf{(6)}$$

where $v_i = e_i^T w_i$. $v_i$ is the $i^{th}$ coordinate in the new space, which is the principal component. The vectors $e_i$ are also for images, hence, known as *eigenimages*, or *eigenfaces* and was first named by [3-5]. The simplest method for determining which face class provides the best description of an input facial image is to find the face class *k* that minimizes the Euclidean distance

$$\varepsilon_k = \left\| \Omega - \Omega_k \right\| \quad \textbf{(7)}$$

where, $\Omega_k$ is a vector describing the $k^{th}$ face class. If $\varepsilon_k$ is less than some predefined threshold, a face belongs to the class *k*.

**Limitations Of PCA**

The main limitations of the PCA are as follows:

1. The face image should be normalized and frontal-view
2. The system is an auto-associative memory system. It is harmful to be over-fitted.

3. Training is very computationally intensive.

4. It is hard to decide suitable thresholds - It is a kind of Art!

5. The suggested methods to deal with unknown faces and non-faces are not good enough to differentiate them from known faces.

**Simulation Results**

Face images for the test are taken from AT&T data base. The database has 400 images. We have selected 12 images, for the demonstration of the algorithm. All the files are in PGM format. Each image is displayed by 92×112 pixels, with 256 grey levels per pixel. The images are arranged in 12 directories (one for each 'subject'), which have names of the form sX, where X indicates the subject number (between 1 and 25).

**Case**

In the first case, 12 images are taken as training set, each with mean 100 and standard deviation of 80. In the second step, the mean and standard deviation of all images are changed for normalization. This is done to reduce the error due to lighting conditions and background

**Figure 2: Training Set (AT&T)**

The normalized images are shown in Figure 3, and these images are very much similar to the images in Figure 2. However when background changes abruptly, the normalization is very effective.

**Figure 3: Normalized Training Set (AT&T)**

In the next step, the mean image is generated as shown in Figure 4. The pixel values of the images ranges form 0 to 255.

**Figure 4: Mean image**

In the next step, co-variance matrix is created, thereafter the Eigen-values are obtained, and the Eigen values close to zero are dropped and for the left over Eigen values, Eigen vector are obtained. Finally, after the normalization of Eigen vectors, Eigen faces are calculated (Figure 5).

**Figure 5: Eigenfaces**

In case of user authentication, template matching is done. In Figure 6, the input facial image and the re-constructed facial image is shown. The re-constructed image is very much similar to the input image.

**(a)** **(b)**

**Fig. 6 (a) Input and (b) Re-constrcuted images**

The major significant difference, between the input and reconstructed image can be seen at the forehead portion of the two images.

**LINEAR DISCRIMINANT ANALYSIS**

LDA is a powerful face recognition technique that overcomes the limitation of Principle Component Analysis technique. The LDA maximizes the ratio of the determinant of the between-class scatter matrix to the determinant of the within- class scatter matrix of the projected samples. Linear discriminant group images of the same class and separates images of different classes of the images [3].

Considering a *C*-class problem with each class *i* consisting of a set of $N_i$, *d*-dimensional samples $\{x_1^i, x_2^i ... x_{N_i}^i\}$, where the superscript $(.)^i$ represents the class label. Defining the total number of samples as $N = \sum_{i=1}^{C} N_i$ and the probability of occurrence of class '*i*' as $p_i = \frac{N_i}{N}$, the sample mean for class '*i*' as

$\mu^i = \frac{1}{N_i} \sum_{j=1}^{N_i} x_j^i$ and the grand sample mean as μ

$$\mu = \frac{1}{N} \sum_{i=j}^{C} \sum_{j=1}^{N_i} x_j^i = \sum_{i=j}^{C} P^i \mu^i \qquad \textbf{(8)}$$

The within and between class scatter matrices represented as $\sum_{\mathrm{W}}$ and $\sum_{\mathrm{B}}$, respectively, and computed as:

$$\sum_W = \sum_{i=1}^{C} P^i \sum_W^i = \frac{1}{N} \sum_{i=1}^{C} \sum_{j=1}^{N_i} \left(x_j^i - \mu^i\right)\left(x_j^i - \mu^i\right)^T$$
$$\sum_B = \sum_{i=1}^{C} P^i \sum_B^i = \frac{1}{N} \sum_{i=1}^{C} N_i \sum_{j=1}^{N_i} \left(\mu^i - \mu\right)\left(\mu^i - \mu\right)^T \qquad \textbf{(9)}$$

In above expression $\sum_w^i$ is the covariance matrix estimate for class *i* and computed as

$$\sum_w^i = \frac{1}{N_i} = \sum_{j=1}^{N_i} \left(x_j^i - \mu^i\right)\left(x_j^i - \mu^i\right)^T \qquad \textbf{(10)}$$

and $\sum_B^i$ is the scatter matrix between the class *i* and the 'grand class' and computed as

$$\sum_B^i = \left(\mu^i - \mu\right)\left(\mu^i - \mu\right)^T \qquad \textbf{(11)}$$

In other words, $\sum w$ is estimated by 'pooling' together $\{\sum_w^i, i = 1...C\}$. Similarly, this also holds for $\sum B$. Finally, LDA evaluates a projection matrix *W*, say of size $r \times d$, that maximizes the criterion function [4]

$$J_W = \frac{\det\left\{W^T \sum_B W\right\}}{\det\left\{W^T \sum_W W\right\}} \quad \textbf{(12)}$$

Above det {.} is matrix determinant. The maximum value of $r$ is $d - 1$. For a test pattern $y$ , its class label $C_y$ can be computed as

$$C_Y = \arg \min_{i=1,2,..C} \{W^T (y - \mu^i)^2 + D_i\} \quad \textbf{(13)}$$

where $D_i$ is used to incorporate prior information.

**Simulation**

In case of LDA, sample images and normalized are same as in Figure 2 and 3, respectively. The obtained *fisherfaces* using the LDA algorithm is shown in Figure 7. The mean image is shown in Figure 8, which consists of feature of all the training images. In Figure 9, input and reconstructed image is shown. These images are very much similar, with slight difference in intensity.

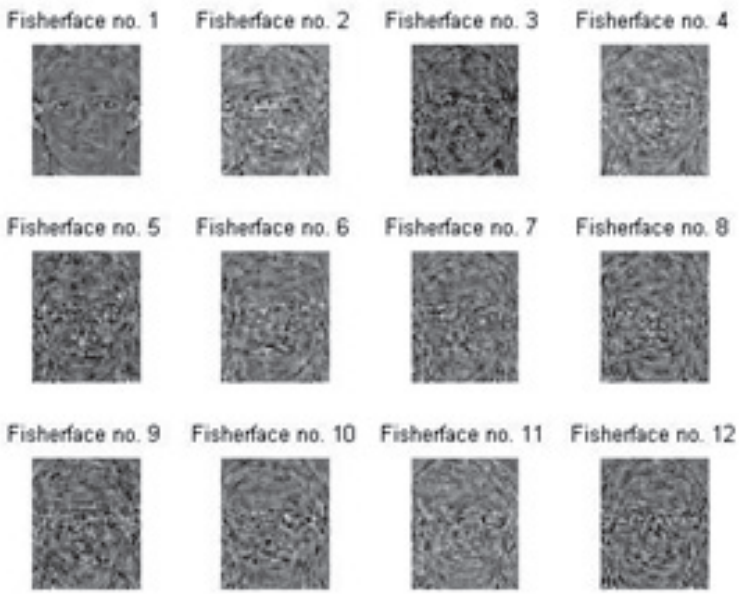


**Figure 7: *Fisherface* Images**

**Figure 8: Mean Images**

**(a)** **(b)**

**Figure 9: (a)Input and (b)Re-constructed images**

## PERFORMANCE EVALUATION

In the face recognition algorithm, the reconstructed image may or may not be same as input image. The degree of accuracy needs to be measured theoretically. Therefore assessment of the different techniques carried out in the present work was performed on the following criterion.

The FAR and FRR can be described as [6]:

$$FAR = \frac{n_{a_i}}{n_i} \times 100\% \qquad (14)$$

$$FRR = \frac{n_{r_c}}{n_c} \times 100\%$$

where: $n_{a_i}$ number of accepted impostor,

$n_i$ number of all impostor identity claims made,

$n_{r_c}$ number of rejected genuine, and

$n_c$ number of all genuine identity claims made.

Results for above test are as follows:

**Table 1: Performance of different algorithms for different metric for 400 images**

| Metric | PCA | ILDA |
|---|---|---|
| The equal error rate equals | 5.03% | 4.28% |
| The verification rate at 1% FAR equals | 86.79% | 90.00% |
| The verification rate at 0.1% FAR equals | 66.79% | 76.43% |
| The verification rate at 0.01% FAR equals | 45.00% | 64.29% |

In Table 1, performance of different algorithms for different metric for 400 images is tabulated.

The equal error rate for PCA, and ILDA is 5.03%, and 4.28% respectively. The verification rate at 1% FAR is 90.00% of ILDA and decreases down to 64.29% for verification rate at 0.01% FAR. Thus, as false acceptance rate decreases, the percentage of verification reduces significantly. Now, even in case of ILDA algorithm, at 0.01% FAR the verification rate is poor. In comparison, the performance of ILDA algorithm is better than the PCA algorithm but not acceptable. Therefore, in security prone areas these methods alone can't provide robust solution.

## FUZZIFICATION OF FACE RECOGNITION METHOD

The idea of Fuzzification of the Face and fingerprint recognition techniques is shown in Figure 10. For the input of the Fuzzifier the selected membership function is $\prod$ and at the output of the fuzzy system the membership function is chosen to be $\Delta$. As the samples follow I.I.D. process, therefore, a truncated Gaussian membership function known as $\Pi$ function is selected. In the function $\alpha, \beta$ and $\gamma$ defined as minimum, maximum and mean value of the training data set. The $c_1$, $c_2$ define the values at which the membership function takes a value of 0.5.

$$\Pi(z;\alpha,\gamma,\beta)=\begin{cases}0 & z\le\alpha\\ 2^{m-1}\left(\dfrac{z-\alpha}{\gamma-\alpha}\right)^m & \alpha<z\le c_1\\ 1-2^{m-1}\left(\dfrac{\gamma-z}{\gamma-\alpha}\right)^m & c_1<z\le\gamma\\ 2^{m-1}\left(\dfrac{z-\gamma}{\beta-\gamma}\right)^m & \gamma<z\le c_2\\ 1-2^{m-1}\left(\dfrac{\beta-z}{\beta-\gamma}\right)^m & c_2<z\le\beta\\ 0 & z\ge\beta\end{cases} \quad \textbf{(15)}$$

The value of the *m* can be selected to alter the shape of the $\Pi$ function. In this work the value of *m* is considered to be 2.

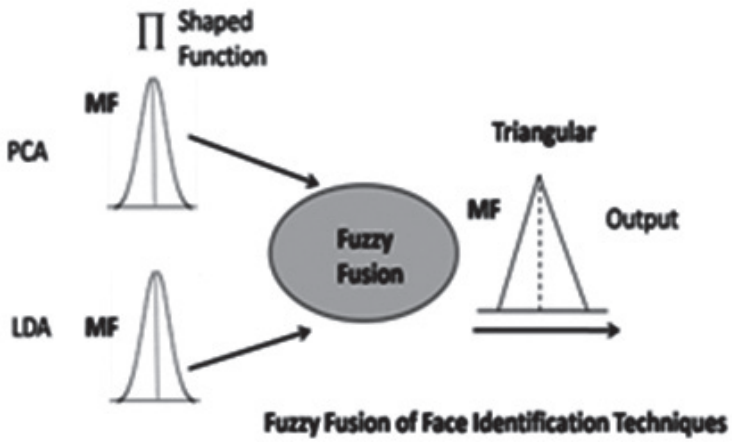


**Figure 10: Fuzzy fusion of Face Techniques**

It is clear from above expression that the shape and structure of the $\Pi$ function can be altered by varying the mentioned parameters.

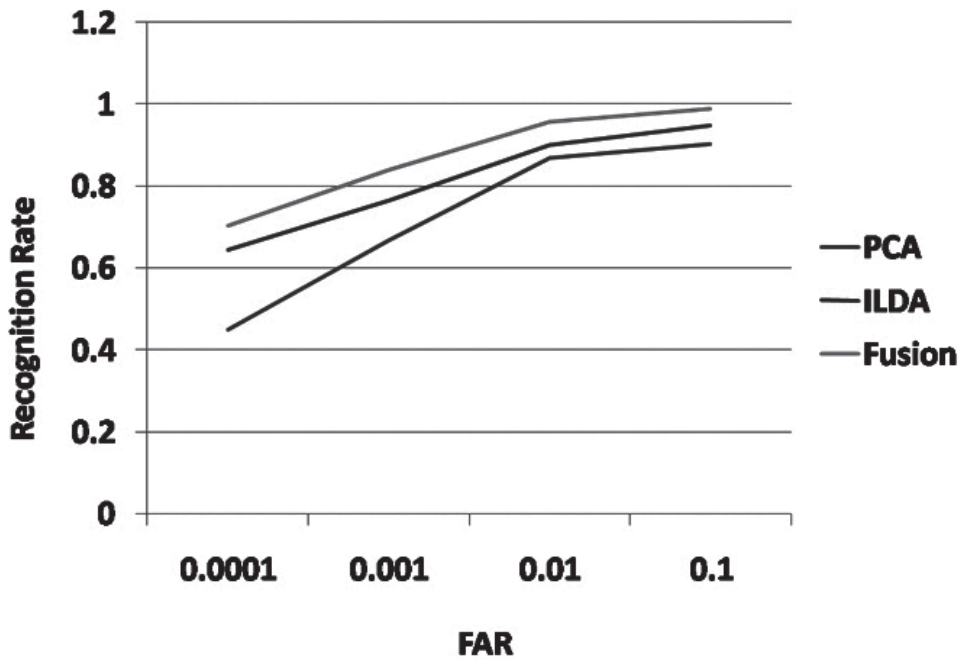


**Figure 11: FAR vs. Recognition rate**

Figure 11 shows the face recognition rate for PCA, LDA, and for the fusion of these two processes. The performance of PCA method is poorest. As for the FAR < 0.001, the recognition rate is only 67 %, and for the FAR < 0.01, the recognition rate is 86 %. The performance of the LDA method is better in comparison to PCA method. For both the methods, as the FAR increases, the recognition rate increases. However as the large FAR is not acceptable in most of the applications, therefore above two methods are combined using fuzzy methods and the obtained results are superior in comparison to others as for FAR < 0.001, the recognition rate is 83.92 %, which can be reached at the level of 98.73% for FAR of 0.1. The obtained preliminary results are promising and provide a basic foundation for the future research.

## CONCLUSION

In this paper, two face recognition algorithms PCA and ILDA are discussed. These algorithms are not the most accurate of face recognition techniques but definitely are one of the easiest to implement. Due to time restrictions in real time systems, these methods were adopted over more accurate methods. The face recognition program returned good results with a few discrepancies. The eigenvalues and eigenvectors of a group of images were calculated correctly. Faces were able to be compared correctly using their decomposition coefficients. Faces were successfully verified as user faces and then the corresponding user was successfully logged on. The only problems were with the time it took to recognise a face. Continually loading images from a database took its toll on the overall recognition time. The comparison of two algorithms is done in terms for, verification rate at 1, 0.1, 0.01% FAR etc. Overall the performance of ILDA is much better than PCA algorithms and fuzzy fusion of two algorithms further improves the results.

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**Engineering**

# STUDIES OF REAL-TIME DOA-BASED SMART ANTENNA SYSTEMS IN WIRELESS COMMUNICATION APPLICATION

***Giriraj Prajapati****
***Dr. K.C. Mahajan*****

**ABSTRACT**

*We designed, built, and tested a real-time processor for a direction-of-arrival-based smart antenna GSM 1800 base station with eight half-wavelength spaced antenna elements. The processing steps include direction-of-arrival (DOA) estimation, user identification, tracking, beam forming and signal reconstruction. We demonstrate that the accuracy of DOA estimation is not of primary concern, but the robustness is. This can be assessed by a new parameter, the estimation range. Tracking of reliable user DOAs only, increases the robustness against interference. Our tracking concept is compatible with frequency hopping. We quantify the benefits of smart antennas by the statistics of the gain in carrier-to interference ratio (C/I) and in signal-to-noise ratio (SNR), both measured at the 90 or 99% levels with actual transmitted data. In an urban environment with large angular spread and overlap of user and interferer signals, the C/I gain is as high as 18 dB. Interferer nulling increases the C/I gain only slightly, but enhances robustness against angular spread, particularly if broad nulls are applied. Separating SNR gain in its contributions due to beam forming and diversity gives valuable insight into the way of operation. In uplink, the processor can exploit angular diversity. The entire suite of processing steps is done within less than 1 ms, demonstration in that sophisticated DOA-based smart antenna processing is feasible in real time. Our solution does not require any change in the GSM standard.*

**Keywords:** Angular diversity, carrier-to-interference ratio(C/I) improvement, component angular spread, direction-of-arrival estimation, signal-to-noise ratio (SNR), smart antenna.

## INTRODUCTION

**S**MART antennas exploit the spatial dimension. These are strong candidates to overcome the capacity limits of second-generation systems, as well as to assist existing high and low data rate users in third-generation systems. Smart antennas affect the link budget positively, meaning that they can enhance coverage. Selecting one strong multi-path out of many will reduce frequency, selective fading and increase maximum possible data rate. Smart antenna technology is on the brink of commercial realization. Although there is enough room for pioneering work of theoretical nature, at this stage another issue is of importance: Smart antenna technology must be proven practically. Implementing smart antenna technology for real-time operation is a challenge for hardware as well as for array processing.

Several approaches have been studied to introduce smart antenna technology into GSM and third generation systems. Most of these schemes either include uplink processing only, or apply separate algorithmic solutions in up- and downlink. In this work, both uplink and downlink are treated in a single homogenous directions-of-arrival (DOA)-based approach. In Section II, we present the developed GSM1800 smart antenna base station. Its heart is the real-time Adaptive Antenna Array Processor.

***Giriraj Prajapati** is a Research Scholar, Mewar University Chittorgarh, Rajasthan. Email: girirajp@yahoo.com
****Dr.K.C Mahajan** is the Principal of the LNCT College of Engineering & Research Center, Jabalpur (M.P.). Email: kc_mahajan@rediffmail.com

It works within the GSM standard and is compatible with frequency hopping .In a first stage, the smart antenna is designed to suppress co-channel interference, i.e., we apply Spatial Filtering for Interference Reduction. We will define the quantities with which we assess A P in mobile radio channels, and find means to separate, diversify, and beam forming gains. To evaluate, we performed an extensive measurement campaign with actual transmitted data. Our assessment of the DOA estimators will indicate that the estimation accuracy of the estimator is not of primary concern, but the robustness is. We will also define a new measure to quantify the robustness.

**SYSTEM CONCEPT**

Many of today's mobile communication systems use frequency division duplex (FDD) for up- and downlink transmission, in which the small-scale (Rayleigh) fading is uncorrelated. Reusing the uplink weights for downlink beam forming can lead to erroneous results. But channel parameters like the directions-of-arrival (DOAs) and the path loss are the same in uplink and in downlink. Thus, we base our array processing on DOA estimation in uplink. The estimated DOAs are tracked in uplink and in downlink separately to form antenna patterns that suppress co-channel interference. DOA-based beam forming relies on the assumption of almost-plane incident waves. Still, there exist uncorrelated antenna signal portions which mean that a diversity gain is also possible. The test bed also provides angular diversity, but this is not covered by the results presented in this paper.

