

Contestation of Environmental Impact Assessment for Greenfield Airport, Mopa, India through the lens of Livelihood Vulnerability

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Abstract— The main aim of the study is to integrate vulnerability concepts in assessment of socio-ecological, cultural and livelihood parameters in the Environmental Impact Assessment done as a feasibility study for large-scale projects. Sustainable livelihood framework was re-interpreted through the study to assess livelihood vulnerabilities by development of an ordinal scale. The study concludes incremental change in vulnerability from 2016 to 2017 through field assessments using qualitative methods of research in a politically sensitive time period and location of Mopa Greenfield international airport site in Barazan plateau of Northern Western Ghats, India. Misrepresentation of field data for environmental assessments is a common tactic adopted to push certain environmentally degrading projects at bureaucratic and administrative level which marks opposition and resistance from people often not documented within the appropriate context. This study affirms the opposition through scientific study results complementing the documented people's struggles.

Index Terms— Cultural land-use, Environmental Impact Assessment, Greenfield airport, Livelihood vulnerability, People's struggles, Western Ghats, Sustainable livelihood framework

1 INTRODUCTION

Ministry of Environment and Forest (MoEF), India has prepared and issued guidelines for projects (mining, infrastructure, industries, river valley, ports, harbours, railways, highways, airport and thermal power projects) that requires clearance from the Ministry for their implementation based on specific indicators developed considering the environment conservation and ecological dependencies. The guidelines include Environment Impact Assessment (EIA) [1], preparation of an environment management report, public hearing which is then evaluated by concerned expert committees established by the Ministry for approval or rejection. Public hearing includes members nominated by the administrative head of the area, respective line department bureaucrats and mid and high administrative level head of department [2]. EIA conducted for Mopa Greenfield Airport Goa, India for receiving clearance for the project in a public-private partnership is under scrutiny and faces opposition from the communities getting displaced, environmental NGOs for lack of appropriate assessment of ecological resources, local people's formal group Mopa Vimantal Pedit Xetkari Samiti for illicit procedures of land acquisition by the government as the public have the right to make an appeal against the decision of the authority[3] and scientists and academicians for destruction of a part of UNESCO recognised[4,41] and socio-cultural site of immense ecological importance.

Greenfield airport project in Mopa is in principle approved on Barazan plateau which is politically popularised as Mopa plateau. The clearances and documentation needed for in-principle approval was done in haste as mentioned by the Sarpanch of Chandel Gram Panchayat and Environmental NGO workers in Goa.

"The rushed, unplanned manner in which the airports are being pushed, without proper consent from local communities and even environmental clearances is symbolic of wanting to create more infrastructure in the name of development without

considering any other policies. While this might be a game of numbers of units created or amount of money pumped in to show in media and international forums about the progress of the Indian aviation sector, there are many things that need to be looked at before pushing for such drastic amounts of new infrastructure" [5]

This brings the context of political play into the picture of Airport projects being pushed since 2014. There is a political rush to build numbers in infrastructural development in order to re-elect in the upcoming elections in 2019 which is also crucial to publicise the party's influential position in Indian politics as a right-wing populist party to the existing opposition party who have had a history of one-family political influence in India post-independence.

The case of Mopa which is a village panchayat (Annexure 1 A describes the details of Panchayati Raj Institutions system in India) along with seven other village or Gram Panchayats in and around the plateau however, some part of Barazan plateau belonging to Mopa village is an area with porous rocks and lateritic cover which is not suitable for growing crops but suitable for other kinds of fruit and nut trees locally significant. "Topographic maps of the region often mark these areas as rocky scrub, stony waste, or simply sheet rock" [6]. Thus, politically deriving that the plateau is infertile as a whole and popularised it as Mopa plateau ceasing its ecological and cultural importance completely by changing its name in media and government documents.

