

In the Quest of Question for Geographic Research*

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At the outset, one may ask as to why I adopted the above as the title of my keynote address? Intuitively it was in response to a realization that one of the root causes underlying the lack of desired quality of research in Indian Geography was a common tendency to start with a topic rather than a question for research. It is my firm conviction that without a really good question for research, one is 'really traveling blind' to one's destination (O' Leary, 2010, p. 47). The power of a research question in delineating the road map, indicating direction and defining the purpose of any research journey is not to be missed.

Discovering a geographic research question

Then how to look for a research question in geography? Here one is to adhere to the rules of game in geography. Which are these ones? These are to be inferred from the perspective in which any research in our discipline is to be conducted. To my understanding anything that can be examined in the spirit of spatial differentiation or spatial interaction or spatial diffusion or spatial organization or spatial planning bears the stamp of geography. Which could be other considerations? Since geography is an integrative discipline, themes which belong to holistic dimension of knowledge, such as environmental studies, development studies

or governance studies, could be of special interest to geographers. What is the next in array of such points of adherence? Simple. Any research question framed must carry the flavor of a discovery into spatial patterns, or spatial processes, or spatial planning.

There is no pretension here to claim that the eminence of research question in geographic research is being raised for the first time. To Morrill (1985) we owe an enunciation of 'some important geographic questions'. He focuses on a number of critical issues which any society must resolve. Let me paraphrase some of these for my sharing with you. Which is the optimal spatial scale at which physical and human resources should be managed to minimize cost and maximize benefit; which mix of pluralism and conformity is most promotive of harmony in a society; to what extent the government should centralize or decentralize its service provision, economic activity and political power; how much of self-sufficiency vis-a-vis interdependence a country should aim at the macro- and micro-regional levels; which blend of localization and globalization will be beneficial in the context of a specific nation state ; and so on.

With 'geography on the agenda' in mind, Messy (2001) raises the question: Why theoretical work in geography on the question of regional uneven-development made little impact on political formulations

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of the state? He attributes such a state of affairs to the failure of geography in playing the card of its specificity. He lists two elements of specificity of our discipline: co-existence between physical and human geography and construction of ideas around space which are politically and administratively relevant. A clear message is that geography will be more visible if it sharpens its focus on environmental and governance issues.

The credit for elaborating the 'big questions in geography' goes to Cutter, Gollege and Graf (2002). The list crafted by them is long. Hence I shall confine to select questions of greater interest. Here we go. What role have geographical skills played in the evolution of human civilization? What is the relevance of similarities and differences among people, places and regions? Why do we need borders, boundaries and administrative areas? What is the story of transformation of landscape at the local, regional, national and global levels? In which way the development of virtual geography will add a new dimension to our discipline? Above all, what are the spatial constraints which do not permit one to pursue his or her life goals? Here one may start with a geographic research on oneself. A full reading of the article will be most stimulating intellectually.

The above representative inventory of questions for geographic research is just illustrative. Vast and diverse is the canvass otherwise. In total terms, the above questions tend to be theoretical in nature which can be pursued through debate and sharing of information. More critical for our purpose is a search for questions which are of empirical nature and are susceptible to

transformation into research topics? Which are these? Let me turn here to the specific theme of our Conference for making an attempt on this path of discovery.

Population, Development and Disaster Management is the agenda for deliberations at the Conference. To me this formulation appears as the trinity of Brahma (population), Vishnu (development) and Mahesh (disaster management). By coincidence this very trinity of theme has been a trajectory of my own research journey. A brief narration of the evolution of my research interests will be in order here. My initial efforts focused on population studies as I reckoned this as most critical in the context of our national priorities following independence. About one-third of my research publications fall in this category. Soon I realized that any analysis of population becomes really meaningful if it is implanted in the context of stage and nature of development. That explains the subsequent forays of my research interest in development studies. These account for another one-third of my research output. I gradually discovered that in a developing country like India, it is the administrative culture which is critical to any development effort. There was concurrently a constant realization that all development has to be managed and protected against any disaster through good governance. Such an assessment fostered my interest in Administrative Geography, which captured the remaining one-third of my research effort.

The intention above is not to be autobiographical but simply to highlight the interlinkage between population, development and disaster management. What is the merit of a population if it does not remain on the path of development as it defines for itself and what will be the fate

of development if cannot be fortified against disasters? Don't you think that in ultimate analysis any development is essentially an antidote to a likely disaster?