In this paper, we focus on measurements demonstrating interference reduction. In noise limited environments, a diversity gain was achieved. We designed our smart-antenna processor, called Adaptive Antenna Array Processor A P, around an existing GSM 1800base transceiver station (BTS). Concerning hardware, the BTS uses one and the same uniform linear eight-element antenna array with a half-wavelength inter-element spacing in up- and downlink. In uplink, all eight branches are down converted and sampled in - and -signal paths to allow full adaptation of the beam forming weights. The Adaptive Antenna Array Processor A P uses the sampled and calibrated input data received during a time slot in the uplink to calculate the antenna weights for up- and downlink beam forming. It is implemented on a single general purpose processor (DEC Alpha 500 MHz), which offers a flexible programming environment while still providing enough computing power to allow a real-time pattern adaptation in *every* GSM frame (4.6 ms). All algorithms are run-time optimized and take about 1 ms for a complete weight calculation. The beam forming control unit (BFCU) performs the physical beam forming (multiplication of the received signals with the complex weight vectors) and controls all system components. Simple algorithms (e.g. switched beam) are incorporated in the BFCU for real-time comparison with the complex algorithms of A P. In principle, our DOA-based smart antenna consists of the following processing modules: A DOA estimation, a DOA identification to link the DOAs with the user or interferer, a tracker, and a final beam former .A careful selection of a DOA estimator that suits the requirements of the mobile radio channel is important. Concerning high-resolution DOA estimation, we will investigate whether angular resolution in the sub-degree range is required. Our goal is to relax requirements on angle estimation to reduce the complexity of the system.

The suppression of interferers by placing nulls requires the knowledge of the interferer DOAs. We will take a two step approach by, first, extracting the spatially resolved signals, and, second, applying user identification. In the first step, for the uplink (pre-) beam former, we use a conventional beam forming algorithm. For the second step, the classification of the spatially resolved signals, we need a user identifier. In case of GSM the midamble serves this purpose. We note that GSM is not an ideal test case in this respect, because the cross-correlation of different midamble sequences is low. Failures of the DOA estimation and false user identifications can be fatal. We will introduce a tracking concept that remedies erroneous decisions of the processing steps executed *before* the tracker: This will relax the requirements on the algorithmic frontend, i.e. the DOA estimation and DOA identification. To be compatible with frequency hopping, only the user DOAs maybe tracked. We will demonstrate how the tracking increases the robustness against interference. Now, reliable user directions are available allowing final beam forming. The question remains whether dedicated interferer nulling is essential or not. If so, the nulling strategy will have to be compatible with the mobile radio channel and the limited number of degrees of freedom (number of antenna elements). We will consider "broad nulls" for this purpose. We will address critical questions concerning the required angular resolution of the DOA estimator, how to separate a wanted signal from an interfering one, and whether dedicated interferer nulling is required or not.

## THE ADAPTIVE ANTENNA ARRAY PROCESSOR A P

The array processing (Figure 2) is based on a DOA estimation DOAE . For each estimated DOA we extract, with the uplink beam former, ULBF , a spatially resolved signal (uplink spatial pre-filtering), containing only the GSM midamble as a training sequence (26 bits). These spatially resolved midambles are then fed to the user identification UID that decides whether a DOA

### A. DOA Estimation

Estimating the DOAs is a well-known problem in signal processing. The input to the estimator is the calibrated baseband matrix of measured data where, a column vector with elements corresponding to the temporal snapshot of the antenna array is the number of sensors. A baseband measurement matrix corresponds to one GSM timeslot. We implemented three different algorithms, two subspace-based approaches and one spectral-based approach. The subspace-based algorithms are Unitary ESPRIT, and Unitary ESPRIT with *subspace tracking* .Unitary ESPRIT estimates the signal subspace by means of an eigen value decomposition. From this estimated signal subspace, the DOAs are calculated by solving the Invariance Equation and a subsequent spatial frequency estimation

## SUMMARY OF EIGENVALUE DECOMPOSITION

Estimating the signal subspace, the subspace tracker PASTd (Projection Approximation Subspace Tracking and Deflation) recursively tracks the signal subspace. In quasi- stationary channels, the base of the signal subspace is only slowly time varying. It is therefore more efficient to track those changes than to perform full subspace estimation every burst. In both algorithms, the model order, or the number of DOAs, is estimated by an information theoretic criterion. The third algorithm is a beam forming technique. *Capon'sBeamforme* also known as Minimum Variance Method(MVM), minimizes the power contribution from noise and any signal coming from other directions , while maintaining a fixed gain into the direction .The resulting spatial power spectrum is given by: (1)where the uniform linear array steering vector is ,it is the wave number, and the antenna element spacing is the sample covariance matrix; (2) A one-dimensional search in the spatial power spectrum is necessary to find the DOAs . After the DOAs have been estimated, we have to separate the user DOAs from the interferer DOAs. The A P considers *all* relevant paths that correspond to the user. Our system thus tries to identify all DOAs for the user and exploits this information to derive weight vectors for the final beam forming. Earlier mobile radio experiments have shown that a DOA estimator may fail if only a single DOA was considered for the user. In a typical cellular mobile radio channel this is not sufficient. In the actual implementation, we will utilize only one of the user directions, i.e., the strongest one. But having at hand more than a single user direction will lead to quickly switching to whichever is the best .The next two steps are required to categorize the DOAs found.

### *B. Spatial Pre filtering*

The uplink beamformer ULBF extracts from a spatially resolved signal for each of the estimated DOAs. Thus we have to derive weight vectors, whose patterns steer a beam into the wanted directions, while nulling all other directions.

Thus each weight vector is constructed to get a main beam into and nulls into all other estimated DOAs. In a second step, the spatially resolved signal vectors, result from the uplink beamforming process is the part of the baseband measurement matrix that contains the midamble (training sequence).In the next step, the spatially resolved midambles are fed to the user identification.

### *C. User Identification*

The user identification UID is based on the detection of the spatially resolved midamble sequence, at bit level. By comparing the received midambles with the known user midamble, we calculate the number of bit errors within the training sequence. A spatially resolved signal, and thus the corresponding DOA, is attributed to a user, when

the number of bit errors is smaller than a threshold. We so identify not only a single user path but *all* paths that correspond to the intended user provided the signal quality is sufficient.

***D. DOA Tracker***

After the user identification, basically all information is at hand to direct the main beam into a user direction and to null the interferer DOAs: estimated and classified DOAs and the corresponding power values. Without the tracker, A P exploits information from the current burst only; information from previous bursts is not yet used. We only track *user* DOAs, because interferer DOAs may change from burst-to-burst with frequency hopping, dynamic channel assignment and discontinuous transmission (DTX) .The DOAT performs several tasks: averaging of estimated DOAs, assessing the reliability of an incident path, and selection of DOAs for final beam forming. A DOA is only selected if a minimum signal quality of an incident path persists over a certain period of time. By exploiting the reliability we improve the system's robustness. Each of these tasks is done separately for uplink and downlink, because the averaging in downlink requires larger memory length. A tracker is initiated for every incident path, containing its average DOA and its reliability. From the pool of trackers, each assigned to a multipath component, we select a single one to determine the main beam direction. Evidently, this can be done on a burst-to-burst basis, giving the possibility to instantaneously react to the current channel situation and thus to optimize the SNR gain. Studying algorithms for DOA-based smart antennas, we found that the far-off estimates were the most detrimental. We found that the statistics of the estimated DOAs determined from measured data could not be rendered by a standard distribution Figure 3. User DOAs and trackers in an environment with two multipaths. In each burst, the current user DOAs are applied to update the existing trackers. A tracker is updated only if a close-by user DOA is present in the current burst. If not, a new tracker is initialized.

***E. Signal Reconstruction—Final Beamforming***

We apply beamforming algorithms in uplink and in down link that place a main beam to the selected user DOA and *broad* nulls to the directions of the interferers. Is the number of *selected* directions, consisting of a single direction for the main beam and directions of the interferers. Note that the situation differs significantly from the pre-spatial filtering ULBF. Now, after UID, we know whether a DOA belongs to a user or to an interferer. Also, the tracker has rendered the estimated DOAs more reliable.

***1) Uplink Post Beamformer****:* For the uplink post beamformer UL pBF the DOAT has selected the user tracker (tracked DOA) with the strongest *instantaneous* power. By adaptation to the current fading situation in the uplink, it thus implements *angular selection diversity*, exploiting any decorrelation of the two strongest paths belonging to the wanted user. A P could, in principle, extract separately the second strongest signal as well. As the base station has a diversity receiver, other forms of angular diversity combining are possible

*2)* ***Downlink Beamformer:*** Downlink fading is, of course, unknown at the base station. Thus we can only use averaged information derived from the uplink. For transmission, the DLBF forms a beam into the direction with the largest *average* power.

**DEFINITION OF GAIN AND SNR GAIN**

The basic benefits of a smart antenna is that it increases *signal power* and reduces *interference*. This will result in a reduced bit error rate, hence an improved service quality. To fully exploit A P's possibilities, it is essential to understand how A P increases the system performance. Only this will allow assessing in which environments A P can be introduced with the largest possible gain. The bit error rate (raw or encoded) is a possibility.

**VI. ANGULAR RESOLUTION OF DOA ESTIMATOR**

First, we want to find the most appropriate DOA estimator, second, we study which angular resolution is required for smart antennas in public cellular mobile radio .In the beginning, we use to quantify the maximum achievable C/I gain, and to study the influence of the angular resolution of the DOA estimators. The gains are very high. The

interference could be suppressed by as much as 22 dB. That A P does not reach the optimum beamforming gain is mainly a consequence of the tapering, i.e., beamforming weights that have amplitude smaller than unity. As expected, there was practically no diversity gain available. This is a consequence of the small angular spread of the user signal. Comparing the various DOAE estimators, we found that the gain is nearly independent of the algorithm's choice. Some larger differences in the SNR gain values are present, especially at the 99%-level. If Unitary ESPRIT is applied, the SNR is significantly degraded. Now a discussion of the actually relevant parameters for DOA-based smart antenna processing is in place. Estimation *accuracy* is the first quantity we investigate. However, during the development of the array processing it turned out that not the accuracy is of main concern, but the *robustness* is. We thus will define a quantity that allows quantification of the estimation robustness and present the robustness of the implemented DOA estimators.

### *A. DOA Estimation Accuracy*

To study accuracy, we first define the *DOA estimate variation*, as the standard deviation of the estimated DOAs, when a *single plane* wave is incident; we used .We measured the estimate variation in a controlled LOS environment. When a discrete wave was incident from broad side, the measured estimate variation was smaller than 1 for an input SNR larger than 0 dB, but decreased monotonically to the order of some hundreds of a degree with increasing SNR up to40 dB, for all three estimators.

### *B. DOA Estimation Robustness*

The estimate variation quantifies the *accuracy* of a DOA estimator, i.e., how accurate a DOA can be estimated under optimum conditions. However, the estimate variation has little meaning in mobile radio channels. Quantifying the robustness of a DOA estimator is a more challenging task. Different properties influence the performance of an estimator, like the angular spread, the number of clusters, the number of signal sources present, and the number of estimated DOAs.

DOAs, resulting from the scanning beam algorithm of previous scenario will be as follow: (a)The user signal had a small angular spread and; (b) the interferer signal had a large angular spread. In fact, this is the only way to exactly diagnose C/I. This strategy leaves room for repeated processing of the *same* data set to compare different configurations of A P.

## DISCUSSION OF CONCEPT AND CONCLUSION

From the evaluation of the smart antenna we will now discuss the essential ingredients for a successful design of a DOA-based smart antenna. Note that such a processor is suitable for both up and downlink operation. In the uplink, the smart antenna senses antenna signals that have passed the receiver and hence can be used for calibration purposes. In the downlink, no such signals that have passed transmitter are available at first place. The theoretical optimum is the sum of the single antenna element SNRs, corresponding to maximum ratio combining when no interference is present and the channel is known.

## EFFECT OF TRACKING ON THE C/I AND SNR GAIN

We have demonstrated that DOA-based smart antenna technology can be introduced in up- and downlink of GSM systems without changes in the standard. We developed A P (Adaptive Antenna Array Processor), a sophisticated system with real-time processing. We measured its uplink performance in urban mobile radio channels with actual transmitted data. As performance measures, we defined SNR and C/I gains at specific outage levels, as is required for cellular network planning. Second, hardware imperfections limit the C/I gain if angular separability is high. To get sharp nulls the conventional beamformer ULpBF Pseudo Inverse is applied. The broad nulls are generated with SmearR .

The relaxed requirements on the DOA estimation can be used to reduce the complexity of the system. A variety

of DOA estimators are available, selecting a proper one that suits the requirements of the mobile radio channel is nontrivial .We demonstrated that the estimation accuracy of a DOA estimator is not of primary concern in a cellular smart antenna application, but the robustness is. An estimator with excellent accuracy but small robustness (where far-off estimates will cause outages) is inferior to an estimator that, in every attempt, successfully estimates the DOAs, but with less accuracy. We provide an alternative indicator to assess a DOA estimator: The *DOA estimation range* allows assessment of the suitability of a DOA estimator in a smart antenna system. Not the averaging of the DOAs, but the concept itself guarantees high C/I gain, especially in low C/I situations. Thus, we found a compromise that allows instantaneous (burst-wise) hopping of the main beam, while reaching very high reliability at the same time. A tracking concept that measures the signal quality of the various multipath components significantly increases the robustness against strong interference. A proper tracking concept should include features like the following: i)A main beam will only be placed in "reliable" directions. Here a direction is reliable, if the signal incident from that direction has good signal quality over an extended period of time; ii) Independent trackers to reduce the influence of far-off estimates. Although the tracked DOAs are averaged, the system is able to hop instantaneously from one tracked DOA to another on a burst-by-burst basis .Concerning nulling strategy, broad nulls for the beam forming increase the robustness against poor interferer DOA estimates and against large component angular spread. In uplink. the smart antenna achieves excellent C/I gain values up to 22 dB. The interferer suppression is not significantly dependent on the environment. Even in an environment with large angular spread and interference from partly the same directions, the interferer suppression can be as high as 18 Db.

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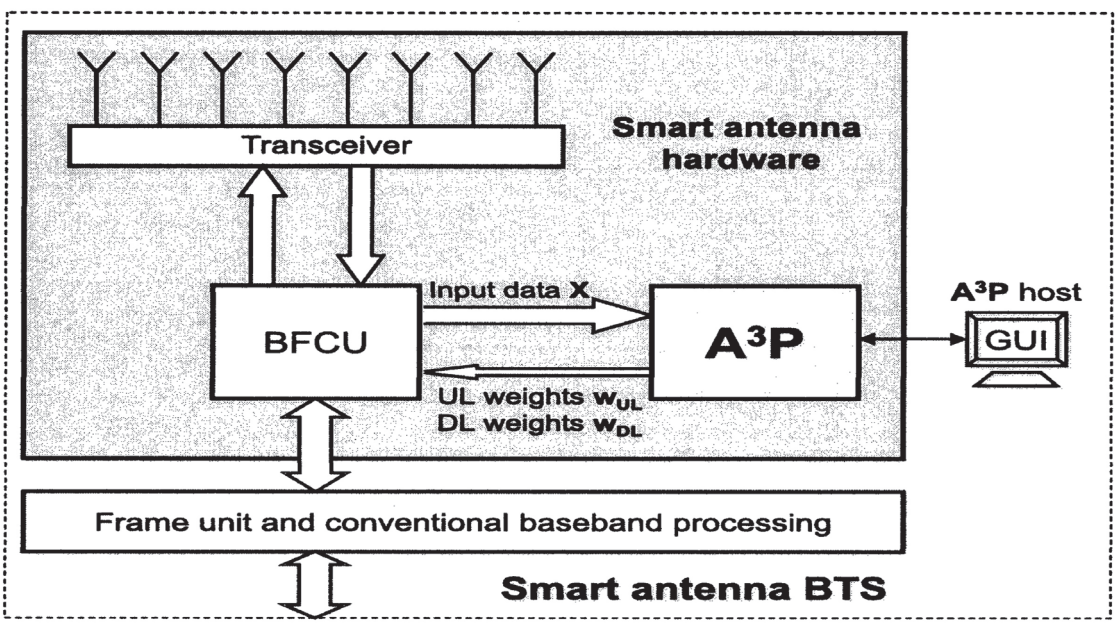


**Figure 1: A P, the A P host and the base transceiver station (BTS)**

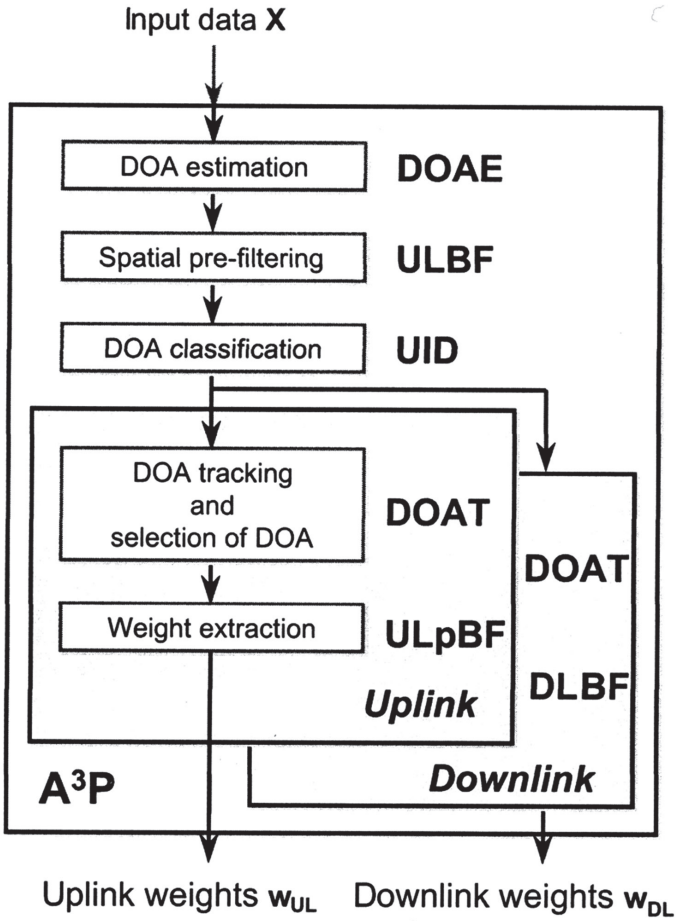


**Figure 2: Adaptive Antenna Array Processor A P. DOAE**

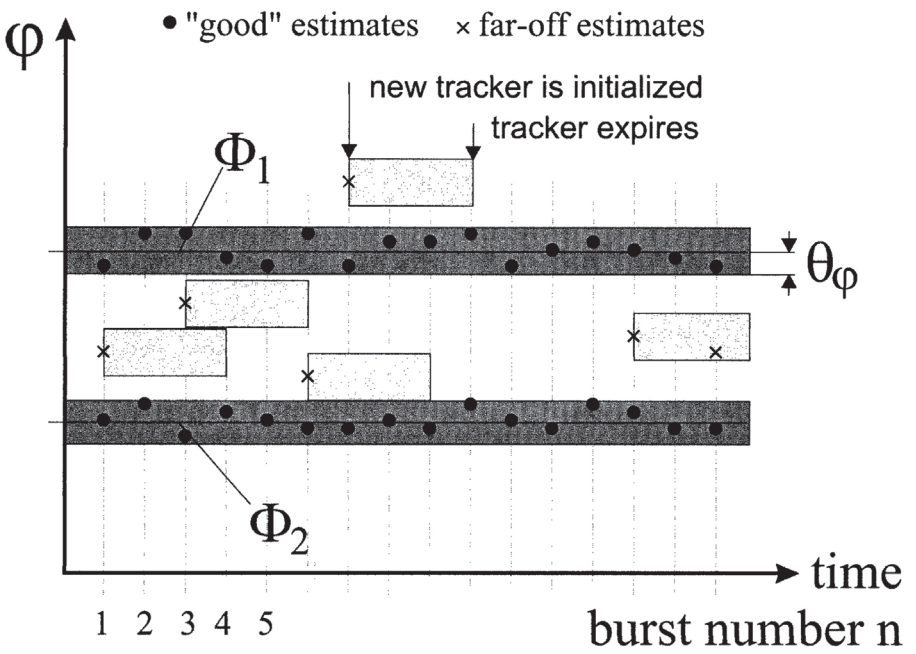


**Figure 3: User DOAs and trackers in an environment with two multipaths**.

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**Engineering**

# AUTOMATION OF DRILLING PROCESS USING ELECTRO-HYDRAULICS

***Pulkit Barala****

**ABSTRACT**

*Automation is today a need of every industry and is extensively used for each and every process. Drilling process requires clamping initially and thus require at least three kinds of operations, clamping the work piece, drilling and then unclamping. In that respect a case study is used to automate this process with the help of electro-hydraulics. Automation of any process leads us to optimized output for each factor such as time, cost, feasibility of operation, reliability, and elimination of human error.*

**Keywords:** Electro-Hydraulics, Direction Control Valves (DCV), Double Acting Cylinder, Pump unit, Relay/ Contactor, Valve Solenoid, Limit switch

## INTRODUCTION

From last few decades, numerous technologies have been developed in the field of manufacturing. Among all these technologies, Fluid Power is unique. Fluid power has played very crucial role in the rapid growth of several industries. Electro-Hydraulics is very important branch of fluid power. Basically, it is a combination of Hydraulics and electrical components.

