Developing a multi-dimensional environmental vulnerability (MEV) indicator for Mongolia

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1. Introduction

The aim of this paper is to describe a multi-dimensional environmental vulnerability (MEV) indicator that has been developed as an input to the Mongolia National Human Development Report 2011.

2. What is vulnerability?

Vulnerability is the susceptibility to an external shock or trend. Vulnerability is a subjective concept – what one person finds unbearable another person may actually relish and not merely cope with. Defining vulnerability is problematic not least because of this subjectivity. A related idea is that of resilience – the ability to cope with variations or shocks and indeed 'bounce back'.

Vulnerability can be measured at the level of a society or nation or at the level of an individual or a household. When the analysis is conducted at the macro or national level, vulnerability concerns national level indicators as compared with other countries. Thus, for instance, economic vulnerability of a nation is the extent to which national economic performance is affected by openness, changes in prices of commodities and traded goods and capital, exchange rate fluctuations and financial crises. Previous efforts to develop economic vulnerability indicators focused mainly on vulnerability of small island states (see Briguglio,1995; Easter et al, 2000).

Environmental vulnerability can be defined as vulnerability originating from or significantly influenced by environmental change. Some environmental changes can be specific events with a clearly identifiable start and end points (or events) and others may be more long term changes with no identifiable start or end points but with significant ecological as well as social consequences. Examples of the former would include earth quake, tsunami or an outbreak of a contagious disease such as avian flu or SARS. Examples of the latter would include desertification, climate change related changes in glaciation, weather patterns or regional dust storms.

However, the same extent of environmental changes can have different impacts depending on the resilience of a given society – its capacity to absorb and withstand change. Hence it can be suggested that environmental vulnerability is not determined by the magnitude of changes in physical environment alone but indeed a function of the nature of social and economic institutions. A number of alternative explanations are relevant.

For example, borrowing from Karl Polanyi's (1944) writings on embeddedness, it can be argued that the ability of a society to absorb external shocks depends on how well the economic institutions are embedded within social, political and cultural institutions. Embeddedness means more than simply co-existing – when social, economic and environmental factors are inter-connected, shortcomings in one can be compensated by advances in another dimension.

Similarly, in the discussion on institutions following Douglas North (1990) and Rodrik (2008) it is possible to argue that the ability to withstand shocks may depend on the nature and quality of institutions. For North, institutions are humanly devised constraints that govern human interactions. In societies where institutions are better developed, there would be more clarity and transparency in the distribution of benefits from a transaction. This enables parties to a contract to negotiate better and develop appropriate incentive mechanisms. In the context of economic vulnerability, 'Singapore paradox' suggests that national policies can be crucial in nurturing resilience and producing strong economic performance even in the presence of vulnerability (Briguglio et al, 2008). In the context of environmental vulnerability too, it has been argued that disasters are essentially human-made – caused by lack of forward planning and mitigating actions or corruption and failure of institutions rather than by nature (see, Ambrayseas and Bilham,2011; Hewitt,1997; Kelman,2007;).

3. Multi-dimensional Environmental Vulnerability (MEV)

Why a multi-dimensional indicator of vulnerability?

In evaluating alternative situations, the policy analyst is faced with a choice of indicators. In some approaches, all the relevant information is converted into a single metric and performance is measured on that metric alone. Examples of this include cost benefit analysis and adjusted savings. In such approaches, measurements along different indicators are 'commensurable' – shortcomings in one can be compensated by improvements in another. In other approaches, alternatives are evaluated or compared on different performance criteria without aggregation. Here, individual dimensions or categories are 'non-commensurable'.

Like poverty, vulnerability is multi-dimensional. This is so both in the case of nation-states and of individuals. A multi-dimensional assessment is helpful in developing resilience or appropriate preventive and mitigating actions and targeting actions on aspects which need most attention.

There are numerous environmental issues which require policy and regulation. The issues affect different *aimags* in different ways. While individual indicators may be useful to inform policy concerning a specific issue, their interactions and multiple deprivations are not captured in that approach. A multi-dimensional indicator can be useful in identifying whether people in some locations are vulnerable to several issues and if so whether a co-ordinated approach rather than an individual sector-focused approach is better.

Why do we need a 'new' indicator?