While in the process of identifying empirical questions for research on the issues pertinent to the Conference, I was tempted to look at the themes adopted by the recent successive congresses of the International Geographical Union (IGU). 'Living with diversity' was the focal theme of the 29th IGU 2000 at Seoul. The same concept was carried forward by the 30th IGU 2004 at Glasgow through its theme 'One earth... Many world's'. The 31st IGU (2008) at Tunis opted for the theme 'Building together territories', wherein the term territories refers to all geographical scales from local to global. The forthcoming 32nd IGU 2012 at Cologne is going by the theme 'Down to earth', with global change and globalization, society and environment, urbanization and demographic change as the sub- themes. Evidently such expressions find an echo, implicitly if not explicitly, in the fabric of our Conference theme of population, development and disaster management.

Let us come back to the task of framing some pertinent research questions in Indian context. Here at best I will be at random, selective and just illustrative. How fondly I wish I had the capability and capacity to do full justice to the assignment it deserves. A sense of inability and incompleteness hovers around my mind when I am struggling to carry on here.

Reflecting on population issues

On the population front one salient point of inquiry would be: Is India homogenizing demographically? What is the difference in

degree of convergence between social and economic parameters of its population? How do different parts of India differ from each other on the count of quality of living space, as inferred from population data made available by the Census of India? Indications are that the country is steadily though slowly acquiring a comparable demographic complexion; such a tendency is visible more on social lines than on the economic; and quality of living space is becoming more similar within the states rather than across them. The impact of stateism is emerging as a strong factor in the scheme of things.

Naturally an effort on these lines will involve an analysis of data over a long period of time, at least since Independence. This will help in raising and resolving another question as a corollary. Which are the critical breaks over time in population change in different parts of India? Let us go by an example. Although 1921 and 1951 are conventionally taken as the critical breaks in the history of population growth of India during modern times yet this spurt-combination is characteristic of only one-third of all the districts in the country. While 1921/1941 and 1921/1961 combinations were more common in South India, 1921/51 and 1921/1971 combinations were more typical of North India. Such spurt timings were associated with the schedule of development process in different parts of country. South India seems to have made an earlier beginning on this count.

To what extent are the existing population distribution patterns, as manifest in a variety of settlements, optimal? That is a moot question. Should we alter the prevailing patterns to achieve some avowed objectives of development efficiency or

social justice or internal security or external integrity? Should the dispersed populations be converted into clusters to reduce the cost of providing infrastructure and services or to facilitate management of security? Will a subtle change in the population composition of politically sensitive areas help in meeting the challenge of centrifugality? To what extent the inner line regulation states in India be kept imperious to flows from outside? An overriding question still remains to be answered that even if the optimal population distribution patterns are carved out, will it be possible to work them out on ground?

Some additional questions of perennial interest on these lines could also be raised. What is the optimal population size of a district at which it can be best administered or that of a block at which it can be best planned? Or for that matter of a state not only for its own governance but also in wider national interest? The available research confirms a positive relationship between the quality of spatial organization for administration and the pace of development process (Kant, 1988, p.246). What is the optimal size of a city, again with a clear enunciation of the criteria of economic cost, employment generation, productivity upgradation, income level and living quality? Which could be the optimal territorial subdivisions of any city for provision of different services, such as water supply, electricity, policing, elections and others, and how do these differ from existing arrangements? Our only fear is that such practical questions of defining norms are likely to be dismissed as highly theoretical.

Same way a question may be raised about the relevance of research on population characteristics of parliamentary constituencies and state legislative

assemblies. Here is congruence between political space and development area to which population geographers have not given any attention. This is amazing in the context of availability of a variety of not only demographic but also economic and infrastructural data by individual villages in India from the National Informatics Centre. Such data can be easily complemented with the village-wise and town-wise information made available by the Census of India.