Hydraulics is based on the principal that fluid power can be used to transmit energy from one form to another. In hydraulics, "oil" is used as working medium to transmit energy at different required pressures. The word, Hydraulics, is derived from a Greek word "*Hudour*" which means water. Hydraulics can be used at high pressure as compared to pneumatics. It is generally used in manufacturing industries for mass production of goods.

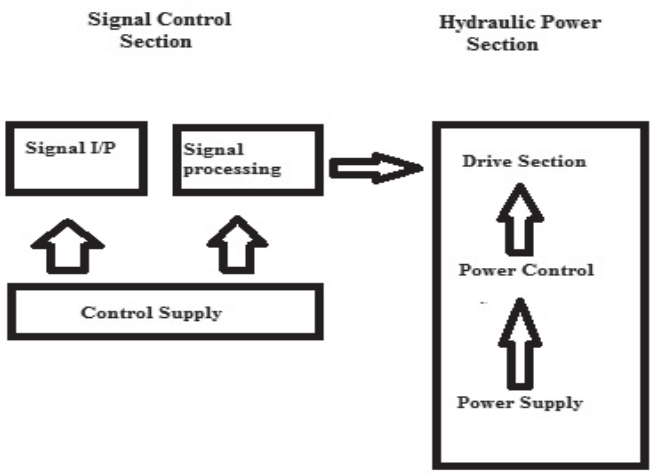



**Figure 1: Structure of Hydraulics**

***Pulkit Barala** is pursuing M.Tech at the Department Of Mechanical Engineering, Mewar University, Gangrar, Chittorgarh, Rajasthan-312901. E-mail: pulkit.barala@gmail.com.

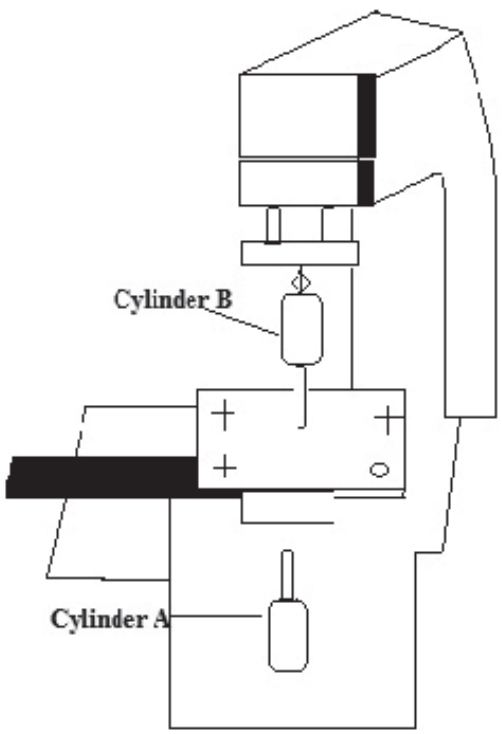
**Figure 1** is the simplified block diagram depicting the division of hydraulic system into a signal control section and a hydraulic power section. The signal control section is responsible to activate valves in the power section.

The Hydraulic power unit (power source) provides the energy required for the hydraulic installation. It's most important components are the reservoir, drive (motor), hydraulic pump, pressure relief valve, filter and cooler. It may act as a carrier for devices like direction control valve.

The field of automation using Electro-Hydraulics is studied by many scholars till date. Michael *et. al*[1] used *Electro-Hydraulic Servo Actuator* (EHA) to determine the direction of motion. System Identification technique was used for system modeling using parameter estimation technique. Fraiser[2]in his paper mechanized the existing drill and blast-method using hydro-powered drill jigs in the regions of South African narrow reefs. Vaida *et. al.*(2012)[3] carried out engineering studies by using features, the convenience and dependence on control and power section. This paper deals with the automation of pump unit and also developed a system that enhanced the flow control, pressure and hydraulic power. Vijay[4] has researched on Position Control Electro-hydraulic Linear Actuator for controlling the motion of helicopter. Based on mathematical modeling, models of the actuator and its components are made using Matlab/Simulink.

## CASE STUDY

A work piece is to be drilled and it is to be clamped by two position. Continuous system is to be developed.




A+ B Clamping by cylinder A
A+ B+ Drilling by cylinder B
A+ B- Retracting cylinder B
A- B- Unclamping by cylinder A

Cycle is continuously operating.

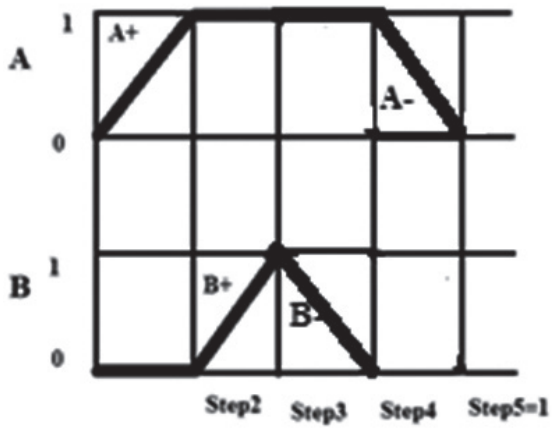



**Figure 3: Functional Diagram**

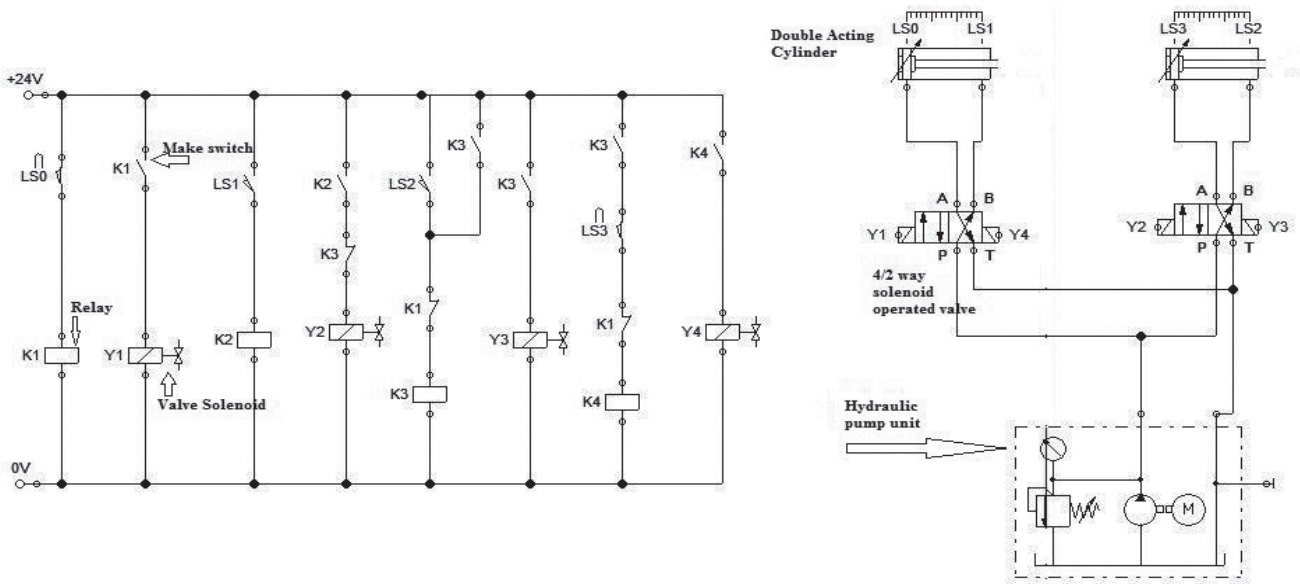



**Figure 4: Electro-Hydraulic Circuit**

In the above Electo-Hydraulic circuit, different fluid tools like relay (K1, K2…,K4), valve solenoids(Y1,Y2…. Y4),make switch(K1,….k4) are used. When power is supplied through power section , K1 will actuate, resulting in the actuation of Y1 solenoid and thus cylinder A will execute forward motion. Cylinder A will clamp the work piece. Then as piston of A reaches Limit switch LS1, K2 (refer to **Figure 4**) and similarly Y2 will actuate and cylinder B will execute forward motion through LS3 (drilling operation). When piston reaches LS2, it will ignite K3 and Y3 will force the cylinder B to move back (after drilling). Finally, LS3 will actuate K4 and unclamping of work piece takes place through Y4.

## SCOPE OF STUDY

Conventional drilling employs man-power. In this paper, we have used Electro-Hydraulics, which is the combination of electrical and hydraulic components to automate the process of drilling very easily. It is very advantageous in respect of each and every factor such as minimizing human error, reduction of time consumption, reliability, and cheeper. The main goal of this study is to automate the operations of drilling and achieve a better

overall efficiency. Today, automation is the need of real world and is useful in almost all manufacturing industries. Hydraulics offer great advantages like we can even use it at the field where large forces of 4000-5000 tonnes and pressure more than 500 bar are required. Hydraulic application has proliferated into vast areas like automotive industries, machine tool manufacturers, power transmission, chemical industries, oil and petrochemical industries, gas industries, even in defense systems, marine and mining plants, etc. So the list of application never ends and on their basis, we can easily predict its future.

## RESULTS AND DISCUSSION

- All the operations required in the given case study are successfully automated through simulation;
- Enhances the efficiency of overall operation greatly;
- Time of operation is reduced to great extent as compared to the conventional process;
- Operation is very economical for mass production;
- Functional diagram helps in defining the required operation.

## CONCLUSION

- Use of sensors may further improve the efficiency;
- Human error is completely eliminated thus diminishes the risk factor;
- FluidSIM is used for simulation;
- Any logic can be developed using following approach.

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**Engineering**

# INVESTIGATION ON DESIGN OF ULTRA WIDEBAND PATCH ANTENNA FOR MEDICAL IMAGING APPLICATIONS

***Siyaram Yadav****
***Priyanka Gautam**, Shilpa Jangid******
***Syed Arif Ali****, Gaurav Sharma********

**ABSTRACT**

*Design of Ultra Wideband Patch Antenna for early detection of cancer tumors has been a priority for antenna designers and all those involved in the detection of cancer in general and brain and breast cancer, in particular. Ultra Wideband microstrip antenna design for the above said purpose had been a popular choice. In this paper, various types of antenna and their results are presented in lucid manner which are operating in the range of 3.1 to 10.6 GHz. Softwares are used for designing of such antennas. Designing parameters, gain, bandwidth, return loss have been shown and results are compared. A single element Direct-fed patch antenna with cavity in ground plane was developed on thin substrate having low dielectric constant (εr = 2.94). Ansoft HFSS ver 11 was used to obtain the simulated results.*

**Keywords:** Direction Control Valves (DCV), Double Acting Cylinder, Electro-Hydraulics, Limit switch, Pump unit, Relay/Contactor, Valve Solenoid.

## INTRODUCTION

Design of Ultra Wideband Antenna for early detection of cancer tumors has been a priority for antenna designers. Ultra Wideband microstrip antenna design for the abovesaid purpose had been a popular choice. In this paper, various types of antenna and their results are presented in lucid manner which are operating in the range of 3.1 to 10.6 GHz. Various designs are presented so far and many design gained the popularity. The antenna presented in this paper is suitable for direct feed method. Although other feeding techniques are also popularly used like Coplanar (CPW feed) antennas. We have designed circular patch, patch with two circles (dumbbell), patch with three circles and patch with four circles. Comparison among four designs has been done. This survey investigates the design of antenna for medical application keeping the view the death tolls due to spread of cancer in India in particular and world in general. However, despite the advantages that microstrip patch antennas provide, they do have some limitations that restrict their applications, such as inherently narrow bandwidth (typically 1-5%), low gain, spurious feed radiation and poor polarization purity. The most desirable substrate for optimal microstrip antenna performance is thick, low dielectric constant and low loss tangent materials. Such a material results in a high efficiency and a large bandwidth [1].

***Siyaram Yadav** is Associate Lecturer at ECE Department, Mewar University, Gangrar, Chittorgarh, Rajasthan. E-mail: er.siyaramyadav@gmail.com
****Priyamka Gautam*, ***Shilpa Jangid, ****Syed Arif Ali, *****Gaurav Sharma** are Research **S**cholars at ECE Department, Mewar University, Gangrar, Chittorgarh, Rajasthan.

This comes at the cost of larger antenna volume. On the other hand, the use of thin substrate with high dielectric constants reduces the size of the antenna and is compatible with MMIC structures [1]. However, this leads to smaller obtainable bandwidths and a less efficient antenna due to the surface wave being launched.

## CONVENTIONAL ANTENNA DESIGN

In this section, a conventional single element Direct-fed microstrip patch antenna (MSA) model is presented on dielectric substrate of permittivity 2.94.

### *A. UWB Antenna with circular Patch*

It is very well known that the impedance bandwidth of a Direct-fed microstrip antenna can be improved by increasing the thickness of the grounded substrate.[3] However, this leads to several undesirable consequences. The larger contribution to surface waves which leads to decreased efficiency of the antenna. Another consequence of incorporating electrically thick substrate is the increased width of the microstrip line feeds leading to spurious radiations.[4]

**Figure 1** illustrates the geometry of a Direct-fed UWB Antenna with circular Patch, low dielectric constant material at 5 GHz. A 50 Ω microstrip feed line with a width of 17 mm and a square patch of 30 mm x 35 mm are modelled on a 0.381 mm thick Rogers RT/Duroid 6002 ($\varepsilon_r$ = 2.94) substrate. All antenna parameters are derived using transmission line model based calculator [5]. A 30 x 16.9 mm ground plane is located on the reverse side of the substrate.

**Table 1: Antenna Parameters**

| $L_{sub}$ | $W_{sub}$ | H | $\varepsilon_r$ | $L_f$ | $W_f$ |
|---|---|---|---|---|---|
| 35 | 30 | 0.381 | 2.94 | 16.9 | 30 |
| f | d | $X_{bpf}$ | $Y_{bpf}$ | BW | |
| 6 GHz | 7.5 mm | 14.5 mm | 5.5 mm | 3.65GHz | |