Barazan plateau lies in the Northern western Ghats and Konkan region near Goa-Maharashtra provincial borders. Konkan region and Goa are two very popular tourist destinations with its coastal line extending until southern tip of India. Mopa Greenfields International Airport, planned on the plateau is an outcome of previous government emphasis on Tourism and categorisation of the area as Special Economic Zone (SEZ) in Goa [7] which was shelved on receiving great opposition from

local communities and environmental NGOs for being environmentally depleting, scams, water depletion and land use change. This project was picked up again by the current National Democratic Alliance (NDA) government in India resonating with Make-in-India programme, a flagship programme of theirs which puts back airport and aviation expansion on the top of their agenda through 100% Foreign Direct Investment (FDI) and a Public-Private Partnership (PPP) mode of operation. Thus making non-aeronautical revenue a lucrative area for investors around the airport [8]. "Airports are still upheld as successful examples of what PPP can achieve in the field of aviation, contemporary airport development is increasingly attuned to upgrading existing domestic airports to international airports"[9]. Barazan plateau is a vast land with laterite cover and porous rocky layer of soil which is a hot spot of biodiversity[10] and the aquifer beneath releases more than 46 perennial springs of socio-cultural and economic importance[9]. Large infrastructure-projects require land and "many state governments are racing to identify and acquire land which includes various categories of government land and village commons located in strategic areas"[11]. Re-allocation of land by acquiring is not a win-win situation for the parties involved in land re-allocation.

The paper critiques the EIA conducted by the Airport Authority of India on the Barazan or popularly known as Mopa plateau for the Greenfields Airport project using Sustainable Livelihoods framework [12] for assessing livelihood vulnerability of the communities getting dispossessed and displaced. Based on the exploratory and detailed qualitative and quantitative assessment, paper discusses the lack of socio-ecological assessments in the feasibility studies conducted for an environmentally destructive project, crucial for obtaining the approval in the first place. The research also uses secondary data from the NGOs and scientists and previous publications to deviate from the existing representation of the problem through resistance movement and people struggles(as discussed in [38] as EIA Struggles) and explores the connection between administrative project approval process and socio-economic and cultural impacts not assessed and included in the process which in itself is the initiation of vulnerability as adopted from the discussions by Adger (1999) and Brooks (2003)

Redefining the problem: initiation of vulnerability

Vulnerability term has been used in different climate change, health, poverty, social collective and biophysical literature to an extent that the characteristics of effects are assumed similar. While defining social vulnerability as W. N. Adger (1999) puts it in climate change and social vulnerability study, she emphasises on **collective nature** of social vulnerability [15]. Studying climate-related hazards, Adger and Kelly (1998) and understanding concepts of vulnerability as a set of entitlements, they conclude that "it is the structure or architecture of these entitlements which underpins both security and vulnerability"[16]. As Chambers (1989) puts it, "Vulnerability is the exposure of groups or individuals to stress as a result of the impacts of climate change and related extremes"[17]. The unit of analysis and scale in climate literature are individual and collective or community level. As also used in poverty and health

literature, individual vulnerability are associated with **accessibility and availability** of resources with respect to social and economic positioning of the individual. While collective or community vulnerability depends on exogenous factors like market structures, institutional capacity and social security other than accessibility and availability based on socio-economic state.

"Incidence of poverty is a relevant proxy for access to resources in its multifaceted forms. Resources are mediated through property rights and access to them and is based on social and economic relations (as mentioned by [15]) [13]. An important observation shared by Adger, (1999, pg 253) is that entitlement to resources is a "prerequisite for recovery" from the impacts of hazards and hence hold a temporal dimension with respect to accessibility and the security of accessibility is reaffirmed with recognised rights over time[13]. The entitlements and capability framework adopted by Adger (1999) is derived from Sen (1984) where he defines entitlements as "the set of commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces"[18]. Thus, rights either inherited or owned by an individual or formal community institutions is a pre-requisite for the claims after the hazard and are crucial in defining their exposure to risks and later vulnerabilities.

In resource-based literature individual vulnerability focusses on livelihood and social dependencies which is an important factor in migration out of dispossession of assets (push migration) or lucrative income opportunities outside (pull migration). For collective vulnerability, capacity and capabilities of institutional arrangements determines the vulnerability caused with interactions at different scales of governance.