There is still another dimension to population dispersal. It has been fashionable to talk about two disparate urban India and rural Bharat. Add a third now, Indiaspora, 30 million strong making it as populous as Canada. While considerable amount of literature is available on Indian diaspora but few studies have gone in depth into the impact of emigration on economy, society, and polity of the regions of outflow, may it be Punjab, Gujarat, Kerala or Tamil Nadu. Brain drain is perceived as injurious to the countries of outflow while authentic research informs that emigration is a brain gain and it turns into brain drain only when more than 20 per cent of university graduates turn their back on their parent country. Diasporas bring in money, ideas, enterprises and development, especially to their native lands. They connect places. Where lies the truth? Geographers may find it through their studies.

Of special interest to me has been a discovery of demographic anomalies on the population map of India. An anomaly is an existing scenario contrary to what is expected. How a remotely located state like Mizoram has more than half of its population as urban and a relatively high income state like Himachal Pradesh has hardly one-tenth of its population in urban

places? Why the smaller cities, with a population of less than half-a-million, have higher percentage of slum population than the metropolitan cities, each with a population of at least one million? Are our big cities becoming elitist and non-receptive to the poor as their municipal corporation areas are recording sluggish population growth? How do we account for misconceptions about the association between religion and language when we find that while 13.4 percent of India's population is Muslim but only 5 percent Urdu speaking? Why is the incidence of mental disability significantly higher in the relatively developed western coastal region than in the less developed eastern coastal plain? Why so? There is much more to go into such regional anomalies.

To this may be added some research questions of practical nature. To what effective use has the massive amount of data collected by the Census of India been put by the government? Which population analysis in geography has guided the policy formulation at the national or state level? To what extent the impact of government policies on regional demographics has been subjected to a systematic research? How strong is the interaction between population geographers and users of research findings? The available evidence on all such issues is rather feeble (Krishan, 1989, p. 257).

Tracing the development contours

While reflecting on population-development interface, one wonders whether population as a factor has been more potent in influencing the development process or development has been more critical to population change in Indian context. A popular perception is that rapid population

growth has been neutralising the gains accruing from development. This, however, is a myth and contrary to what actually happened. During 1951-2001, India's population multiplied almost three times, with an average annual population growth rate of 2.1 percent. Meanwhile the annual rate of increase of net national product was 4.1 percent. This represents a compound annual increase by 2 percent in per capita income in real terms, that is after controlling inflation. As such, per capita income of an Indian in 2010 works out as 4.5 times of that in 1950, at constant prices. Food production went up by four times, transforming the country from a status of food-deficit to food-surplus. Poverty ratio declined by almost one-half. Rich may have been getting richer but the poor have also become less poor. The scenario on the demographic front has thus been evolving on the lines of 'transition model' which has 'stage of development' as its analytical tool.

Persistent regional disparities are a salient feature of India's development map. Which model best explains the evolving scene of these regional disparities? Is it W.W. Rostow's (1960) 'five stage theory or Gunda Frank's (1966) 'metropolitan satellite model' or Gunnar Myrdal's (1957) 'cumulative-causation process'? It seems that Slater's (1973) model of 'colonial penetration followed by post-colonial concentration', is most successful in capturing the development trajectory of India during the modern period (Singh, 2009, p. 214). To begin with, the country had a pre-colonial spatial structure with a historically evolved internal interdependence and cohesion. The colonial penetration introduced an external orientation and internal disorganisation. As a result, the different parts of the country

were turned into hinterlands of Calcutta in the east, Madras in the south and Bombay in the west. Following independence, the development impulses started converging on the national and state capitals in most cases. Since 1990's, New Economy Policy has started integrating India more intensely with the global economy. The nodes of such interlinkage the ones which offer quality infrastructure, promise security conditions, and enjoy good governance, and thereby are capable of attracting massive internal and foreign investment. Contours on the development map of India are in flux again.

One marvels at the popular tendency to perceive development as 'economic' and backwardness as 'social'. This is observed in measurement of development more often on economic indicators, such as per capita income or percentage of urban population, and backwardness in social terms, such as proportion of scheduled caste/tribe population and percentage of female literacy. The two are made to look like different commodities while they are supposed to lie at the two ends of the same continuum. Why is it so? Probably we could not propagate a comprehensive definition of development which 'in geographical parlance denotes the quality of functioning of a regional system in terms of economic progress, social advancement, political maturity and environmental conservation'.