A number of global studies focus on environmental sustainability indicators based on national level data. Examples include:

a. The Yale University's environmental performance index (EPI): This provides data for 163 countries on 25 indicators under 10 policy categories or themes. The two key objectives include environmental health i.e., environmental factors that affect human health and ecosystem vitality (see Emerson et al, 2010). Under environmental health, there are four indicators; under ecosystem vitality there are seven indicators. Different weights are applied to different indicators. Based on this methodology, each country is scored on a scale of 0 to 100 with higher score for better performance. Iceland, Switzerland, Costa Rica, Sweden and Norway took the top five ranks while Sierra Leone, Central African Republic, Mauritania, Angola, and Togo took the bottom five ranks.

b. Adjusted savings or genuine savings: In this approach, a society that maintains its capital intact will have positive savings rate. If all forms of capital are taken into account i.e., human made and natural capital – maintaining the overall capital intact requires that the overall savings rate is positive. In the World Bank (2008) approach, data is presented for 128 countries. Gross national savings are adjusted for consumption of fixed capital, energy depletion, mineral depletion, net forest damage, net CO_2 damage, and damage caused by particulate pollution (PM10). Solomon Islands, Bhutan, Botswana, China and Singapore take top five places with high values of positive adjusted savings rates while Slovak Republic, Republic of Congo, Chad, Angola, and Equatorial Guinea take bottom five palces with high values of negative adjusted savings rates.

c. The happy planet index: This index aims to combine environmental impact with human well-being. HPI is wellbeing per unit of environmental impact. Well-being is measured as 'happy life years' - arrived at by combining information on life satisfaction and life expectancy. Environmental impact is measured in terms of ecological footprint. NEF (2009) provides data for 143 countries. Costa Rica, Dominican Republic, Jamaica, Guatemala, and Vietnam take the top five ranks with high scores of HPI while Zimbabwe, Tanzania, Botswana, Namibia and Burundi take the bottom five ranks with low scores of HPI.

d. SOPAC Environmental vulnerability index (EVI): An environmental vulnerability index was constructed at national scale combining three aspects – risks to the environment, innate ability of the environment to cope with the risks and ecosystem integrity. Kaly et al (1999) discuss the development of one sub-index for each of these three components and then estimated EVI values for three countries namely, Australia, Fiji, and Tuvalu.

These examples are illustrative of how environmental indicators can be measured independently or combined with other indicators. However, these indicators are developed mainly for international cross-country comparisons. Some of the indicators can be extended to sub-national levels provided data is readily available. For national policy purposes, sub-national indicators are more useful. Where existing indicators do not provide such information, there may be a case for developing new indicators.

In the context of a country such as Mongolia, there are distinct ecosystems. Even global and regional climate phenomena do not produce uniform or homogeneous effects in all these ecosystems. Hence, there is a case for developing indicators that capture this variation. Naude et al (2009) note that there is a gap in the literature in terms of few studies focusing on sub-national geographic levels and proceed to develop sub-national indicators of vulnerability for South Africa. In that study, the authors developed a local vulnerability index based on information for 354 magisterial districts.

How to develop an indicator?

There are three issues to consider in developing a multi-dimensional indicator: how many dimensions to consider; how many indicators or variables within each dimension; and how to aggregate.

Developing a multi-dimensional indicator is not difficult- any number of dimensions can be included subject to availability of data. However, each dimension must be distinct. One categorisation is to consider all natural factors (land, water, climate etc.) under one group and all human-made factors (economic, cultural, institutional etc.) Another alternative is to consider categories such as environmental, social, economic, cultural dimensions.

Having considered the dimensions, next the policy analyst has to identify various indicators for each dimension.

Both the content of such an indicator and the process by which it is developed are important. The content of an indicator must provide policy-relevant information. Thus, an indicator of vulnerability must provide information to policy analyst to distinguish aimags or locations that are less vulnerable and others which are more vulnerable. The indicator must measure what is intended; it should be possible to observe variation in the values of indicator across different cases in relation to some variation in external circumstances or policy inputs and outcomes.

Who should be involved in developing an indicator?

The process of developing an indicator should be based on participation of all the relevant stakeholders who will be using the indicator. Otherwise, the development of an indicator becomes a technocratic exercise which that can further disempower the very stakeholders who are supposed to be the final users of information contained in such an indicator.
A national workshop of relevant stakeholders should be convened to develop appropriate multi-dimensional indicators. The discussion and illustration in this paper is presented essentially as an example and not as a substitute of such a process.

4. An illustration

Indicators of economic vulnerability could include: unemployment, (barriers to) access to markets, (barriers of) access to capital or financial support, the inability of local government to support individuals, lack of opportunities for education, stagnation of local economy.

Indicators of social vulnerability include: horizontal inequality, ethnic and gender inequality, health inequality, breakdown of social units including family, problems such as drug use or trading, sense of insecurity, gangs and violence, social exclusion.

Indicators of environmental vulnerability include: land degradation, deforestation, water and air pollution, lack of access to improved water and sanitation and clean energy, increasing competition for local resources such as pastures and so on.