This discussion brings out the political economy associated with the vulnerability definitions prevalent in different literatures. Specifically, concerned here is the definition of social vulnerability and as Brooks (2003) puts it, "Although social vulnerability is not a function of hazard, it is, to a certain extent at least, hazard specific - one must still ask the question vulnerability of who or what to what? Nonetheless, certain factors such as poverty, inequality, health, access to resources and social status are likely to determine the vulnerability of communities and individuals to a range of different hazards (including non-climate hazards)"[14]. However, Brooks misses out on including ecological vulnerability which in certain communities defines the entangled relationship of environment, culture and income dependencies. Ecological vulnerability in a dependent context for communities overlaps with livelihood and socio-cultural dependencies. Traditional indigenous communities in the case study area have developed their cultural identification from the natural resources around them and over years grew a social dependency out of the cultural integration of society with the natural resources.

Thus, for the context of this study, **vulnerability would mean the exposure of individuals and community to risks as a consequence of change in entitlements to their resource by exogenous factors** and can be measured through analysing specific parameters of socio-ecological and livelihood change assessment. As an extended understanding of vulnerability in

the study, critique for the process designed for Environmental Impact Assessment (EIA) as issued under the guidelines lacks the assessment of socio-ecological and livelihood vulnerabilities which becomes an important factor especially when project clause includes land acquisition and displacement of some or all of the communities. Mopa Greenfield Airport project proposal includes an EIA submitted by the Engineers India Limited (EIL) in October 2014 (Document No. A523-EI-1741-1401, Government of Goa) for public hearing. The report includes a component of Environmental and social impacts (chapter 5), geological, demographic, economic and socio-cultural aspects in terms of project site (chapter 2) and a satellite-based analysis of land use (annexure IX). The exclusion of social, cultural and ecological dependencies of the community demarcated for displacement in the feasibility studies conducted itself is a kind of vulnerability developed due to missing acknowledgement and incomplete assessment (referring to the document submitted for EIA). Thus vulnerability measurement has a tangible component where it needs to be assessed by field-investigation tools in order to explore the externalities associated with it.

Study area description

Barazan plateau which is part of the Northern Western Ghats region along the Konkani-Sahyadri corridor is an ecologically diverse lateritic plateau with porous rocky cover hosting a wide range of flora and fauna varieties [19], over 46 perennial springs and serving the communities both settled and nomadic (Dhangar community) of closely inter-dependent eight village panchayats- Varconda, Casarvarnem, Amberem, Uguem, Chandel, Mopa, Netarde and Tamboxem. The affected communities which shall be displaced and dispossessed of their lands belongs to first seven village panchayats accounting to a population of around 15,000 people getting impacted. Most of the lands in the area are being cultivated by tenants (culturally called Kud) who have been working on these lands and developing their fruit and nut orchards, sustaining their livelihoods, deriving non-timber forest produce (NTFP) from the surrounding forests, irrigating through a traditional system of making soil and elevation based bunds throughout the orchard supplying spring water to each tree through pied and non-piped gravity based network. Some specific biologically distinct variety of trees also hold religious and cultural value [20] and are centres of community gatherings, religious ceremonies [21] and cultural integration.

Most of the land owners (culturally called Bhatkar) have settled near the highway NH 17 connecting Mumbai and Goa and preferably have other non-agricultural, livestock or forest dependent occupations. The primary occupation of settled population in and around the plateau region is cultivating cashew nuts, beetle nut, black pepper, coconut, Kokum, banana, custard apple, some varieties of endemic NTFPs collected for pharmaceutical requirements, subsistence vegetables, red millet, paddy and spices cultivation.

