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Multidimensional Poverty in Bhutan: Estimates and Policy Implications

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Abstract

This paper estimates multidimensional poverty in Bhutan applying a recently developed methodology by Alkire and Foster (2007) using the 2007 Bhutan Living Standard Survey data. Five dimensions are considered for estimations in both rural and urban areas (income, education, room availability, access to electricity and access to drinking water) and two additional dimensions are considered for estimates in rural areas only (access to roads and land ownership). Also, two alternative weighting systems are used: a baseline using equal weights for every dimension and another one using weights derived from the Gross National Happiness Survey. Estimates are decomposed into rural and urban areas, by dimension and between districts. It was found that multidimensional poverty is mainly a rural phenomenon, although urban areas present non-depreciable levels of deprivation in room availability and education. Within rural areas, it was found that poverty in education, electricity, room availability, income and access to roads, contribute in similar shares to overall multidimensional poverty, while poverty in land ownership and water have a relatively smaller contributions. The districts of Samtse, Mongar, Chukha, Trashigang and Samdrup Jongkhar are identified as giving the highest contribution to overall multidimensional poverty. The methodology is suggested as a potential formula for national poverty measurement and for budget allocation among the districts and sectors.

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1. Introduction

Fostered by Sen's (1985, 1990, 1999) pioneering 'capability approach', there is now an increasing consensus that poverty is an intrinsically multidimensional phenomenon. This has led scholars to propose different multidimensional poverty measures. However, some of the proposed measures seem to have incorporated a multi-dimensional perspective at the cost of giving up the simplicity and intuition that characterise the unidimensional measures. Departing from this, Alkire and Foster (2007) propose a new family of multidimensional poverty measures which is a variant of the extensively used Foster, Greer and Thorbecke's (1984) class of one-dimension poverty measures (FGT from now on). The *dimension adjusted* FGT measures keep the simple structure of the one-dimension case and satisfy a set of convenient properties, among which decomposability across population subgroups and the possibility to break it down by dimension are useful for policy purposes.

In this paper, the mentioned new class of measures is applied to estimate multidimensional poverty in Bhutan. Bhutan constitutes an extremely interesting example of how a country can define development goals, tailor its policies to these goals, and see them materialized. Since 1961, the country implemented coordinated efforts towards development through consecutive five-years-plans. In particular, the country has made significant progress in extending the access to safe drinking water and sanitation, protecting and managing the country's natural resources, providing basic health care and increasing the access to primary education. However, more can still be done in some of the mentioned areas as well as in others. Within this development agenda, the Millennium Development Goals play a key role since Bhutan is seriously committed to contribute to the realisation of the Millennium Declaration.

In this context, this paper intends not only to present estimates of multidimensional poverty in Bhutan, which would complement the income poverty estimates performed

by the National Statistics Bureau, but also to suggest the applied methodology as a potential formula for budget allocation among the twenty districts, and within each district, among the different gewogs, the lowest administration units.

The data used in this paper correspond to the 2007 Bhutan Living Standard Survey. It constitutes a unique data source of this country, representative both at the national and district levels. Estimations are performed for rural and urban areas considering five dimensions and also for rural areas exclusively, with two additional dimensions. Each measure is also estimated at the district level, and in all cases, using two alternative weighting structures: a baseline of equal weights and another one with weights derived from the ranking of 'sources of happiness' identified through the Gross National Happiness Survey.

Results confirm that, indeed, income deprivation should not be the only considered dimension. Deprivation in other dimensions such as education, access to electricity and room availability in the house, are significant both in rural and urban areas, and not necessarily related to deprivation in income. Additionally, deprivation in access to roads is a significant component of multidimensional poverty in the rural areas. Land ownership in the rural areas and access to drinking water in both rural and urban areas, seem to be relatively less important. It was also found that multidimensional poverty is mainly a rural problem, which is particularly important given that 74% of the population in Bhutan live in rural areas. When analysing at the district level, it is found that Samtse, Mongar, Chukha, Trashigang and Samdrup Jongkhar are the five districts with the highest contributions to aggregate multidimensional poverty. However, even in the other districts with lower contributions, improvements in the mentioned dimensions are still important.

The rest of the paper is organised as follows. Section 2 briefly revises the literature on multidimensional poverty measures. Section 3 presents the methodology used in the paper (measures estimated, data-set used, selected dimensions, deprivation cutoff values and weighting structures). Section 4 presents the estimation results. Finally, Section 5 contains the concluding remarks.

2. Literature review

Since Sen (1976), the measurement of poverty has been conceptualised as following two main steps: identification and aggregation. In the unidimensional space, the identification step is relatively an easy one. Even when it is recognised that the concept of a poverty line-as a threshold that dichotomises the population into the poor and the non-poor- is somehow artificial, it is agreed to be necessary. Greater consideration is given to the properties that should be satisfied by the poverty index that will aggregate individuals' data into an overall indicator. However, in the multidimensional context, the identification step is more complex. Given a set of dimensions, each of which has an associated deprivation cutoff or poverty line, it is possible to identify for each person whether he/she is deprived or not in each dimension. However, the difficult task is to decide who is to be considered multidimensionally poor.

One proposed approach has been to aggregate achievements in each dimension into a single cardinal index of well-being and set a deprivation cutoff value for the well-being measure rather than for each specific dimension to identify the multidimensionally poor. This approach has some practical drawbacks, in particular, in that it is based on a number of restrictive assumptions, such as the existence of prices for all dimensions. Moreover, it does not agree with the conceptual framework of the capability approach which considers each dimension to be intrinsically important. Then, each dimension with its corresponding deprivation cutoff value needs to be considered at the identification step of the multidimensionally poor.

In this perspective, two extreme approaches have been traditionally used. On the one hand, there is the *intersection* approach, which requires the person to be poor in every dimension under consideration so as to be identified as multidimensionally poor. Clearly, this is a demanding identification criterion, by which the set of the poor is reduced as the number of dimensions considered increases, and may exclude people that are indeed deprived in several important dimensions. On the other hand there is the *union* approach, which requires the person to be poor in at least one of the considered dimensions. Clearly, with this criterion, the set of poor increases as the number of dimensions does, and it may include people that many would not considered to be multidimensionally poor (Alkire and Foster, 2007, pp.8). The union approach has received important support both in the theoretical and empirical literature. In particular, Tsui (2002) and Bourguignon and Chakravarty (2003) adopt it for the measures they propose.

Tsui (2002) develops an axiomatic framework for multidimensional poverty measurement (which includes subgroup consistency) and derives two relative multidimensional poverty measures, one of which is a generalization of Chakravarty's (1983) one-dimensional class of poverty indices, and the other is a generalization of Watt's (1968) poverty index. He also derives two absolute multidimensional poverty measures.[1]

Bourguignon and Chakravarty (2003) distinguish two groups of multidimensional poverty indices, depending on whether they consider dimensions to be independent or to have some substitutability or complementarity. Those that consider

[1] The distinction between relative and absolute poverty indices is due to Blackorby and Donaldson (1980). Relative poverty indices are invariant to changes in scale, such as a doubling of the poverty line and all incomes, while absolute indices are invariant to translations or additions of the same absolute amount to each income and to the poverty line (Foster and Shorrocks, 1991). In practice, relative poverty indices are the ones that have been most frequently used.

attributes to be independent satisfy what they call the One Dimensional Transfer Principle, by which poverty decreases whenever there is a Pigou-Dalton progressive transfer of the achievement in some dimension between two poor people. The progressive nature of the transfer is judged by the achievements of the two poor people in that specific dimension, independently of the achievements in the other dimensions. These indices are additively decomposable. The second group of indices are non-additive –ie. non decomposable- and by choosing appropriate values of the parameters they can reflect either a substitutability or a complementarity relationship between the dimensions. For both groups of indices, extensions of the FGT class are proposed.

On a more practice-based perspective, the Unsatisfied Basic Needs Approach, widely used in Latin America, also uses a union criterion, identifying as households with unsatisfied basic needs those that are deprived in one or more of the selected indicators.

In view of the two prevailing extreme criteria to identify the multidimensionally poor, Alkire and Foster (2007) propose a new identification methodology which, while containing the two extremes, also allows for intermediate options. Assume that there are $k = 1,.....,d$ considered dimensions, and that c_i represents the number of dimensions in which individual $i = 1,.....,n$ is deprived, then an individual is considered to be multidimensionally poor if $c_i \geq k$. When $k = 1$, the approach coincides with the union approach, whereas when $k = d$, it is the intersection approach. For $1 < k < d$, the identification criterion lies somewhere in the middle between the two extremes. Then, for the aggregation step, they use the well-known FGT class of poverty indices. The resulting family of measures satisfies a set of convenient properties including decomposability by population subgroups and the possibility of being broken down by dimensions. These last properties

make it particularly suitable for policy targeting. Additionally, the class includes measures that can be used with ordinal data, which is very common in a multidimensional context. A detailed description of this class of measures is presented in Section 3.2.

A final note must acknowledge the probably most popular multidimensional poverty measure, which is the Human Poverty Index (HPI), developed by Anand and Sen (1997), companion index of the Human Development Index (HDI). Both indices are periodically estimated by the United Nations Development Programme for all countries to monitor the level of deprivation and development correspondingly with a broader perspective than income. The components of the HPI are survival deprivation (measured by the probability at birth of not surviving to age 40), deprivation of education and knowledge (measured by the adult literacy rate) and economic deprivation (measured by the average of the percentage of population without access to an improved water source and children under weight for age). In developed countries the indicators for each of the components are specified according to the higher living standards.[2] An important advantage of the HPI is that it only requires macro-data, which can be especially important for countries in which micro-data collection is still at its beginnings and its quality is not assured. However, it has some disadvantages. Clearly, the three selected dimensions can be argued to be arbitrary as well as the weighting system used to calculate the measure. When micro-data sets are available more informative measures can be calculated, with a higher number of dimensions and alternative weighting systems.

[2] In particular, the survival deprivation is estimated as the probability at birth of not surviving to age 60, the deprivation of education and knowledge is defined as adults lacking functional skills, the economic deprivation is defined as the percentage of population below 50% of he median adjusted disposable income, and a social exclusion component is also added, defined as the rate of long-term unemployment (lasting 12 months or more).

3. Methodology

3.1 Data

The dataset used is the 2007 Bhutan Living Standard Survey (BLSS) conducted by the National Statistics Bureau (NSB). There are 9798 households in the sample and 49165 people. This is the second BLSS performed; the previous one was done in 2003. Both surveys have followed the Living Standard Measurement Study methodology developed by the World Bank. However, the 2007 survey has more than doubled the 2003 sample size and it has also extended the coverage, so that the sample is representative both nationally and at each of the 20 Bhutanese districts (Dzongkhags), in rural and urban areas.

The unit of analysis to identify the poor is the household. However, households are weighted by their size (as well as by their sample weights), so that results are presented in population terms. Table A.1 in the Appendix presents the composition of the sample.

3.2 Multidimensional poverty measures

The poverty measure applied in this paper corresponds to Alkire and Foster's (2007) family of multidimensional poverty measures. Before introducing it, it is convenient to clarify notation in the first place.

Let $M^{n,d}$ denote the set of all $n \times d$ matrices, and interpret a typical element $y \in M^{n,d}$ as the matrix of achievements of n people in d different dimensions. For every $i = 1,2,...,n$ and $j = 1,2,...,d$, the typical entry y_{ij} of y is individual i's achievement in dimension j. The row vector $y_i = (y_{i1}, y_{i2}, ..., y_{id})$ contains individual i´s achievements in the different dimensions; the column vector $y._j = (y_{1j}, y_{2j}, ..., y_{nj})'$ gives the distribution of achievements

in dimension j across individuals. Let $z_j > 0$ be the deprivation cutoff value (or poverty line) in dimension *j*. Following Alkire and Foster (2007)'s notation, the sum of entries in any given vector or matrix υ is denoted by $|\upsilon|$, while $\mu(\upsilon)$ is used to represent the mean of υ (or $|\upsilon|$ divided by the number of entries in υ).

For any matrix y, it is possible to define a matrix of deprivations $g^0 = [g_{ij}^0]$, whose typical element g_{ij}^0 is defined by $g_{ij}^0 = 1$ when $y_{ij} < z_j$, and $g_{ij}^0 = 0$ when $y_{ij} \geq z_j$. That is, the ij^{th} entry of the matrix is 1 when person *i* is deprived in dimension *j*, and 0 when he/she is not. From this matrix, define a column vector of deprivation counts, whose i^{th} entry $c_i = | g_i^0 |$ represents the number of deprivations suffered by person *i*. If the variables in y are cardinal, then a matrix of normalised gaps $g^1 = [g_{ij}^1]$ can be defined, where the typical element $g_{ij}^1 = (z_j - y_{ij}) / z_j$ when $y_{ij} < z_j$, and $g_{ij}^1 = 0$ otherwise. The entries of this matrix are non-negative numbers between 0 and 1, and each non-zero entry gives the extent of the deprivation experienced by person *i* in dimension *j*. This matrix can be generalised to $g^\alpha = [g_{ij}^\alpha]$, with $\alpha > 0$, whose typical element g_{ij}^α is the normalised poverty gap raised to the α-power.

The methodology to identify the multidimensionally poor proposed by Alkire and Foster (2007) compares the number of deprivations with a cutoff level *k*. When each selected dimension has the same weight, the possible values of *k* go in the range of $k = 1,.....,d$. However, the methodology also allows other weighting systems, which will be explained at the end of the section. In general, for any weighting system, let ρ_k be the identification method such that $\rho_k(y_i, z) = 1$ when

$c_i \geq k$, and $\rho_k(y_i, z) = 0$ when $c_i < k$. That means that an individual is identified as multidimensionally poor if he/she is deprived in at least k dimensions. This methodology is said to be a *dual cutoff* method, because it uses the *within dimension* cutoffs z_j to determine whether an individual is deprived or not in each dimension, and the *across dimensions* cutoff k to determine who is to be considered multidimensionally poor. It is also presented as a *counting approach*, since it identifies the poor based on the number of dimensions in which they are deprived. When equal weights are used, when $k = 1$, the identification criterion corresponds to the union approach, whereas when $k = d$, the identification criterion corresponds to the intersection approach. This identification criterion defines the set of the multidimensionally poor people as $Z_k = \{i : \rho_k(y_i; z) = 1\}$. Once identification is applied, a censored matrix $g^0(k)$ can be obtained from g^0 by replacing the i^{th} row with a vector of zeros whenever $\rho_k(y_i, z) = 0$. Matrix $g^\alpha(k)$ can be defined analogously for $\alpha > 0$, with its typical entry $g_{ij}^\alpha(k) = g_{ij}^\alpha$ if i is such that $c_i \geq k$, while $g_{ij}^\alpha(k) = 0$ if i is such that $c_i < k$.

A first natural measure to consider is the percentage of people that are multidimensionally poor: the multidimensional Headcount Ratio $H = H(y; z)$ defined by $H = q/n$, where q is the number of people in set Z_k. This measure is the analogous to the unidimensional Headcount Ratio, and it has the advantages that it is easy to compute and understand, and that it can be calculated with ordinal data. However, it suffers from the disadvantages first pointed by Watts (1969) and Sen (1976) for the one-dimensional case, namely, being insensitive to the depth and distribution of poverty, violating monotonicity and the transfer axiom. Moreover, in the multidimensional context, it also violates what Alkire and

Foster (2007) call *dimensional monotonicity*: if a poor person becomes deprived in an additional dimension (in which he/she was not previously deprived), *H* does not change.