India is transiting from a phase of ethnicity based organization of states to a phase of development-centric demand for carving of new states out of the existing ones. The call for Telengana is one such case. In which way geographers can contribute to our understanding of such issues involving spatial segmentation? Do we have tools for carrying out authentic cost-benefit analysis

of the trade-off between staying together or falling apart by a region aspiring for the status of a state? Should we leave such questions to the domain of politics and wait for the event to take place and then make a study of the outcome?

What has been the development experience of new states? Singh (1998, p. 2) observes that the birth of Haryana as a consequence of reorganization of Punjab in 1966 rendered this territory as culturally homogeneous, spatially more integrated and administratively more intense. The fulfillment of regional aspirations provided the necessary stimulus to its development impulses. What has been the development experience of newly carved out states like Jharkhand, Chhattisgarh and Uttarakhand? This is a research question of geographic interest. In the case of North-East Region, there is a suggestion from some quarters to deterritorialize the spatial framework of its constituent states. How? For example, all areas and dispersed pockets of concentration of Nagas should be brought under the umbrella of one administration. The same holds good for other major tribal groups. What have geographers to say on such a proposition? The response should not be a matter of opinion but a product of rigorous research. Geographers are obliged to suggest alternative organizations of space for administration which are promotive of development, protective of ecology and facilitator of societal harmony (Krishan, 2000, p. 139).

What is the outcome of Backward Area Development Programmes, which have been a sterling feature of Indian planning since the Fourth Plan (1969-74)? The overall impact was less than desired and differed from one programme to another (Mohan, 2005, p.

217). Why has it been so? In all likelihood, our bureaucracy did not have the requisite skill and experience to implement the area-based programmes. They implemented them on the pattern of sectoral ones. Funds more often got distributed amongst target populations in place of getting invested in asset making development projects. An additional reason adduced is that funds were mostly inadequate to make a dent on backwardness under attack.

Naxalism-affected districts of northeastern peninsula have acquired an epithet of red corridor. Here the map of insurgency overlaps a map of rugged topography, forested land, tribal population, mining activity, weak transport links and truant government. Virtually similar conditions of relief, vegetation cover, connectivity and mineral wealth exist in southern Rajasthan and its environs. Mercifully this region is safe from any extremist activity. What explains such a regional differentiation? There must be some lessons to learn from the latter for emulation by other such parts of India.

Another contrast lies between North-Eastern Region and North-Western Region, which coincide with the Eastern Himalayas and Western Himalayas. While the former is rich on almost every item of natural resource, it is the latter which excels on several parameters of development, may it be hydel-power generation, road connectivity, horticulture and tourism. This is a test case of the role of natural bounty in promoting the development process. Such resources are a necessary but not a sufficient condition for taking a region on a fast trajectory of progress. In this case, what helped the northwestern wing of India is its greater exposure to outer influences

through active links with the adjoining areas, recruitment in army and outmigration, relatively early arrival of technology, and challenge before the state governments to perform at a pace. Hopefully, the North-Eastern region will soon catch up. Casting shadows are indicative of a positive trend.

Proximity to a developed core as a factor in development prompts us to examine still another case. What is the story of development in districts which surround the capital cities of different states of India? These are expected to have benefitted from the spread effects of their core. To an immense surprise, districts in which state capitals of Himachal Pradesh (Shimla), Rajasthan (Jaipur), Jharkhand (Ranchi), and Chhattisgarh (Raipur) are located, find themselves at a lower level of development than the national average. In districts surrounding Bangalore, Bhopal and Dehradun, backwardness persists by and large. How do we explain this? The fact is that a strong infrastructure base and absence of physiographic constraints of the region surrounding a capital city are essential for the flow of development impulses to spread around.

And what about the impact of New Economic Policy on regional disparities? It was expected that with greater flow of private sector investment in more developed regions, this disparity will accentuate. The emerged scene is on expected lines. The ratio between the per capita income of the state at the top, Goa, and the one at bottom, Bihar, was 5:1 in 1993-94. This disparity widened to 9:1 in 2009-10. There was, however, an emergence of a positive tendency in the overall context. Every state became conscious of its development agenda more than ever before. To what

effect? While regional disparities increased at national level these decreased virtually in every state. Such a fall in internal disparity was of higher order in less developed states like Bihar, Chhattisgarh and Uttarakhand than in more developed states like Kerala, Punjab and Haryana.