2 METHODOLOGY AND PROCESS

The objective of the case study [22] (as derived from the definition in Simons (2009), “ Case study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in real life” and as Flyvbjerg, (2011) extends it mentioning, “using a case study does not mean selection of a method but rather a selection of what will be explored”) is to analyse socio-ecological and livelihood vulnerabilities through sustainable livelihood framework [23] analysis [24,25] to support the critique of EIA conducted for Mopa Greenfield Airport in Goa, India. Qualitative methods [26] for exploratory [27] and descriptive analysis [28] like conversation analysis, focussed group discussions, narratives, ethnography, semi-structured interviews and identity memos are used through purposive sampling [29-31] from all the seven village panchayat. The study is conducted in the local language of Malwan Konkani and are translated by local language speakers without impacting the integrity of responses received. The responses of research participants were audio recorded for cross-verification from other native speakers of local language. The different methods were adopted with different research participant(s) and groups including tenant farmers, women, elders (age more than 60 years), children (age less than 12 years), NGO representatives, leaders of social movement Mopa Vimantall Piditt Xetkari Samiti (translated to Mopa Airport Victim Farmers Committee), real estate person, advocate and land owners. The study was conducted in two phases- Preliminary study conducted during May-June 2016, pre-monsoon period and December 2016-January 2017, winter period just before elections in February 2017. Secondary studies in hydrology and ecology are referred along with local studies conducted by NGOs and Goa University students and Government documents, public interest litigation documents, legal documents and plea submitted to the court, court orders, feasibility study reports, GPS recordings and maps developed for spring location analysis by hydrologists, media reports and audio-visual recordings and evidences collected by local NGOs and members of social movement group.

Table 1: Details of sampling status, assessment method adopted, research participants is described in detail.

Assessment type	Sampled population (Percentage of sampling)	Qualitative methods used
Socio-ecological assessment	Varconda- 22 HH ¹ in 7 wards ² (10%) Casarvarnem-30 HH in 6 wards (10%) Amberem-3 HH in 2 wards (5%)	Focussed Group discussion in Chandel and Varconda; conversation analysis,

¹ HH is an abbreviation for household, here considered as an average household size of 5 persons

² Ward is a smaller administrative unit within a city, village or town

Livelihood vulnerability	Uguem- 2 HH in 1 ward (5%)	narratives of women and men
	Mopa- 2 HH in 1 ward (5%)	from nomadic community (age group between 18 to 35 years), semi-structured interviews and identity memos in all seven Panchayats
	Chandel- 48 HH in 2 wards (18%)	Livelihood asset assessment through semi-structured interview schedule and ethnography of one HH in Varconda
	Netarde- 2 HH in 1 ward (10%)	
	Varconda-3 wards- 21 HH (13%)	
	Casarvarnem- 1 ward of Nomadic community- 5 HH (33.33%)	

Table 1 describes the sampling status and assessment methods adopted for different group of research participant. For socio-ecological vulnerability assessment, the areas (administratively divided as wards) or wards which were closer to the marked airport site were focussed for household level assessment. For Livelihood vulnerability assessment, politically sensitive and most affected areas of Varconda and Casarvarnem villages were selected to assess in detail the severity and influential status of airport related political engagements.

Semi-structured interview schedule was prepared to assess the socio-ecological indicators for household level interviews for both 2016 and 2017 assessment period. The indicators include the research participant identity and residential information, family composition, family income source, family income dependencies, migration status, land ownership/tenantship, land use pattern, fruits and nut trees, income from each source, expenditure and saving level, gender based division of labour work in the cultivation process, wage rates for men and women, access to credit, access to credit through formal institutions like self-help groups (SHGs), water source-drinking and others, water quality and history of water borne diseases in family, access to market, access to other governmental saving and/or pension programs, sites of societal gatherings, cultural ties with natural environment, access to public services like electricity, roads, transport, waste disposal, potential and/or alternative livelihood options for men and women in the family, job opportunity promised/available in Mopa airport, potential opportunity/threat from Mopa airport construction and understanding of ecological dependence of flora and fauna species around them.

Focussed group discussion indicators included occupation and other livelihood options, water supply source(s) for the village, demand from government, compensation amount offered, current market assessment of their land (demarcated for acquiring by government), socio-cultural dependence on

springs, trees, land, soil, sacred groves, incidences/events of political pressure, different opinions of participants on Mopa airport and potential benefits/losses incurred to them, current relationship between land owners and tenants, alternatives for tenants when land owner sells land to potential buyer and impacts on women and youth.

For livelihood vulnerability assessment, Sustainable Livelihood Framework (SLF) principles were adopted to include ecological, physical, social, human and financial capital assets and their influence and received influence through interactions with local and governmental institutions and processes of participation, market interaction and livelihood derivatives are studied through above mentioned assessment methods. An ordinal scale ("An ordinal scale is a measurement scale that allocates values to variables based on their relative ranking with respect to one another in a given data set" [40]) is developed considering the variables in accordance with SLF with scales between 1 to 5, the details of interpretations of each scale score is described in table 2.