Considering this, Alkire and Foster (2007) propose the dimension adjusted FGT measures, given by $M_\alpha(y;z) = \mu(g^\alpha(k))$ for $\alpha \geq 0$. When $\alpha = 0$, the measure is the Adjusted Headcount Ratio, given by $M_0 = \mu(g^0(k)) = HA$, which is the total number of deprivations experienced by the poor ($|c(k)| = |g^0(k)|$), divided by the maximum number of deprivations that could possibly be experienced by all people (nd). It can also be expressed as the product between the percentage of multidimensionally poor individuals (*H*) and the average deprivation share across the poor, which is given by $A = |c(k)|/(qd)$. In words, *A* provides the fraction of possible dimensions *d* in which the average multidimensionally poor individual is deprived. In this way, M_0 summarises information on both the incidence of poverty and the average extent of a multidimensional poor person's deprivation. As *H*, this measure is easy to compute, and can be calculated with ordinal data. However, it is superior to *H* in that it satisfies dimension monotonicity: if a poor becomes deprived in an additional dimension, *A* will increase and therefore M_0 will also increase.

When $\alpha = 1$, the measure is the Adjusted Poverty Gap, given by $M_1 = \mu(g^1(k)) = HAG$, which is the sum of the normalised gaps of the poor ($|g^1(k)|$) divided by the highest possible sum of normalised gaps (nd). It can also be expressed as the product between the percentage of multidimensionally poor individuals (*H*), the average deprivation share across the poor (*A*) and the average poverty gap (*G*), which is given by $G = |g^1(k)|/|g^0(k)|$. M_1 summarises information on the incidence of poverty, the average range of deprivations and

the average depth of deprivations of the poor. It satisfies not only dimension monotonicity but also monotonicity: if an individual becomes more deprived in a certain dimension, M_1 will increase.

Finally, when $\alpha = 2$, the measure is the Adjusted Squared Poverty Gap, given by $M_2 = \mu(g^2(k)) = HAS$, which is the sum of the squared normalised gaps of the poor ($|g^2(k)|$) divided by the highest possible sum of normalised gaps (nd). It can also be expressed as the product between the percentage of multidimensionally poor individuals (*H*), the average deprivation share across the poor (A) and the average severity of deprivations (*S*), which is given by $S = |g^2(k)| / |g^0(k)|$. M_2 summarises information on the incidence of poverty, the average range and severity of deprivations of the poor. If a poor person becomes more deprived in a certain dimension, M_2 will increase more the larger the initial level of deprivation was for this individual in this dimension. This measure satisfies both types of monotonicity and also transfer, being sensitive to the inequality of deprivations among the poor.

All members of the $M_\alpha(y;z)$ family are decomposable by population subgroups. Given two distributions *x* and *y*, corresponding to two population subgroups of size $n(x)$ and $n(y)$ correspondingly, the weighted average of sum of the subgroup poverty levels (weights being the population shares) equals the overall poverty level obtained when the two subgroups are merged:

$$M(x,y;z) = \frac{n(x)}{n(x,y)} M(x;z) + \frac{n(y)}{n(x,y)} M(y;z)$$

Clearly, this can be extended to any number of subgroups.

Additionally, once the identification step has been completed, all members of the $M_\alpha(y;z)$ family can be broken down into dimension subgroups. To see this, note that the measures can be expressed in the following way: $M_\alpha(y;z) = \sum_{i=1}^{n} \mu(g^{\alpha}_{*j}(k))/d$, where g^{α}_{*j} is the j^{th} column of the censored matrix $g^{\alpha}(k)$. Strictly speaking, this is not decomposability in terms of dimensions, since the information on all dimensions is needed to identify the multidimensionally poor. However, it is still a very convenient break-down property. Once identification has been applied, and the non-poor rows of g^{α} have been censored to obtain $g^{\alpha}(k)$, for each *j*, $(\mu(g^{\alpha}_{*j}(k))/d)/M_\alpha(y;z)$ can be interpreted as the post-identification contribution of dimension *j* to overall multidimensional poverty.

The $M_\alpha(y;z)$ family adopts the neutral assumption of considering dimensions as independent. In this way, it satisfies a property, based on Atkinson and Bourguignon (1982), called *weak rearrangement*. Imagine that one individual that begins with weakly higher achievements in every dimension than another individual, switches one or more dimension achievement levels with this other individual, so that this ranking no longer holds. This is called an association decreasing rearrangement. Under such rearrangement one would expect multidimensional poverty not to increase. This is postulated by the weak rearrangement axiom and it is precisely satisfied by the $M_\alpha(y;z)$, which will not change under such transformation. Because of its completely additive form, it evaluates each individual's achievements in each dimension independently of the achievements in the other dimensions and of others' achievements. In this way, the $M_\alpha(y;z)$ family can be

associated with the first group of measures of Bourguignon and Chakravarty (1983).[3]

Until now, the $M_\alpha(y;z)$ family has been presented assuming that all dimensions receive the same weight. However, the family can be extended into a more general form, admitting different weighting structures. Let w be a d dimensional row vector, whose typical element w_j is the weight associated with dimension *j*. Then, define the matrix g^α of size $n \times d$, where the typical element $g_{ij}^\alpha = w_j((z_j - y_{ij})/z_j)^\alpha$ when $y_{ij} < z_j$, while $g_{ij}^\alpha = 0$ otherwise. Then, as before, from this matrix, a column vector of deprivation counts can be defined, whose i^{th} entry $c_i = \| g_i^0 \|$ represents the sum of weights for the dimensions in which person i is deprived. c_i varies between 1 and *d*, and so the dimensional cutoff for the identification step of the multidimensionally poor will be a real number *k*, such that $0 < k \leq d$. Note that when $k = \min\{w_j\}$, the criterion coincides with the union approach, whereas when $k = d$, it is the intersection approach. Also note that when $w_j = 1$, it is the previous case where all dimensions receive the same weight and the dimensional cutoff *k* is an integer. Then, the methodology works exactly in the same way as before, defining the

[3] Alkire and Foster (2007) explain that their measures can be converted into measures that consider either all dimensions as substitutes or all dimensions as complements, and in this way, they would be in line with the second type of measures considered by Bourguignon and Chakravarty (2003). However, they remark that imposing the same type of relationship between all dimensions, and with the same assumed degree of either substitutability or complementarity seems rather restrictive. Moreover, such transformation would be at the cost of losing the possibility of breaking down the measure into dimensions.

censored matrices $c(k)$ and $g^{\alpha}(k)$, and the $M_{\alpha}(y;z)$ measures.

3.3 Dimensions and deprivation cut-offs

The selection of the dimensions for the multidimensional poverty measure is guided by the eight Millennium Development Goals (MDG) that Bhutan has defined to fulfil the Millennium Declaration, and it is subject to data availability.[4] Table 1 presents the dimensions with their corresponding cutoff values.

Having an adequate income, and for rural households, having access to roads and owing some land, can be framed into the first MDG, which is *to Eradicate Extreme Poverty and Hunger*. For the income cutoff, the official Bhutanese poverty line was used, which is calculated in Nu 1,096.94 per capita per month. During 2007, this was equivalent approximately to US$25. This poverty line is composed of a food poverty line, which is the cost of a food basket consisting of 53 items that is considered to fulfil the requirement of 2,124 Kcal. per person per day, plus a non-food allowance.[5] Given that the

[4] The eight goals are: Goal 1: Eradicate extreme poverty and hunger, Goal 2: Achieve universal primary education, Goal 3: Promote gender equality and empower women, Goal 4: Reduce child mortality, Goal 5: Improve maternal health, Goal 6: Combat HIV/AIDS, malaria and other diseases, Goal 7: Ensure environmental sustainability, Goal 8: Develop a global partnership for development.

[5] The 2,124 Kcal per person per day is the nutritional norm applied in Nepal, and the NSB decided to follow it for the case of Bhutan. The cost of the food poverty line is Nu 407.98, which in 2007 was equivalent to US$ 9 approximately. The NSB does not account for differences in nutritional requirements across age and sex, that is, they do not use equivalised scales. They do not account for economies of scale in the household either. Despite this, it is a common practice to consider both issues in poverty estimates. It was decided to stick to the NBS methodology to make the results of this paper comparable to the official income poverty estimates. The non-food allowance is estimated averaging the non-food per capita expenditure of households in the reference population that spent for

percentage of people below the food poverty line is only 6%, the target in Bhutan with respect to this MDG is more demanding, and it consists of halving poverty, rather than extreme poverty (2005 MDG Progress Report). This is why the overall poverty line rather than the food poverty line is used for the multidimensional poverty estimation. If a household does not make a monthly per capita income of at least Nu 1,096.94, it is considered *income deprived*, and so are all its household members.

To achieve the mentioned target in terms of income poverty, Bhutan faces some significant constraints, one of which is the geographical isolation of some rural areas. Lack or limited road access and links to markets impede the development of the area and, more seriously, it can cause food shortage in these remote regions. The further development of rural road and communication infrastructure and access to markets has become a priority in the country. Based on this, access to services is included among the selected dimensions. A household in a rural area that can not reach either a feeder or a tarred road within 30 minutes by any means of transport, it is considered to be *access deprived*, and so are all its household members.

Another potential constraint to reduce poverty regards land ownership. Households in rural areas with small land holdings are at risk in terms of food access, since small land holdings are usually compounded with low productivity, inadequate storage facilities, poor irrigation and vulnerability to natural disasters, crop depredation by wild animals, birds and pests (2005 MDG Progress Report, pp. 26-28). The BLSS has information on different type of land holdings: wet land, dry land, orchard, sokshing (leaf litter wood lot), pasture and tseri (swidden cultivation land). Given that sokshing and pastures have been recently nationalised, it was decided to only consider the other four types of land. Despite the differences of land qualities between the different types of

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food a value near the food poverty line.

land, a deprivation cutoff of 1 acre of total land holding (either any of them or the sum of any combination) was defined. The selected threshold is clearly debatable. However, 1 acre seems a reasonable amount of land that would allow cultivating for subsistence, even considering that land quality may vary.[6] A household in a rural area with less than 1 acre of land holdings is considered to be *land deprived,* and so are all its household members.

A third selected dimension is closely related to the second MDG: *Achieve Universal Primary Education*. The target of the country regarding this MDG is that by 2015 all children are able to complete a full course of primary schooling. The country has achieved significant progress towards this target, raising the primary enrolment rate from 55% in 1990 to 84% in 2004. Reaching children in rural and remote communities, reducing early dropouts, and improving the quality of education are among the priorities of the education policy and programs. A need to expand secondary school education has also been identified, as the number of those completing primary education continues to increase.

The education indicator constructed for this paper is composed of two requirements. In the first place, following Basu and Foster's (1998) idea of *proximate literacy,* it is required that at least one household member is literate. The logic behind this is that illiterate people that live in a household where at least someone is literate enjoy some of the literate person's abilities; in other words, they enjoy an intra-household externality. Despite that the literacy rate in the country is still low (55%), the proximate literacy requirement is a mild one, since even if the adults in the household are illiterate, as long as the children are literate - which is very likely given the progress in primary school enrolment, the household will be considered literate.

[6] Although an absolute poverty line approach is followed for all indicators in this paper, it is worth mentioning -for reference-, that 1 acre is half of the median rural land holdings and less than the country's median land holdings (which is 1.32 acres).

However, the second requirement for the education indicator is that all children between 6 and 16 years of age are attending school. This is in line with the mentioned MDG. On the one hand, it is more demanding than the target, in that children are required to be in school even at an older age than what primary education demands. On the other hand, it is not excessively demanding since children are not required to be in the school grade corresponding to their age (even if a 16 year old was in primary school, the household would satisfy the requirement). A household with no-literate member and with children between 6 and 16 years of age that are not attending school is considered to be *education deprived*, and so are all its household members.

The following two dimensions are directly related to the seventh MDG: *Ensure Environmental Sustainability*. Increasing the access to electricity (especially in rural areas) is one of the key objectives within this goal, since it will not only improve the living conditions of the rural population but it will also reduce the proportion of population using solid fuels improving the quality of the air. Bhutan would like to achieve "electricity for all" by 2020 and it is working steadily towards this goal. A household with no access to electricity is considered to be *electricity deprived*, and so are all its members. Access to safe drinking water is another key objective within this goal and Bhutan has progressed significantly in increasing this access. However, there are areas in which more progress can still be made, so this dimension was selected as one to be considered for multidimensional poverty measurement. A household with no access to either a pipe in dwelling, a neighbour's pipe, a public outdoor tap or a protected well, is considered to be *water deprived*, and so are all its members.

It is worth mentioning that within the goal to ensure environmental sustainability, increasing the access to safe sanitation is also considered. However, Bhutan has progressed tremendously in extending the access to improved sanitation, that only 3.6% of the population is deprived in

this dimension. Therefore, it was decided not to include it among the dimensions of the multidimensional poverty measure to be estimated.

Finally, the number of people per room in the household is also considered. Although this is not included as a target in any of the 8 Goals of Bhutan, it is a commonly used socio-economic assessment indicator, since it provides a measure of housing quality. It is mentioned as an indicator in the 2003 Indicators for Monitoring the Millennium Development Goals. It can be related to Goal 7, since dwelling's overcrowding can promote different type of diseases and it does not contribute to a sustainable environment. A household with 3 or more people per room is considered to be *room deprived*, and so are all its members. The number of rooms excludes kitchens, bathrooms, toilets and balconies. The use of 3 or more people is quite standard in different countries.

Table 1: Selected dimensions, deprivation cut-off values and weights

Dimension	**Deprivation Cutoff value**
Rural and Urban Areas	
Related to MDG 1: Eradicate Extreme Poverty and Hunger	
Income	Have monthly per capita income of Nu 1096.94 pc p/month (Bhutan Poverty Line)
Related to MDG 2: Achieve Universal Primary Education	
Education	At least one literate household member and all children between 6 and 16 are going to school.
Related to MDG 7: Ensure Environmental Sustainability	
Access to Electricity	Access to electricity
Access to Drinking Water	Access to drinking water (either pipe in dwelling, neighbour's pipe, public outdoor tap or protected well)
Room Availability	Less than 3 people per room
Rural Areas Only: Two additional MDG1-related dimensions are considered	
Access to Roads	Access to either a feeder or a tarred road in 30

	minutes or less (by any means of transport).
Land Ownership	Own at least 1 acre of land of any kind. (Land is the sum of wet land, dry land, orchard and tsheri (swidden cultivation land)).

Clearly, the list of dimensions is not intended to be exhaustive. There are another four MDGs that Bhutan is trying to accomplish, and within all the eight goals there are many other indicators which could be considered. However, there are two difficulties. In the first place, not all goals and targets are applicable to obtain a multidimensional poverty estimate from micro-data that is relevant for the whole population. For example, even when *Improving Maternal Health* (Goal 5) is a goal of utmost importance, indicators that account for these issues at the household level would only have meaning for households with pregnant or recently pregnant women. Secondly, even when indicators on some of the other goals, such as *Reducing Child Mortality* (Goal 4), or *Combating HIV/AIDS, Malaria and Other Diseases* (Goal 6) could be included, the BLSS does not provide information on these issues. Goal 3 of *Promoting Gender Equality and Empowering Women* is also a fundamental one, but it is centred on a specific part of the population. Finally, the targets included in Goal 8 of *Developing a Global Partnership for Development* (such as telephone density or computers in use) might not be necessarily associated with poverty, especially in a country that is in the first stages of modernisation.

All the selected dimensions refer to material-conditions. However, there are basis to argue that other non-material conditions should also be included in the measurement of multidimensional poverty as it is suggested by the capability approach. The Oxford Poverty and Human Development Initiative (OPHI), at the University of Oxford, has identified five *missing dimensions* of poverty, namely: the quality of employment, empowerment, physical safety, the ability to go about without a shame and psychological and subjective wellbeing (Alkire, 2007). Unfortunately data on any of these

dimensions is not available in the BLSS, so indicators related to these dimensions can not be included in the estimations of this paper. Most of these data are available in this GNH Survey but the period of survey and respondents are not compatible with the BLSS data set. On the other hand, GNH Survey does not include questions on a few requisite data like water and sanitation. However, Bhutan is planning to incorporate questions on these issues in poverty surveys in the near future. This will eventually allow broadening and enriching the present analysis.