For this illustration, variables were chosen as indicators for which information is readily available from the NSO or MNET. For each indicator, an index is constructed by considering the maximum and minimum values of the variable concerned. The indexes are constructed in such a way that the most negatively affected *aimag* will have highest value (1) and the least negatively affected *aimag* will have lowest value (0). The dimensions and indicators used in our illustration are listed in Table 1 below.

In the remainder of this section, each variable is discussed. Since each indicator is measured in different quantities, we construct an index of relative vulnerability for each aimag:

$$P_{ij} = (P_{ij} - P_{i\,min})/ (P_{i\,max} - P_{i\,min}) \qquad \ldots\ldots (1)$$

Where P_{ij} is value of variable i in aimag j. Subscripts min and max correspond to minimum and maximum values amongst all aimags.The index values therefore take between 1 and 0 for each aimag and each variable.

Table 1: Illustration of indicators included in Multi-dimensional environmental vulnerability indicator	
Economic dimensions	• Distance from Capital city • Unemployment • Local government finance per capita (deviation from average) • Non-performing loans outstanding per capita
Social dimensions	• Untrained persons among those unemployed • Divorce rate • Offences per 1000 population • Persons per physicians
Environmental dimensions	• Land degradation (total land area degraded) • Forest fires (area affected) • Steppe fires (area affected) • Surface water sources dried up (% of sources dried up) • Water scarcity index (high score means small amount of usable water per capita) • Livestock density (livestock per area) • Air pollution NO2 level (compared to acceptable standard) • Air pollution SO2 level (compared to acceptable standard)

Each dimension represents an aspect which contributes to vulnerability – thus an aimag which has high values on these will score 1 and an *aimag* with least vulnerability will score zero. These indicators were chosen because data was readily available. To avoid correlation with HDI, variables directly related to HDI or its components were not included.

Economic vulnerability indicators

E1: Distance from capital city:

This variable is chosen as an indicator of 'tyranny of geography'. This captures many aspects of economic backwardness or vulnerability including (economic distance to) access to markets, economies of scope or agglomeration economies and information costs. Distance from Ulaanbaatar to the aimag centre is used as an indicator of distance. This gives us Bayan-Olgii with highest score of 1 and Ulaanbaatar with lowest score of zero.

E2: Unemployment:

Registered unemployment rate in 2008 ranged from 1.1 per cent in Tov aimag to 5.4 per cent in Bayankhongor aimag (NSO,2009:116). Using these as the minimum and maximum values, unemployment index is constructed for each aimag. Of course, the choice of this indicator is subject to the quality of data. Other alternative indicators can be proportion of dependents (i.e., not economically active) or total unemployment rate (table 4.8) rather than only registered unemployment rate. Also, to take into account under-employment or unpaid work, appropriate adjustments need to be made. We have used registered unemployment in this illustration.

E3: Local government finance gap:

Local government finance is used as an indicator of local government's capacity to provide services and reduce vulnerability. The lower an *aimag's* local government expenditure per capita the higher is the value of this indicator. This is estimated based on expenditure by local government (table 8.8, NSO,2009) and population of each aimag.In 2009, local government expenditure was 123,580 million MNT in Ulaanbaatar but only 1,537 million MNT in Govisumber aimag. However, when we estimate on per capita basis, national average is 97,769 MNT per capita. The lowest per capita local government expenditure was in Bayan-Olgii where this is only 34,803 MNT per capita in 2009. It was the highest in Omnogovi aimag, where per capita local government expenditure was 494,909 MNT per capita. In six aimags, the local government expenditure was more than the national average. Since we are measuring vulnerability, all aimags where local government expenditure per capita is more than national average are considered not vulnerable and hence they are scored zero. All other aimags that had per capita expenditure lower than national average were indexed such that the lower the expenditure the higher is the score.

E4: Non-performing loans:

This indicator is chosen to represent difficulty in access to capital. Data is available from section 7 of NSO, 2009. Table 7.7 in the Statistical Handbook provides data on non-performing loans outstanding. In 2008, for example, in Ovorkhangai aimag, 0.30 per cent of all loans outstanding were non-performing while in Ulaanbaatar NPLs constituted 8.42 per cent. These provide the minimum and maximum values. The index values are constructed using these.

Social vulnerability indicators

S-1: Untrained among unemployed:

From Labour Force Survey, data is available on details of some of the characteristics of those who are unemployed. While unemployment is already included as indicator of economic vulnerability, among those who are unemployed, the proportion of those without training is an indicator of underlying issues related to access to vocational and higher education. Hence, this is considered a suitable indicator of social dimension of vulnerability. For example, nationally, in 2008, the total number of unemployed persons was 29,813. However, 21,119 of these were untrained

(NSO,2008:120). In Khovd aimag, only 46 per cent of those who were unemployed were also untrained while in Bulgan nearly 95 per cent of those who were unemployed were untrained. These two values provide the lowest and highest values for calculating the index.