Table 2: Description of ordinal scale and interpretations

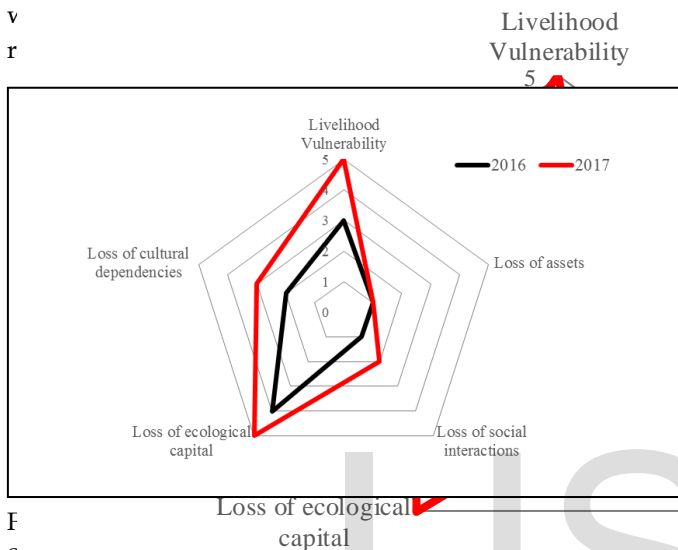
Scale 1	Least Vulnerable (Coping mechanism available)	Livelihood security, income security, least dependence on plateau, low social cohesion, low cultural immersion
Scale 2	Low Vulnerability (manageable and can be coped with)	Income and livelihood alternatives accessible, socio-culturally connected, dependent on plateau
Scale 3	Moderate vulnerable (coping mechanism desirable)	Income and livelihood alternatives need to be explored, socio-culturally connected, dependent on plateau, loss of assets but not the only source of income
Scale 4	Vulnerable (lack of coping mechanism)	Income and Livelihood alternatives under threat, dependent on socio-cultural cohesion, highly dependent on plateau for its resources, loss of assets
Scale 5	High Vulnerability (no choice/ accessibility to coping mechanism)	Income and livelihood not existent, highly dependent on socio-cultural ties, highly dependent on plateau for its resources, forced to migrate, loss of assets

Limitations: Legislative elections were approaching in February 2017 which made the research area sensitive with political ideation and at the same time inhibited open opinions about the controversial airport which became an agenda in many political manifestos. Hence time period of the study did not support the open discussions however, sensitive considera-

tions were undertaken by the author to avoid compromised responses from the study participants and local help was taken for purposive sampling in order to avoid prejudiced responses.

3 RESULTS

The study revealed high vulnerability of livelihood, socio-



The radar chart (figure 1) describes the incremental change in vulnerability during 2016 and 2017 with increased land acquiring and clearing activities in progress and destruction of fertile land for approach road construction to the airport site. However, there were no cases until January 2019 of demolition of houses when one of the petitioner's house was demolished despite the Supreme court stay on destruction activities. The chart describes the overall average vulnerability assessment conducted in 2016 and 2017 which highlights the impact of the airport project on the community when construction of approach road, clearing of land, levelling of land for construction activities and material procurement had already begun in early 2016.

Table 3: Vulnerability assessment matrix of participant responses

Village Panchayat	Least Vulnerable	Low vulnerability	Moderate vulnerability	Vulnerable	Highly vulnerable
Socio-cultural vulnerability					
Varconda	1	1	3	6	11
Casarvarnem	1	1	0	3	25
Uguem	0	0	0	0	2
Mopa	0	0	0	0	2

Amberem	0	0	2	0	1
Chandel	0	0	5	15	28
Netarde	0	0	0	0	2

Ecological Vulnerability					
Varconda	0	0	0	4	18
Casarvarnem	0	0	1	2	27
Uguem	0	0	0	0	2
Mopa	0	0	0	0	2
Amberem	0	0	0	3	0
Chandel	1	2	10	14	21
Netarde	2	0	0	0	0