In any case, given Bhutan's interest in non-traditional dimensions and in a holistic approach to the measurement of well-being, the main purpose of this paper is an illustrative one: to demonstrate the methodology and its potential both for multidimensional poverty measurement as well as for budget allocation. A different list of dimensions could be used eventually.

Provided that four out of the seven selected indicators are dichotomous variables, only the multidimensional Headcount Ratio H and M_0 are estimated. These two measures are estimated for both urban and rural areas considering the five dimensions applicable to both areas: income, education, room availability, electricity and water. The two measures H and M_0 are also estimated only for rural areas considering all the seven dimensions.

3.4 Weighting

The selection of dimensions to be included is not the only controversial task when measuring multidimensional poverty. Defining the weights to give to each dimension is another difficult issue since it implicitly entails value judgements (Decanq and Lugo, 2008). In this paper, two groups of estimations were performed for each measure. One of them uses equal weights, assigning a value of one to each dimension. This can be thought as a benchmark, since it implicitly assumes that all dimensions are equally important.

The second group of estimates uses a set of weights derived from the 2007 Gross National Happiness Survey (GNHS). One of the questions of this survey, which had a sample size of 950 people, required the respondent to rank his/her sources of happiness. The question was an open one, so that the respondent could mention any source of happiness that was important for him/her. Answers were then grouped and categorised. Interestingly, the seven dimensions selected in this paper are among the dimensions ranked in the ten first places.[7] The percentage of people that placed each of the selected dimensions at some point in the ranking was re-scaled so as to add up to the total number of dimensions used, obtaining the weights listed in Table 2.

Table 2: Weights derived from the Gross National Happiness Survey

Dimension	**% of responses by 950 respondents who mentioned it as a source of happiness**	**Derived Weight For the urban & rural estimates**	**Derived Weight For the urban & rural estimates**
Income	41%	2.0	2.0
Education	27%	1.3	1.3
Room Availability	14%	0.7	0.7
Electricity	16%	0.8	0.8
Water	4%	0.2	0.2
Access to Roads	27%	-	1.3
Land Ownership	15%	-	0.7

[7] The list of 'sources of happiness' derived from this question of the GNHS, ranked in order of their preference reads: financial security, transportation, education, good health, family relationships, agricultural productivity, electricity, basic needs (food, clothing, shelter, cleaning drinking water), land, housing, good governance, health infrastructure and facilities, faith and spiritual practices, community relationship, job, national security, communication facilities, environment, sports and travelling.

	5	7

Note: Room Availability was not listed itself as a source of happiness, but 'Housing' was, so the percentage of people mentioning this was used to derive this weight. Access to roads was listed within 'Transportation'.

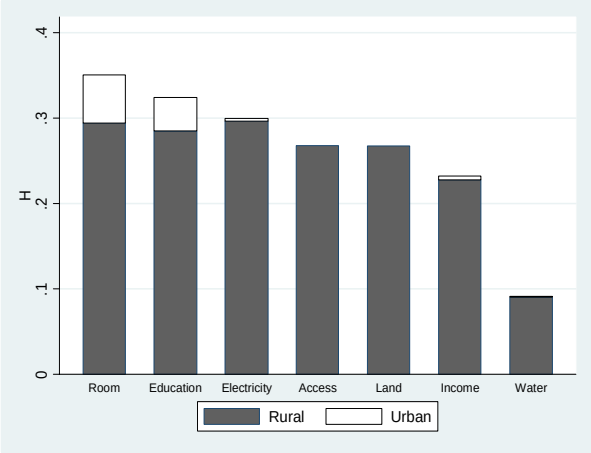
4. Estimation results

4.1 Aggregate deprivation by dimension

Figure 1 presents the estimated Headcount in each dimension, ranked from highest to lowest. It also shows the contribution to the overall deprivation in each of them done by rural and urban areas. Note that, by definition, all the deprivation in access to roads and land ownership corresponds to rural areas.

From this graph, it can be seen that while 23% of the population do not earn enough income to afford the basic needs basket, the incidence of deprivation in all the other dimensions except for water is higher. In particular, 35% of the population in Bhutan live in a household with 3 or more people per room, 32% live in a household where either no-one is literate or there are children in school age not going to school and 30% do not have access to electricity. Only 9% do not have access to drinking water. Virtually all the deprived population in electricity, income and water live in rural areas. Most of the population deprived in room and education also live in rural areas, although it is worth noting that 12% of all the deprived in room and 15% of all the deprived in education live in urban areas, suggesting that improvement in these two dimensions is also needed in urban areas. Among people living in rural areas, 26.7% do not have access either to a tarred or to a feeder room within 30 minutes, and the same percentage owns less than one acre of land.

Figure 1: Head Count Ratio in each Dimension Rural and Urban Contributions



These figures provide a first basis for priorities within the selected dimensions in terms of policy design. They also suggest that deprivation is mainly a rural phenomenon, where 74% of the population in Bhutan live. This provides a strong reason to focus deprivation-reducing efforts in these areas.

4.2 Aggregate multidimensional poverty estimates

4.2.1 Rural and urban estimates with five dimensions

Table 3 presents the estimates of the Multidimensional Headcount Ratio (*H*) and the Adjusted Headcount Ratio for both urban and rural areas using the five dimensions applicable to both, for different values of *k*, using equal weights and the weights derived from the GNHS.

It should be noted that the meaning of each *k*-value in the estimates using the GNHS weights differs from the meaning when equal weights are used. With equal weights *k*=1 requires for someone to be considered multidimensionally poor to be deprived in at least one of the five dimensions,

which can be any of them. With GNHS weights, k=1 implies requiring being deprived in at least a dimension or a combination of dimensions which weights add to 1. For example, someone deprived only in safe water is not considered to be multidimensionally poor with k=1, neither is considered someone deprived only in room or in electricity. However, someone deprived only in income or only in education is considered multidimensionally poor with k=1, as well as someone deprived both in water and electricity, electricity and room or electricity and water, for example. The H and M_0 measures using GNHS weights were estimated for all possible values of k, which range from 0.2 to 5, and not only the entire values from 1 to 5. For simplicity and comparison purposes Table 3 presents the estimates only for the same five values of k for which the measures using equal weights were estimated.

Clearly, both with equal weights and GNHS weights, the multidimensional poverty estimates decrease as k increases. With equal weights, estimates indicate that 64% of the population is deprived in one or more of any the five dimensions, and -on average- they are deprived in 2 dimensions, so that the Adjusted Headcount Ratio M_0 is 0.26. Analogously, 37% of the population in rural and urban areas is deprived in two or more of the five dimensions, and on average, they are deprived in 2.7 dimensions, so that the Adjusted Headcount Ratio is 0.20. The percentage of people deprived in 3 or more dimensions is 20%, with M_0 being 0.14 and people being deprived on average in 3.5 dimensions. The estimates are smaller for k=4 and finally only 1.4% of the population is deprived in all the five dimensions. The estimates using GNHS weights are smaller for k=1 to k=3, which is a consequence of the lower importance given to some of the dimensions such as people per room, electricity and water, so that combinations of these deprivations are equivalent to being deprived only in income or only in education. With k=4, H and M_0 with GNHS weights are slightly higher than with equal weights because people deprived in a combination of three dimensions (such as

income, education and room) are considered multidimensionally poor (since their weights add up to 4) but are not considered multidimensionally poor with k=4 in the equal weighting system. Obviously, when it is required to be deprived in all 5 dimensions to be considered multidimensionally poor, all estimates coincide and are indeed very low.

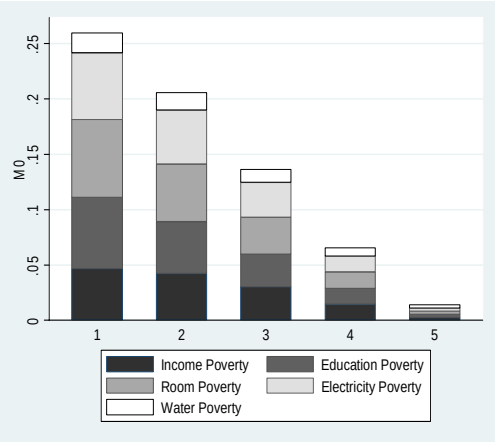
Table 3: Multidimensional Headcount Ratio (H) and Adjusted Headcount Ratio (M_0) in rural and urban areas - Different k values -Equal weights and GNHS weights
Five Dimensions considered

K	Equal Weights			GNHS Weights		
	H	**M_0**	**Average Deprivation**	**H**	**M_0**	**Average Deprivation**
1	0.64	0.26	2.0	0.48	0.23	2.4
2	0.37	0.20	2.7	0.34	0.19	2.8
3	0.20	0.14	3.5	0.17	0.12	3.5
4	0.08	0.06	3.75	0.11	0.08	3.6
5	0.014	0.014	5	0.014	0.014	5

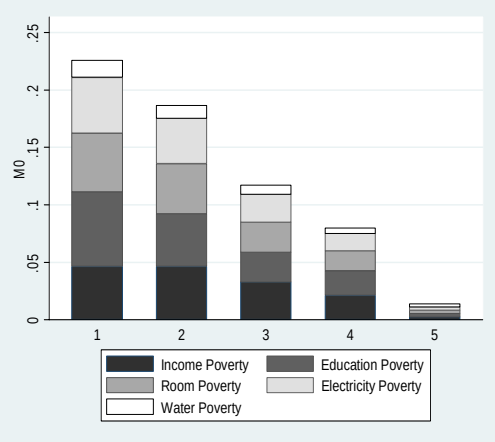
The multidimensional poverty incidence (H) estimates can be related to the one-dimensional (income) poverty incidence, which is 23%. One should always present the estimates for the different k-values. However, if one had to choose a value to define policy, k=2 might be a reasonable intermediate cutoff which focused the attention on a set of people narrow enough so as to ensure that they are indeed multidimensionally deprived, and broader enough so as to include people that, even if not deprived in a high number of dimensions, they still experience deprivation in several relevant ones.

A natural question is how does deprivation in each dimension contributes to the overall multidimensional poverty. This can be analysed breaking down M_0 by the dimensions, which is precisely one of the advantages of this measure. Figure 2 presents this decomposition in the form of a bar graph for each k value with each of the weighting systems.

Figure 2: Multidimensional Adjusted Headcount Ratio (M_0) in rural and urban areas
Different k – Contributions by each of the five dimensions



(a) Equal Weights



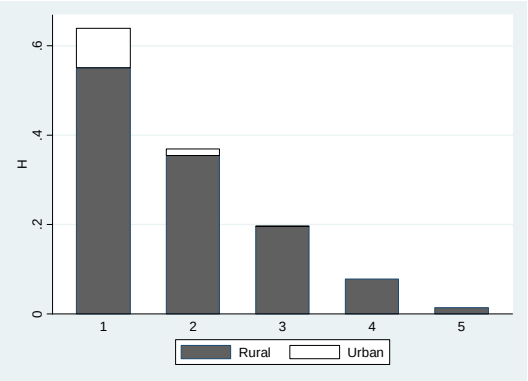
(b) GNHS Weights

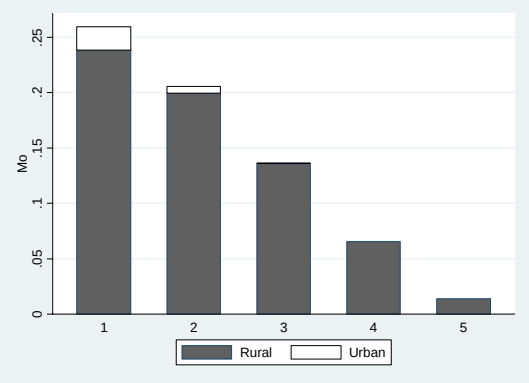
In the figure it can be seen that income, education, room and electricity have roughly similar contributions to overall M_0 for k=1 to k=4 in both weighting systems, whereas water is clearly the dimension with the smallest contribution. Within the four dimensions with similar contributions, when equal weights are used and k=1, room is the one with the highest contribution (27%), followed by education (25%), electricity (23%) and income (18%). Poverty in water contributes with only 7%. When k=2, the ranking of contributions is similar, except that electricity has a slightly higher contribution than education (23% *vs.* 22%). When k=3 and k=4, the ranking order is room, electricity, income, education and water. It is interesting to note that when the GNHS weights are used, the rankings of the contributions differ from the case of equal weights. With k=1, deprivation in education gives the highest contribution (29%), followed by room (23%), electricity (21.5%), income (20.5%) and water (6%). With k=2, the ranking is income (25%), education (24.5%), room (23.5%), electricity (21%) and water (6%). With k=3 and k=4, the rankings are the same, except that with k=3, education switches the place with room. The fact that education ranks first with k=1, and income ranks first in the other cases, is reflecting the higher weight given to these two dimensions when GNHS weights are used. Overall, and by definition, as k approaches the maximum k value, the structure of contributions by each dimension approaches to an *equal*-contribution. When k=5, each dimension contributes with 20%.

Another interesting decomposition of the aggregate multidimensional poverty measures is between rural and urban areas. Figure 3 presents the estimates of H and M_0 contained in table 3 with the corresponding contributions of rural and urban areas. These are consistent with what was suggested in Graph 1. Only in the case of k=1 does the urban areas have some contribution to overall H and M_0, which is 14% to overall H with equal weights and 9% with GNHS weights, and it is 8% to overall M_0 with equal weights and 5% with GNHS weights. These results reinforce previous results

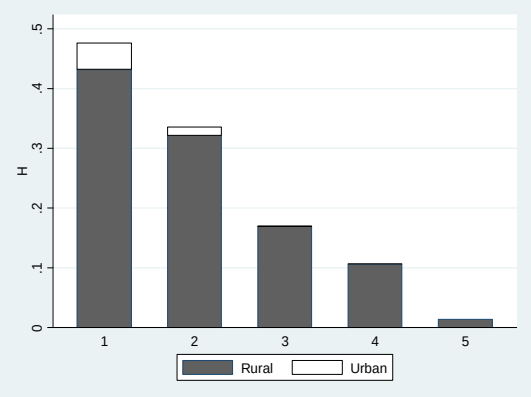
from the 2004 and 2007 *Poverty Analysis Reports*, which had identified income poverty as a predominantly rural phenomenon. The estimates in this paper suggest that multidimensional poverty is also fundamentally a rural problem.

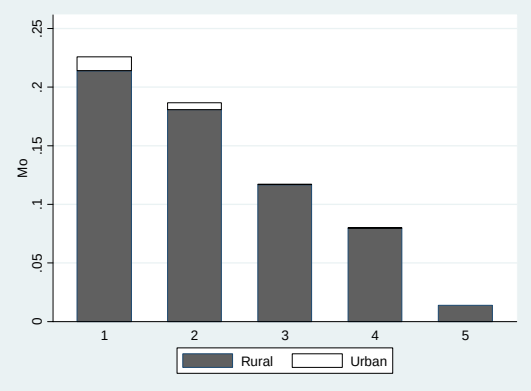
Figure 3: Multidimensional Poverty Headcount Ratio and Adjusted Headcount Ratio
Different k – Rural and Urban Contributions





(a) Equal Weights





(b) GNHS Weights

4.2.2 Rural estimates with seven dimensions

Given that multidimensional poverty is virtually all concentrated in rural areas, it is worth estimating H and M_0 only for these areas, expanding the set of dimensions to also include deprivation in access to roads and land ownership. These results are presented in table 4, both using equal weights and GNHS weights, for different values of k. The same comment given when explaining table 3 on the meaning of the k-cutoff with GNHS weights applies here.