S-2: Divorce rate:

Divorce rate in itself is not an indicator of vulnerability. In fact, it can be argued that divorce rate is an indicator of urbanisation and freedom to seek legal intervention in case social norms of family are not working. For this illustration we chose divorce rate as an indicator of social vulnerability mainly because the national policy as enunciated in the Comprehensive National Development Strategy places a lot of importance on the structure of the family. For example, paragraph 4.3 within the CNDS refers to the policy on family development and for creating 'favourable conditions for families to be united and harmonious'. Demographic data indicates that there were 1,901 divorces in 2008 nationally – or 0.7 divorces per 1,000 population. However, the variation is from 0.1 divorces per 1,000 population in Bayan-Olgii aimag to 2.0 in Orkhon aimag.

S-3: Crime rate or offences rate:

Crime rate is an indicator of human security and 'freedom from fear'. In 2008, nationally there were 20,704 offences or 7.7 per million population. The rate varied from 2.96 offences per million persons in Govi-Altai aimag to 10.9 offences per million persons in Ulaanbaatar. These provide the minimum and maximum values for estimating the index.

S-4: Persons per physicians:

The 'number of persons per physician' is indicator of inequality in access to health services. According to the MDG based CNDS, one of the development strengths of Mongolia is the 'relatively high number of medical doctors per 1,000 people'. However, there is considerable variation. Nationally, when we take the average for the period 2005-2009, there were 361 persons per physician. However, Ulaanbaatar was better served with only 232 persons per physician while in Bayankhongor aimag there were 707 persons per physician.

Environmental vulnerability indicators

Eight indicators have been chosen to provide a detailed picture of environmental dimension.

En-1: Land degradation

The Ministry of Nature, Environment and Tourism collects information on land area degraded in each aimag annually. Based on data for year 2009, we find that nationally 111,676 square km of land was degraded. Aimags with large extent of land degradation were Dornogovi with 19,198 sqkm and Sukhbaatar with 16,048 sqkm. At the other extreme, in Darkhan-Uul, only 94 sqkm of land was degraded.

En-2: Forest fire index

Nationally, the number of forest fires increased from 90 in 2006 to 148 in 2008 before falling to 91 in 2009. The number of forest fires does not capture the full extent of damage caused. A better indicator would be area affected. We do not have recent data on this. Data from MNET indicated that in 2006 around 3,917 sqkm of forests were burnt. In 2007, forest fires affected 5,123 sqkm of forests. Largest extent of forest fires affected Khentii to the extent of 2,328 sqkm in 2006 and 2,911 sqkm in 2007 giving an average of 2,619 sqkm. In many aimags, no forests were burnt. Aimags with significant extent of forest fires were: Selenge, Khovsgul, Bulgan, Dornod and Tov. For the purposes of calculating index, highest value of Khentii was used as maximum and zero was used as minimum.

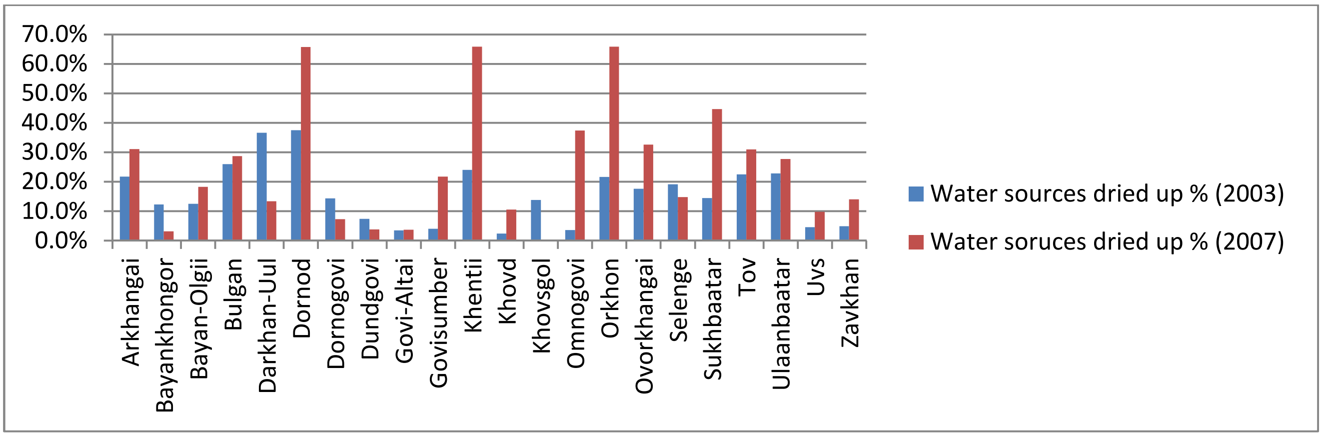
En-3: Steppe fire index:

The extent of steppe damaged by fires is also significant –in 2006, this was 52,021 sqkm nationally and in 2007 this decreased to 8,229 sqkm. When we take an average, this gives us 30,125 sqkm of stppe damaged by fires. A significant share of this area was located in Khentii aimag alone. Sukhbaatar and Dornod also had a significant extent of steppe fire damage. Most other aimags reported very little by way of area of steppe damaged in fires.