Economic and livelihood Vulnerability					
Varconda	0	0	0	1	21
Casarvarnem	0	0	0	3	27
Uguem	0	0	0	0	2
Mopa	0	0	0	1	1
Amberem	0	0	0	3	0
Chandel	0	5	12	15	16
Netarde	0	0	2	0	0

The detailed ordinal scores are assessed in table 3 for socio-cultural, economic and ecological indicators as discussed in the section before with number of participant responses indicated under each scale of vulnerability. Highest socio-cultural vulnerability was observed in Chandel, Casarvarnem and Varconda while the least was observed in Mopa, Amberem, Uguem and Netarde. Similar observations were found for ecological, economic and livelihood vulnerability. Hence, Mopa, Uguem, Amberem and Netrade are least vulnerable Gram Panchayats in ecological and livelihood vulnerability.

Most of the research participants lie in the scale of 3,4,5 which is evident for higher vulnerability. Seasonal changes in livelihood of the research participants was also accounted while assessing the vulnerability, which did not make any significant changes as the community is engaged in some kind of livelihood opportunity throughout the year, deriving from the forests and natural resources available on the plateau. Casarvarnem data includes the vulnerability of nomadic community Dhangars whose land, house, occupation, cultural ties and social dependencies will be lost and their traditions and belief system will be lost in time while struggling to meet their ends for income and employment.

4 DISCUSSION

Around 8,29,455 square meters of land was already acquired

by January 2017 and around 7,00,000 square meters of land was demarcated for potential acquirement on the plateau. Goa has an international airport in Dabolim whose operations are shared between Indian Navy and civil aviation. The increasing passenger traffic led to expansion of Dabolim airport in 2008-2012. As per the assessment report submitted to Government of Goa by Airport Authority of India (AAI) in 2012, renewed aircraft capacity of the airport can handle potential passenger traffic until 2035[33]. Dialogue with Indian Navy on its operations and long-term strategies was not conducted before proposing and pushing the Mopa international airport plan. This is one of the crucial backdrops of the Mopa airport project. Large-scale projects with 100% FDI approval are profitable if the surrounding areas are developed hence for the potential airport city, floor-area-ratio of 4 is permitted which makes the built-up area to be approx.15,00,000 square meters. However, as per the new data shared by Government of Goa in Centre of aviation summit 2015, potential land acquired is around 60,70,285 square meters which is four times than the previously declared area[34]. The plateau will lose its biodiversity cover and water sources that make over 15000 people resource-dependent. Weak proposal for incorporating rain water harvesting methods for ground water recharge (chapter 6, [35]) which mentions of digging harvesting pits is incomparable to natural ground water recharge by porous rocky cover on the plateau.

The EIA also misses on mentioning 40% area of Dodamarg-Sawantwadi corridor, under the project site which is declared as a protected area for tiger populations by High court of Bombay in PIL 179 of 2012[36]. Also, hotel lobbyists and tourist centres are lobbying for the airport as the location is closer to Ratnagiri area along the Maharashtra provincial border which is also a popular tourist spot as per Maharashtra Tourism Development Corporation [37].

4.1 Multiple Polarisation (discussions emerging from villages of field work

Visiting the plateau and interacting with the communities during second field work in 2017, there are mixed opinions, some demand higher compensation as per the then land rates of the region, which include mostly the land owners who are directly not dependent on the plateau for cultivation or plantation while others who are opposing the construction, include the cultivators, the tenants and the dependent nomadic and non-nomadic communities. For few others, who have accepted the land acquisition imposed by the government, their concern is availability and accessibility to alternate livelihood opportunities as proposed by the government. The North and South Goa divide is growing with different associations, local movements, NGOs taking different sides. Southern Goa is a major hit among tourists while Northern Goa aligning to Maharashtra border is increasing its footprint as a growing tourist destination. However, it is a zero-sum game where one party loses

its resources, livelihood, socio-cultural ties and is detached from their cultural heritage and the environmental degradation and ecological disruptions while the other party gains revenue from passenger and tourist traffic and increased investments from FDI policy.

The vulnerability assessment done for the Mopa airport site is crucial in determining the polarised opinions especially after assembly elections held in February 2017. Political parties, social leaders and NGOs are propagating differential agenda while the community remains at a loss with irreversible environment degradation as a by-product.