Table 4: Multidimensional Headcount Ratio (H) and Adjusted Headcount Ratio (M_0) in rural areas only - Different k values - Equal weights and GNHS weights
Seven Dimensions considered

K	Equal Weights			GNHS Weights		
	H	**M_0**	**Average Deprivation**	**H**	**M_0**	**Average Deprivation**
1	0.84	0.31	2.6	0.68	0.28	2.9
2	0.60	0.27	3.1	0.54	0.25	3.2
3	0.38	0.21	3.9	0.32	0.18	3.9
4	0.21	0.14	4.6	0.24	0.14	4.1
5	0.09	0.07	5.4	0.09	0.07	5.4
6	0.024	0.021	6.1	0.05	0.04	5.6
7	0.002	0.002	7	0.002	0.002	7

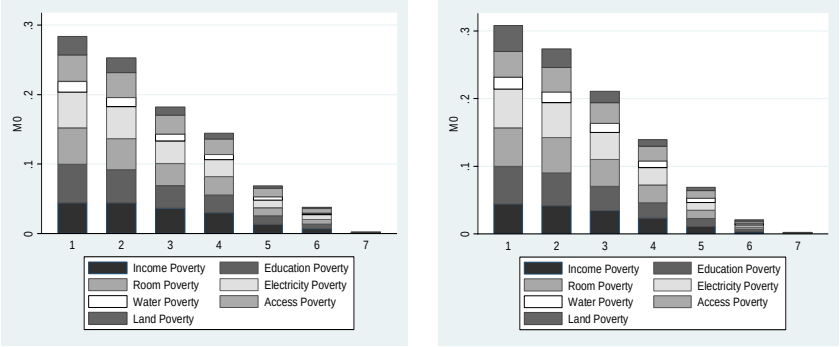
Table 4 shows higher estimates than before both because these refer only to rural areas, where multidimensional poverty is higher, and because a higher number of dimensions are being considered. Using equal weights, estimates suggest that 84% of the population in rural areas is deprived in at least one of the seven considered dimensions, being deprived on average in 2.6 dimensions giving a M_0 value of 0.31. 60% are deprived in two or more, 38% in three or more and 21% in four or more, increasing the average deprivation among these groups and reducing M_0 correspondingly. Using GNHS weights, the multidimensional poverty estimates in the rural areas are lower for k=1 to k=3 than the ones obtained with equal weights for similar reasons to the ones explained in table 3. Note that starting with k=5, estimates both using equal weights and GNHS weights decrease significantly and are only 0.2% for k=7. This suggests that a k cutoff value of 5 or higher is extremely demanding for estimating multidimensional poverty in the rural areas of Bhutan.

The Income Poverty Headcount Ratio is 30.9% in the rural areas of Bhutan, which can be compared with the Multidimensional Poverty Headcount Ratios for the different k values and the two weighting systems. Analogous to the

analysis for both urban and rural areas, even when estimates for the different *k* values must be considered, a cutoff value of *k*=3 might be a good option for monitoring multidimensional poverty in the rural areas.

As in the case of the overall estimates, it is worth analysing the decomposition of overall M_0 in rural areas among the seven dimensions. The results of this decomposition are presented in figure 4.

Figure 4: Multidimensional Adjusted Headcount Ratio (M_0) in rural areas only
Different k – Contributions by each of the seven dimensions



(a) Equal Weights (b) GNHS Weights

In the figure it can be seen that for all *k* and for the two weighting systems, poverty in electricity, education, room and income are among the highest contributors to overall poverty in rural areas, coinciding with the contributions analysed for both rural and urban areas. These are followed in all cases by deprivation in access to roads, deprivation in land ownership and, finally, water. This means that the two additional dimensions considered in rural areas do not affect significantly the ranking of the other deprivations; rather, they are placed after the mentioned four and before water.

Within the four dimensions with the highest contributions, when equal weights are used and k=1, electricity ranks first (contributing with 18.7% to overall poverty), then room (with 18.5%), education (17.9%) and income (14.3%). Poverty in access and land contributes in both cases with 12.4%, and water with 5.7%. When k=2 and k=3, room poverty ranks first, and it is followed by electricity, education, income, access, land and water. And when k=4, income switches positions with education. For higher values of k, the four main contributors have more and more equal contributions. As it happened with estimates for both rural and urban areas, when the GNHS weights are used, education and income tend to have higher contributions to overall poverty relative to electricity and room because of the higher importance attributed to these two dimensions.

4.3 Overlapping and correlation between dimensions

The typical argument to focus poverty analysis exclusively on income is that income is highly correlated with achievements in other dimensions, such as education. If this was the case, by targeting the income-poor, one would be targeting the deprived in other dimensions. However, this does not seem to be the case of Bhutan.

A first simple exercise is to analyse the Spearman correlation between any pair of variables. Table 5 (a) presents this coefficient between deprivations in the different pairs of dimensions used to estimate multidimensional poverty in both rural and urban areas, using the total sample. Table 5 (b) presents the same, but for all pairs of dimensions used for the estimations only in rural areas.

Table 5: Spearman correlation coefficients between deprivations

(a) Rural and Urban Areas-Five Dimensions

	Income Deprived	Education Deprived	Room Deprived	Electricity Deprived	Water Deprived
Income Deprived	1				
Education Deprived	0.24	1			
Room Deprived	0.36	0.17	1		
Electricity Deprived	0.30	0.22	0.25	1	
Water Deprived	0.14	0.14	0.11	0.22	1

(b) Rural Areas Only- Seven Dimensions

	Income Deprived	Education Deprived	Room Deprived	Electricity Deprived	Water Deprived	Access Deprived	Land Deprived
Income Deprived	1						
Education Deprived	0.21	1					
Room Deprived	0.36	0.16	1				
Electricity Deprived	0.22	0.16	0.23	1			
Water Deprived	0.09	0.11	0.09	0.17	1		
Access Deprived	0.22	0.14	0.20	0.36	0.22	1	
Land Deprived	-0.09	-0.03	0.01	-0.08	-0.015	-0.08	1

In both tables it can be seen that any pair of deprivations has a high correlation coefficient, and even though deprivation in income is the one with higher correlations with the others, it never exceeds 0.36. This suggests that a multidimensional analysis is indeed important: a policy targeted to the income poor might not reach other segments of the population deprived in other dimensions.

A second exercise consists of analysing whether there is overlap between the group of poor identified with the multidimensional approach and the group of poor identified with the traditional income approach. Ruggeri-Laderchi, Saith and Stewart (2003) present empirical evidence of significant lack of overlap in the identification by the monetary and the capability approach for the case of India and Peru. Similar evidence is found in the case of Bhutan.

Table 6 (Panels a and b) present the percentage of population that is income non-poor but multidimensionally poor, and the percentage of the population that is income poor but multidimensionally non-poor, for the different k values in the estimates of rural and urban areas using equal weights and GNHS weights. Similar tables can be constructed for the estimates of rural areas only. By definition, the percentage of the income non-poor that are multidimensionally poor decreases as k increases, being zero when $k=d$, since all the multidimensionally poor in that case are deprived in every considered dimension, including income. For the same reason, the percentage of income poor that are not multidimensionally poor increases as k increases. It goes from 0 when $k=1$, since in that case all the income deprived are considered multidimensionally poor, to a percentage close to the aggregate income Headcount Ratio when $k=d$, since in that case only the few income deprived that are also deprived in all the other dimensions are considered multidimensionally poor.

This suggests that, if one would want to reach the multidimensionally poor by using the income poor as a 'proxy'

variable there would always be some non-depreciable error: either a group that is only income poor but not multidimensionally poor would be included, which would be a Type-I error, or a part of the multidimensionally poor would be excluded for not being income poor, which would be a Type-II error. If one considers the minimum possible *k* value to be the relevant to identify the multidimensionally poor, using an income approach in that case minimises the Type-II error but maximises Type-I error. On the other hand, if one considers that *k=d,* is the relevant deprivation cutoff to identify the multidimensionally poor, using an income approach minimises Type-I error but maximises Type-II error. For *k*-values in the middle of the extremes, there is some combination of each error type when an income approach is used.

Table 6: Lack of overlap between Income and Multidimensional Poverty

(a) Rural and urban areas, five dimensions, equal weights

% of Population	**k=1**	**k=2**	**k=3**	**k=4**	**k=5**
Income Non-Poor but Multidimensionally Poor	40.7%	15.8%	4.6%	0.5%	0%
Income Poor but Multidimensionally Non-Poor	0%	2.1%	8.1%	15.9%	21.8%

(b) Rural and urban areas, five dimensions, GNHS weights

% of Population	**k=1**	**k=2**	**k=3**	**k=4**	**k=5**
Income Non-Poor but Multidimensionally Poor	24.4%	10.4%	0.54%	0%	0%
Income Poor but Multidimensionally Non-Poor	0%	0%	6.7%	12.5%	21.8%

4.4 Analysis at the district level

Given that the 2007 BLSS is representative at the district level, the multidimensional poverty measures *H* and M_0 were estimated for each district. Table 7 presents these estimates for both rural and urban areas of each district, using five dimensions, with k=2, using the GNHS weights. It also presents the income Headcount Ratio in each district. Two type of analysis can be done at the district level. On the one hand, it is interesting to analyse the estimates of each measure in each district, which are presented in columns (2), (6) and (10) for Income *H*, Multidimensional *H* and M_0 correspondingly. Districts can be ranked according to the estimate in each measure, which is done in descending order in columns (3), (7) and (11), and then rankings can be compared. Column (14) presents the difference in the rank order obtained by each district when ranked by Income *H* and when ranked by M_0.

On the other hand, provided that the three measures can be decomposed by population subgroups, it is worth analysing the contribution of each district to the aggregate estimate of each measure. This is obtained weighting the measure estimate in each district by the district's population share, such that: $C_s^P = [(100n_s / n)P_s / P]$, where C_s^P is the contribution of district s (with $s = 1,.....,20$) to the aggregate poverty measure *P*, P_s is the poverty estimate in district *s*, and $(100n_s / n)$ is the population share of district *s*. The population share of each district is presented in column (1) of the table and the contribution of each district to the aggregate Income *H*, Multidimensional *H* and M_0 estimates are presented in columns (4), (8) and (12) correspondingly. Districts can be ranked according to their contribution to each of the aggregate measures. These rankings are done in columns (5), (9) and (13), and again, changes in the rankings can be analysed. In particular, column (15) presents the difference in the rank order obtained by each district when

ranked by their contribution to Income *H* and when ranked by their contribution to M_0.

Regarding the first type of analysis, one interesting point to note is that the districts having the lowest estimates of Income *H* are not necessarily the ones having the lowest estimates of multidimensional *H* and M_0. Looking at column (14), it can be seen that although the change in the rank order of the districts when moving from Income *H* to M_0 is not striking, there are some interesting cases, such as the districts of Gasa and Tsirang. Note that when ranked in descending order by Income *H*, the district of Gasa ranks in the 18th place, since its income *H* is one of the lowest (only 4% of the population is income poor), and the district of Tsirang ranks in the 15th place (with only 14% of the population being income poor). However, when ranked by M_0, Gasa is ranked in the 8th place, that is, it climbs 10 places in the ranking because its M_0 estimate is 0.25, whereas Tsirang ranks in the 10th place, with an M_0 estimate of 0.22, climbing 5 places in the ranking.

Table 7: Income and Multidimensional Headcount Ratio and Multidimensional Adjusted Headcount Ratio (M_0) decomposed by districts Urban and Rural Areas- Five dimensions considered, k=2, GNHS weights

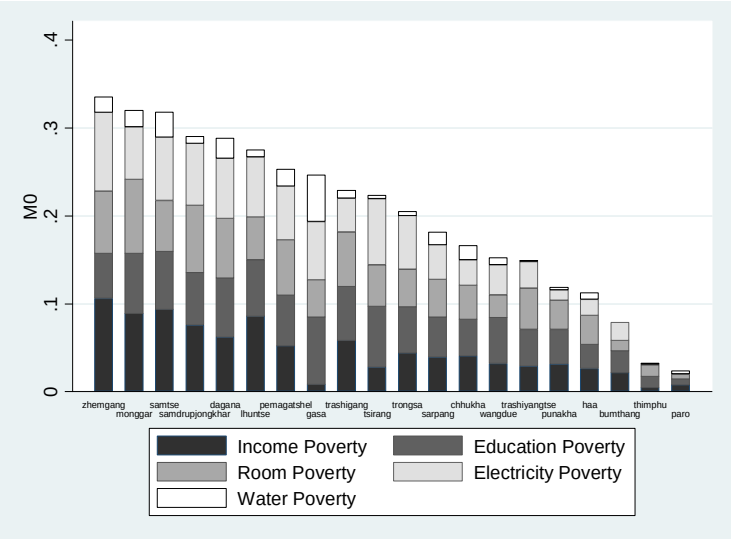
District	Pop. Share (%) (1)	Income H (2)	Desc. Rank Order Inc. H (3)	Contri. Overall Income H (%) (4)	Desc. Rank Order Contrib to Inc. H (5)	Multi. H (k=2) (6)	Desc. Rank Order Inc. H (7)	Contrib. Overall Multi. H (k=2) (%) (8)	Desc. Rank Order Contrib to Inc. H (9)	M0 (k=2) (10)	Desc. Rank Order M_0 (11)	Contrib. Overall M_0 (k=2) (%) (12)	Desc. Rank Order Contrib. to M_0 (13)	Diff. b/w. Rank Order in Inc. H and M_0 (3)-(11) =(14)	Diff. b/w Rank Order in Contrib. Inc. H and M_0 (5)-(13) =(15)
Zhemgang	3.11	0.53	1	7.09	6	0.58	1	5.42	1	0.33	1	5.59	7	0	-1
Samtse	8.85	0.47	2	17.84	1	0.55	2	14.44	2	0.32	3	15.08	1	-1	0
Mongar	6.06	0.44	3	11.61	2	0.54	3	9.82	3	0.32	2	10.40	2	1	0
Lhuntse	2.49	0.43	4	4.62	8	0.53	4	3.96	4	0.27	6	3.67	11	-2	-3
S/Jongkhar	5.55	0.38	5	9.08	5	0.49	5	8.02	5	0.29	4	8.63	5	1	0
Dagana	3.00	0.31	6	4.02	10	0.50	6	4.45	6	0.29	5	4.63	10	1	0
Trashingang	7.58	0.29	7	9.56	3	0.43	7	9.74	7	0.23	9	9.30	4	-2	-1
Pemagatshel	3.76	0.26	8	4.24	9	0.44	8	4.97	8	0.25	7	5.09	8	1	1
Trongsa	2.32	0.22	9	2.21	13	0.37	9	2.56	9	0.20	11	2.54	14	-2	-1
Chukha	10.74	0.20	10	9.38	4	0.29	10	9.20	10	0.17	13	9.55	3	-3	1
Sarpang	6.38	0.19	11	5.35	7	0.31	11	5.84	11	0.18	12	6.21	6	-1	1
Punakha	4.03	0.16	12	2.71	11	0.26	12	3.16	12	0.12	14	2.56	9	-2	2
Wangdue	5.70	0.16	13	3.89	12	0.31	13	5.29	13	0.15	16	4.66	13	-3	-1
T/Yangtse	2.89	0.14	14	1.79	15	0.29	14	2.49	14	0.15	15	2.32	16	-1	-1
Tsirang	3.01	0.14	15	1.80	14	0.38	15	3.45	15	0.22	10	3.61	12	5	2
Haa	1.99	0.13	16	1.13	18	0.20	16	1.17	16	0.11	17	1.20	17	-1	1
Bumthang	2.55	0.11	17	1.20	17	0.18	17	1.35	17	0.08	18	1.07	18	-1	-1
Gasa	0.60	0.04	18	0.11	20	0.38	18	0.68	18	0.25	8	0.79	19	10	1

Paro	5.63	0.04	19	0.96	19	0.05	19	0.84	19	0.02	20	0.71	20	-1	-1
Thimphu	13.77	0.02	20	1.42	16	0.08	20	3.15	20	0.03	19	2.38	15	1	1
Bhutan	100%	0.23		100%		0.34		100%		0.19		100%			

The explanation for this sort of change in the relative positions of these two districts can be found in figure 5, where the 20 districts have been ranked from highest to lowest by the M_0 estimates. The bar for each district also presents the composition of multidimensional poverty by each of the dimensions. There, it can be seen that in the case of Gasa only a very small fraction of the multidimensional poverty in this district is explained by income. However, even if not highly deprived in income, significant parts of the population in this district are deprived in the other considered dimensions. Deprivation in education accounts for 31% of the overall multidimensional poverty estimate, deprivation in electricity accounts for 27%, deprivation in drinking water accounts for 21.4% and deprivation in room accounts for 17% of M_0. The high levels of deprivation in the other dimensions relative to the income deprivation explain the big change between the ranking by income H and by M_0. Moreover, it is a paradox that given Bhutan's achievement in terms of access to drinking water (such that only 9% of the population in the country is deprived in this dimension), being Gasa one of the richest districts in income terms, it is the one that has the highest deprivation in access to water. Something similar happens with Tsirang, in which the deprivation in education, room and electricity accounts for most part of the M_0 estimate. On the contrary, in most of the other districts, deprivation in income accounts for a very significant part of overall multidimensional poverty, which explains why they do not have such striking changes in the rank order when moving from Income H to M_0. However, this does not mean that deprivation in income would suffice for a comprehensive poverty analysis since these districts are highly deprived in the other considered dimensions, suggesting that they have coupled disadvantages, which makes them particularly vulnerable. Similar conclusions are obtained when the analysis is performed on the estimate results of the rural areas only.