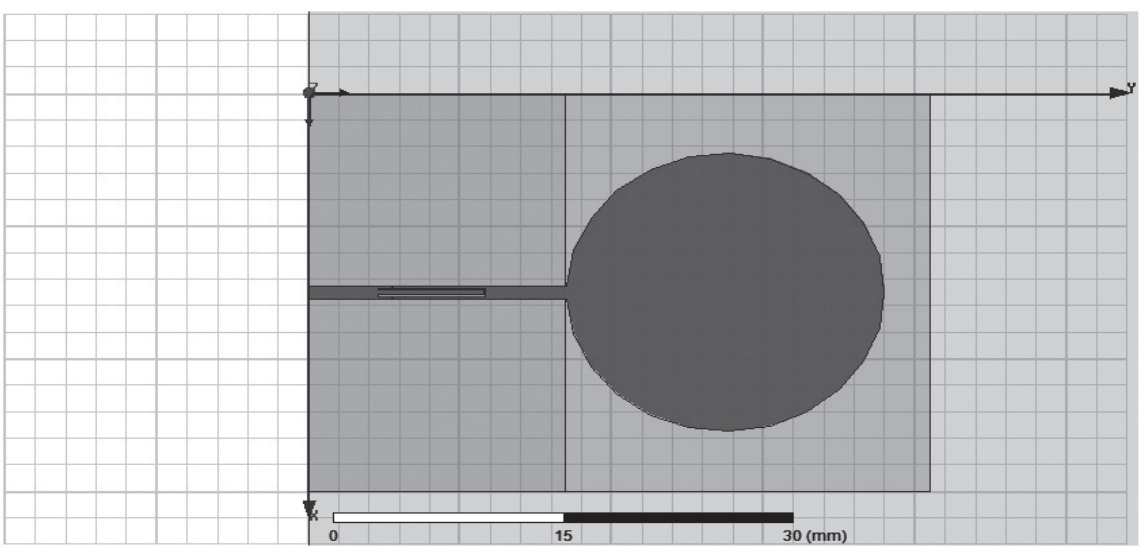


**Figure 1: Circular Patch with BPF and Result**

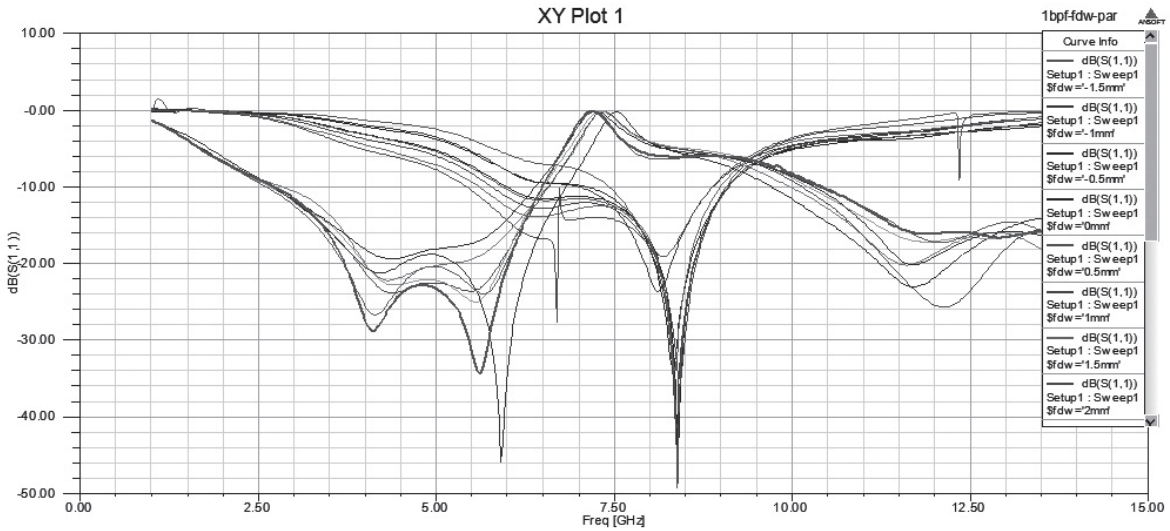


**Figure 2: Plotting Gain of Antenna**

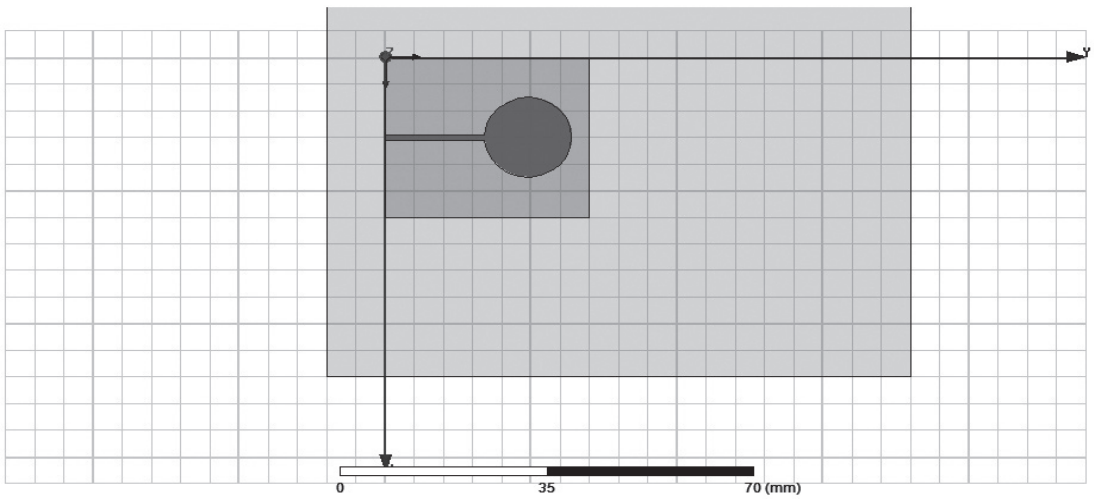


**Figure 3: Circular Patch without BPF and result**

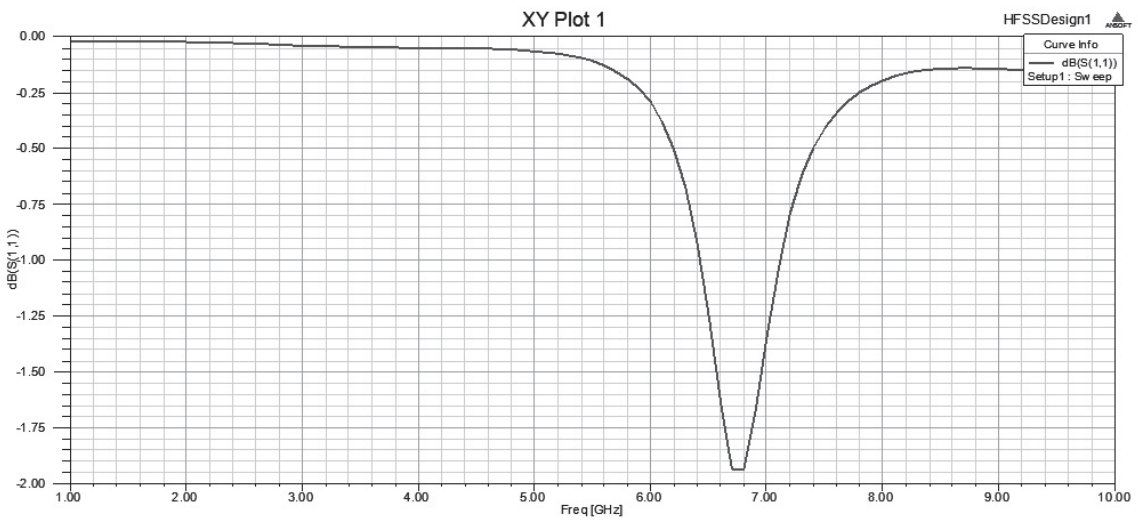


**Figure 4: Gain of Antenna**

In Figure 4, return loss $S_{11}$ obtained is shown below at resonance frequency $f_o$ of around 5 GHz. Gain of the antenna is very low at just only 1.06 dB and it is varying over the frequency.

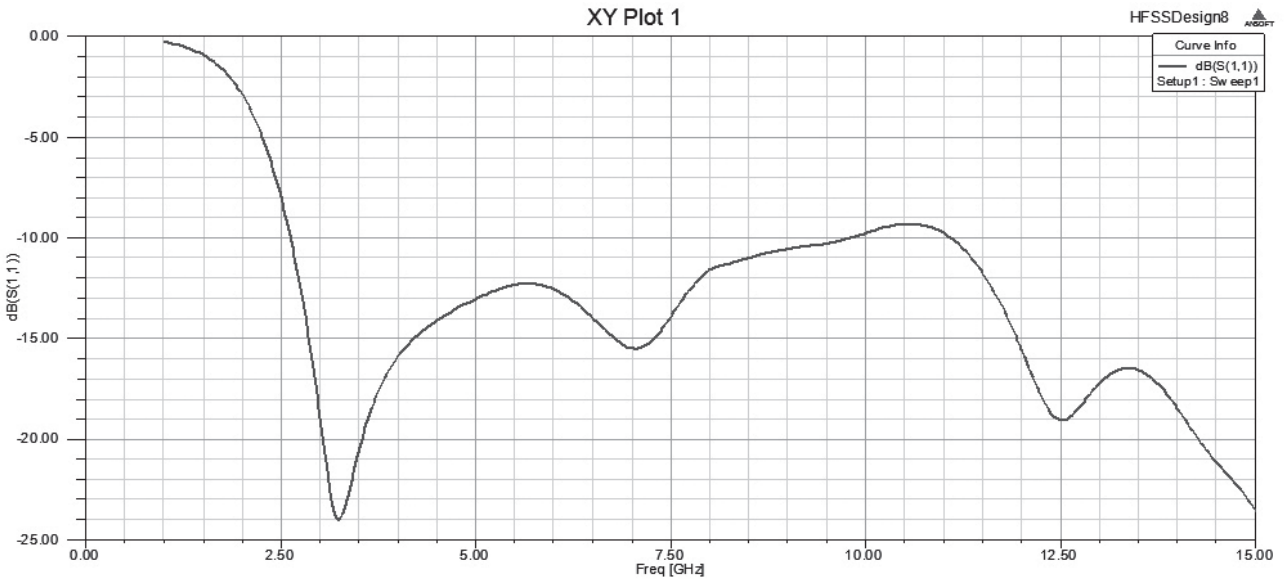


**Figure 5: Gain of Antenna**

We can observe that feed line is generating high levels of spurious feed radiations. As a consequence of this around 8 dB distortion in E-plane on the broadside (at 5 deg) can be seen in Figure 5.

***UWB Antenna with dumbbell shaped Patch***

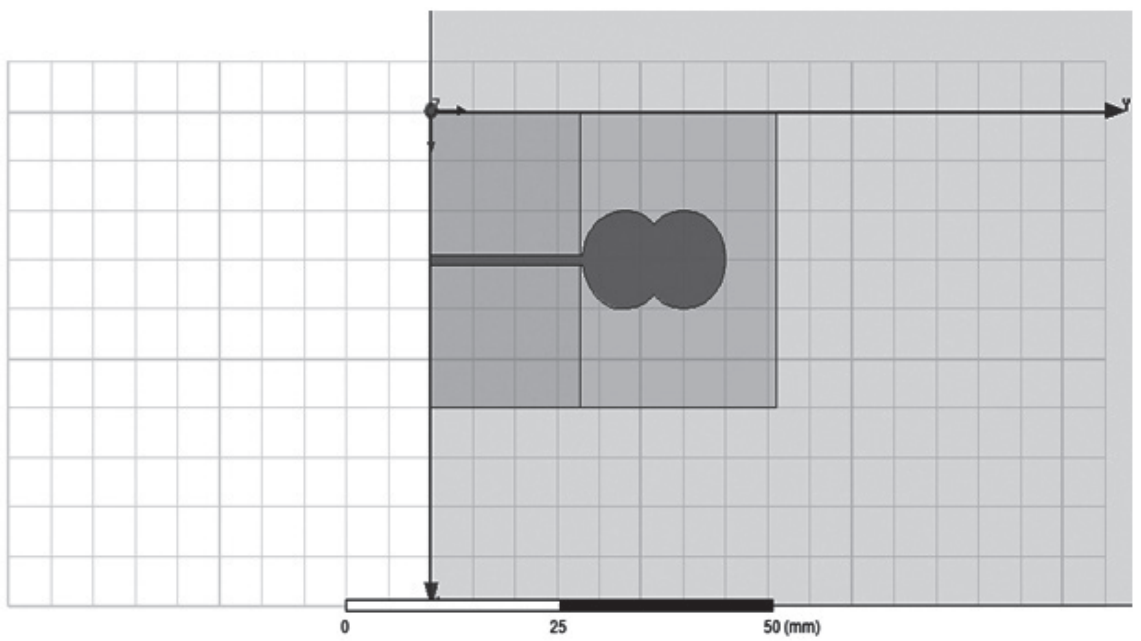


**Figure 6: Top view of dumb bell shaped Patch (vertical)**

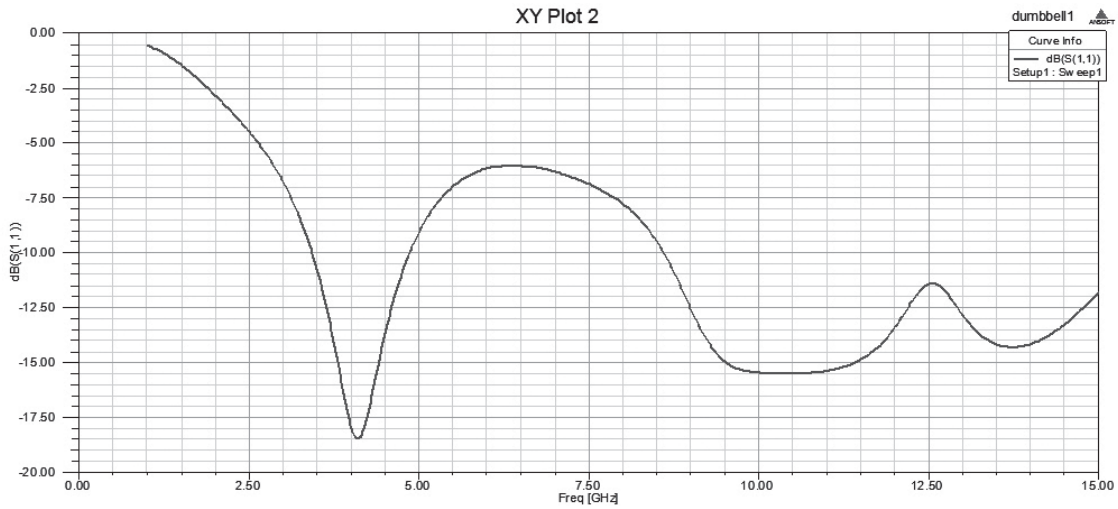


**Figure 7:Return loss**

Top view of the designed antenna have been shown. In Figure 6 to Figure 7, we can observe different antenna characteristics plotted in HFSS. Return loss of -20 dB at resonance frequency 5.16 GHz is obtained with a very low bandwidth of 0.47 % as expected due to thin substrate. Broadside gain at resonance frequency is obtained around 7 dB which is much higher than thick substrate MSA as expected. Also very low variation in gain can be observed over bandwidth (see Figure 8) i.e. almost constant. Due to decreased width of feed, very low level of feed radiations are observed, hence E-plane radiation pattern is very good.

## CONCLUSION

Thick substrate offers the advantage of good bandwidth but low gain and the gain varies considerably over bandwidth also. Above designs are based on the knowledge of procedures utilized for the simulation and manufacturing of patch antennas for medical imaging purposes. Although not depicted here but the hexagonal design will prove to be a match for the future medical imaging. Low profile antennas are desirable for the above said applications. Authors are committed to bring out a positive result thereby giving a solution for those in the field of antenna design and alternatively to those whose need such devices like imaging companies and doctors. With optimum technology in service, doctors may clearly forecast the probability of malignant tissues to be cancerous for safety of those patients with grown tissues.

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**Zoology**

# EFFECT OF MALATHION ON CHROMOSOMAL PATTERN OF Drosophila kikkawai

***Parul Gupta****
***Dr.Ajai Kumar*****

**ABSTRACT**

*Drosophila has long been a favorite model system for studying the relationship between chromatin structure and gene regulation due to the cytological advantages provided by the giant salivary gland polytene chromosomes of third instar larvae. This study emphasize adverse effect of an organophosphate compound, Malathion, on chromosomal pattern in the form of puffing in D.kikkawai. Drosophila kikkawai was selected as model organism for biomonitoring of pesticides due to its genetic importance and coexistence with other insect pests in agriculture field. The pesticide was administered by feeding the larvae at 100ppm, 10ppm, 0.1ppm, 0.01ppm in every 30 ml of food medium. Through chronic toxicity test, the 2 days LC50 was evaluated. In all the concentrations, markable effect on chromosomal pattern was observed. Such an effect of Malathion, is discussed in the light of the effects caused by other insecticides.*

**Keywords:** Chromosomal pattern, *Drosophila kikkawai*, genetic importance, Malathion.

## INTRODUCTION

Malathion is a pesticide that is widely used in agriculture, residential landscaping, public recreation areas, and in public health pest control programs such as mosquito eradication. Malathion was used in the 1980s in California to combat the Mediterranean fruit fly. Malathion is approved by the United States Food and Drug Administration for treatment of pediculosis. Dulout(1983) worked on Malathion induced chromosomal aberrations in mice. Malathion itself is of low toxicity; however, absorption or ingestion into the human body readily results in its metabolism to malaoxon, which is substantially more toxic. In studies of the effects of long-term exposure to oral ingestion of malaoxon in rats, malaoxon has been shown to be 61 times more toxic than Malathion (Gayatri MV and Krishnamurty, 1981 ). According to the United States Environmental Protection Agency, there is currently no reliable information on adverse health effects of chronic exposure to Malathion. Possible symptoms include skin and eye irritation, cramps, nausea, diarrhea, excessive sweating, seizures and even death. Most symptoms tend to resolve within several weeks. Since Malathion is widely used in agricultural field, we were prompted to evaluate its toxic effect on choromosomal pattern of *Drosophila kikkawai*, a wild species inhabiting agricultural field.

Strickberger (1962) explained the genetics of *Drosophila*. We picked to perform genetic studies, but this organism also offers an outstanding opportunity to study chromosome structure due to the polytene nature of the chromosomes found in its salivary glands. In these glands, many multiple DNA replications have occurred without mitosis. The multiple DNA strands remain closely associated yielding large chromosome structutres with specific

* **Parul Gupta** acquired Master's Degree in Zoology from HNGB Garwal University in 2007. Currently, she is pursuing Phd. from Mewar University, Gangrar, Chittorgarh, Rajasthan,India.
**Dr.Ajai Kumar** is Associate Professor, Department of Zoology**,** Feroze Gandhi College, Raebareli, U.P., India.

banding patterns along their length. Thus chromosomal alterations such as deletions, transpositions, duplications, etc can be visually verified using the unique banding as identifying landmark features.these changes can be considered by comparing with chromosomal map of *Drosophila melanogaster* prepared by Bridges (1935) and chromosomal map of *Drosophila kikkawai* by Diwedi and Gupta (1980). Charlesworth (1996) also worked on genetics of *Drosophila*. Daneholt B (1992), Dulout *et al*. (1983), Hartwell *et al*. (2011), Johnson *et al*. (2009), Prakash *et al*. (2010), Ristroph (2010) are some other scientists who worked on chromosomal structures of *Drosophila*, mice and some others.

## MATERIALS AND METHODS

Slightly toxic compound of EPA toxicity class III Malathion (EC 50%)

## TEST ORGANISMS

Flies and third instar larve of *Drosophila kikkawai* were used as test organism.

## COLLECTION AND CULTURE OF THE *Drosophila kikkawai*

*Drosophila kikkawai* were collected from different eco-geographical areas and agricultural field from nearby places of central U.P. All culture was maintained in lab, on corn-sugar-agar *Drosophila* food medium in B.O.D incubator at 24±1°C.

**Treatment Schedule:** For each study, the test chemicals were dissolved in 0.3% DMSO (Dimethyl Sulfoxide) finely mixed with food after cooling. Larva and adult were fed on this treated food for experiment at different concentrations.

**Determination of LC50 ( by method of Bliss1935, Finney 1989) of *Drosophila kikkawai* :**LC50 at 48 h of organophosphate test chemical Malathion was determined after feeding the 20 first instar larvae with 100 ppm,10 ppm,0.1ppm,0.01 ppm,0.001ppm,DMSO and control food medium. Ten replicates were used for each concentration. The LC50 concentration Experiment showed truly on 0.1ppm concentration 50% mortality was observed. (Figure 1, Table 1)

**Preparation of polytene chromosome:** Johnson *et.al*. prepared polytene chromosome by using antibodies. We prepared chromosomes at different concentrations viz., 1ppm, 0.1ppm (LC 50%) and control of Malathion.

Following are the summarized way to prepare polytene chromosome.

1. Take IIIrd instar larvae and pour them into PSS solution.
2. Dissect salivary gland of larvae.
3. Pour 45% acetic acid.
4. Wash with one drop HCL.
5. Stain with aceto-orecin for 4-5 minutes.
6. Wash with 60% acetic acid to remove excess stain.
7. Pour cover slip.
8. Squeeze the salivary gland.
9. See under microscope.
10. Take a photograph.