Goa, a touristic destination which attracts more investments and presents a cost-effective case for them has been in the centre of political interplay. Goa also envelops crucial mining destinations for large-scale industrial projects. Thus, it is a revenue-generating hub for the government. Hence revenue-generation in Goa becomes a strong influence in deciding the political agenda. Right-wing populist party who is also the current (2014-19) ruling party government in India has a strong political hold since the Chief Minister (elected head of the state) is a native Goan and also is an influential leader in the party. After his recent death, politics has opened new avenues for other political parties to intervene in the hot-pot of revenue in India. Thus, polarisation tactics prove to be effective means of creating a political hold and influence in the communities.

4.2 Critique of EIA [35]

The critique for Mopa Greenfield airport is discussed through table 4 on important environmental issues which questions the assessment as a whole and as taken up by the local social groups in the court. It discusses in detail the controversial components and community concerns in a section wise assessment of EIA report submitted to the government for airport project.

Table 4: Critique of EIA submitted to the Government of Goa for Mopa Greenfield airport

Section in EIA	Controversial Components	Concerns
Water source (Chapter 2,4)	Ground water	-Barazan Plateau is the largest store of water in Pernem -Much of the plateau will be concretized, impacting recharge -With the creation of Storm-water drainage, groundwater recharge will decrease further
Plateau and Ecology (Chapter 4)	Data collection and interpretation in EIA; lateritic plateaus have high biodiversity	Data collection and representation as done only in Oct-Dec 2011 for EIA; Monsoon and other crucial seasons not cov-

Land and Environment interface (Chapter 2,4)	Probability of flooding of the agricultural land and other areas due to the proposed development/ construction of the airport	ered Storm water drains will increase the velocity of water, leading to scouring and lower ground water recharge. No safeguards are proposed for contamination of rain water and would encourage flooding Contour map shows the slopes, drainage pattern of the site and surrounding area of the site. However, the plans for diversion of surface drain system because of low lying area is critical for Ground water recharge. Diversion through a storm water system will impact groundwater recharge and reduce it further
Environment Degradation (Chapter 4)	Reserved Forests and Diverse Species	Reserved and Private forests will be lost forever. The distinct species of different flora and fauna endemic to this part of the Western Ghats will be lost. No land recovery possible once land is acquired for public purpose even if it is in excess
	Water Body near the site	Nearest water body from the project site which would also be impacted adversely - <i>Tiracol</i> river is around 1.3 km from the end of the planned runway, not considered for planning the airport drainage, sewage and waste disposal plans
	Groundwater recharge and Rain water harvesting	Rain water recharge through the plateau and hydrological studies to assess the ground water level is not done. The

Socio-economic situation (Chapter 4,5)	Social and economic environment	plateau serves more than 46 perennial springs and feeds water for the whole <i>Pernem</i> Taluka Rehabilitation and Resettlement policy 2007 to be followed for displacing <i>Dhangar</i> Community, who are traditionally pastoral people and over 100 years ago settled on the plateau. To the extent that their grazing lands and common lands are affected
Environment (Chapter 4)	Analysis	Environment loss was unaccounted throughout the Airport planning and no compensation plans have yet been suggested

Airport planning requires levelled concretised infrastructural development. As mentioned by [6], the plateau has a laterite cover with porous rocks which recharges the ground water beneath leading to perennial springs as an outlet source. With concretised cover for the airport, ground water recharge will be drastically affected leading to subsequent drying up of springs in future.

The data collection duration as mentioned in [35] was not conducted during Monsoon which is a period of rains and greenery blooming hence the discussions related to flora and fauna are incomplete interpretations in the report based on the duration of conducting the EIA. There is a river around 1.5 km, *Tiracol* from the plateau and market airport site. Sewage and drainage outlets as described vaguely in the EIA might contaminate the river further impacting the dependent areas further downstream. Ecological loss and environmental cost associated with the airport construction is not accounted in calculating the benefit-cost calculations presented in the EIA report (as chosen method by the field area assessors of EIA). In addition, socio-cultural loss is also unaccounted because of rehabilitation and resettlement policy of 2007. There are uncertainties and polarised understanding of the implications of rehabilitation, making the communities vulnerable to political agenda.