How did globalization bring in a change in scheme of things? The process knits together different parts of the world. It can take a variety of forms: economic, wherein international trade, investment and technology are allowed to flow free across; communicational, wherein internet and e-mail put people of different settings into a new mutually sharing domain; cultural, wherein hybridization of culture and spread of English language in particular is taking place; demographic, wherein international migration is facilitated; ecological, wherein climate change transcends all boundaries; and ideological, of which international terrorism is one component. Under the emerged situation, developed countries are often investing in polluting industries, such as chemicals, oil refineries and cement, in developing countries. They also seek land, forests and mines for their installations which cause massive displacements of local populations, apart from causing land degradation. Developing countries have a limited choice between a faster rate of growth and deterioration of environment. They agree to be 'pollution havens' and are rendered more vulnerable in their search for foreign direct investment. This leads us to the issue of disasters.

Facing the disaster onslaught

What explains the heightened interest in disasters when these have been occurring throughout history? Is it an outcome of the

Disaster Risk Reduction Decade (1990-2000), as designated by the United Nations? Or does it follow the enactment of the Disaster Management Act 2005 in the case of India? Or is that the price tag on human life today has been raised and there is much more to lose in material terms if a disaster occurs any time? Or is it a response to the development process which must be safeguarded against any damage? There is of course now more wealth at risk when a disaster strikes.

Much happened during the last year of 2011 to trigger such an interest. Japan's earthquake and tsunami in March and their recurrence in October; the devastating floods in large parts of Thailand, deluging even the capital city of Bangkok; and a deadly earthquake in New Zealand in November deserve a special mention. United States of America was also in news for a cocktail of hurricanes, tornadoes, wildfires and floods during the year.

Disasters today are less deadly in terms of death rates but have emerged as most ruinous in economic terms. Death toll is falling but economic toll is rising. Disaster management systems may ensure less loss of human life but these have not proved effective in saving the fruits of development from being washed away. Why is it so? Is it because a larger share of population, economic activity and growth foci are located in disaster-prone areas? It may be possible to evacuate people but not fixed assets, including infrastructure in case of an eventuality. Such is the story of coastal cities anywhere; or of river deltas in countries like Bangladesh; or of river courses manipulated for spread of cities along them, as in China; or diffusion of housing in wooded areas or on forest margins, as in the United States. Thus by allowing people and

cities to encroach upon coastal belts, river beds, wooded pockets and sand dunes, development has been getting concentrated more on vulnerable sites.

Added to this is the tendency of the people to rebuild and continue inhabiting the areas which had been devastated earlier. Is it because such sites have some lasting gains despite occasional losses taking place? Is it due to the fact that people fail to fix the cost of unpredictable events into their life time decisions? Is it that human nature is embedded in inertia? Then what to do? Perhaps government policies may help. In which way? By making people aware of the impending disaster if their locational decisions are myopic, as in the case of coastal strip in Maharashtra; by not allowing construction of multi-storied buildings in earthquake prone areas, as in Himachal Pradesh; by not being indifferent to encroachment of agriculture on river beds, as in Punjab. It is a news to emulate that Netherlands is now depolderising its coastal areas and thereby making 'room for the rivers' to flow free, and thus making cities and other settlements more resilient to floodwaters.

A reference to Ecuador and Bolivia, two small countries in South America, will be in order here. They are pioneer in granting 'right to nature' in the case of the former and 'right to mother earth' in the case of the latter. Laws put in place by them allow the River Amazon to sue for any damage to its ecosystem. It is indeed a bold and difficult approach to a serious and complex problem.

This brings us to a comparison between India and China on matters relating to disaster management. Where lies the difference between the two on this count? India does

have an impressive conceptual framework for dealing with disasters but is on weak wicket in implementing them. The focus is always on repairing what has suffered destruction. By comparison, in China, the thrust is upon sustainable practices and capacity building exercises at local level. The country goes by concentrating on key areas of shelter, infrastructure, and industry in the spirit of building a devastated area anew. It remains for India to establish the supremacy of democracy over state capitalism in management of any kind of affairs.

Here is an illustration. The Ministry of Environment and Forest, Government of India, has come out with a coastal Management Zone Notification 2008 for 'protection and sustainable development of coastal stretches and marine environment.' The boundaries of this zone will extend from the outer limit of territorial waters, 12 nautical miles from the low water line along the coast up to the landward boundary of the local self government or local authority, adjacent to the sea. The idea awaits implementation since a national board to further advice on the matter is to be constituted. To cap it all, there is no regulatory process involved in the provisions of the Act.