**Table 1: Determination of LC50 of *Drosophila Kikkawai* at different concentration of Malathion**

| Concentration | Total larvae taken | TOTAL | MORTALITY (%) |
|---|---|---|---|
| **100 ppm** | 200 | 200 | 100 |
| **10 ppm** | 200 | 198 | 99 |
| **1 ppm** | 200 | 142 | 71 |
| **0.1 ppm** | 200 | 99 | 49.5 |
| **0.01 ppm** | 200 | 62 | 31 |
| **0.001 ppm** | 200 | 31 | 15.5 |
| **0.0001 ppm** | 200 | 16 | 8.0 |
| **Dmso** | 200 | 8 | 4.0 |
| **Control** | 200 | 0 | 0 |

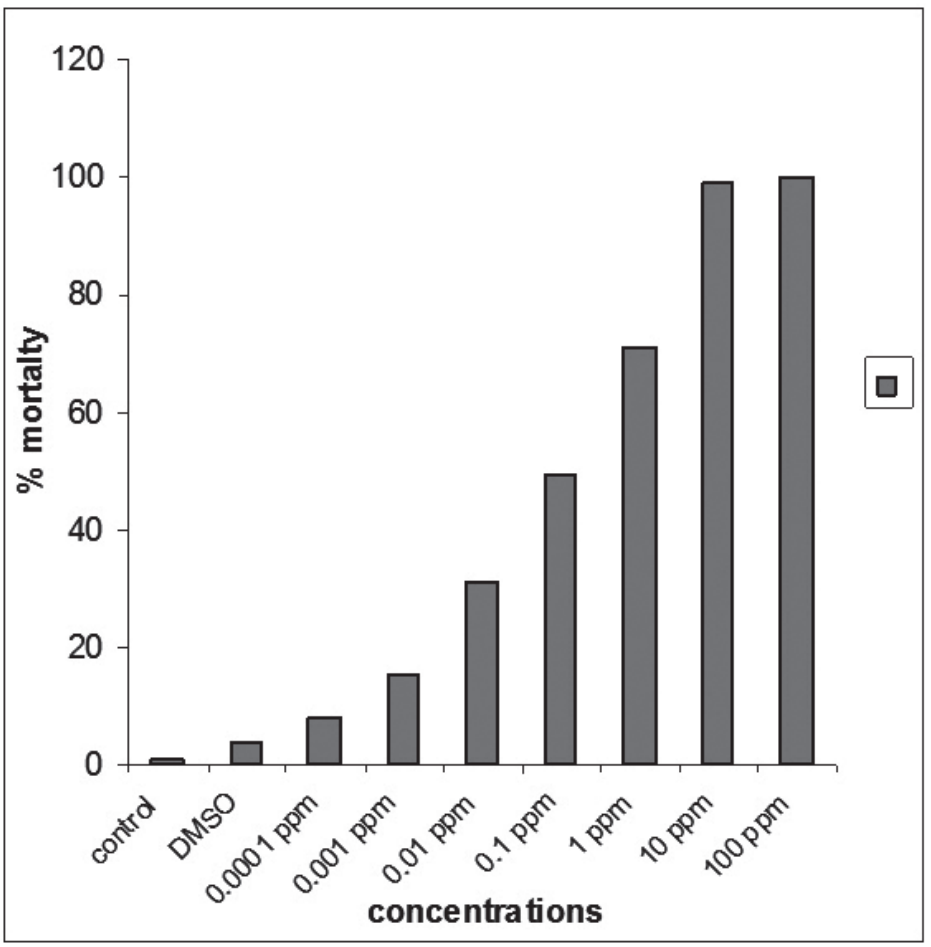


**Figure 1: Determination of LC50 of *D.kikkawai***

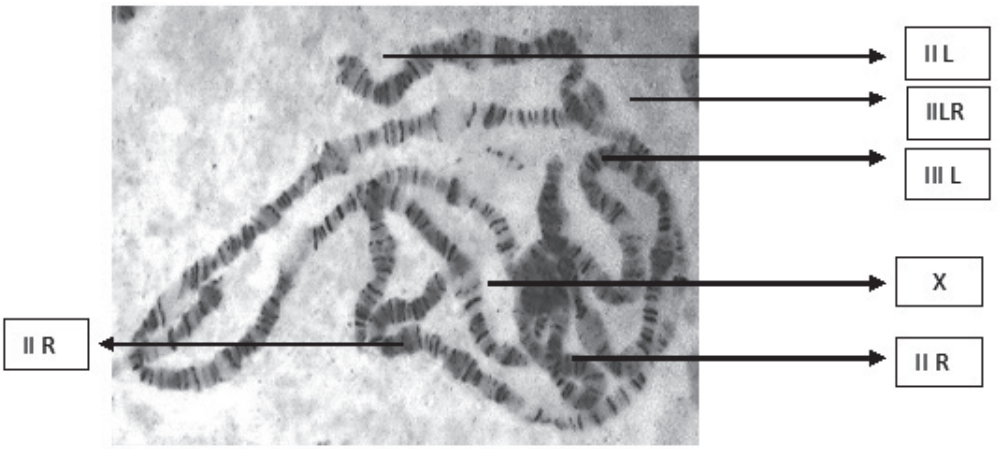


**Figure 2: Control Chromosome of *D.kikkawai* (with arms)**

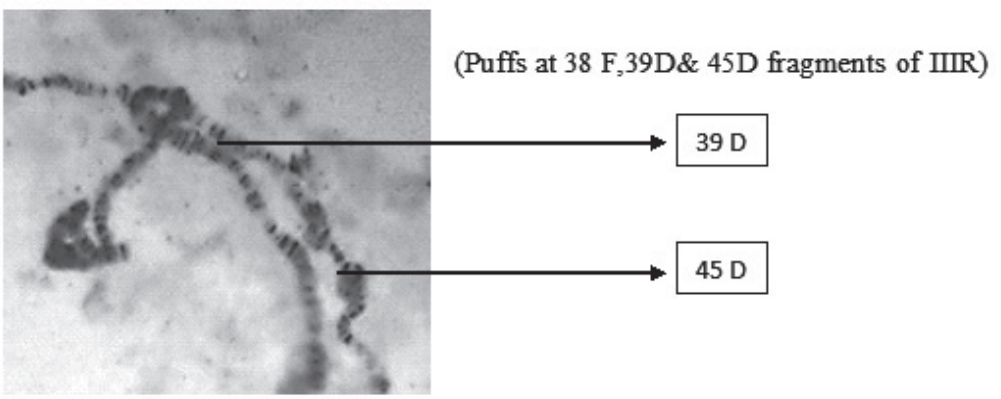


**Figure 3: Changes in 1ppm concentration of Malathion**

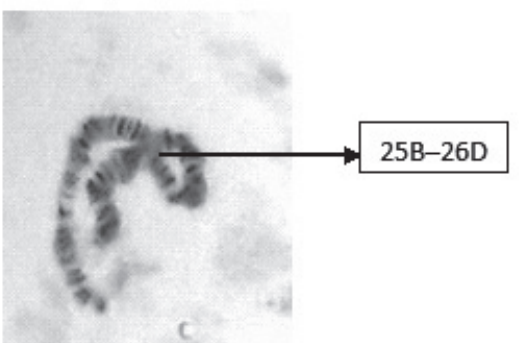


**Figure 4.1**
(Inversion at 25B-26D fragment of IIR)

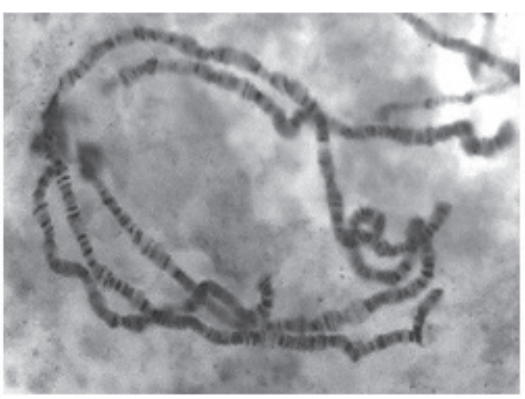

**Figure 4.2**
(Five arms with chromocentre)

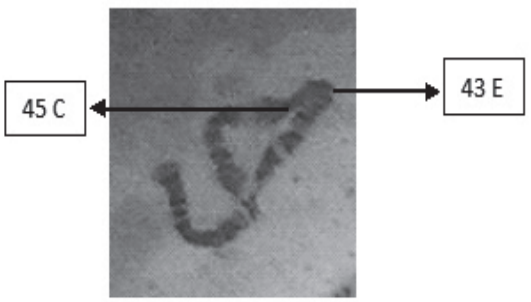


**Figure 4.3**
(Puff at 43E fragment of IIIR)

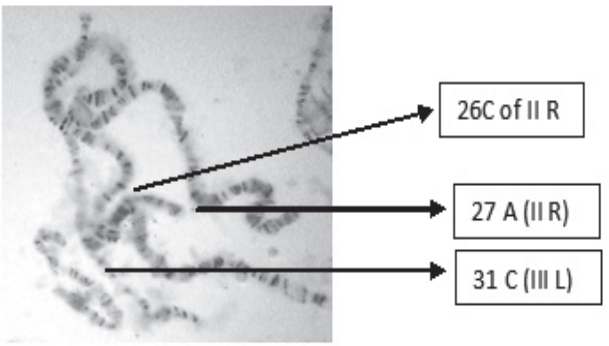


**Figure 4.4**
Puff at 27 A,26C of IIR & 31C fragment of IIIL)

**Figure 4: Changes in 0.1ppm concentration of Malathion**

## RESULT AND DISCUSSION

The Polytene chromosomes prepared from salivary gland chromosomes of third instar larvae showed five euchromatin arms and one very short strand arising from common chromocentre. The most eminent way to describe the Polytene configurations, the arms were arbitrarily designed: I for X chromosome, II L,IIR,III R, III L for the left and right arms of two pairs of V shaped chromosome and IV for the small dot shape chromosome of metaphase.

The gene arrangements from natural populations of *Drosophila kikkawai* and its breakpoints over Polytene chromosomes were conveniently described by comparing it to a standard Polytene map published by Diwedi & Gupta(1980).The chromosomes X , II, III and IV and these chromosomal configurations in natural populations were chosen as standard. Larvae obtained from the treatment of different concentrations of malathion were examined for naturally occurring chromosomal polymorphism in form of inversions.

The cytological observations for effect of Malathion also revealed some minor changes in chromosomal rearrangement in the salivary gland chromosome and also the induction of new puffs in the fragment 38F & 39D & 49D fragment of IIIR arm of chromosome in 1ppm concentration and 45C, 43E fragment of IIIR, 27A, 26 C and 31 fragment of IIIL arm in 0.1ppm concentration of malathion which may be due to stress conditions. Inversion was observed at the region of 25B-26D of IIR arm of chromosome at 0.1 ppm concentration of malathion. The stress puffs require further molecular or radioisotopic confirmation for mRNA formation.

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**Zoology**

# COMPARATIVE ANALYSIS OF FISH DIVERSITY OF UTTARAKHAND (GANGANANI TO HARIDWAR)

***Priyanka Sharma****

**ABSTRACT**

*Present investigation was carried out during December 2012 to April 2013, to assess the comparative analysis of diversity and composition of freshwater fishes in Uttarakhand. Uttarakhand is a beautiful hilly part of India, enriched with various aquatic ecosystem like rivers, streams, lakes and reservoirs. They all contain a very rich and colourful fish fauna. In the present study, we analyze fish diversity of river Ganga at two different locations i.e. UG-1(Ganganani to Devprayag) and UG-2(Devprayag to Haridwar). The paper examines the effect of human interference and pollution over fish diversity. The study is focussed on a total of 21 fish species belonging to 12 families reported in both the region. The paper also deliberates over some endangered and rare fish fauna.*

**Keywords:** Endangered, Fish diversity, Human interference, Pollution.

## INTRODUCTION

Uttarakhand came into existence as the 27th state of India on November 9, 2000. It is located between latitude $28^0 40'$ – $31^o$ 29' N and longitude $77^o$ 35' – $81^o$ 5' E. It covers about 53,483 Km² area and is inhabited by 10.1 million people (2011 Census). It encompasses thirteen districts i.e. Uttarkashi, Chamoli, Rudraprayag, Tehri Garhwal, Dehradun, Pauri Garhwal, Pithoragarh, Champawat, Almora, Bageshwar, Nainital,Udham Singh Nagar and Haridwar. Uttarakhand is enriched with aquatic ecosystem of various disciplines like rivers, streams, lakes and reservoirs. Some of the important rivers are Alaknanda, Bhagirathi, Bhilangana, Mandakini, Koshi and Ganga. There are several spring- fed and snow-fed rivers such as Henwal, Hemganga, Song, Suswa and hundreds of rivulets which have very rich flora and fauna. The climate of the region is mainly tropical with a well defined rainy season between June and October, a very mild winter between December and February and a relatively dry pre-monsoon summer between March and May.

In the present paper, we study fish diversity of fresh water fishes of the river Ganga at two different locations. Some earlier work on fresh water fishes are as follows:

Out of the 2,500 species of freshwater fishes that have been recognised in the Indian subcontinent, 930 are categorized as freshwater species (Jayaram 1999). Much of the early study on the freshwater systems of the Indian subcontinent can be traced back to the works of British officers working for the East India Company, who took great interest in the natural history of the region. Some early assistance were those of Hamilton-Buchanan in '*The Fishes of the Ganges'*(1822) and by others like McClelland (1839), Sykes (1839) and Jerdon (1849). Subsequently, studies were made by Francis Day in his *Fishes of India* (1875–1878). Substantial literature is now available on the identification and systematic of freshwater fishes of India, starting with Hora's assistance between 1920–1950s. Hora in the 1930s to 1950s addressed the difficulty of the anomalous division of hill stream fishes in peninsular India. Many species belonging to the peninsular part of India were found to be the same to

***Priyanka Sharma** is a Research Scholar at Department of Zoology, Mewar University, Gangnar, Chittorgarh, Rajasthan.

the species found in the North East of India. Most recent texts by Talwar & Jhingran (1991), and Jayaram (1999) discuss this similarilty in fish diversity.Though most of these contributions have been taxonomic in nature, there exist some works on the bio- geographic distributions of fishes in the region as well (Jayaram 1974).

A sequence of papers published by *Introduction Studies of Freshwater Fishes in the Indian Subcontinent* have been limited to scattered works on commercial fisheries and even these have been largely restricted to some of the major river systems like the Ganges and the Yamuna.

Taxonomic collections apart, not much work has been done on the study of freshwater fishes in the Northern India mainly in the Upper Ganga Region. Given the high levels of faunal diversity observed so far, there is an urgent need to understand the fish diversity and distribution of this region. The need is, in fact, made all the more urgent by the recent spurt of human actions in this region in exploiting its water resources for hydroelectric purposes. Not only are the rivers directly affected by the developmental activities, but they are also affected by other threats like introduction of exotic species, overfishing and the disposal of industrial and domestic wastes from new industries and settlements. Before the rich species diversity of this region of the subcontinent is lost forever, the records of the species found here as well as their distribution is essential; this together with the identification of the threats will help in formulating the needed conservation measures. As an initial step in this direction, the main objective of this study was to collect data on species richness and distributions that could serve as baseline information to monitor the potential Upper Ganga Region and show that this region is very high in diversity. One would expect similar trends during the study in different region since human impact over aquatic ecosystem is similar all across the country. Secondly, with the help of this study on fish diversity in the Northern India, we try to answer following questions: What is the level of diversity of freshwater fishes in this region and how does it compare to rivers of similar dimensions in other parts of the subcontinent? How does this diversity vary at differing spatial scales like entire river systems, or the upper and lower reaches in a river?

## MATERIAL AND METHODS

### STUDY AREA

The study was conducted in two region of Uttarakhand UG-1 (Ganganani to Devprayag) and UG-2 (Devprayag to Haridwar).

*UG-1 (Ganganani to Devprayag):* The stretch between Ganganani (Latitude: 30°55'.15.4" N; Longitude: 78°40'43.2" E ; Elevation: 1945 m above mean sea level) to Devprayag (Latitude: 30°08'49.5"N; Longitude: 78°35'51.9"E; Elevation: 474 m above mean sea level) was undertaken for study since there is considerable lack of variety of river system and connectivity has been ruined by the building of barrages and dams (Maneri Bhali I and II Projects, Tehri and Koteshwar dams). Water temperature ranges between 4.3-16.3°C (Nautiyal, 2010). Water temperatures (in the range 8.5-17.2°C) have also been recorded by Agarwal *et al*. (2003) and Sharma *et al*. (2008) at Tehri.

*UG-2(*Devprayag to Haridwar): The stretch between Devprayag (Latitude: 30°08'49.4"N; Longitude: 78°35'51.9"E; Elevation: 474 m above mean sea level) to Haridwar (Latitude: 29o57'20.1"N; Longitude: 78°10'56.3"E; Elevation: 290 m above mean sea level) is the convergence point of the rivers Bhagirathi and Alaknanda, and the river Ganga descends downstream at Rishikesh before traversing upto Haridwar in plains. Before reaching Rishikesh, it is connected by another tributary Nayar, which is a recognized breeding ground for the most important game fish of Ganga, referred as Mahseer (*Tor* sp.). The river stretch consists of rapids, riffles and pools. The substrate consists of mature boulders, cobbles and pebbles. Sand is also present at few places in this zone. The river water in this stretch appears clean and clear, and has high transparency with moderate depth. The current velocity ranges between 0.1-3.0 m/s (Kishor, 1998). The water temperature is also moderate and varies between 15-23°C. The flows are significantly fluctuating and the river meanders into few channels at Haridwar downside of Rishikesh.

**SAMPLING**

Fishes were collected from two sampling sites identified as UG1 (Gangnani to Devprayag) & UG2 (Devprayag to Haridwar). Details of the length, catchment areas and elevation for each river are summarized in Table 1. Fishes on these rivers were sampled regularly over a period from Dec. 2012–Apr. 2013 (see Table 2 for dates of samplings) on two sampling sites. The sites were chosen such that one was on the higher elevation zone and another at the lower elevation zone. Thus, regional comparisons along a river were made across the upstream and downstream sites. Sampling was done from a boat along the shoreline during period of comparable discharge and focused on the near shore zone where most fishes are found and where our sampling method was most efficient. A selection of about 150 to 200 m was sampled upstream at every river kilometer marker within the study stretch. Two selected sites were sampled in the Upper Ganga region. Captured fishes were stored in a big container in the boat. As sampling was done at each stretch, all fishes were identified, measured (SL) and dropped back to water. The relative density (catch per unit efforts) was explained as the number of individual per 100 meter of sampled shoreline, with a standard width 3.0 m of the sample area. The fishes were identified and some representative specimens were collected and preserved in (4% formaldehyde solution) in plastic bottles. Identifications done were based on keys for fishes of the Indian subcontinent (Jayaram 1999, Talwar & Jhingran 1991) and also with the help of taxonomic expertise from the Regional Station of the Zoological Survey of India at Chennai.

We collated data on fishes of the Himalayan Rivers from published sources, documents, checklists and augmented this with primary data from our regular field surveys undertaken during the last six to eight years (see *Appendix* S1). We also used online sources (**www.fishbase.org**) for supplementing data on diversity and distributions of the Himalayan fishes.

**Table 1: Details of the length, catchment areas and elevation**

| | | **Latitude** | **Longitude** | **Total area** | **Elevation** | **Source of pollution** |
|---|---|---|---|---|---|---|
| **UG1** | | | | | | |
| Gangnani to Devprayag | Gangnani | $30^0$ 55’ 15.4” N | $78^o$40’43.2”E | 239 km² | 1945 m | minimal |
| | Devprayag | $30^o$08’49.5”N | $78^o$35’51.9”E | | 474 m | minimal |
| **UG2** | | | | | | |
| Devprayag to Haridwar | Devprayag | $30^o$08’49.5”N | $78^o$35’51.9”E | 93.4 km² | 474 m | minimal |
| | Haridwar | $29^o$57’20.1”N | $78^o$10’56.3”E | | 290 m | Sewage, pesticides |

**Table 2 : Details of seasons, date and time of sampling**

| **Sampling season** | **Sampling date** | **Time of Sampling** | **Duration (Hrs.)** |
|---|---|---|---|
| Winter | Dec, 2012-Jan,2013 | Day | 6:00-10:00 |
| Summer | Mar, 2013 | Night | 17:00-24:00 |
| Pre-monsoon | April,2013 | Day | 8:00-10:00, 16:00-18:00 |

**RESULTS AND DISCUSSION**

During the present study, 21 species of fishes belonging to 12 families (as shown in Table 3)were reported. Out of these *Tor tor, Tor putitora, Raimas bola* were found as endangered fishes while *Barilius vagra* and *Garra gotyla gotyla* were found as vulnerable fish species, while *Garra lamta, Labeo boga, Labeo dero, Labeo dyocheilus, Puntius chola, Puntius sarana, Puntius sophore, Puntius phutunio, Rasbora daniconius, Esomus danricus, Crossocheilus latius latius, Leploephalus guntea, Noemacheilus botia, Noemacheilus savona, Noemacheilus bevani, Mystus vittatus, Xenentodon cancila, Mastacembelus armatus, Channa gachua,Glyptothorax pectinopterus* were found at low risk.