4.3 Practical applications of the results

The Sustainable livelihood framework has been re-interpreted in this study by combining vulnerabilities with respect to social, cultural, ecological, household assets and livelihood indicators

using qualitative methodology. This approach can be used in other similar studies involving displacement of population, people's resistance and public or private projects acquisition their land and resources. This although is a simplified approach to put the vulnerabilities in foreground. Most of the feasibility studies and environmental impact assessments lack the vulnerability component to be assessed which when quantified would make the projects economically non-viable. However, deliberate actions of mis-interpreting and mis-representing facts from the field is an old trick used by consultants to push for a project. Governments are crusading towards the high return and high visibility option of infrastructure development projects at the cost of environmental gain and resource abundance and richness, compromising environment for infrastructures. This approach finds opposition from not only the dispossessed communities but academicians, scientists, environmental NGOs and activist groups building in more resistance. Thus, projects finding similar grounds of research requirement can be assessed using modifications of SLF such as the one discussed in this paper.

5 CONCLUSION

The study brings out in foreground, vulnerabilities in the context of socio-ecological, cultural and livelihood using some modifications in sustainable livelihoods framework. Environmental Impact Assessments lack the quantification of social, ecological and economic impacts on the community and environment which can be bridged through similarly adapted studies. Mopa greenfield airport project proposal presents caveats which are questionable on a lot of grounds making it a non-viable project in the long run at the cost of environmental damage of the plateau and percolated negative effects especially in ground water level. Thus, this study supports the critique of EIA conducted for the project through a vulnerability lens which can be of immense importance in future assessments.

APPENDICES

A. Additional Information on local self-governance system of India[39]:

73rd Amendment in Constitution led to the enforcement of Panchayati Raj Institutions (PRI) under article 243B as the three-tier system of local self-governance system in India. The act came into force in 1993 financial year starting April. The article defines Panchayat as the elected institutional body of governance in rural areas with Gram Sabha functioning as a legislative body comprising of population living in the territorial boundaries of the Panchayat administration. The three tiers in PRI system comprised of Gram Panchayat (translated as Village Council) at village level with elected member Sarpanch as its head, Panchayat Samiti (translated as Development Block) at intermediate or block level (administrative sub-unit of a district with Block Development Officer (BDO) as the

administrative head) and Zila Parishad (translated as District council) at district level (sub-provincial administrative units with Chief Executive Officer (CEO) as administrative head). Each Gram Panchayat has a population of more than 500 people. This system is different from that of traditional indigenous or tribal system of self-governance. In some areas, Indian government recognises tribe administrative system as a grass root administrative system within the structure of PRI system.

B. Additional information on Goa rural and traditional governance system:

Traditional, pre-independence governance system prevalent in Goa was that of Gaunkary (or Comunidade) comprised of indigenous local village men from first settlers with inherited common responsibility. All the land was owned by the Comunidade council or Maand or Ekvath and cultivable areas were leased out for fixed duration by auction. Marriage, festivals and other crucial social systems requirement agreement from Maand. Even today, after independence, the people who live in close proximity to Barazan area come under Varconda Ekvath which got de facto formulation as village heads and later as Gram Panchayat in the PRI system seek permission for marriage, land transfer, land utilization from the Gram Panchayat. This is an integrated system of traditional governance within the structural framework of PRI as mandated by the government of India. Ekvath has its own socio-cultural norms that affect their operational decisions. This also makes this system prone to exploitation by political leaders for political gains as influencing Ekvath leaders would imply influencing the whole Gram Panchayat and neighbouring culturally-linked areas.

ACKNOWLEDGMENT

About the research: The paper is an outcome of master's thesis and 4 months of field work during 2016-17 in different seasons of the year in the Barazan plateau of Western Ghats, India by first author under the supervision of the second author as part of the fulfilment of the degree programme at Tata Institute of Social Sciences during 2015-17. The research was funded by non-governmental organisation Biomes Conservation Foundation and supported by Federation of Rainbow Warriors. The authors sincerely thank Abhijit Prabhudesai and Diana from Federation of Rainbow Warriors, friends and local supporters Suresh and Sharmila Tadkatkar, motivators Terence George and Dr. Gouri Mallapure

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