En-4: Surface water sources dried up

Water census conducted in years 2003 and 2007 indicated a significant increase in the total number of surface water sources that dried up (table 24.12 in NSO,2009). Given that in much of the country, surface water sources are crucial for survival of both humans and livestock, this indicator has been included. In some aimags such as Orkhon, Khentii and Dornond more than 65 per cent of surface water sources dried up in 2007 (see figure 1).

Figure 1: Proportion of all surface water sources which dried up- 2003 and 2007



Source: Based on data from Water Censuses, NSO,2009.

For constructing the index, Orkhon's65.9% provides the maximum while zero provides the minimum.

En-5: Water scarcity index:

From Water Census, we have data on total water resources and usable water resources (surface and ground) available. From this, we can estimate usable water resources cubic metres per capita. Selenge aimag appears to be better endowed with usable water resources of 20,869 cubic metres per capita while Govisumber has merely 7.5 cubic metres of usable water per capita. Using these figures as the maximum and mimimum, we can construct a scarcity index such that aimags with a lot of water get low score and aimags with little water get high score.

Table 2: Water scarcity index

Aimag	Usable water resources cu km	Population in thousands	Useable water resources per capita	Water scarcity index
Arkhangai	0.83	92.5	8972.97	0.57
Bayankhongor	0.1	85.4	1170.96	0.94
Bayan-Olgii	0.81	101.9	7948.97	0.62
Bulgan	1.09	62.3	17495.99	0.16
Darkhan-Uul	0.013	90	144.44	0.99
Dornod	0.35	73.6	4755.43	0.77
Dornogovi	0.005	58.3	85.76	1.00
Dundgovi	0.01	47.7	209.64	0.99
Govi-Altai	0.04	59.4	673.40	0.97
Govisumber	0.0001	13.3	7.52	1.00
Khentii	1.2	71.5	16783.22	0.20
Khovd	0.25	88.5	2824.86	0.86
Khovsgol	2.11	124.1	17002.42	0.19
Omnogovi	0.001	49.3	20.28	1.00
Orkhon	0.0011	83.1	13.24	1.00
Ovorkhangai	0.27	117.5	2297.87	0.89
Selenge	2.16	103.5	20869.57	0.00
Sukhbaatar	0.01	55	181.82	0.99
Tov	0.4	88.5	4519.77	0.78
Ulaanbaatar	0.15	1112.3	134.86	0.99
Uvs	0.2	78.8	2538.07	0.88
Zavkhan	0.57	79.3	7187.89	0.66

Source: Author’s calculation based on Water Census data from MNET.

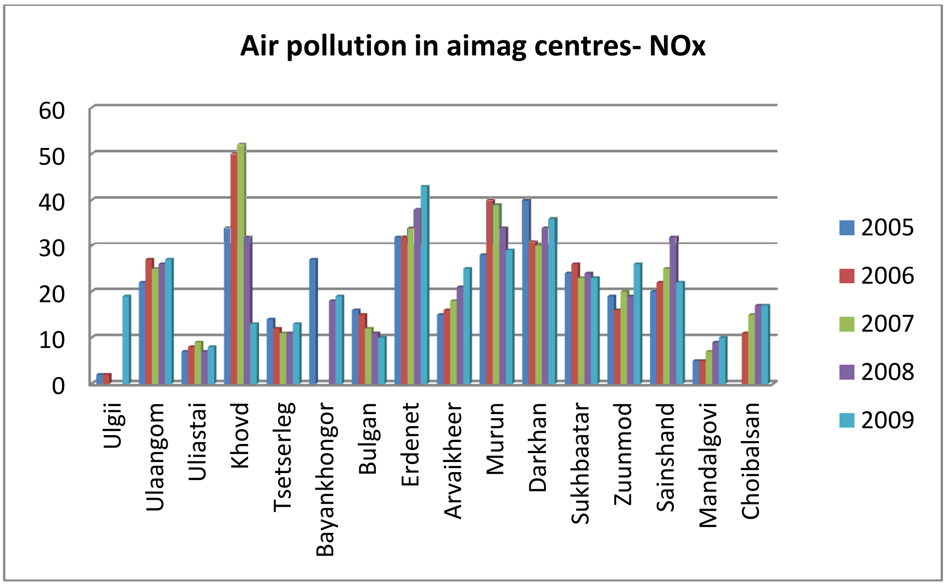
En-6: Livestock density:

One of the main arguments concerning land degradation is the extent to which growth in livestock numbers has been a factor. Since aimags vary in terms of pasture area as well the nature of ecosystems and pasture productivity, there is no simple indicator of human-induced pressure on pastures. We can use livestock density or number of livestock heads per unit area of pasture as basic indicator, though even here some caution is needed. Livestock density varied from 537 sheep units per square km in Orkhon to 14 sheep units per square km in Dornogovi. These two provided the maximum and mimum values for constructing the index.