**Table 3: Comparative analysis of fish species of Gangnani to Devprayag and Devprayag to Haridwar**

| TAXA | Gangnani to Devprayag | Devprayag to Haridwar |
|---|---|---|
| **Cyprinidae** | | |
| *Barilius barna* | P | A |
| *B. barila* | P | P |
| *B. bendelisis* | A | P |
| *B. bola* | A | P |
| *B. vagra* | P | A |
| *Crossocheilus latius latius* | P | P |
| *Garra gotyla gotyla* | P | P |
| *G. lamta* | P | A |
| *G. prashadi* | A | A |
| *Labeo angara* | A | P |
| *L. calbasu* | A | P |
| *Labeo dero* | P | P |
| *L. dyocheilus* | A | P |
| *L. gonius* | A | A |
| *Puntius sarana sarana* | A | A |
| *P. sophore* | A | A |
| *P. ticto* | A | P |
| *Raiamas bola* | A | A |
| *Rasbora daniconius* | A | A |
| *Salmostoma bacaila* | A | P |
| *Schizothoraichthys esocinus* | A | A |
| *S. progastus* | P | P |
| *Schizothorax curviforns* | A | A |
| *S. intermedius* | A | A |
| *S. micropogan* | A | A |
| *S. niger* | A | A |
| *S. plagiostomus* | P | P |
| *S. richardsonii* | P | A |
| *S. sinuatus* | P | P |
| *Tor chilinoides* | A | A |

| | | |
|---|---|---|
| *T. putitora* | P | P |
| *Tor tor* | P | P |
| **Balitoridae** | | |
| *N. multifasciatus* | | |
| *N. montanus* | A | A |
| *N. rupicola* | P | A |
| *N. Savona* | A | A |
| *N. zonatus* | P | A |
| **Sisoridae** | | |
| *Bagarius bagarius* | P | A |
| *Glyptothorax cavia* | A | A |
| *G. conirostris* | A | A |
| *Glyptothorax lineatus* | A | P |
| *G. madraspatanum* | P | A |
| *G. pectinopterus* | A | A |
| *G. trilineatus* | A | A |
| *Pseudecheneis sulcatus* | P | A |
| **Schilbeidae** | | |
| *Clupisoma garua* | P | A |
| **Osphronemidae** | | |
| *Colisa fasciatus* | A | A |
| **Cobitidae** | | |
| *Botio Dario* | A | A |
| **Belonidae** | | |
| *Xenantodon cancila* | A | A |
| **Channidae** | | |
| *Channa gauchua* | A | A |
| **Mastacembelidae** | | |
| *Mastacembelus armatus* | A | A |
| **Bagridae** | | |
| *Mystus tengara* | A | A |
| *Rita rita* | A | A |
| **Clariidae** | | |
| *Clarias batrachus* | A | A |
| **Mugilidae** | | |
| *Rhinomugil corsula* | A | P |
| **Total** | 21 | 19 |

**(Note: A** *stands for Absent*, **P** *stands for Present*)

An overall fish survey in the area has revealed a rapid decline in fish diversity. As compared to previous data of fish diversity of river Ganga in UG1(Gangnani to Devprayag ), there were total of 36 fish species which has now dwindled to 21 species with a loss of nearly 15 species. This is a worrying sign for the aqua system in this region. In fact, fecal coliform levels are increasing very fast in this stretch of river , suggesting that there is inadequate flow for dilution even in these highly oxygenated stretches .In UG2(Devprayag to Haridwar), there was a total of 35 species which has now declined to the figure of 19 with a loss of nearly 16 species. According to the CPCB's monitoring data, biological oxygen demand (BOD) levels are high downstream of Haridwar. The main reason for decline of fishes is due to overfishing by various destructive fishing methods especially during breeding season. The pollution of the river by flash flood, landslides and soil erosion etc. are also responsible for the depletion of fish fauna.

## CONCLUSION

India is gifted with affluent water resources with nearly 45000 km long riverine system that criss-crosses the length and breadth of the country. Out of this, Ganga basin is amazingly diverse in altitude, climate, land use and cropping pattern. Ganga has been a cradle of human civilization since time immemorial. It is one of the most holy rivers in the world and deeply regarded by the people of the country. India has 12 river basins, and 14 minor and desert river basins. Out of those, Ganga is the largest river basin which flows through the state of Uttarakhand, Uttar Pradesh, Himachal Pradesh, Bihar, Jharkhand and West Bengal. The quality of Ganga which makes it different from other rivers is its self-cleansing ability, which allows for assimilation and treatment of biological waste. But in the current context, withdrawal from the river is much higher than the discharge of water. Moreover growing discharge of waste and pollutant is devastating the aquatic ecosystem. In the upper reaches of the river, where the oxygenating abilities of the river are the highest, there are growing signs of contamination. This suggests that even here, water withdrawal for hydroelectricity is endangering the health of the Ganga .As the river reaches the plains, the water withdrawal peaks for irrigation and drinking water. In this stretch of the river from Rishikesh to Allahabad, there is almost no water during winter and summer months. In other words, the river stops flowing. But the waste water flow does not ebb. The river then receives only waste and turns into a sewer which results in decreasing fish diversity in the river Ganga and increased number of fish mortality due to choking of gills. Besides these problems, illegal fishing causes decline of fish population in the Ganga river system. Hence there is an urgent need of an Action Plan for conservation of fish habitat, fishery development etc. Moreover, safety measures should be taken to control illegal fishing by directing a total ban on fishing especially during the breeding season.

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**Education**

# A STUDY OF ACADEMIC ACHIEVEMENT MOTIVATION AND STUDY HABITS OF SECONDARY CLASS STUDENTS

***Madhvi Agrawal****
***Dr Anil Kumar*****

**ABSTRACT**

*The present study was undertaken to find a relationship between academic achievement motivation and study habits of secondary class students in Delhi and Delhi, NCR. The sample for the study consisted of 400 Secondary class students of 16 public and government schools under Directorate of Education, Delhi. The multi- stage random stratified technique was used in the study. The tools used were AAMT scale of Dr T.R. Sharma (2005), to measure the academic achievement motivation and SHI(Study Habit Inventory) developed by M. Mukopadhyay and D.N. Sansanwal, to measure the study habits. The coefficient of correlation between variables of study habits and academic achievement motivation and t- ratio were computed for the analysis of the data. The findings of the study revealed that there exist partially significant relationship between academic achievement motivation and study habits of the Secondary class students. The academic achievement motivation of boys and girls were also quite different, but there was not much significant difference between the study habits of boys and girls.*

**Keywords:** Academic achievement motivation, SHI (Study Habit Inventory).

## INTRODUCTION

Education helps in development of overall personality of the individual in all fields and aspects making young minds intelligent, learned, bold, and courageous and of good character. Education aims at making children capable of becoming responsible, productive and useful members of the society. Knowledge, skill and attitudes are built through learning experiences and opportunities created for learners in school. The aim of education simultaneously reflects the current needs and aspirations of a society as well as its lasting values and human ideals. At any given time and place they can be called the contemporary and contextual articulations of broad and lasting human aspirations and values. An understanding of learners, educational aims, the nature of knowledge, and the nature of the school as a social space can help us arrive at principles to guide classroom practices. Conceptual development is thus a continuous process of deepening and enriching connections and acquiring new layers of meaning. Alongside is the development of theories that children have about the nature and social worlds, including themselves in relation to others, which provide them with explanations for why things are the way they are and the relationship between cause and effect.

Academic Achievement is the prime and perennial responsibility of a school or any other educational institution established by the society to promote wholesome scholastic growth and development of a child. Good (1973) in *Dictionary of Education* has defined '*academic achievement as knowledge attained skills developed in the school subjects, usually designed by test scores or by works assigned by the teacher or both*'.

***Madhvi Agrawal** is a Research Scholar in Mewar University, Chittorgarh Rajasthan and working as TGT (Mathematics) in Delhi Administration. E-mail: madhvibansal@yahoo.com
****Dr.Anil Kumar** is the Principal in DIET (SCERT), Dilshad Garden, Delhi

Academic achievement is defined by Crow and Crow (1969) as the extent to which a learner is profiting from instruction in a given area of learning i.e. achievement is reflected by the extent to which skill and knowledge has been imparted to him. Achievement is influenced by personality, motivation, opportunities, education and training. There are several other factors also which influence the academic achievement of student like study habit, self-concept, socio- economic status, intelligence etc. There are several factors that influence the academic achievement of an individual like his personality, intellectual ability, school adjustment and environment etc.

Study- habits is a combination of two words 'Study' and 'Habits'. When taking it separately, study means, 'Application of the mind to the acquirement of knowledge'. According to *Encyclopedia of Education* (1971) study habit is methods of study. The teachers should present to the class the most effective techniques or methods of work, as proved by experience and experiment, so that the students may make their choice. According to *Good's Dictionary of Education*, "Study habit is the tendency of a pupil of student's way of studying whether systematic or unsystematic, efficient or inefficient etc". Going by this definition, it literally means that good study habit produces positive academic performance while inefficient study habit leads to academic failure. Study habit are measured directly through reports, examination, assessment and rating.

Its measurement is done by individual scores on each dimension regarding study i.e. comprehension, concentration, task-orientation, interaction, drilling, supports, recording and total scores can be calculated on the basis of Study Habit Inventory(SHI) developed by Mukhopadhyaya and Sansanwal (2002).

A review of literature highlighted the importance of students' study habits and attitudes in their academic performance. A number of studies have been carried out in the U.S.A. and India to find the relationship between study habits and academic achievement. According to *Menzel,* as cited by *Rana* and *Kausar* (2011), many students fail not because they lack ability but because they do not have adequate study skills. Students who have difficulty in college frequently do not have adequate study habits that affect their academic achievement. A central problem noted was that many of these students had not learned how to take effective notes and manage time for studying (cited by *Mutsotso S.N. & Abenga E.S.*, 2010). Moreover, a study by *Nagaraju* (2004) found that students usually do not devote sufficient time to their studies and seldom have proper study habits. A substantial amount of research has examined the role of students' study habits on academic performance. The study of *Osa-Edoh* and *Alutu* (2012) which examined the usefulness of imbibing in the students study habit, as a means of enhancing their academic performance, revealed a high correlation between study habits and students' academic performance. This suggests that it is only when students imbibe or cultivate proper study habits that their academic performance can be improved upon. The study of *Fazal* (2012) identified various study skills used by learners and ascertain which study skill is more related to academic achievement. Results of the study indicate significant relationship of time-management skills, reading and note-taking skills with academic achievement. Students with higher academic achievement used a wide range of study skills as compared to students with lower academic achievement. *Singh* (1984), *Schoeive* (1993) *& Blackstone* (1994) surveyed the study habits of secondary school students as related to their academic achievement and found the relationship to be positively significant.

In the quest to improve academic achievement, researchers have studied about the factors, which influence academic achievement. The correlation between these factors and academic achievement has always held interest for researchers of all ages.

## OBJECTIVES OF THE STUDY

(1) To find out the study-habits (comprehension, concentration, task-orientation, study-sets, interaction, drilling, supports, recording, language) of secondary class students;

(2) To find out the relationship between academic achievement and various dimensions of study-habits;

(3) To study the difference between the achievement motivation of boys and girls;

(4) To study the difference between the study habits of boys and girls;

(5) To study the difference between the achievement motivation of urban students and the rural students; and

(6) To study the difference between the study habits of urban students and the rural students.

## HYPOTHESES

To achieve the above mentioned objectives, the following hypotheses were formulated and tested-

HO1. There exists positive and significant relationship between study-habits (nine dimensions viz. comprehension, concentration, task orientation, study-sets, interaction, drilling, recording, supports, and language) and academic achievement motivation.

HO2. There is no significant difference between boys and girls with respect to their academic achievement motivation.

HO3. There is no significant difference between boys and girls with respect to their study habits

HO4.There is no significant difference between urban students and rural students with respect to their academic achievement motivation.

HO5.There is no significant difference between urban students and rural students with respect to their study habits.

## RESEARCH METHODOLOGY

The study attempted the relationship between the scores on Academic Achievement Motivation test and the scores of Study Habit Inventory (SHI) in the context of different variables like sex, and rural and urban backgrounds. The methodological details like samples, tool and procedure of data collection are outlined below.

## SAMPLING

In the present study the investigator selected schools of district East and North-East of Delhi and Delhi NCR as the field of investigation. The multi-staged stratified random sampling technique was used in this study. The sample for the study consists of 400 Secondary class students of 16 schools of Delhi and Delhi NCR. Students from both types of schools were categorized on the basis of their sex as well as on the basis of the location of their school i.e. urban and rural. Required number of students from each category was then randomly selected.

## TOOLS USED

To measure academic achievement motivation, Dr. T. R. Sharma's AAMT inventory was used as a tool. On the basis of characteristics of the inventory given in the manual, it was considered suitable for the purpose. Reliability and validity of this inventory have been reported satisfactory. This inventory measures the levels of academic motivation. The inventory comprises of 38 statements pertaining to the academic achievement motivation of the students. Scores ranges from 0 to 38. To measure the study habits, Study Habit Inventory (SHI) developed by *M. Mukhopadhyay* and *D. N. Sansanwal* (2002) was used as a tool. This was found appropriate tool for the study. The inventory comprises of 52 items pertaining to line sub-components namely comprehension (12 items), concentration (10 items), task orientation (9 items), study sets (7 items), interaction (3 items), drilling (4 items), supports (4 items), recording (2 items), language (1 item) which characterize the bases of study habits. The items have been drafted in affirmative (34 items) and negative (18 items) forms.

## STATISTICAL TECHNIQUES USED

Mean, S.D., Correlation and t-test techniques were used for the analysis of the data.

**ANALYSIS OF DATA AND INTERPRETATION OF RESULTS:**

The following were the findings of the study:

**HYPOTHESIS 1**

There exists positive and significant relationship between study-habits (nine dimensions viz. comprehension, concentration, task orientation, study-sets, interaction, drilling, recording, supports, and language) and academic achievement

**Table 1: Different variables and their values of coefficient of correlation**

| S.No. | Variables | r-value |
|---|---|---|
| 1. | Academic Achievement and Comprehension | 0.349 |
| 2. | Academic Achievement and concentration | 0.354 |
| 3. | Academic Achievement and task orientations | 0.318 |
| 4. | Academic Achievement and study-sets | -0.074 |
| 5. | Academic Achievement and interaction | 0.105 |
| 6. | Academic Achievement and drilling | 0.076 |
| 7. | Academic Achievement and supports | 0.189 |
| 8. | Academic Achievement and recording | 0.243 |
| 9. | Academic Achievement and language | 0.191 |

It is indicated by the **Table 1** that out of the nine dimensions of study-habits, four dimensions have positive and highly significant relationship with academic achievement. These dimensions were- comprehensions (Coeff. r of Corr. = 0.349), concentration (Coeff. r of Corr. = 0.354), task-orientation (Coeff. r of Corr.=0.318),and recording, (Coeff. r of Corr.=0.243). Five dimensions indicated that there was no significant relationship with academic achievement. These dimensions were- study-sets (Coeff. r of Corr.=0.074), interaction (Coeff. r of Corr.- 0.105), drilling (Coeff. r of Corr. = 0.076), support (Coeff. r of Corr. = 0.189), language (Coeff. r of Corr. = 0.191). Therefore, Hypotheses 1 that there exists positive and significant relationship between study habits (nine dimensions) and academic achievement; has been partially accepted.

**HYPOTHESIS 2**

There is no significant difference between boys and girls with respect to their achievement motivation.

Difference in mean, S.D. and t -value is indicated in **Table 2** in respect of achievement motivation of boys and girls.

**Table2: Achievement Motivation of Boys and Girls**

| | Gender | N | Mean | Std. Deviation | Std. Error Mean | t- value |
|---|---|---|---|---|---|---|
| **ACHIEVEMENT MOTIVATION** | Boys | 200 | 29.91 | 3.875 | .274 | 2.081 |
| | Girls | 200 | 29.02 | 4.645 | .328 | |

(*Here, df=398, Mean difference=0.890, Std. Error difference=0.428*)

It was hypothesized that there exists no significant difference between the achievement motivation scores of boys and girls of secondary classes. Observation of **Table 2** reveals that t value is 2.081, which is significant at 0.05 level. It means that the achievement motivation of boys and girls is quite different. Thus hypothesis is rejected.

**HYPOTHESIS 3**

There is no significant difference between boys and girls with respect to their study habits.

Difference in mean, S.D. and t- value is indicated in **Table 3** in respect of study habits of boys and girls.

**Table 3:Study habits of Boys and Girls**

| | Gender | N | Mean | Std. Deviation | Std. Error Mean | t- value |
|---|---|---|---|---|---|---|
| **STUDY HABITS** | 1 Boys | 200 | 130.16 | 17.955 | 1.270 | 1.853 |
| | 2 Girls | 200 | 126.98 | 16.263 | 1.150 | |

(Here, df=398, Mean difference=-3.175, Std. Error difference=1.713)

It was hypothesized that there exists no significant difference between the study habits of boys and girls of secondary classes. Observation of **Table 3** indicates that the t-value is 1.853 which is not significant at 0.05 levels. It means that the study habits of boys and girls are found to be similar. Thus, the hypothesis is accepted.

**HYPOTHESIS 4**

There is no significant difference between urban students and rural students with respect to their achievement motivation.

Difference in mean, S.D. and t- value is indicated in **Table 4** in respect of achievement motivation of rural and urban students.

**TABLE 4: Achievement Motivation of Rural and Urban students**

| | Area | N | Mean | Std. Deviation | Std. Error Mean | t- value |
|---|---|---|---|---|---|---|
| **ACHIEVEMENT MOTIVATION** | 1 Rural | 200 | 29.40 | 4.306 | 0.304 | -0.326 |
| | 2 Urban | 200 | 29.54 | 4.294 | 0.304 | |

(Here, df=398, Mean difference= -0.140, Std. Error difference=0.430)

It was hypothesized that there exists no significant difference between the achievement motivation scores of urban students and those of rural students. Observation of **Table 4** reveals that the t value is -0.326 which is not significant at 0.05 level. It shows that the location of the school does not affect the achievement motivation of the students. Thus the hypothesis is accepted.

**HYPOTHESIS 5**

There is no significant difference between urban students and rural students with respect to their study habits.

Difference in mean, S.D. and t- value is indicated in **Table 5** in respect of study habits of rural and urban students.

**Table 5: Study habits of Rural and Urban students**

| | Area | N | Mean | Std. Deviation | Std. Error Mean | t- value |
|---|---|---|---|---|---|---|
| **STUDY HABITS** | RURAL | 200 | 127.93 | 18.337 | 1.297 | -0.747 |
| | URBAN | 200 | 129.22 | 15.964 | 1.129 | |

(Here, df=398, Mean difference=.-1.285, Std. Error difference=1.719)

It was hypothesized that there exists no significant difference between the study habits scores of urban students and those of rural students. Observation of **Table 5** reveals that the t value is -0.747, which is not significant at 0.05 levels. Thus the hypothesis is accepted.

## CONCLUSION

Thus, on the basis of the obtained results it can be concluded that, academic achievement motivation of Secondary class students get partially affected by their study habits. Students who have good comprehension, concentration, task orientation and recording ability have relatively good academic achievement motivation, as they may subsume the new learning with the previous knowledge and orientation and behavior of such students towards accomplishment of the tasks in a pre-decided time frame helps them to get motivated themselves. It is also clear from the findings that the Secondary Class boys have better achievement motivation as compared to that of Secondary Class girls, while their study habits is found to be the same. It is also seen that whether the schools are in urban or rural area, there is not much difference in the achievement motivation and study habits of students. In order to increase the achievement motivation of girls, it will be imperative that girls should be given more motivation, care, freedom of expression and exposure, so that they may desire to set some realistic goal in life, and strive to achieve them. Various training activities ought to be operated by their teachers through behavior and planned interventions.

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**Education**

# ASSESSMENT OF VARIOUS PARAMETERS FOR QUALITY IN HIGHER TECHNICAL EDUCATION

***Sanjay Soni****
***Dr.B.K.Chourasia*****

**ABSTRACT**

*In the present research, an attempt has been made to find the effect of various parameters such as total faculty in the Institute, migration of faculty, placement of students, and Attendance of students in classes, availability of funds for Infrastructure development etc. over quality of higher technical education. Delphi technique has been used as a methodology in the research finding. The rationale behind the study is to find the critical parameters that affect the quality of technical education and whether by controlling them, the quality of the Institute can be enhanced for the betterment of all the stakeholders.*

**Keywords:** Delphi technique, infrastructure, National Assessment and Accreditation Council (NAAC), pay structure, Quality of technical Education.

## INTRODUCTION

Technical Manpower is the driving force in the rapidly changing globalized economy and society. Emergence of Technical manpower as a driving factor results in both challenges and opportunities. The growth of global economy has increased opportunities for countries with good levels of Technical education (Altbach, 1993) [1]. In the current global competitive environment, an accessible and high quality of higher education system is imperative for a nation's economic progress. A sound higher education system supports and enhances the process of economic and social development for a better future. Developing and transition countries are particularly challenged in a highly competitive world economy because their higher education systems are not adequately developed for the creation and use of technical manpower available. Converting the challenges into opportunities depend on the rapidity with which they adapt to the changing environment.