Figure 5: Composition of the Adjusted Headcount Ratio (M_0) in each Bhutanese district

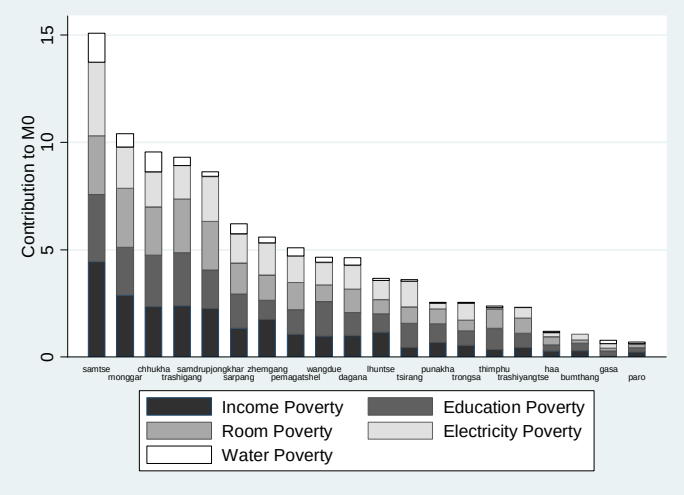
Rural and urban areas – Five Dimensions – k=2 – GNHS weights



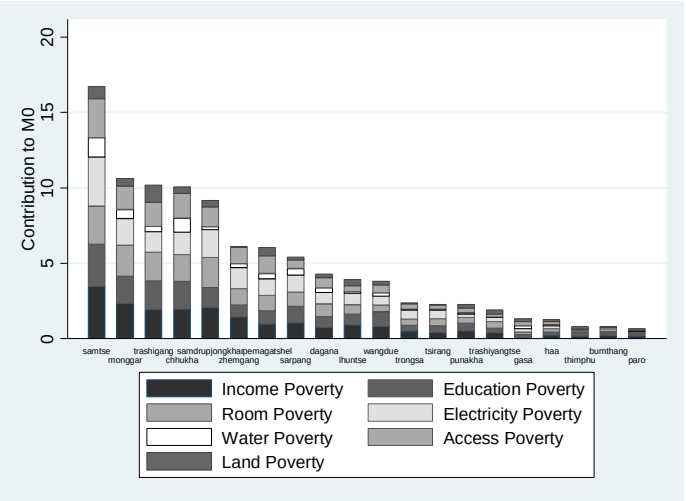
In terms of policy design, the second type of analysis seems particularly important. When governments are faced to the difficult task of assigning public budget among the different districts in order to reduce poverty, it is necessary to consider the contribution of each district to the aggregate poverty estimate, that is, it is necessary to weight district-level estimates by their population share. Figure 6 summarises two type of relevant information for policy purposes. In the first place, it presents the contribution of each district to overall M_0, given by the height of each bar. In the second place, the figure also presents, within each district, the contribution of deprivation in each dimension to overall M_0 in the district. Panel (a) is referred to estimates in both rural and urban areas, using five dimensions, k=2, and GNHS weights; panel (b) is referred to estimates in rural areas only, using seven dimensions, k=3, and GNHS weights. In Panel (a) it can be seen that Samtse, Mongar, Chukha, Trashigang and Samdrup Jongkhar are the districts with the highest contribution to aggregate M_0. Note that Gasa is one of the

districts with the lowest contribution to aggregate M_0 despite it is one with the highest estimates of M_0. This is because its population share is below 1%. Within the districts with the highest contribution to aggregate M_0, improving income conditions, extending the access to electricity, guaranteeing that children in school age attend to school and that at least one household member becomes literate, and improving housing conditions to reduce overcrowding seem to be the most urgent needs. Extending even further the access to drinking water comes at a second place. It is worth noting that improvements in the mentioned dimensions should also be priorities even among the districts with lower contributions to aggregate M_0. Similar conclusions can be drawn from the rural estimates of Panel (b), with the addition that access to roads is a also key dimension that should be added to priorities in the case of rural areas, whereas land ownership comes -together with access to drinking water- seems to be less relevant.

Figure 6: Contribution to overall M_0 by each district and contribution of each dimension to the M_0 value in each district



(a) Rural and urban areas – Five Dimensions – k=2 – GNHS weights



(b) Rural areas only – Seven Dimensions – k=3 – GNHS weights

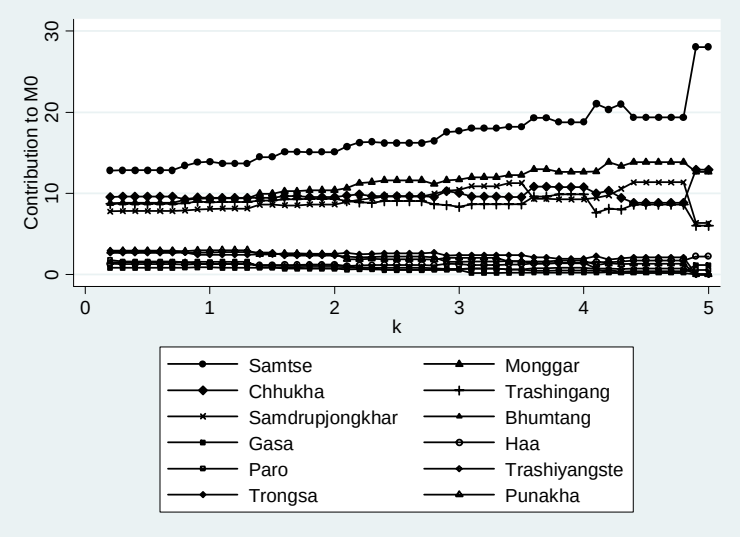
Clearly, the ranking of the districts by their estimates of M_0 (as the one presented in Figure 5) as well as by their contribution to aggregate M_0 (as the ones presented in Figure 6) are subject to the selected value of k, the weighting system, the chosen dimensions and the deprivation cutoffs.

Figure 7 plots the contribution of two groups of districts for the different k values in the rural and urban estimates (with five dimensions) when GNHS weights are used.[8] One group is composed by the districts of Samtse, Mongar, Chukha, Trashigang and Samdrup Jongkhar. These districts have the highest contributions across all the different k values. Among them, Samtse always has a higher contribution, while the ranking of the other four changes with k, as it can be seen by the lines crossing with each other. The other group is composed by the districts of Paro, Gasa, Bhumtang, Haa,

[8] When GNHS weights are used, the minimum k value is 0.2. Then it is increased in 0.1 until its maximum level, which is 5 in the case of the estimates for both rural and urban areas (since 5 dimensions are considered). That gives 49 different possible k cutoff values.

Trashiyaste, Trongsa and Punakha. These are at the other extreme, always having the lowest contributions to the aggregate M_0 estimate. Within this group, the ranking changes with the k value. In the middle of these two groups lie the contributions of the other districts: Dagana, Lhuntse, Pemagatshel, Sarpang, Thimphu, Tsirang, Wangdue and Zhemgang. This type of analysis can facilitate assigning priorities of public budget distribution among districts.

Figure 7: Contribution to overall M_0 by each district for different k values
Rural and urban areas – Five Dimensions – GNHS weights



5. Concluding remarks

This paper has estimated multidimensional poverty in Bhutan using a recently developed methodology by Alkire and Foster (2007). The selection of dimensions was based on the Millennium Development Goals that are applicable for estimations of poverty at the household level and for which the BLSS provides data. For the case of both urban and rural areas five dimensions were selected: income (access to the

basic basket), education (at least one literate person in the household and all children attending school), number of people per room (less than three), access to electricity and access to drinking water. Estimations for rural areas included two additional dimensions: access to roads (in 30 minutes or less) and land ownership (at least one acre). In each case, two alternative weighting structures were applied: one using equal weights and one using weights derived from the ranking of 'sources of happiness' identified through the Gross National Happiness Survey.

Estimates suggest that 37% of the population in both rural and urban areas is deprived in two or more of the five considered dimensions, and 20% are deprived in three or more. When these Headcount Ratios are adjusted by the average deprivation, the M_0 estimates are 0.20 and 0.14 correspondingly. If the dimensions are weighted using the ranking of sources of happiness obtained from the Gross National Happiness Survey, the estimates of the Headcount Ratio and the Adjusted Headcount Ratio are slightly lower for these values of k. The results also indicate that multidimensional poverty is mainly a rural phenomenon, although urban areas present non-depreciable levels of deprivation in room availability and education. In the rural areas of Bhutan, poverty in education, electricity, room availability, income and access to roads, contribute in similar shares to overall multidimensional poverty, while poverty in land ownership has a relatively smaller contribution, being poverty in water the smallest one. When the aggregate multidimensional poverty estimate is decomposed by districts, it is found that Samtse, Mongar, Chukha, Trashingang and Samdrup Jongkhar are the ones with the highest contribution to overall multidimensional poverty.

The paper is innovative not only in that it changes the focus from the traditional unidimensional perspective of poverty, centred on income, to a broader multidimensional one, but it also provides with a methodology that is potentially useful for allocating the budget among the districts and within them,

among the different dimensions. The property of Alkire and Foster's (2007) M_0 measure of being decomposable in population subgroups and suitable for breaking it down into dimensions is what makes it suitable for such purpose.

Clearly, other dimensions could be incorporated and alternative deprivation cutoff values could be considered in the analysis. In any case, Bhutan constitutes a striking example of how significant and fast progress can be made towards development when goals are clearly set and policies specifically designed to fulfil them. The proposed methodology could prove to be a useful instrument to monitor such progress.

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Annex

Table A.1: Sample size by district and by rural and urban areas

District	Rural	Urban	Total	Weighted sample
Bumthang	1051	286	1337	16,033
Chukha	2930	2088	5018	67,606
Dagana	1362	104	1466	18,867
Gasa	1076	48	1124	3749
Haa	1079	138	1217	12,511
Lhuntse	1206	81	1287	15,705
Mongar	2529	436	2965	38,187
Paro	2615	175	2790	35,475
Pemagatshel	1649	184	1833	23,646
Punakha	1879	134	2013	25,346
Samdrup Jongkhar	2027	679	2706	34,940
Samtse	3490	717	4207	55,727
Sarpang	2119	802	2921	40,182
Thimphu	662	5482	6144	86,717
Trashingang	3301	388	3689	47,704
Trashi Yangtse	1274	175	1449	18,216
Trongsa	1097	176	1273	14,585
Tsirang	1385	121	1506	18,970
Wangdue	2223	564	2787	35,890
Zhemgang	1257	176	1433	19,606
Bhutan	**36,211**	**12,954**	**49,165**	**629,662**

Socio-economic and Environmental Impact Analysis of Khothagpa Gypsum Mine

Karma Galay[*]

Part 1. Overview of mining sector in Bhutan

Bhutan is rich in mineral resources such as dolomite, limestone, slate, and coal. It also has small deposits of marble, quartzite, granite, talc, iron ore, and pink shale. Mining in Bhutan started in the early 1970s and it was mostly carried out by the government enterprises. Gradually under the auspices of policy of privatization, mining sector operations were privatized. Mining activities are now solely carried out by private agencies. Currently, there are 27 private mining companies. In addition to the mining companies, there are 83 mineral based industries. In terms of geographical spread, most of the mineral based industries are located in the west, south and south eastern parts of the country. See chart 1.

Chart 1: Geographical spread of mineral based industries

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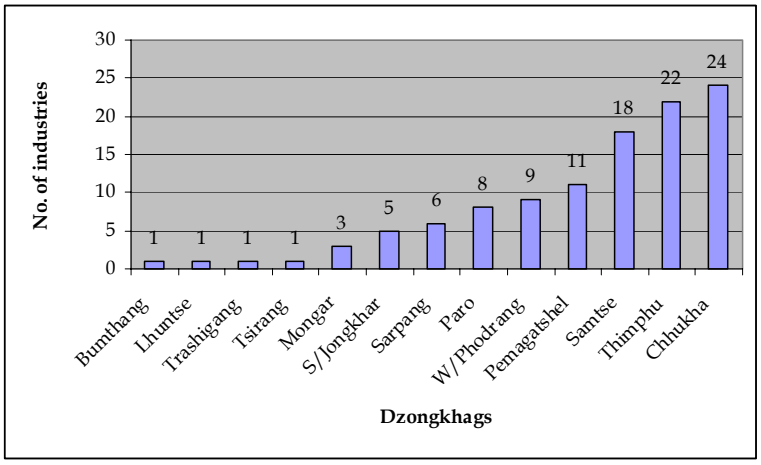
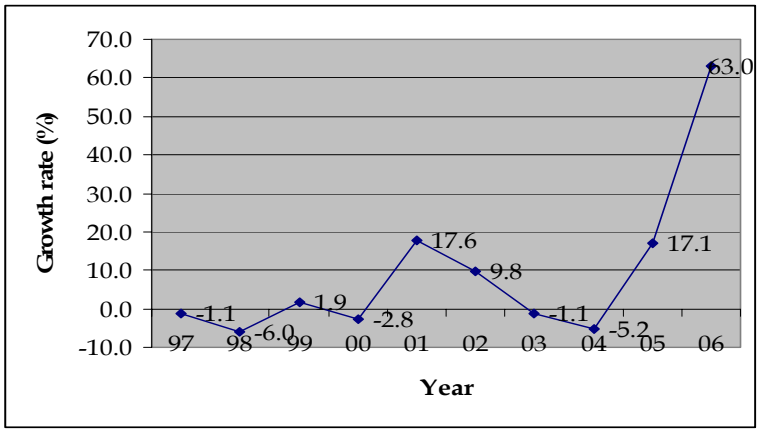


Although mining is one of the modern economic activities pursued by Bhutan since the start of planned development, mining sector has not expanded much. The performance of mining sector has been very erratic with some years experiencing negative growth rates. See chart 2.