En-7 and En-8: Air pollution- NOx and SOx

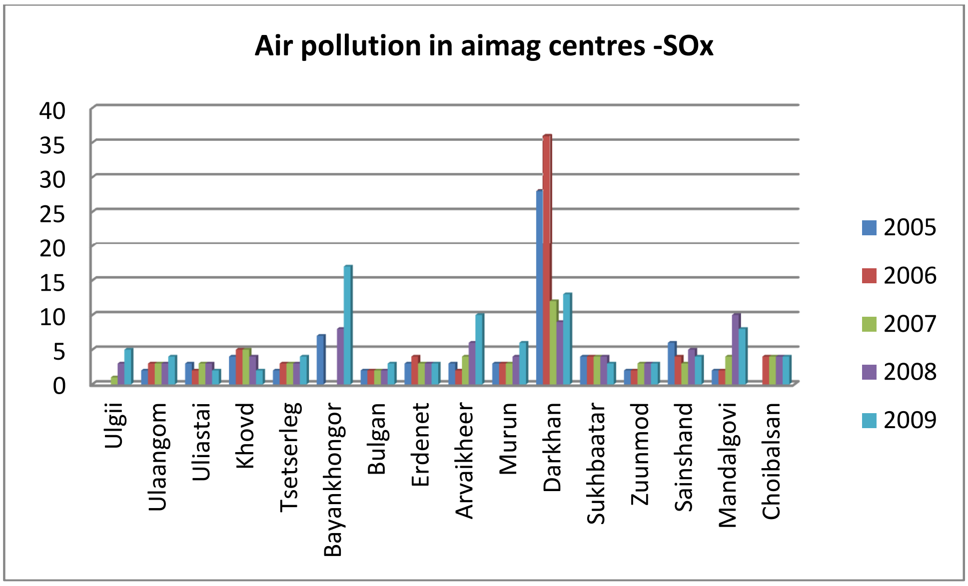
Air pollution data is available mainly for aimag centres (or urban areas- see figures 2 and 3 below). This data is available for a period of five years from 2005 to 2009. The five year average figures suggest that NOx levels were highest in Orkhon and were lowest in Khentii. These provide the maximum and minimum for the purposes of estimating the index.

Figure 2: NOx levels in aimag centres



Source: Based on MNET data

Figure 3: SOx levels in aimag centres



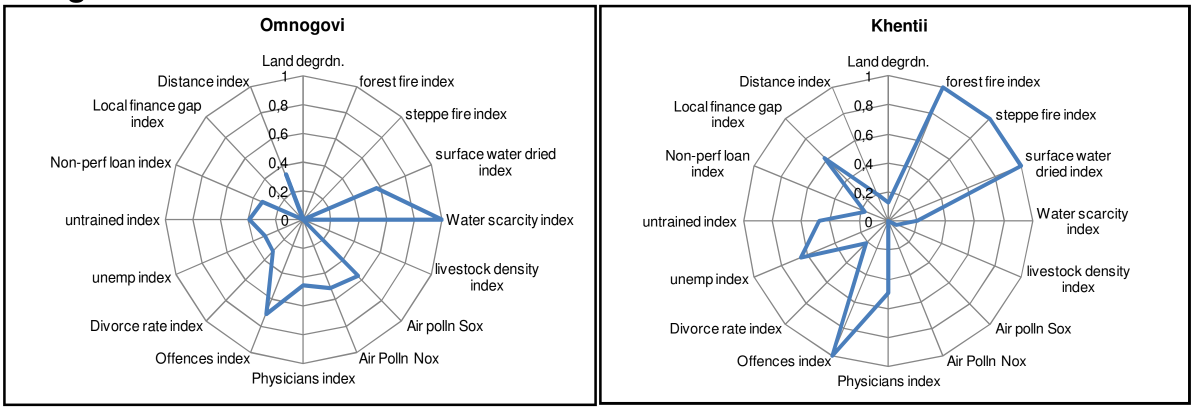
Source: Based on MNET data.