## TECHNICAL EDUCATION SYSTEM IN INDIA

The higher education system in India grew rapidly after independence. By 1980, there were 132 universities and 4738 colleges in the country enrolling around five percent of the eligible age group in higher education. Today, in terms of enrollment, India is the third largest higher education system in the world, behind China and the U.S.A. China having the highest enrolment in the world (nearly 23 millions) has organized the technical education around only about 2,500 institutions. On the other hand, the average enrolment in a Technical institution in India is about 500-600 students with 6223 technical institutions (Source: A.I.C.T.E).This makes the system of Technical education in India a highly fragmented one that is far more difficult to manage than any other system of higher education in world.

***Sanjay Soni** is a Research Scholar, Industrial Engineering and Management, Mewar University, Gangrar, Chittorgarh, Rajasthan, India. E-mail: soni563@yahoo.com

****Dr.B.K.Chourasia** is Associate Professor, Department of Industrial Production, Jabalpur Engineering College, Jabalpur. **Email:** basant_chourasia@rediffmail.com.

## CHALLENGES FACED BY TECHNICAL EDUCATION IN INDIA

In India, the entry of the private sector in Technical education is on massive scale and is largely driven by inadequacy in government funding in the education sector, paving way for private investment. This is due to liberal policies in early 90's.With the present growth in GDP, it is expected that India's economy will surpass Italy by 2015, France by 2020, Germany by 2025 and Japan by 2035.It has been predicted that India, being driven by Knowledge economy, will become the third largest economy by 2050 (Varghese, 2010)[13].Technical education in India is more privatized than any advanced countries. A large number of Institutes are private and self financed as prestigious Institutions are not able to accommodate all aspirants (Source: A.I.C.T.E.2012).Most private Institutes concentrate on profit making rather than on imparting quality education to students by limiting the essential requirements needed to fulfill the curriculum .Pay structure variations among faculties makes their retention and availability difficult. To propel the nation in 21st century, there is need for planned change in higher education with realistic perception for policy formation as to what is possible and what is not.

## PRESENT SCENARIO OF QUALITY IN HIGHER TECHNICAL EDUCATION

The huge demand of 151 million by 2022 in all sectors of Indian industry for skilled manpower in India (Source: N.S.D.C) demands private sector role as a major leader in imparting higher technical education in India. Due to the failure of government sector to provide affordable higher education to all, private sector has emerged as a major player in higher technical education in India. Private participation in higher technical education has also increased the danger of dilution of quality in higher technical education for earning more profits from this sector (Rusa, 2012). Also the reports put out by the National Assessment and Accreditation Council (NAAC) have time and again emphasized how major higher education institutions are facing problems of experienced and motivated teachers, lack of innovations, lack of academic and physical infrastructure. Hence it was not at all surprising when a National Association of Software and Services Companies (NASSCOM)-Mckinsey Reports (2005)[12] found out that mere 25 percent of technical and 10 percent of non- technical graduates are actually employable. The companies employing these graduates have to pay huge amount in training them for their work potential. This can be seen as skill gap between what industry requires and what quality they are receiving. Since higher technical education in India is an important part of modern Indian society and is intertwined with the political and social systems of the society, this sector is in need to change, development and improvement (Albatch, 1993)[1].

## METHODOLOGY

Delphi technique has been used as a methodology for studying effect of various parameters on quality of higher technical education. The Delphi technique is well suited as a means and method for consensus building by using a series of questionnaires to collect data from a panel of selected subjects ( Dalkey & Haelmer, 1963[5]; Lindeman,1981[8]; Martino,1983[11];Young,2001[14]).Delphi compared to other data gathering and analysis techniques uses more than one iterations for going on a consensus of opinion concerning a specific topic (Ludwig, 1994)[10].

More specifically, the feedback process allows and encourages the selected Delphi participants to reassess their initial judgments about the information provided in previous iterations. Thus, in a Delphi study the results of previous iterations regarding specific statements and or items can change or be modified by individual panel members in later iterations based on their ability to review and assess the comments and feedback provided by the other Delphi panelists. Other important characteristics inherent with using the Delphi technique are the ability to provide anonymity to respondents, a controlled feedback process and the suitability of a variety of statistical analysis techniques to interpret the data (Ludlow,1975[9] ; Douglas,1983[7]).These characteristics are designed to offset the shortcomings of conventional means of pooling opinions obtained from a group interactions i.e. influence of dominant individuals, noise, and group pressure for conformity (Dalkey, 1972)[6].

**THE DELPHI PROCESS**

Theoretically, the Delphi process can be continuously iterated until consensus is determined to have been achieved. However, Cyphert and Gant (1971)[3], Brooks (1979)[2], Ludwig (1997)[10] point out that three iterations are often sufficient to collect the needed information and to reach a consensus in most cases. In the present research study, a questionnaire is developed comprising of various factors of higher technical education and consensus is built in three iterations for degree to which they affect the quality of technical education.

**Table 1:Various Parameters of higher technical education**

| S.No | Various Parameters of higher technical education |
|---|---|
| | **Faculty Quality** |
| 1.1 | Number of Teaching Faculty. |
| 1.2 | Number of Guest faculty. |
| 1.4 | Time Management. |
| 1.5 | Behavioral Skills. |
| 1.6 | Research Potential. |
| 1.7 | Conduction of Seminars and Workshops. |
| 1.7 | Participation in Workshops and Conference. |
| 1.8 | Policy Towards Promotions of Faculty. |
| 1.9 | Work environment |
| 1.10 | Selection mode for faculty. |
| 1.11 | Faculty Appointment on vacant sanctioned posts |
| 1.12 | Faculty departure from the Institute |
| 1.13 | Migration of Faculty to other Institute |
| 1.14 | Faculty growth factor |
| 1.15 | Faculty Satisfaction |
| 1.16 | Fund Availability for Faculty welfare |
| 1.17 | Service period of Faculty |
| | **Infrastructure** |
| 2.1 | Seating capacity in Classrooms. |
| 2.2 | Laboratory as per curriculum requirements. |
| 2.3 | Build up Infrastructure as per AICTE requirement. |
| 2.4 | Modern Teaching. |
| 2.5 | Housing facility for Faculty and Staff. |
| 2.6 | Adequate Hostel facility for Students. |
| 2.7 | Library facility for Students and Faculty. |
| 2.8 | Regular Maintenance of class rooms, furniture etc. |
| | **Students** |
| 3.1 | Attendance of Student in classes conducted. |
| 3.2 | Performance of students in mid-semester Exams. |
| 3.3 | Placement of Students in company through campus Interviews. |
| 3.4 | Scholarships for meritorious students. |
| 3.5 | Reservation policy in Admissions. |

| | |
|---|---|
| 3.6 | Delay in admission and readmission. |
| 3.7 | Drop out students from the Institute. |
| 3.8 | Total number of sanctioned seats for admission. |
| 3.9 | Fund availability for student's research programs. |
| 4.0 | Selection of students of Institute in national level exams. |
| 4.1 | Pass percentage |
| 4.2 | Total Number of students scoring first division. |
| 4.3 | Total Number of students admission. |
| 4.4 | Student's satisfaction. |
| 4.5 | Total registered students |
| 5 | **Administration** |
| 5.1 | Working hours of institute. |
| 5.2 | Fee structure and Examination fee. |
| 5.3 | Transportation Facility. |
| 5.4 | Regular Curriculum revision for graduation program. |
| 5.5 | Official working procedures. |
| 5.6 | Availability of fund for building and Maintenance of Infrastructure of Institute. |
| 5.7 | Availability of fund for Training Programs for faculty. |

**Round1**: In first round of Delphi process, the open ended questionnaire is sent to 25 experts via email form out of which 23 were responsive and three were unaccepted due to multiple answers put up by the experts.

**Round 2**: In the second round of Delphi process, the questionnaire was restructured after the first round and was again sent to 23 experts out of which all 22 were responsive.

**Round 3**: In the third round of Delphi process, the questionnaire was given to panelists with their scores and they were asked to revise their judgments whether they wanted to continue or to quit. After the third round, only 20 panelists remained and three quitted. The data obtained from the panelists was processed in excel sheet and results were interpreted which are present and discussed in the succeeding section.

## RESULT

**Table2: Median and Standard Deviation of Various Parameters**

| S.No | Parameter | Median | Standard Deviation |
|---|---|---|---|
| | **Faculty Quality** | | |
| 1.1 | Number of teaching Faculty. | 3 | .75 |
| 1.2 | Number of Guest faculty. | 1 | .75 |
| 1.4 | Time Management. | 2 | .85 |
| 1.5 | Behavioral Skills. | 2 | .78 |
| 1.6 | Research Potential. | 2 | .74 |
| 1.6 | Conduction of Seminars and Workshops. | 2 | .82 |
| 1.7 | Participation in Workshops and Conference. | 2 | .67 |
| 1.8 | Policy Towards Promotions of Faculty. | 2 | .51 |
| 1.9 | Work environment | 2 | .78 |

| | | | |
|---|---|---|---|
| 1.10 | Selection mode for faculty. | 2 | .76 |
| 1.11 | Faculty Appointment on vacant Sanctioned posts | 3 | .60 |
| 1.12 | Faculty departure from the Institute | 2 | .71 |
| 1.13 | Migration of Faculty to other Institute | 3 | .60 |
| 1.14 | Faculty growth factor | 3 | .75 |
| 1.15 | Faculty Satisfaction | 2 | .83 |
| 1.16 | Fund Availability for Faculty welfare | 2 | .74 |
| 1.17 | Service period of Faculty | 2 | .79 |
| **Infrastructure** | | | |
| 2.1 | Seating capacity in Class rooms. | 1.5 | .74 |
| 2.2 | Laboratory as per curriculum requirements. | 2 | .76 |
| 2.3 | Build up Infrastructure as per AICTE requirement. | 2 | .78 |
| 2.4 | Modern Teaching aids. | 1.5 | .78 |
| 2.5 | Housing facility for Faculty and Staff. | 2 | .76 |
| 2.6 | Adequate Hostel facility for Students. | 2 | .79 |
| 2.7 | Library facility for Students and Faculty. | 2 | .71 |
| 2.8 | Regular Maintenance of class rooms, furniture etc. | 2 | .85 |
| **Students** | | | |
| 3.1 | Attendance of Student in classes conducted. | 2 | .82 |
| 3.2 | Performance of students in mid-semester Exams. | 3 | .68 |
| 3.3 | Placement of Students in company through campus Interviews. | 3 | .60 |
| 3.4 | Scholarships for meritorious students. | 2 | .88 |
| 3.5 | Reservation policy in Admissions. | 2 | .76 |
| 3.6 | Delay in admission and readmission. | 2 | .85 |
| 3.7 | Drop out students from the Institute. | 1.5 | .68 |
| 3.8 | Total number of sanctioned seats for admission. | 1.5 | .74 |
| 3.9 | Fund availability for student's research programs. | 2 | .75 |
| 4.0 | Selection of students of Institute in national level exams. | 2 | .71 |
| 4.1 | Pass percentage | 2 | .76 |
| 4.2 | Total Number of students scoring first division. | 1.5 | .68 |
| 4.3 | Total Number of students admission. | 2 | .61 |
| 4.4 | Student's satisfaction. | 2 | .63 |
| 4.5 | Total registered students | 2 | .61 |
| 5 | **Administration** | | |
| 5.1 | Working hours of institute. | 1 | .59 |
| 5.2 | Fee structure and Examination fee. | 1.5 | .74 |
| 5.3 | Transportation Facility. | 1 | .75 |
| 5.4 | Regular Curriculum revision for graduation program. | 2 | .85 |
| 5.5 | Official working procedures. | 2 | .67 |
| 5.6 | Availability of fund for building and Maintenance of Infrastructure of Institute. | 2 | .79 |
| 5.7 | Availability of fund for Training Programs for faculty. | 2 | .74 |

## CONCLUSION

From the Table 2, we find that in the first section of questionnaire i.e. Faculty quality section; parameter with serial number 1.1 which is for the total number of faculty in the Institute, is having the highest scores of values obtained by processing data after three iterations and parameter with serial number 1.13 which is migration of faculty to other institute, is having the second highest value. This indicates that in this section, they are the most dominant parameter for quality in technical education. Similarly, the second section of questionnaire which relates to Infrastructure; parameter with serial number 2.8 which is for regular maintenance of classrooms is having the highest scores of values along with the parameter at serial number 2.6 for the adequate hostel facilities for students having second highest scores. This indicates that these factors are critical for quality in technical education. Likewise the third section of the questionnaire which concerns infrastructure indicates that the parameter with serial number 3.3 and 3.2 which are performance of students in mid -semester exams and placement of students, respectively are important for quality of technical education. Similarly , the fourth section of the questionnaire which relates to administration shows that parameter with serial number 5.4 and 5.6 which relate to regular curriculum revision and fund availability are critical for quality of technical education. From the above research findings, we reveal that if these parameters are given priority in the Institute, than quality status of the institute can be enhanced significantly.

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**Literature**

# TAGORE AS A FEMINIST: A STUDY OF HIS SELECT NOVELS

***Anupam Chakrabarti****

**ABSTRACT**

*In India, the feminist movement, unlike the Western feminist movement, was initiated by men. Raja Ram Mohan Roy, Ishwar Chandra Vidyasagar and Keshab Chandra Sen were pioneers in India. Swami Vivekananda strongly affirmed elevation of women in all aspects of society to complete the history of India. Deeply influenced by these reformers, Tagore tirelessly wrote about the liberation of women in which they are not bound by gender stereotyping, rather could experiment as freely as men could do in their lives. Tagore wrote Binodini (Chokher Bali) in 1903 to highlight the struggles of the widows. In the Home and the World, through the character of Bimala, he presented his concept of the new women who were capable of moving out of the family courtyard. But their movement from the Zenana to the world outside should not lead them to be treated as second sex by persons in authority. As a visionary, his message to his female reading public was loud and clear: eternal vigilance is the price of freedom. This paper develops a concept of female aesthetic by re-reading Tagore's female-centric novels.*

**Keywords:** Autonomous being, *Binodini*, Brahmoism, empiricism, *Gora*, patriarchy, *Pride and Prejudice*,realism, seduction, sexual politics, Shakti of the motherland, *The Home and the World* ,*The Second Sex*, Victorian England, widow.

## INTRODUCTION

Feminist theories caught the eye of the reading public in England in the last quarter of the eighteenth century when Mary Wollstonecraft published her thought–provoking books. That was nearly eighty years before the birth of Tagore. In 1787, the feminist, Wollstonecraft, influenced by the empiricism of John Locke, realized the need for the education of the female child and wrote *Thoughts on the Education of Daughters* (1787). She followed it up with *A Vindication of the Rights of Women* (1790) in which she castigated the patriarchal ideology of the male – dominated society and its unfair attitude of subjugating women. To what extent Tagore familiarized himself with those feminist theories as he grew to sensitive manhood is a debatable point, but most of his novels were excellent illustrations of Wollstonecraft's thesis.

Wollstonecraft did not live long enough to see her feminist theories getting translated into practice, but the women (as well as men) of Victorian England saw a spate of reforms in the 1870's as a result of her reformist ideas: establishment of public schools for girls and colleges for women. A few career options opened for women: teaching, nursing and typing. When Tagore went to England for higher studies in 1878, he was much pleased to see the reforms in the lives of women.

In India, the feminist movement, unlike the Western feminist movement, was initiated by men, and later joined by women. Raja Ram Mohan Roy carried on a crusade against the patriarchal society for its practice of Sati,

***Anupam Chakrabarti** is Associate Professor of English at Department of Post Graduate Studies & Research,M.M.H. Post Graduate College,Ghaziabad (U.P.). E-mail: achakrabarti270@gmail.com

polygamy and child marriage. He demanded property inheritance rights for women so that he could free women from the economic stranglehold of men. Vidyasagar legalized remarriage of widows in 1856 and thereby raised their status considerably. Keshab Chandra Sen formed the Indian Reform Association in 1870 and set up schools for girls. All those great reforms had a tremendous impact on the mind of Tagore. But the reformer who exercised the most potent influence on Tagore's thought process was Vivekananda who affirmed that by relegating women to the background of society, politics and culture it was impossible to complete the history of India.

Tagore wrote *Binodini* (The original Bengali title was *Chokher Bali* or Eye Sore) in 1903 to highlight the struggles of the widows. The condition of the widows had improved theoretically in 1856 with passing of *The Remarriage of Widows Act*, but in actual practice their condition was far from satisfactory. With no education and no career options before them, the alternative to remarriage was bleak indeed. In the absence of education, widows existed in a state of ignorance and depended on external circumstances and associations in a servile manner. Even if some widows could analyze situations by their power of reasoning, the patriarchal society turned a deaf ear to their voice of reason. Tagore showed the conflict in the psyche of the widows and their search for identity in a world where men ruled the roost.

Binodini, an accomplished girl, lost her father early in life and this resulted in the impecunious condition of her house. A bosom friend of her mother, Rajlakshmi, got her married to one of her distant and diseased cousins, who died soon after their marriage. Mahendra (Rajlakshmi's son), who had declined the offer of marriage made to him by Binodini's mother, now surprised everybody by marrying the simple, Asha. Rajlakshmi fell out with her son and left for the village. In the village, Rajlakshmi was awed by the efficiency of Binodini's housekeeping and brought her to Calcutta, where shortly, she became the cynosure of all eyes. Binodini's efficiency in household chores could easily be compared to that of Agnes Wickfield in Dickens' *David Copperfield*. As Asha was no match at all for Binodini, she expressed a feeling of inferiority before her and addressed her in the sobriquet, 'Eye Sore'.

Binodini gave vent to her jealousy against Asha and even ranted at the male-biased society for all the injustice that it meted out to her:

"What I was denied and deprived of now belongs to the slip of a girl, this little play-doll!" (*Binodini* 37)

Binodini could differentiate between appearance and reality and it rankled her when she realized that Mahendra's nonchalance towards her was mere pretence:

" **....** Why this difference? As though she was a piece of furniture!" (*Binodini* p.42).

Tagore's novels evinced his opposition to the feminist theory of gender-stereotyping which states that men can experiment but women must conform. Tagore showed that Binodini could experiment too. Srikumar Banerjee showed the scheming side of Binodini's nature at this part of the plot when he stated that her picture was *"that of a woman denied her right to love, afire with jealousy, bent upon bringing Mahendra to his knees by all means, an arch plotter, torn with mental conflict and repression."* (*Homage to Rabindranath Tagore,* p.73). That intriguing ability of Binodini individualized her completely.

Tagore showed how the conduct of certain males towards the widows went beyond the pale. But they were never arraigned for it. One night, Mahendra entered into the room of Binodini with a wicked motive of seducing her. Although Mahendra's plot of seduction failed, Rajlakshmi, instead of bringing her son to book, branded Binodini, a seductress. She did not know how to prove herself guiltless, but in her letter to Mahendra, she stated in no uncertain terms:

*I have no right to love or be loved in this world. That is why I play at love to lighten my sorrow* **.....** *I have no desire to play the game any longer.* (*Binodini,* p. 132)

Tagore's feminist ideas were reflected in the theories of the American feminist, Kate Millet. In *Sexual Politics* (1969) she argued that the patriarchal authority has given woman the minority status that inflicts on her "s*elf-hatred and self-deception, contempt both for herself and her fellows*." (*Sexual Politics,* p. 55).

Another feminist theorist, Toril Moi argued in the book *Sexual / Texual Politics*(1985) that *feminist struggle must try to undo the patriarchal strategy that makes 'feminity' intrinsic to biological femaleness and at the same time insist on defending women precisely as women."* (*Sexual / Texual Politics,* p. 82)

Binodini turned to Bihari and was sanguine that he would fill the emotional vacuity in her heart caused by the perfidious, Mahendra but Bihari, influenced by the male-bias, labelled her a seductress. Surprisingly, the excursion to Dum Dum picnic garden enabled Bihari to discover a new Binodini, in whom, burnt *"the austere light of a pure and devoted woman."* (*Binodini,* p. 60)

Rajlakshmi and Asha proceeded to Kashi but prior to their journey, they left Mahendra in charge of Binodini. Mahendra now made sardonic mockery of the love affair of Bihari and Binodini in the presence of Binodini.