Chart 2: Growth rate of mining sector



The contribution of mining sector to GDP has been very low; it constituted less than 2% of GDP for most of the years. See table 1.

Table 1: Share of mining sector in GDP

Year	**% share**
1997	2.1
1998	1.8
1999	1.7
2000	1.6
2001	1.7
2002	1.7
2003	1.6
2004	1.4
2005	1.5
2006	2.3

However, as we see in Chart 2, mining sector is experiencing some upsurge in the recent years. In 2006, mining sector experienced a growth rate of 63%. More business agencies see engagement in mining activities as a lucrative business and have taken up mining business in the recent years.

While mining sector certainly could play an important role in the industrial development and benefit the country in terms of generation of employment and revenue, it is also a sector that could bring about a wide range of costs to the society. Some of these costs could be felt in short-term and while many others could be felt over and after much longer period of time.

It is in this context that the current study has been initiated. As a baby step towards studying overall impacts of mining sector on Bhutan's economy and society, a case study of mining of

gypsum in Khothagpa under Pemagatshel dzongkhag was carried out. The study looks at the economic, social and environmental impacts of the gypsum mining on people living nearby as well as at the national level. However, given the non-existence of economic and social data on the communities, the impacts outlined in the study are mostly perceived ones.

Part 2: A brief background of Khothagpa gypsum mine

The gypsum mine is located at Khothagpa village, some 13 kilometers below Pemagatshel town. It has a total mine area of 26.67 hectares. Mining first began in the early 1980s and was managed by the department of Geology and Mines. Subsequently for a brief period of time, it was managed by the Penden Cement Authroity. In 1993, government leased out the mine to Druk Satair Corporation for a period of 10 years. The corporation won the bid to operate the mine for another 10 years in 2004.

Using semi-mechanized open cast method, the corporation mines gypsum which is mostly exported to India. A small proportion is exported to Bangladesh and Nepal, and a small amount sold to Bhutanese buyers. In 2002, the corporation, along with some other promoters set up Druk Plaster and Chemicals Limited. As it is a spin-off company, it is managed by the same team of managers. The two companies, however, have separate staff at the field offices. Remaining part of paper is organised as follows: part three highlights economic impacts; part four social impacts; part five health and environmental impacts; and part six some

concluding remarks. The impacts outlined below are based on random interviews of some farmers of Khothagpa, Nangkor, Yalang, Shali, Gamung, and Jaipobrangsa villages; businessmen of Khothagpa and Pemagatshel; *gup* of Shumar gewog; truckers; Chief Executive Officer and some employees (both permanent and temporary) of the corporation as well as the on-site observations of the author of this paper.

Part 3: Economic impacts

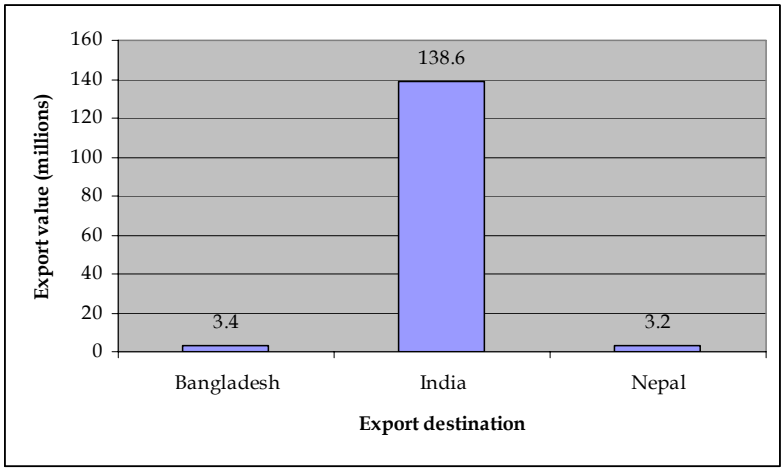
A. Positive impacts

Most publicized economic benefits of gypsum mining are the following:

i) Generation of foreign exchange

Over 90% of gypsum that the corporation mines is exported to India, Bangladesh and Nepal. Since India is the main buyer, it earns a significant amount of rupees. It contributes towards building up of rupee reserves. In the recent years, rupee shortage has inconvenienced Bhutanese businessmen. Through its rupee earning, it can be said that the corporation contributes towards easing the problem. Furthermore, it contributes towards overall hard currency earnings of the country. Bangladeshi and Nepalese buyers pay in US dollars. Following chart shows the export earnings for the first six months of 2008.

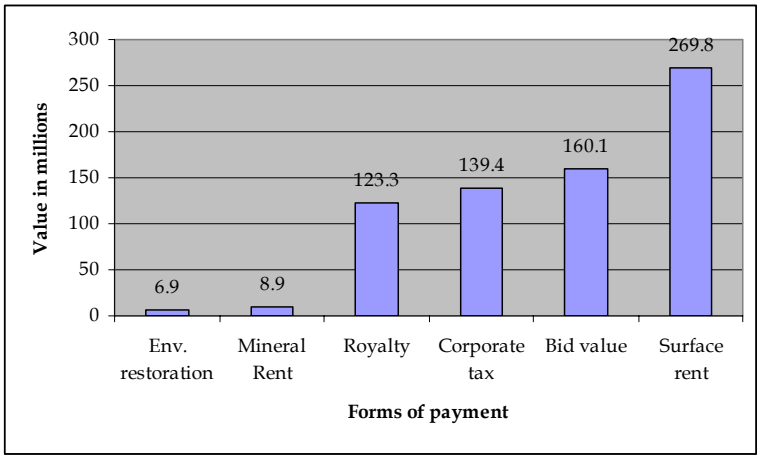
Chart3: Rupee value of gypsum exports (January 08-June 08)



ii) Generation of government revenue

The corporation generates revenue for the government payment of bid value, corporate income tax, royalties, mineral rent, surface rent and environment restoration fund. Between January 1994 and December 2007, the corporation has so far paid Nu. 438.95 million as tax and rents. See chart 2.

Chart 4: Various forms of payments made to the



government

As a percentage of national revenue, the contribution of the corporation is less than 1% for most years. See table 2.

Table 2: Share of DSCL's contribution in the national revenue

Year	DSCL's contribution (in millions)	National revenue (in millions)	% contribution of DSCL
1999	17.1	4381.1	0.4
2000	21.6	4671.5	0.5
2001	20.4	5100	0.4
2002	20.9	4785.3	0.4
2003	24.7	5055.2	0.5
2004	84.9	6066.1	1.4
2005	46.3	6902.9	0.7

Source: Statistical Yearbook of Bhutan,2003 & 2007 and information from DSCL.

However, when DSCL's contribution to the government revenue is juxtaposed with its overall turnover or gross income, it amounts to a high percentage of its turnover. From the point of view of a single corporate entity, the amount it pays to the government is very high; for no year since its operation has its contribution been lower than 19% of its turnover. See table 3.

Table 3: DSCL's contribution to the national revenue as percentage of its turnover

Year	Turnover	Contribution	% of turn over
1994	31,748,126.00	9,785,557.00	30.8

1995	34,883,821.00	6,759,223.00	19.4
1996	46,439,104.00	12,267,424.00	26.4
1997	54,386,017.10	13,458,329.00	24.7
1998	59,908,815.20	14,541,117.00	24.3
1999	84,960,303.40	17,132,168.00	20.2
2000	96,227,307.00	21,622,053.00	22.5
2001	106,919,159.00	20,373,601.00	19.1
2002	108,654,288.00	20,948,637.00	19.3
2003	129,590,773.00	24,749,117.00	19.1
2004	143,659,434.00	84,928,763.00	59.1
2005	181,626,300.00	46,344,022.00	25.5
2006	261,333,265.00	74,188,966.00	28.4
2007	237,572,321.00	71,852,267.00	30.2

iii) Broad based ownership of the corporation

The structure of ownership of the corporation is broad and diversified. When the corporation came into being in 1993, His Majesty the Fourth King commanded it to sell its shares to the people of six eastern dzongkhags. Following this command, 30% of the company's shares were sold to people of six eastern dzongkhags. Thanks to the farsighted vision of His Majesty, many farmers from six eastern dzongkhags own shares and receive dividends every year from the company. However, number of shares owned by farmers is small and the number of shareholders varies widely between dzongkhags with Pemagatshel accounting for the highest.

Table 4: Distribution of DSCL shares

Name	No. of shareholders	No. of shares	% share
Promoters	8	182,272	40
Central monastic body	1	155,112	34
Public of Pemagatshel	431	43,593	10
Public of Trashiyangtse	324	29,678	7
Public of Trashigang	179	24,314	5
Other buyers	37	8,071	2
Public of S/jongkhar	288	5,784	1
Public of Mongar	19	4,552	1
Public of Lhuntshe	5	3,167	1
Total	1,292	456,543	100

Note: Institutional shareholder and individual shareholder are taken as same

Except for 2001 and 2002, the shareholders have been paid dividend every year. By 2007, the company disbursed over Nu. 86 millions as dividends to various shareholders. (See table 5 for details). The company also issued some bonus shares and those shareholders who had only one share initially now own a minimum of 14 shares. It can be said that through the disbursement of dividends, the mining operation not only benefits the promoters and people of Pemagatshel but some people from rest of the eastern dzongkhags as well.

Table 5: Year-wise disbursement of dividends

Year	Dividend disbursed
1994	831,167
1995	1,853,500
1996	1,647,125
1997	2,362,500
1998	7,762,500
1999	5,067,200

2000	5,067,200
2001	12,161,280
2004	4,560,480
2005	15,201,600
2006	15,979,005
2007	13,696,290
Total	86,189,847

iv) Generation of employment

Mining activities usually generates formal as well as informal employment opportunities. All the workers (both regular and wage workers) employed at the company are Bhutanese. It employs 20 staff at its head office in Samdrupjongkhar, 52 at its field office in Khothagpa, and 13 at the field office of its sister-concern Druk Plaster and Chemicals Limited in Khothagpa. Thus, the company provides formal employment to 85 individuals. Most of these employees, particularly those at the field offices are from Pemagatshel; over 46% of employees at the field office of Druk Satair Corporation Limited and 33% of employees at the field office of Druk Plaster and Chemicals Limited are from Pemagatshel.

In addition to the formal workers, the companies employ wage or informal workers. During the time of this research, there were 27 wage workers at Druk Plaster and Chemicals Limited and 37 at Druk Satair Corporation Limited. These workers are paid Nu. 100 per day. Over 66% of them are from Khothagpa and a few other villages under Shumar gewog and 48% of the employees are women.

Number of informal employees could be much higher if we include truckers engaged in transporting gypsum from the mine. During the time of this research, there were 91 trucks that were engaged in transporting gypsum on regular basis. Except for 12 trucks, rest of them had handy boys. This means that about 170 people (91 + 79) were engaged in trucking. Besides, those truckers that carry gypsum on regular basis, several other trucks show up daily to carry gypsum. Most of these drivers are in their early twenties (mean age was 24) and had attended school. It could be argued that if it had not been for the corporation which provides them with job opportunities, these young people would have been elsewhere in the country looking for job, which is increasingly difficult to find.

Interviewees said that the opportunities to find employment, particularly part time work as a wageworker, have dwindled over the years. The management has mechanized some aspects of mining operations and the need for wage workers declined significantly. Management said that the deployment of wage workers could decline further in future as it mechanizes further.

v) Business opportunities

During the time of this study, there were eight shops in Khothagpa. Most of the shopkeepers said that people working at the mines were their main customers. Besides shopkeepers, people also benefit through rental income that they earn. More than 10 farmers living nearby the mine have rented out their houses to truckers

and employees of the mine. A few farmers interviewed said that their living standard has improved due to supplementary income they were able to earn through renting and off-season work at the mine.

The corporation assures constant business to the truckers. Most of the trucks belong to the people of Pemagatshel. See table 6 for district origin of trucks currently employed at the mine.

Table 6: No. of trucks employed by DSCL by districts.

	Districts	**No. of truck**
1	Pemagatshel	46
2	Trashigang	13
3	S/jongkhar	14
4	Thimphu	5
5	Mongar	5
6	Paro	2
7	Haa	1
8	Bumthang	1
9	T/yangtse	1
10	Trongsa	1
11	Wangduephodrang	1
12	Others	1
13	Total	91

A few truck owners that were interviewed for this study said that the constant engagement at the mine to transport gypsum provided them with an assured and convenient business opportunity. The monthly income that they get from hiring of their trucks enables many of them to pay back their loans on time. It must also be noted that many of the truck owners,

particularly those from Pemagatshel, were able to own one because of constant business they got from the mine. So far the corporation has paid Nu. 483.07 millions as transport charges to various truckers employed at the mine. See table 7.

Table 7: Charges paid to truckers for transporting gypsum

Year	**Amount**
1994	1,491,379.0
1995	7,915,309.0
1996	9,849,145.0
1997	19,037,759.4
1998	19,724,084.4
1999	28,981,762.5
2000	25,588,849.0
2001	36,841,213.0
2002	37,152,416.0
2003	40,106,849.0
2004	46,769,979.0
2005	59,580,583.0
2006	82,544,245.0
2007	67,487,589.0
Total	483,071,162.35

vi) Convenient means of transport

There is no public transport between Pemagatshel and Samdrupjongkhar or Trashigang. In addition to carrying gypsum, trucks ferry people and goods between Pemagatshel and Samdrupjongkhar. People say that since there are trucks plying throughout the day, they are able to find transport to go to Samdrupjongkhar or nearby places at any time

of the day. They also say that if they go in a truck that leaves early to Samdrupjongkhar, they can return to Pemagatshel the same day, enabling them to save time.

B. Negative impacts

As much as there have been positive impacts, there have also been negative economic impacts. A few of them are discussed below:

i) Siphoning off of labour from other economic activities

Because of the readily available job opportunities that do not employ them but warrant assured flow of income, people have been discouraged from taking up other economic activities. One such opportunity for people in Pemagatshel, particularly for those in Shumar gewog, is to work as wage workers at the mine. An orange pulp processing unit was set up a few years ago with some 28 farmers as members; now the unit has only 15 members. Likewise, a silo that was set up recently has not attracted many members; initially it had 50 members but now it has only 18. The Dzongkhag Agriculture Officer and the Agriculture Extension Agent of Shumar gewog said that the problems of wildlife depredation on the one hand and the availability of economic opportunities outside agriculture on the other were collectively making many farmers to quit farming. Such developments could have significant repercussions on the policy of ensuring food security in the country.

ii) Decreased horticultural productivity

Farmers living nearby the mining site, particularly those households nearby the Druk

Plaster and Chemicals Limited, said that yield of their oranges have gone down significantly over the last few years. Farmers alleged this decline to effects of dusting from blasting, factory where gypsum powders are produced, and trucks that transport gypsum. Farmers said that dusting during flowering hampers pollination and ultimately the fruiting. Dusting after fruiting affects colour of oranges; oranges turn dark greenish from continuous dusting. People also alleged that dusts stunt the size of oranges and when they market them, they do not get good prices. Mr. Tshechula said that until few years ago, he used to earn around Nu. 17,000-18,000 on average every year but for the past two years, he earned only about Nu. 7,000 from sale of his oranges. Decline in orange production is also caused by death of trees. Ms. Tera Wangzom said that about four orange trees have died in her orchard from extensive dusting decreasing her earnings from sale of oranges significantly. She said that earnings from the sale of oranges used to be around Nu. 20,000 during the previous years but last year she earned only Nu. 10,000.

iii) Absence of public transport

Because most people travel to and from Pemagatshel by trucks, it has not attracted any individual to operate a public transport there. Absence of public transport is seen as a problem by civil servants and police personnel working there. They say that when they go on transfers, they are not able to find transport that can accommodate all of their belongings and family members. Some civil servants also say that the absence of a public transport is not good for

Pemagatshel in the long-run; should ever the mining close down or the route of transport of gypsum changes in future, many people in the district will have no means of transport until a public transport is instituted.

iv) Loss of customers

Druk Satair Corporation has set up a grocery shop that supplies ration and other essentials to their employees. It's a legal establishment with formal license and sells stuffs at much cheaper rates than other shops in Khothagpa. While the employees of the corporation buy from these shops, they do buy as much as they used to do before the setting up of canteen. Shopkeepers complain that the canteen was cutting on the viability of their business.

v) Increase in local wages

Some farmers complained that as most of the able bodied were working at the mine, it was difficult to find workers during agricultural season. They said that even if they found some, they refused to work for wages less than what they got at the mine, thereby pushing up the local wage rates and making it expensive for many farmers to hire workers.