Among the main sources of nitrogen oxides are automobile emissions. High levels of NOx emissions are indicative of automobile use and dependence within a given area. The main source of sulphur oxide emissions is the burning of fossil fuels, mainly coal which contains sulphur as an impurity.

Summary of the 16 indicators

The information can be presented in tabular form. However, a more useful approach is to present data on each of the 16 indicators for each aimag. This is illustrated in Figure 4 below. Since each indicator is indexed to vary from 0 to 1, the presentation suggests the vulnerability of a given aimag in respect of each of the 16 indicators relative to all other aimags.

Figure 4: Performance on various dimensions- Omnogovi and Khentii *aimags*, Mongolia



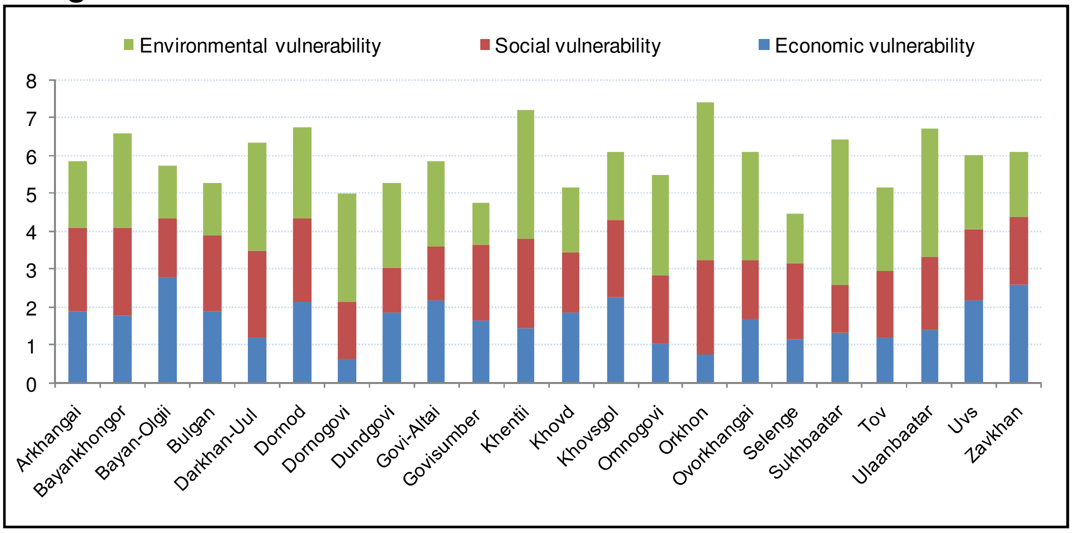
Source: Calculation for Mongolia HDR, 2011.

We can see that Khentii scores maximum possible value on three environment dimensions and one social dimension (offences) and fairly high value for one other social dimension (unemployment rate). On the other hand, Omnogovi scores high on only one of the environmental dimensions, namely, water resources available per capita. This illustration suggests that addressing both social and environmental issues will be a priority to reduce vulnerability in Khentii whereas in the case of Omnogovi, addressing water insecurity will be crucial.

Aggregation

A multi-dimensional index can be developed from the 16 individual indicators. Various alternative statistical methods are available for developing such indicators. For simplicity, an arithmetic aggregation has been used here. The resulting multi-dimensional environmental vulnerability (MEV) index has a range of values between 0 and 16 - a score of 0 meaning an *aimag* is not vulnerable in any of the 16 indicators and the maximum score of 16 means that the *aimag* concerned has highest level of vulnerability in all 16 indicators. We find that the actual values range between 4.3 and 7.2 (Figure 5).

Figure 5: Multi-dimensional Environmental Vulnerability Index- illustration, Mongolia



Source: Calculation for Mongolia HDR, 2011.

From this summary, it appears that in this illustration and for the 16 indicators chosen, Khentii amongst the more rural *aimags* and the three large urban areas Ulaanbaatar, Darkhan-Uul and Orkhon come out as being more vulnerable. This can be expected given that we have two air pollution indicators out of 16 (contributing one eighth of the overall index value). Air pollution levels are higher in the more urbanised *aimags*. Selenge and Govisumber appear to have lower values of MEV index. The above illustration suggests that developing a multi-dimensional indicator can be useful in identifying key challenges for each *aimag*.

5. Discussion

In this illustration, indicators were chosen mainly on the basis of data availability. However, the potential usefulness of such an index for policy is quite clear. One issue concerns *aimags* which have high MEV values i.e., those *aimags* are vulnerable on several indicators. Second issue is to look at individual indicators and identify *aimags* for priority actions.

In taking this approach forward, it is necessary to hold a national workshop of stakeholders to discuss the dimensions and indicators as well as aggregation methods. Though MEV can be constructed for individual households, for policy purposes, it is more likely to be useful as a planning tool that focuses on collectives such as aimag level or soum level.