One day Bihari saw Mahendra cringing before Binodini and that altered his impression of Binodini. Despite the change in Bihari's impressions regarding Binodini, her admiration for the former increased manifold. When Bihari flung her away in a fit of angry contempt, she remained impassive. She did not even allow Mahendra to touch her wounds. When Mahendra pestered her with his protestations of love, she sought the protection of Bihari. Bihari took her to be somewhat "melodramatic theatrical". He advised her to go to the village.

Life in the village was really harrowing for Binodini. She was branded a whore wherever she went and was called names. No experience in her life could be more mortifying to her than that. To escape further calumny, she decided to elope with Mahendra. Majumdar, in his perceptive study of Tagore's heroines, described the elopement as "*the strangest elopement in the world*," (*Heroines of Tagore,* p. 212). Despite the sweeping generalization of the critic, any reader could realize that she was perfectly justified in eloping with Mahendra, her perfidious companion. The thought of vindicating herself before Bihari was uppermost in her mind; hence her plan of elopement.

Towards the concluding part of the novel, Bihari went to Allahabad in search of Mahendra with the desired objective of taking him to attend to his ailing mother. Bihari found Binodini in the adjacent room, all spick and span. Besides the room exhaled the fragrance of flowers. Without verifying the relations of the two, he declared her unchaste. Binodini set his doubts at rest by affirming that she had carried Bihari's image in her heart like shining gold. To prove her unquestionable chastity she minced no words: "*I touch your feet and swear that nothing has happened to destroy this value*." (*Binodini,* p. 217).

Binodini's case was just the reverse of Hardy's Tess. Towards her end, Tess knew Angel as the man *'who had believed in her as pure'*. (*Tess,*p. 386) Binodini had to convince a suspicious Bihari that she '*remained chaste'* (*Binodini*, p. 217). Though critical opinion was sharply divided about Hardy's assessment of Tess as 'A Pure Woman' in 1891, yet Hardy had to fight against the sexual prejudices of his age to justify her chastity. Tagore, who composed *Binodini*, (a decade after Hardy composed his Tess) was very much occupied with Binodini's chastity and could have given to his novel 'Eye Sore' (1903), the secondary title, 'The Chaste Woman'. Perhaps his cynical indifference to censorious criticism prevented him from doing so.

At the end of the novel, Bihari proposed to Binodini but she declined the proposal in a mood of self-abnegation. Her reason for declining the proposal was, '*Religion and society would never tolerate it*'. (*Binodini*, p. 218) By 'society' Tagore implied patriarchal society. Majumdar was critical of Tagore's lack of courage when he stated that it prevented him from uniting Bihari and Binodini in a wedlock. But had Tagore solemnized their marriage, he would have failed to arouse the conscience of the insular males of the society. Nihar Ranjan Ray, who studied Tagore's novels from the standpoint of psychological realism, averred that Binodini's sacrifice became "*the symbol of the stricken conscience of the contemporary middle-class Hindu society."* (*An Artist in Life,* p. 186)

In dealing with the struggles of the widows, Tagore's novels showed much advancement over the novels of his predecessors, namely those of Bankim Chatterjee. In *Bishabriksha* (1873) and *Krishnakanter Will* (1878) Bankim had highlighted their crippling social and economic condition. But Tagore turned his focus inward and showed the anger, the dejection, jealousy and revenge natural to any sensitive widow, maltreated by the society. By imparting to Binodini, an identity different from that of other widows, Tagore "*emerged as a non-conformist, ready to expose social conservatism*." (*An Introduction to Rabindranath Tagore,* p. 117).

Tagore wrote *The Home and the World* in the second decade of the twentieth century when Indian women were no longer buffered, denatured and decushioned by patriarchal mores. With the opening of schools and spread of education, women no longer had the nagging feeling that they were condemned to the enfeebling darkness of bondage to external reality. As women became enlightened, they moved out of their cabined world. They came into

contact with reality and as a sequel to that they were torn between the pull of the "home" and the pull of the "world". At one stage, the love of women which remained confined within the four walls of the room, now came "*in conflict more narrowly more fiercely with politics also.*" (*Rabindranath Tagore,* p. 84).

Nikhil, the protagonist of the novel had a sprawling estate which formed the background of the novel. Lord Curzon's partition of Bengal into Hindu and Muslim states had created anarchy everywhere. Bengal was in a state of great political turmoil. The Swadeshi movement was boycotting the purchase and use of all foreign goods and cries of 'Bande Mataram' were renting the skies. Though Tagore made use of the political imbroglio to project his themes, yet his principal concern was to explore a world beyond politics, a world in which human relationships, particularly of the husband and wife, is of paramount significance.

Nikhil, a well-meaning husband, was concerned with the development of the mind and soul of his wife, Bimala. With that end in view, he engaged an English teacher, Miss Gilby so that her English education would help her gain an awareness of the world outside. Though Bimala was enjoying a laid-back tranquility in her private world of the *Zenana*, yet she could not remain unaffected by the deafening calls of the Swadeshi. Her decision of dispensing with the services of Miss Gilby and her adamancy in burning foreign clothes were clear indicators of her growing disenchantment with anything English. Her fire-brand politics distanced her from that of her husband, Nikhil, whose notion and practice of Swadeshi appeared "dull milk–and– watery Swadeshi." (*The Home and the World,* p. 122). All his compromising statements on the Swadeshi appeared lackadaisical to Bimala when she compared Nikhil's speeches of moderation with the flamboyant rhetoric of Sandip.

Sandip won his way to Bimala's heart by his mixture of flattery and stratagem; sometimes he addressed her as the "Shakti of the motherland"; sometimes he applied to her the appellation of "Queen Bee" of the Swadeshi workers. But underlying his glib talk of patriotism was his latent, hideous motive of gratifying his sexual lust, perceived by none other than the insightful Nikhil.

Sandip's language of flattery mesmerized Bimala to such an extent that she no longer thought of herself as "*the lady of the Raja's house, but the sole representative of Bengal. And he was the champion of Bengal*… (*The Home and the World,* pp. 28-29)

Nikhil was strongly opposed to the idea of providing any healthy corrective to Bimala's fallacious notions about men and manners. He wanted Bimala to come out of the delusions herself. By not exercising the traditional authority of a husband over his wife, he gave his creator (Tagore) the opportunity to express his feminist concerns. Patriarchy or the ideology committed to male supremacy had no place in his thought process; He was a true feminist as he was opposed to the use of physical force on his wife: "*Use force? But for what? Can force prevail against Truth?"* (*The Home and the World,* p. 49). Tagore's Nikhil stood in sharp contrast to the protagonists of the modern novel. Men like Rycker and Victor Baxter's father in Greene's novels, *A Burnt- out Case* (1960) and *The Captain and the Enemy* (1988) respectively, indulged in domestic violence and tyrannised over their wives.

Here Tagore, through the Sandip-Bimala relationship, was giving wonderful illustrations of Wollstonecraft's notions. Tagore raised the question of gender-stereotyping which results on a culture producing the images by which it deludes itself. Both Bimala and Sandip, on account of faulty culture-conditioning and education looked out for the wrong things in each other. Sandip looked for a veneer of attraction in the beautiful Bimala. Bimala, more prone to deception on account of her faulty and unfinished education, looked for Sandip who had the appearance and manners of a gentleman, but in reality was a scheming, promiscuous person.

The call of Swadeshi flared up the nationalist sentiments of many people who demanded the outright boycott of foreign goods. But Nikhil was adamant in his refusal of banishing imported goods from his state. The Muslim traders decided not to go the Swadeshi way. The adamancy of the Muslim traders goaded Sandip and his workers to resort to violence. When the militant Swadeshis sunk the boat of one influential trader, Mir Jaan, he threatened to report it to the police. The Swadeshis decided to pay him some hush money. As money was not forthcoming, Sandip requested Bimala to do the needful. Throwing all moral scruples to the winds, Bimala stole some gold coins from Nikhil's treasure chest. In doing so, she constantly felt the qualms of conscience for her having robbed her house as well as her country. She could no longer hear the melodious notes of the flute or shehnai that once drew her to her nuptial ceremony. Tagore's message to such impudent, hasty and trustless women was crystal clear. Tagore was

hammering the idea that a woman eventually ruins her own happiness by betraying the trust of a well meaning and faithful husband.

Sandip, who had lust written all over him, was waiting expectantly for the beauty and the gold. As Bimala drew close to hand him over the gold, Sandip sprang forward to seduce her. He reeled backward, hit his head on the edge of a marble table and dropped on the floor. Any reader could find an illustration of the feminist theories of Simone de Beauvoir in Sandip's motives and actions. Though Beauvoir wrote *Second Sex* nearly thirty years after Tagore's composition of *The Home and the World*, yet Tagore seemed to anticipate Beauvoir's concepts: Beauvoir wrote:

"…. Humanity is male and man defines woman not in herself but as relative to him; she is not regarded as an autonomous being…. [woman is simply what man decrees: thus she is called 'the sex' by which is meant that she appeals essentially to the male as a sexual being." (*Second Sex*, p. 16)

Bimala could never read into Sandip's motive of treating her as the second sex. So she breathed a sigh of relief when she eventually freed herself from Sandip's clutches which she referred to as 'his snaky coils'. Though Bimala was re-united with Nikhil yet she was constantly hounded by the thought of her act of betrayal. Within the space of a few days, a fatal injury of Nikhil in a communal disturbance during the Swadeshi gave her the most shocking blow of her life.

Through the character of Bimala, Tagore presented his concept of the new women who were capable of moving out of the *Zenana*. But their movement from the *Zenana* to the world outside implied danger at every step. They could be exposed to the false patriotism of spurious leaders who could shatter their peaceful, conjugal lives by their establishing a wrong connection between the home and the world. They could be treated as second sex by persons in authority and their modesty could be outraged anywhere. Tagore was the last to forestall the movement of ladies in public life. He was a pace-setter in bringing out girls from educated families on the public stage and this spoke volumes for his liberal outlook about women. But at the same time, he wanted them to use their discretion (in keeping their chastity unassailed) before they moved to the centre-stage of politics and public life. As a visionary, his message to his female reading public was loud and clear: eternal vigilance is the price of freedom.

*Gora* (1909), Tagore's fifth novel was a landmark in the history of the Bengali novel. It could be interpreted on several planes: the novelist's evolution of outlook from revivalism of Hinduism to universal brotherhood, from nationalism to internationalism and finally his change from rigid Brahmoism and Hinduism to the religion of man. To a reader in search for Tagore's feminist concerns, the novel had much to offer.

Tagore began the novel by depicting Binoybhusan. Tagore's feminist concerns could be gauged through Binoybhusan, who freely discussed matters pertaining to women. Several of his discussions centered on women's relationship within the female circle and outside it. A road accident brought him face to face with Sucharita. At the outset, Tagore presented Sucharita as a symbol of nature. But with the progress of the plot, he gave to his symbol, an independent mind. Tagore was opposed to gender-stereotyping, the feminist theory that states that men can experiment but women must conform. Through Sucharita, Tagore rebutted the theory.

*Gora* was brought into the narrative through his argumentative discussion with Binoybhusan. He opposed Binoybhusan's decision of visiting his Brahmo neighbour, Paresh Babu. Gora could smell the reasons that were driving Binoy to the house of Paresh Babu ---- his lovely daughters. Then he stated his concept of womenhood that rightly smacked of patriarchy:

"The altar at which Woman may be truly worshipped is her place as Mother, the seat of the pure, right-minded lady of the house." (*Gora,* p. 12).

By using the familiar image of the moth and the candle, he denigrated Binoy's love for Sucharita. In Gora's fundamentalist ideology, women could only be deified as Goddess Kali or Goddess Durga, ever ready to step out of the home and crush the forces of evil. Gora's peculiar mindset made him ungrateful in acknowledging the services of the Christian domestic help, Lachmiya. Lachmiya mothered him in as much as Anandomoyi and nursed him back to life during a bout of small pox. Gora's thought-process was so warped by his fundamentalism and shaped by his patriarchy that he betrayed the impotency of his mind, particularly in his interactions with women ------ his initial dialogues with Sucharita being an illustration in point.

Tagore depicted Anandamoyi in such a way that she became his idea of ideal womenhood. In undergoing a transition from an orthodox, Bengali, Brahmin woman to a non-sectarian woman, she had to discipline herself mentally, but that in no way suppressed the mother in her. She was always hounded by the fear "*that if I looked down upon anyone for being of low caste or a Christian, then God would snatch you away from me."* (*Gora,* p.17) Anandamoyi had all the graces befitting a mother despite her not being the biological mother of Gora. Gora was downright in declaring, '*How many possess a mother like mine!*' (*Gora,* p.18) In his thoughts, Binoy addressed her 'Mother' and both Sucharita and Lolita addressed her so.

Tagore created the orthodox Barodashundari as a foil to the liberal Anandamoyi. By portraying Barodashundari, Tagore was trying to show how gender-stereotyping damaged both men and women. Through Paresh Babu's marriage with Barodashundari, Tagore proved how defective education could lead a man to choose a wrong partner in marriage and that could be the root-cause of a great many social and personal problems. Her detestation of idolatry, traditional outfit, religious Hindu names and anything that smacked of non-Brahmoism, was used by Tagore to pillory the hypocrisy of the pseudo-educated Brahmo women. Barodashundari like Mrs. Bennet of Austen's *Pride and Prejudice* was completely lacking not only in knowledge of her daughters but also in knowledge of her husband. Austen humorously commented how the long twenty three years of their matrimonial life were " insufficient to make his wife understand his character"(*Pride and Prejudice,* p. *7*). Such was Paresh Babu's wide tolerance and implacable faith in the unity of all religions that even Gora turned to him for his guidance in secular philosophy. But Barodashundari looked down at Paresh Babu as a simpleton: "*Mistress Baroda regarded Paresh Babu as being devoid of all practical commonsense and knowledge of the world.*" (*Gora,* p.266). By pointing out the defective education of women, Tagore made his novel a good illustration of Wollstonecraft's thesis.

Paresh Babu's study of Lolita's character was both insightful and authentic. In his opinion, she was conspicuous by her "*firmness of strength, the brightness of independence ---- characteristics which attract a chosen few, but repel most others*." (*Gora,* p. 231).Those traits of character were also common in Elizabeth Bennet of Austen's *Pride and Prejudice*. Elizabeth was characterized by her scintillating wit, an independent mind and above all an ability to admit her mistakes. Of her fallacious judgements on both Wickham and Darcy, she made the candid admission:

"How humiliating is this discovery! --- Yet, how just a humiliation! ----Had I been in love, I could not have been more wretchedly blind. But vanity, not love, has been my folly.---" (*Pride and Prejudice,* p. 202**)**.

Similarly, Lolita, who displayed her independent decision by staying away from the programme of the English magistrate, was the last to shy away from admitting her wrongs that had brought endless humiliation to her family:

"Father, I know I've done wrong, but I've now come to understand one thing clearly ---- the relationship between the magistrate and the people of our country is such that his patronizing hospitality does us no honour." (*Gora*, p. 231)

Tagore portrayed Lolita in order to make her an embodiment of morality and conscience. When Haran Babu spoke disparagingly of her unrestrained freedom in the company of Binoy, she voiced her concept of liberty which is '*freedom from the slavery of falsehood.*" (*Gora,* p.344)

Anandamoyi allowed the love of Binoy and Lolita to blossom fully and she even assisted them in the solemnizing of their marriage despite the obstacles raised by the Brahmo society. Her logic based on her humanism was also evidence of her enlightened mind. While speaking of marriage as a union of hearts she asked Suchitra: "*Will your society keep apart, by its external decrees, two by whom God has made one in heart?"* (*Gora,* p. 361)

Tagore's praise of Lolita was never lopsided and he rightly gave her the stamp of maturity when it was needed the most in the plot. He was alive to her failures as well. Though he presented Lolita as an independent and spirited lady, yet he exposed the flaw in her exhibition of feminism. While making plans for setting up a Girl School, Lolita did not examine the pros and cons of the plan. Small wonder, her plan ended in a fiasco. The affluent class did not favour the idea of sending girls to schools. Though feminism was trying to make steady progress in 1910 when *Gora* was serialized, yet the entire society was not prepared to accept it.

Lolita's failure at the social level was no indicator of her lack of maturity. When Binoy was in a quandary

regarding the question of his converting to Brahmo, Lolita convinced the sensible Anandamoyi that such a change was not incumbent upon him in the light of Binoy's mutual relations with another person.

Tagore showed Gora moving from his rigid, fundamental Hinduism to universal brotherhood after his travelling a full circle. His encounter with the family of the poor barber, who took care of a Muslim boy, in the event of Ghosepara was the first of his many encounters that made him understand the principles of liberal humanism. The events culminating at Nanda's death and the Brahmin cab driver's total nonchalance to the Muslim trader's shopping basket which turned turtle were some events that made him see the liberal face of Hinduism. His incarceration made him see Suchaitra in the eye of his mind with all her tenderness. She was the real embodiment of grace for she could attend the sick, look after the afflicted and bless even the insignificant persons with love. The novelist Conrad found such zeal in social service in his leading lady, Miss Haldin in *Under Western Eyes* (1911). The same Gora, who was opposed to the participation of women in national life, realized that, "*the smaller the place we give to her in our lives, the weaker does our manhood become*." (*Gora,* p.384) Tagore gave vocal expression to Vivekananda's teaching which underscored the truth that without bringing women into the mainstream of public life, India's history would remain incomplete.

Anandamoyi certainly enriched Gora's growth as a human being. It was from her that Gora learnt how to acquire true freedom from orthodoxy and superstition and adopt a true, secular outlook. In the epilogue, Tagore's vision of the women who would usher India into the next century found eloquent expression through Gora: *You have no caste, you make no distinctions, and have no hatred ---- you are only the image of our welfare! It is you who are India!* (*Gora,* p.570)

In nineteenth century Bengal, there was a wave of emancipation of women and Tagore could not help swimming on its crest. In many of his short stories, he represented female voices without any inhibition. But there was no trace of extremism in his representation. Whether we looked at Mrinmayi of *The Conclusion (Samapti),* Uma of *Exercise-Book (Khaata)*, Chandara of *Punishment (Shasti)*, Mrinal of *The Wife's Letter (Streer Patra*) and Dakshayani of *Taraprasanna's Fame* (*Taraprasanna's Kirti*); we found Tagore showing the confrontation between social dictates and individual assertions of femininity.

The patriarchal society of the nineteenth century Bengal was in favour of the repression of the feminine psyche, but Tagore was vehemently opposed to it. He had to counter stiff opposition from both Bipin Chandra Pal and C.R. Das, who, in their periodical, *Narayani*, pilloried Tagore for his radical views on women, but Tagore was unfazed by them. While taking up the female question, Tagore was torn between radical thought and traditional beliefs. One could wish to agree with the observation of Uma Dasgupta who stated that Tagore stood somewhere between "radical modernism and proud traditionalism" (*Tagore and Modernity,* p. 1).

As we study Tagore's novels and short stories, we begin to recognize that images, themes and plots emerge from women's social and psychological experience in patriarchal societies. Tagore's study of women could give fresh direction to two classes of feminists: the socio-feminists and psycho-feminists. Socio-feminists study the images of women in different literary types and then examine their roles in the society. The Psycho-feminists on the other hand, try to decipher the unconscious expressions of feminine desire and the way the feminine psyche has been curbed by patriarchal mores. In this way, both the socio-feminists and the psycho-feminists help in evolving a concept of female aesthetic.

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