Part 4: Social impacts

Social impacts are not as distinctly defined as economic and environmental ones. It would require one to spend much longer time and immerse with community to find or understand the social impacts of the mine. The issues discussed here are, therefore, at best perceived ones and some of them are just a means

towards ultimate social impacts and are not themselves the impacts.

A. Positive impacts

i) Contribution to purchase of land for construction of school

The corporation contributed Nu. 250,000, close to 50% of the total cost when the community of Khothagpa bought land for construction of a primary school. A primary school was built in 2004. Without the contribution from the corporation, it would have been difficult for the people of Khothagpa to buy the land. The presence of school has enabled many young children of both people of Kohthagpa as well as the employees of the mine to attend school. The company also contributed 60 bags of cement when the new building was built in 2005.

ii) Contribution to Health Trust Fund

The corporation contributed Nu. 1.5 million to the Health Trust Fund. The corporation's management claims that they were one of the first Bhutanese organisations to make such a contribution and it sparked off similar donations by other corporate bodies, enabling a good flow of donations from within the country.

iii) Contributions for organisation of annual religious ceremonies

The corporation contributes Nu. 1.5 million every year to Yongla Dratshang to conduct drubchen. It has been making this contribution since 1998. Besides, the corporation has also contributed Nu. 150,000 to making of a

thongdrel at Pemagathsel Dratshang. The corporation also helps the dzongkhag administration organise annual Moenlam Chenmo by His Holiness the Je Khenpo. In 2007, the corporation contributed Nu. 20,000 to the community of Khothagpa during its annual *tshechu*. It also allows the people of Khothagpa to use its trucks for free to fetch firewood for annual tshechu at the community temple. While the annual tshechu of Khothagpa is attended by members of its community and a few others from nearby villages of Bartseri and Denchi, Yongla Drucbchen is attended by people from several other villages. Since tshechus and other annual religious ceremonies act as a forum for people to come together, it can be said that the corporation, through its financial contributions, is helping maintenance of community vitality in these villages.

iv) Employment of students

During winters when the students are on vacation, the company employs between 80-90 students. Management says that students are employed even when there is no labour shortage at the mine site; they are recruited largely to enable them to make some income.

v) Other social contributions

Whenever someone in the villages nearby the mine site falls sick, the corporation provides its vehicle to transport the sick to the hospital. It has donated two television sets with DVD players and two room heaters to the general hospital. The corporation allows the children of Khothagpa and Denchi studying at Nangkor High and Pemagatshel Middle Secondary schools

to use their school bus both to and from their schools. It has donated a refrigerator to Nangkor Higher School which has enabled the school proper storage of vegetables and other perishable items required for the students' mess.

B. Negative impacts

i) Family disorganisation

The mine operates for sixteen hours: from 7 a.m. till 11 p.m. This requires the workers to work in shifts. This long hours of the mine's operation causes inconveniences to the workers and their families. When they are required to work in the first shift, i.e. from 7 a.m. through 3 p.m. they have to wake up early and leave for work. This doesn't allow them to have breakfast with their family. For the workers who work the second shift, they are late for dinner and by the time they are home, their children and spouses are already asleep. This doesn't allow families to spend much time together.

ii) Inconvenience in participating in community events

The need for consistent and reliable workforce that does not take time off on a seasonal basis creates a situation in which the benefits of employment in the mines are often offset by the social and family disruptions and loss of opportunities to participate in community life. Like in family affairs workers, particularly the wage workers working at various shifts of the mine's daily operation are only partially able to participate in community events such as annual *tshechus*. The corporation operates seven days a week and sixteen hours a day; this inconveniences many workers from participating

in community events. For instance, a wage worker sought a replacement for him when he was attending mask dance practice sessions for the annual community *tshechu*.

iii) Migrant workers

Many local people complain that the presence of migrant workers, mostly from Bhangtar, has deprived them of opportunities to work at the mine. These migrant workers stay and work at the mine site regularly. The need for consistent and reliable workforce that does not take time off on a seasonal basis forces the management of the mine to prefer migrant workers, disallowing people of the local areas from taking advantages of opportunities to work part time at the mine.

iv) Inadequate housing

Most of the migrant workers that have come to work at the mine are living in make-shift structures while a few of them live in hired rooms in the houses of the nearby people. The permanent employees of the corporation live in semi-permanent houses. All these structures are unfit for decent living. This poor quality of housing has potentials to cause diseases to employees and their children, if none of them are suffering from one already.

v) Safety problems

People complained of threats to safety of their animals and children from speeding and overloaded trucks. Empty trucks returning from Samdrup Jongkhar speed up to arrive on stipulated time for loading at the mining site. So

far, there had been no accidents but people are worried of some mishaps in the future. People also complain that the trucks overload themselves; sometimes almost twice their legal capacity. This not only poses the risks of accidents but because the road from mining area to the Trashigang-Samdrupjongkhar highway is all uphill, the overloaded trucks produce more noise and vibration to people living by roadsides.

vi) Other social problems

There is no prostitution in the legalistic sense but people do mention of prevalence of overt promiscuity among or between workers of mine and sister agency- Druk Plaster and Chemicals Limited. This has a high chance of spreading sexually transmitted diseases. There have also been some five or six cases of local women having children from illegitimate relationship with drivers. Gup of Nangkor said that it was difficult to track down the fathers of these children.

Part 5: Environmental and health impacts

A. Environmental impacts

All the mining operations are inspected regularly by the National Environment Commission to check that their operation does not cause no or little footprints to the nature. Despite these regular visits by the staff of the National Environment Commission, mining operations are causing significant damages to environment. Given the technicalities of environmental impacts which the author of the study is not

familiar with, only obvious ones are reported below.

i) Air pollution

Dusts generated by various mining activities are of major concern to the people living in the nearby areas. Dust is generated by blasting, loading and haulage, vehicular movements, open air disposal of waste rocks, drilling, and crushing. These fugitive dusts from mine site as well as from the factory of Druk Plaster and Chemicals Limited are added to the air and eventually settle down as fine dusts on nearby trees and houses. People said that dusts were dirtying their houses as well as making their fodder plants unpalatable for animals to consume. People say that the level of hygiene in their community has deteriorated due to presence of so much of dusts in the air; a few of them said that the problem was particularly worse during winters. Company claims that it sprays water along the road to reduce dusts emission due to vehicular movements but people complain that the company does not carry out this function faithfully. As discussed under economic impacts, dusting has hampered horticultural productivity in the nearby areas. People also complain of unpleasant odour that they smell after blasts at the mine site.

ii) Noise and vibration

Main sources of noise and vibration are blasting, operation of heavy machineries, and movement of trucks. People allege that vibration from blasts, operation of large machineries at the mine, and movement of trucks vibrates their houses, causing their roof materials to slide. Mr.

Karma Gyeltshen of Borangchilo complained that every year he spends two or three days fixing the roof materials that slide down due to vibration caused by blasts. He said that since he uses slates, some of them get damaged during the repairs, forcing him to find new ones.

People also allege that the cracks in some government buildings nearby the dzong located about two kilometers from the mining site are caused by vibration from the blasts. The management of the mine however argues that these allegations are baseless as not a single house in the immediate neighbourhood where the vibration is supposedly stronger has suffered any cracks.

The mine starts its operation at 7 a.m. and goes on till 11 p.m. People of Borangchilo village, which is located across the mining site, complained that the noise of vehicles and machineries affects their sleep and quiet moments. They said that due to deafening noise from the mine site, they were not able to hear the sounds of wild animals when they entered their fields, losing substantial amount of their crops to wild animals every year.

iii) Water pollution

There are no complaints of pollution of drinking water as all the water sources are from places above mine site. However, rock and mud wastes that are unmindfully disposed off down the slopes get deposited into the stream below. This has caused siltation of its banks. Disposal of a large amount of wastes into the stream increases its sediment load. People said that

during monsoons, when the volume of water increases in the stream, it floods causing damages to plants and aquatic lives as well as causing great risks to people living downstream.

Picture a: Wastes sliding down to the stream

iv) Soil erosion

The mine site does not have a proper place to dispose off the wastes and debris generated by blasts. Rock and mud wastes are disposed off unmindfully down the steep slopes below the mine site. Bigger rocks and other debris slide down to the stream below while smaller ones are left hanging loosely onto the slopes. The run-off water after heavy rainfalls washes down these materials. During such process, not only are the lose materials carried away but also the intact materials on to which the lose materials hang

also gets washed away, causing blanketing of the bottom of the gorge and the banks of the stream.

Picture b: Truck unloading debris on to the slope

Picture c: Unloaded debris sliding down the slope

v) Physical damages

What has been a group of some nine households and their farmlands along with pristine forests around some 26 years ago has now been converted into a brown opencast mine site. Trees and plants have all disappeared and the topography has been altered significantly. What has been a gentle slope is now converted into steep slopes. People of Borangchilo, a village on the opposite side of the mine, say that the site has certainly degraded in its aesthetic beauty. Another physical damage associated with the mine is degradation of roads between Tsheringkhor and Pemagatshel. They said that a large number of heavily loaded trucks plying the road has damaged roads in many places.

Picture d: Scar caused to the landscape by mining

Picture e: Close-up view of the scar

B. Health impacts

A few interviewees of this study reported that the frequency of occurrence of diseases such as cold and cough which people believe are commonly caused by presence of more dusts, is more now as compared to previous years. There was no data to substantiate such a claim. The district medical officer said the hospital received two or three accident cases from the mine site every week.

Part 6: Summary and conclusions

This study points out to a number of conclusions. The mining of gypsum at Khothagpa does have some economic benefits. At a national level, it contributes to the exchequer and helps our country to earn rupees and hard currency. Locally, people benefit from part-time jobs and renting of their extra space in their house to migrant workers. Local business community benefits from the extra customers generated by the mine. Truckers are able to deploy their trucks in transporting gypsum on regular basis. In the social sector, the corporation provides financial support to organise some important community religious ceremonies and has made donation of goods for social causes. These tidbits of contributions that the corporation makes, however, are very sporadic.

People are of opinion that benefits, especially the economic ones, are shrinking every year. They say that during the first lease period (1993-

2003), more local people were able to work at the mine and earn some extra cash. During the second lease, migrant workers have arrived from other parts of the country, competing with the local people for jobs at the mine. Besides, due to deployment of more dozers and rock breakers, the need for manual workers has been reduced significantly; the need for manual workers will be even lower when more dozers are deployed, which the management intends to do in future.

While benefits or positive impacts are small and shrinking, mining operation has caused several negative socio-economic and environmental impacts, most of which cannot be quantified. Interviewees said that many people were discarding their farming practices to embrace non-farm work such as working at the mine, which warrants them some assured monthly income. This has not only led to fallowing of land but also to labour shortages and increased wages in the local areas. Horticultural productivity in the areas nearby the mine has decreased. The management compensates three households annually but there are still both moral and economic issues involved in such compensation packages. The management of the company has agreed to compensate two households Nu. 7,500 each every year until the manufacturing of plaster of paris is discontinued. Manufacturing of plaster of paris may conveniently stop when it is no longer profitable and farmers will not get compensation. But many orange trees would have died by then and the health of surviving ones hampered seriously. For several years down the road, these households would neither

get compensation nor would earn anything from their horticulture.

Cohesive family life and participation in community events are important aspects of Gross National Happiness. The shift system induced by 16 hour daily work period for the mine is causing inconvenience to social life of the community. People are not able to spend time with their family and partake in community events. Some workers are of opinion that despite handsome profits that company makes, they are paid very low. Some workers wondered if it was worth inhaling so much of dusts for just Nu. 100 a day.

The mining operation has caused some serious ecological footprints. Given the technicalities of the environment impacts, this study has outlined only those that are obvious to a lay person's eyes. A huge scar has been inflicted to the landscape and it will only worsen as more trees are cut and more rock faces are blasted. Ensuing soil has resulted in siltation of a stream below. If researches elsewhere have found that siltation and flooding kills aquatic lives, it must also be so those aquatic organisms of the stream below the mine and others that it joins downstream. Continued mining could pose a serious challenge to the communities nearby. Not only there be more vibration, noise and dusts but the stability of the whole slope could be threatened as the company digs in deeper every year. There are villages adjacent to the mine; some day, if not any time soon, these villages would face serious problems of environmental instability.

In the final analysis, it can be said that the mining operation does have benefits as well as costs. Although this study has attempted to pass some judgments in that it is of the opinion that there are more costs than the benefits, more detailed study involving multi-disciplinary team would be required to see whether the benefits outweigh costs or the other way round. Also, given the ownership pattern of the mine, which is very broad and diverse, the findings of this study may not be applicable to other mines with different patterns of ownership.

Defamation Law in Bhutan: Some Reflections

*Venkat Iyer**

Introduction

The recent judgment of the Thimphu High Court in the defamation case involving the former Director of Revenue and Customs, Sangay Zam, the present Finance Minster, Lyonpo Wangdi Norbu, and Lyonpo Yeshey Zimba, on the one hand, and the former authorised agent of PlayWin online lottery, Sangay Dorji, raises some interesting questions about the manner in which reputational interests of individuals are protected under Bhutanese law.

The case, which arose out of comments made by Sangay Dorji at a workshop on "Review of Anti-Corruption Strategies" conducted by the Anti Corruption Commission of Bhutan in August 2007, was first filed in the Thimphu District Court by the Office of the Attorney General (OAG) which reportedly acted at the behest of the three complainants. The District Court delivered a judgment in July 2008 in which it dismissed the case and laid down certain principles to be followed in defamation suits.

The case was then taken in appeal to the High Court by the OAG. A Full Bench of the High Court heard arguments from both sides and delivered the abovementioned judgment on 30 December 2008 which effectively affirmed the verdict of the District Court, holding it to be "fair and reasonable enough".[1]

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[1] "Defamation suit comes unstuck", *Kuensel*, 31 December 2008, p.4. The judgment of the High Court was rendered in Dzongkha and since no English translation has been published, the author has relied on the above newspaper report for guidance.

Basic principles

Before we analyse the two judgments, it would be helpful to cast a quick glance at the basic principles of, and approaches to, defamation law in some major jurisdictions. For the sake of convenience and to keep this discussion within manageable limits, reference will be made particularly to the position prevailing in England and the United States of America, two of the most widely respected legal jurisdictions in the world.

The law of defamation rests on the value that people attach to the reputation of individuals. In most countries, a person's reputation is considered to be as important as his personal possessions – in other words, the right to reputation is treated as being on par with the right to property. Shakespeare put it even higher when he said:

> "Who steals my purse, steals trash; 'tis something, nothing;
> 'Twas mine, 'tis his, and has been slave to thousands;
> But he that filches from me my good name,
> Robs me of that which not enriches him,
> And makes me poor indeed."[2]

Therefore, just as the law provides for compensation to be paid when a person is wrongfully deprived of his property, so the law also requires the payment of compensation to anyone whose reputation is damaged. Additionally, some countries also allow for punishment – in the form of a fine or imprisonment – for the defamer, although this aspect of the law is fast falling into disuse.[3]

There are two types of defamation: libel and slander. Libel consists of defamation in a permanent form, e.g. in print,

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[2] *Othello*, Act 111, Scene 3, 167.