As the illustration above clearly shows, aggregation is not essential – even by presenting information on individual indicators, it is possible to use this approach to identify policy priorities and to target actions.

The indicators chosen here should be seen merely as examples rather than definitive policy variables.

Candidates for economic dimension can include: the level of education and skills among the population, labour productivity, the extent of micro-credit, indicators of innovation and enterprise and so on. Vulnerability should be carefully defined as not having access to these positive aspects.

Candidates for social dimensions could include the role of traditional and other institutions of local collective action, indicators of social capital, access to information and opportunities for cultural intercourse, robustness of family as well other institutions of trust. For example, institutions governing access to pastures or the extent to which fencing is required in order to protect pasture areas set aside as winter pastures.

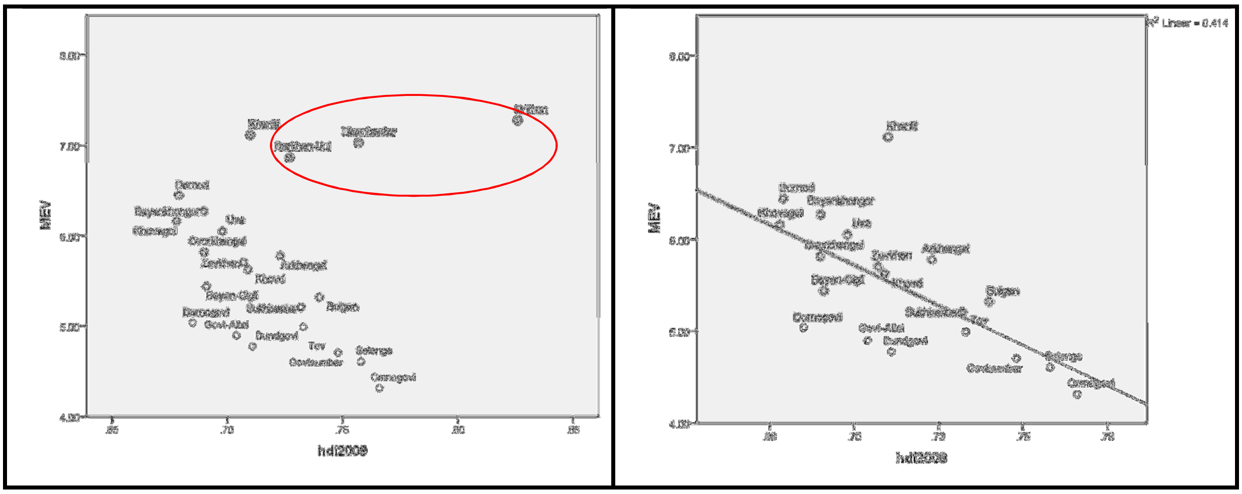
The choice of environmental dimensions can include the extent of formal and informal mining activity and the nature and extent of chemical pollution affecting land, proportion of population with access to improved water and sanitation, access to clean energy and opportunity to reduce indoor air pollution, vegetation index or appropriate measures of pasture resilience, forest vitality and water resources dependability. Again, all of these are positive aspects and hence vulnerability has to be carefully defined as the deviation or absence of such factors.

MEV and HDI:

Since the MEV does not have variables which are also in HDI, to some extent these are independent of each other. This allows us to test the conjecture whether *aimags* that do well on HDI also are better at reducing vulnerability.

From Figure 6 it is apparent that once we exclude the three urban *aimags*, a fairly strong negative correlation between multi-dimensional environmental vulnerability and HDI exists. This supports the view that promoting human development and reducing vulnerability are consistent with each other.

Figure 6: Human Development Index and Multidimensional Environmental Vulnerability by *aimags*, Mongolia



Source: Calculation for Mongolia HDR, 2011.

The main advantage of the MEV is that it highlights that vulnerability is multi-dimensional and that different *aimags* may have different priority issues. The tool can be used to design appropriate risk management and institutional capacity development policies for each *aimag*. The main criticism is that the indicators are *aimag* based and do not capture variation within an *aimag*. As an illustration, this exercise focused on *aimag* level because of data availability. The methodology can be easily replicated with *soum* level data for comparative analysis within an *aimag* also. Another potential criticism relates to gender inequality. In this illustration, divorce rate was chosen as an indicator; alternative approaches can include maternal mortality rate or other indicators of gender inequality.

These criticisms do not affect the main argument being made here, namely the potential usefulness of a multi-dimensional environmental vulnerability indicator as a tool for policy analysis. These criticisms in fact add emphasis to the urgency to hold a national workshop of stakeholders to discuss both the choice of indicators and also appropriate methodology to develop a ‘people’s indicator of environmental vulnerability’.

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