How serious are the states in addressing issues pertinent to disaster management. This can be gleaned from the priorities reported by the different states to the 13th Finance Commission of India 2010-2015, while seeking special grants. Strengthening of police apparatus and up-gradation of prisons, conservation of archaeological sites and promotion of tourism, development of backward regions and border areas, and construction of new Raj Bhawans and

bridges find a frequent mention. Feeble are the demands relating to management of disasters. Some states like Assam, Nagaland, Manipur, Madhya Pradesh, Uttar Pradesh and Rajasthan have a little to seek on this count. Are they free of disasters? North-Eastern Region did not go beyond asking for repairs of suspension bridges (Arunachal Pradesh), construction of bridges (Meghalaya), fire and emergency services (Mizoram) and improvement of drainage system in Agartala (Tripura). What should one make out of all this? Coastal states have been somewhat more demanding in asking for sea barricades to enhance tourist safety (Goa), eco-restoration of Chilka lake (Orissa) strengthening of river banks in Sundarbans (West Bengal), and check on salinity and marine pollution (Gujarat).

Based upon a comprehensive analysis of district wise data on destruction ascribed to 16 climatic hazards, Kapur (2010, p. 5) observes that India is a virtual disasterscape of which characteristics may have remained unexplored and causes camouflaged. 'The disasterscape which etches the face of India today can neither be denied nor wished away. It is a fact and has its facts'. A further cluster analysis based on 13 indicators relating to three criteria of vulnerability, namely fragile living (kutch houses), lack of services (no road connectivity), and disadvantaged people (scheduled caste/tribe population) reveals that North-East region, northeastern peninsula and northeastern Jammu and Kashmir are the most vulnerable to disasters; eastern coastal plain is much more vulnerable to hazards than the western coastal region; and lower Ganga plain is more vulnerable than the upper Ganga plain. Punjab-Haryana Plain, Maharashtra

littoral region, and Kerala coastal zone are somewhat less susceptible to hazards. One could infer that development does mitigate the intensity of vulnerability.

In ultimate analysis, disaster management has to be an integral part of any development effort, especially in developing countries like India. Development seems to be the ultimate disaster mitigation strategy, in such cases. For this then an optimal policy design has to be pursued with vision, clearly laid out road map, and firm determination to effectuate. Failing this, we shall remain under the peril of disasters. 'Disasters are inevitable but their consequences are not'.

In the Upanishdic mode, may we now go for a discovery of geographic questions for finding out answers to issues relating to the Conference's theme of population, development and disaster management. The task is well defined. Let us move onto this pasture.

Thank you, one and all.

References

- Cutter, Susan L., Reginald Gollege and Willam F. Graf (2002): "The big questions in geography", *Professional Geographer*, Vol. 54, No. 3, pp. 305-317.
- Kant, Surya (1988): *Administrative Geography of India*, Rawat Publications, Jaipur.
- Kapur, Anu (2010): *Vulnerable India*, Sage, New Delhi.
- Krishan, Gopal (1989): "New themes in population research", *Demography India*, Vol. 18, pp. 249-260.
- Krishan, Gopal (2000): "Indian Geography"; *Tasks ahead*", *Annals of the Association*

- of Geographers, India, Vol. 20, Nos. 1&2, pp. 131-141.
- Massey, Doreen (2001): "Geography on the agenda", Progress in Human Geography, Vol. 25, No. 1, pp. 5-17.
- Mohan, Krishna (2005): Addressing Regional Backwardness, Manak, New Delhi.
- Morill, Richard (1985): "Some important geographic questions", Professional Geographer, Vol. 37, No. 3, pp. 263-270.
- O' Leary Zina (2010): Essential Guide to Doing Your Research Project, Sage, New Delhi.
- Singh, Nina (1998): Administration and Development of Indian States, Anmol, New Delhi.
- Singh, Ripudaman (2009): Trends in Regional Disparities in India since Independence, Unpublished Ph.D. Thesis, Panjab University, Chandigarh.
- Slater, D. (1973): "Geography and under-development", Antipode, Vol. 5, pp. 21-32.

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