[3] Most Western countries have either abolished, or abandoned the use of, prosecutions for defamation. However, such prosecutions continue in a number of Asian jurisdictions, e.g. India, Malaysia, Singapore, and Thailand.

tape, or compact disc, while slander consists of defamation in non-permanent or transient form, e.g. in spoken words. Sometimes, the same matter may constitute both libel and slander: for example, when a person utters defamatory words during a live radio broadcast (slander) which is then recorded on tape by another person (libel). Some legal systems provide for special rules in respect of slander but, generally speaking, the effects of both types of defamation are the same in law.

Arguably, the most important question that arises is: what constitutes defamation? Although there are some variations between countries, the most commonly used definition states that defamation consists of any act which results in the reputation of a person being lowered in the eyes of other right-thinking members of society. Note that the lowering of the reputation must be in the eyes of *others*, not the person concerned himself. This means that, if someone were to say something highly abusive about another person to his face, the abused person cannot complain of being defamed, however hurt he may be by the abuse. Note also that the effect of a defamatory statement will be judged on right-thinking members of society, viz. reasonable people of ordinary sensibilities, not someone who is hypersensitive or very thick-skinned.

It is important, of course, that the statement being complained of must be false. True accusations against someone, even if it has the effect of lowering his reputation, cannot amount to defamation. This means that truth can be a defence by anyone accused of defaming another person.

The law recognises a number of other defences as well to a charge of defamation. The most commonly used among these, particularly by the media, is fair comment and privilege. Fair comment involves the defendant arguing that the statement complained of was an honest and reasonable opinion expressed by him without malice on a matter of public interest and upon facts which had been clearly established. In order to succeed, the comment should have

been expressed in moderate language. It should not be motivated by personal grudge or other selfish considerations.

As for privilege, the law recognises certain occasions when the public interest requires complete freedom of speech, including protection from proceedings for defamation, even if the speech is subsequently shown to be false or mistaken. There are two types of privilege: absolute privilege and qualified privilege. Absolute privilege allows a person to say or write anything, even maliciously, and still not face the possibility of defamation suits. The most commonly cited example of this type of privilege is speeches made by Members of Parliament on the floor of the House.[4] Qualified privilege, on the other hand, requires that those making statements which may turn out to be defamatory do so without malice. The basis of qualified privilege is that the speaker or writer has a duty to say or write the words complained of to protect a legitimate interest, and the audience to which the words are addressed has an interest in receiving those words. An example of qualified privilege would be job references: here, the person writing a reference has a duty to speak frankly about the person being written about, and the person who has sought the reference has an interest in obtaining a frank opinion about him.

Qualified privilege and the media

In recent years, the defense of qualified privilege has been creatively adapted by the courts in some countries to give the media a greater degree of freedom to comment on matters of public interest without fear of being sued for defamation. This has been done on the premise that journalists have a duty to tell their readers, listeners and viewers about matters of public interest and the readers, listeners and viewers have an interest in receiving such information. The leading case which laid down this principle is *Reynolds v. Times*

[4] It needs to be remembered, however, that the extent of an MP's freedom to speak in Parliament is limited by the control exercised by the Speaker of the House.

Newspapers,[5] which was decided by the House of Lords in England. In this case, the court set out the following 10 factors that judges should take into account when deciding whether the duty and interest tests were met sufficiently for a media defendant to succeed in a defamation case:

1. The seriousness of the allegation: the more serious the charge, the more the public is misinformed and the individual harmed, if the allegation is not true.
2. The nature of the information, and the extent to which the subject-matter is a matter of public concern.
3. The source of the information. Some informants have no direct knowledge of the events. Some have their own axes to grind, or are being paid for their stories.
4. The steps taken to verify the information.
5. The status of the information. The allegation may have already been the subject of an investigation which commands respect.
6. The urgency of the matter. News is often a perishable commodity.
7. Whether comment was sought from the claimant. He may have information others do not possess or have not disclosed. An approach to the claimant will not always be necessary.
8. Whether the article contained the gist of the claimant's side of the story.
9. The tone of the article. A newspaper can raise queries or call for an investigation. It need not adopt allegations as statements of fact.
10. The circumstances of the publication, including the timing.[6]

The *Reynolds*' defence, as it has come to be called, has been seen as furthering the cause of media freedom in a significant way, especially in countries like England where, traditionally,

[5] [1998] 3 All ER 961.

[6] The above list was prepared by Lord Nicholls, one of the Law Lords who gave judgment in the case. The word 'claimant' used in the list refers to the person bringing the case, i.e. the 'plaintiff'.

the law of defamation has been seen as a major hurdle for investigative journalism. It needs to be remembered, however, that this defence can only be availed of by media defendants and then only in matters involving the public interest.

This defence has since been developed further, notably in the case of *Jameel v. Wall Street Journal Europe*,[7] where the House of Lords ruled that, as long as the media engaged in 'responsible journalism', viz. checked its facts, behaved reasonably and ethically, did not sensationalise the story, offered the alleged victim of defamation an opportunity of 'setting the record straight' in relation to any errors that may have crept into the story, and acted in the public interest, it could escape liability for defamation. The result is that, as the authors of a leading textbook put it, "[t]he writer and publisher on subjects of public interest will henceforth only be liable if he has acted negligently – by putting defamations believed to be true in the public domain without making reasonable checks."[8]

The use of qualified privilege in favour of the media – albeit not to the same extent as laid down in the *Jameel* case – has precedents in other countries as well. Courts in Australia and NZ, for example, have in the late-1990s delivered judgments that have had a liberalising effect on the law of defamation.[9]

Public figures and the law of defamation

One of the other important aspects of the law of defamation which is worth noting is the distinction that is made between public figures and ordinary citizens by the courts of certain

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[7] [2006] UKHL 44.
[8] Robertson and Nicol (2008), *Media Law,* London: Penguin, 5th ed., p. 100.
[9] E.g. *Lange v. Australian Broadcasting Corporation* (1997) 189 CLR 520 (Australia); *Lange v. Atkinson* No. 1 [1998] 3 NZLR 424 and No. 2 [2000} NZLR 385 (New Zealand).

countries. The most prominent of such countries is the United States of America where, in a series of decisions going back to at least 1964, the Supreme Court has held that public figures should enjoy a lesser degree of protection against defamation.[10] As a result, if a public figure was to bring a suit for defamation against, say, a journalist, the suit would be thrown out by an American court unless the public figure was able to show actual malice (e.g. a personal grudge or an ulterior motive) on the part of the journalist.

This distinction has proved controversial. The media have generally welcomed it, arguing that it affords greater protection for investigative journalism against those in the public eye (especially politicians), but others have strongly criticised it, arguing that it is discriminatory. One of the problems is that there can be disputes about whether someone is a public figure or not. This is particularly the case with minor celebrities who may not hold any public office or exercise any public function but who may simply be famous by virtue of their success in a certain profession, calling or occupation. Such persons may feel genuinely aggrieved that the law treats them – and their desire for privacy and dignity – less favourably than many of their less well-known fellow citizens.

An example of possible injustice as a result of the 'public figure' rule arose in a case involving the former Prime Minister of India, Morarji Desai. Mr Desai was the subject of an allegedly defamatory allegation in a book authored by the American writer, Seymour Hersh.[11] Since the book was sought to be sold in both the United States and India, and since Mr Desai had a reputation to defend in both countries, he sued Mr Hersh and the publisher of the book in the courts in both places. Unfortunately for him, his case in the US was thrown out because American law did not allow public figures

[10] See, e.g. *New York Times v. Sullivan* 401 US 265 (1964).
[11] The book in question, *The Price of Power*, critiqued the role played by Dr Henry Kissinger in the shaping and conduct of American foreign policy.

to bring defamation cases unless they could show that the alleged defamer had acted maliciously. Indian law did not make any such distinction, but Mr Desai was still unable to obtain any redress because civil litigation in India is notorious for its delays (such cases often take up to twenty years or more to be heard), and Mr Desai, who was already in his seventies at the time, died before his suit came up for hearing.[12]

The Sangay Dorji case

Bhutanese law does, like its counterparts in other South Asian countries, allow for both civil and criminal liability to attach to defamatory statements. Indeed, the Sangay Dorji case involved the use of criminal law, i.e. Section 317 of the Bhutan Penal Code which says that:

> "A defendant shall be guilty of the offence of defamation if the defendant intentionally causes damage to the reputation of another person or a legal person by communicating false or distorted information about the person's action, motive, character or reputation."

What is striking about the Sangay Dorji case is that the courts – at both District and High Court levels – have thought fit to go beyond the standard requirements applicable in most Anglo-Saxon countries and introduced two further elements to be established by the prosecution before they can procure a conviction, namely:

1. that, if the person aggrieved by the alleged defamation (the complainant) is a public figure, the prosecutor must prove that the person or persons responsible for the defamation (the accused) acted with actual malice; and

2. that prosecutor must further prove that the accused knew that the statement in question was false when he made it.

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[12] In most countries, defamation suits come to an end when the plaintiff dies.

While the first stipulation has some precedents to support it (e.g. the law in the United States noted above – although the Bhutanese courts do not refer to any precedents), the second is somewhat unique, at least in the common law world. It imposes a higher than normal burden on the part of the prosecution and therefore makes successful prosecutions much more difficult. However, it would be lauded by those free speech campaigners who have, over the years, argued that the traditional approach of requiring the defendant to prove the truth of the alleged defamatory statement was unfair and out of line with the normal rules of burden of proof in criminal cases.

Although the judgments in the Sangay Dorji case do not elaborate on the concept of 'public figure', they do make it clear that this concept is "broader than celebrities and politicians".[13] Accordingly, they have concluded that Mrs Sangay Zam, the then Director of Revenue and Customs (who was one of the complainants in this case), was – despite being neither a celebrity nor a politician – a public figure. How the concept of 'public figure' is developed in the future by the Bhutanese courts will be important, because that will determine the outcome of many defamation cases. Obviously, some caution is required lest the law of defamation becomes skewed against a whole class of people who, sometimes for no fault of their own, find themselves in the public eye.

Another noteworthy aspect of the judgments is that the District Court has attempted to signal its preference for reduced protection for the reputation of public officials as a group compared to other citizens. "The jurisprudence adopted by the Bhutanese court," it says, "is clear that public officials enjoy lesser protection of their reputation since they are routinely exposed to public opinion because of their public profile."[14] This may be seen as a welcome development from the point of view of freedom of speech in a democracy,

[13] Unnumbered para. 10, Part II of the District Court judgment.
[14] Unnumbered para. 17, ibid.

because it echoes the liberalising trend evident in a number other countries in this regard. As far back as 1993 the House of Lords in London expressed the view that if public bodies were allowed to sue for defamation, they might misuse that power to stifle legitimate criticism of their activities.[15] This, said the court, would have a "chilling effect" on free speech. In the words of one of the judges, it would be "a serious interference . . . if the wealth of the State, derived from the State's subjects, could be used to launch against those subjects actions for defamation because they have, falsely and unfairly it may be, criticised or condemned the management of the country."[16] In England, it is now not possible for local authorities, government-run corporations and political parties to sue for defamation. This principle has also been accepted by the Supreme Court of India.

The Thimphu District Court has been equally vigorous in its affirmation of this principle. It has said that

> "in a modern democratic society, constructive criticism by any individual citizen against the government should be accepted as a necessary evil for effective governance. It is only the freedom of expression and thought that would translate the true meaning of democracy [sic]."[17]

The role of the Attorney General

One of the particularly controversial aspects of the Sangay Dorji case appears to be the involvement of the Office of the Attorney General in launching the prosecution – and the subsequent appeal – which led to the two court judgments. The OAG is reported to have acted on the basis of a directive issued by the Cabinet Secretary, but this came in for some criticism by the courts. The judges noted that, although the Attorney-General has a "special responsibility to be a

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[15] *Derbyshire County Council v. Times Newspapers* [1993] AC 534.
[16] Ibid. At 557-59 (per Lord Keith).
[17] Ibid., para. 5.2 (Note: from the copy of the judgment obtained by the author, it is not entirely clear why some paragraphs have been numbered and others have not.)

guardian of rule of law, which include guardian [sic] of the public interest," his responsibility for individual criminal prosecutions

> "must be undertaken on strictly objective and legal criteria, free of any political considerations and independent of the traditional cabinet decision. Any deviation would lead to dysfunction of the democratic process and will be becoming more pronounce [sic] in the near future. No prosecution of this nature may be initiated in the court at the cost of the public purse."[18]

The High Court reportedly endorsed this view and suggested that "[s]uch cases should not be represented by the OAG and left to the aggrieved individual."[19] The basis for this finding was that the alleged defamatory statement did not materially affect the reputation of the Revenue and Customs Department of which the aggrieved person, Mrs Sangay Zam, was at the relevant time the Secretary.

Quite clearly, this is a matter which deserves serious consideration. Where public expenditure is involved, it is important that the highest standards of probity are adhered to. For this reason, it would be desirable if proper norms and guidelines are framed about the extent, and the manner of exercise of, the Attorney-General's discretion in such matters. These norms and guidelines should have regard not only to the peculiar needs of Bhutanese society but also to best practices in other democracies.

Other issues

The Sangay Dorji case raises a number of other issues as well which it would be beyond the scope of the present article to elaborate on. These include:

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[18] Ibid., para. 5.3.

[19] "Defamation suit comes unstuck", *Kuensel*, December 31, 2008, p. 4.

1. the manner in which the defence of 'truth' vis-a-vis defamation has been dealt with by the courts, and its apparent conflation with the defence of 'fair comment';[20]
2. the use and evidentiary value of Parliamentary Resolutions in defamation proceedings (and in court proceedings generally);[21]
3. the manner of collection of evidence prior to the launching of proceedings for defamation;[22]
4. the proper scope and limits of the offence of 'sedition' and its relevance to cases involving alleged attacks on individual reputation;[23] and
5. the proper scope and limits of the offence of 'spreading false information' and its relevance to cases involving alleged attacks on individual reputation.[24]

More generally, the case points to the need for a wider and deeper debate involving legal professionals, policy analysts, the government's law officers, the media, and members of the public who may have an interest in such matters, over the place that defamation law should occupy in a new democratic Bhutan, the relative merits of resort to prosecutions on the one hand and civil proceedings on the other for the vindication of individual reputations, and the strengths and weaknesses of the present Bhutanese law on defamation.

Conclusion

The Sangay Dorji case offers both opportunities and challenges for the reform of media law in Bhutan. It is

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[20] See unnumbered para. 15 of the District Court judgment.
[21] See unnumbered paras. 13-15, ibid.
[22] In the present case, the Office of Attorney General reportedly prepared and put out questionnaires which those attending the ACC workshop were asked to complete and return to the OAG. Some of the recipients of the questionnaire were apparently unsure of the legal status of the document and their own legal rights in relation to it.
[23] See Part III of the District Court judgment.
[24] See Part I, ibid.

arguably the first case in which the courts have undertaken a major assessment of the complex issues that defamation law often throws up. The importance of engaging with such issues is heightened by the fact that Bhutan now has a written constitution which guarantees freedom of speech and expression and which therefore requires policy makers, prosecutors and the judiciary to ensure that the correct balance is struck between that important freedom and other competing interests such as the right to personal reputation. As Bhutanese democracy matures, and as the country's economic, social and cultural development gathers pace, more and more cases of this kind are likely to emerge, calling for creative solutions and sophisticated approaches to dispute resolution.

For all the limitations of Bhutan's nascent legal infrastructure – including obvious constraints of judicial capacity – both the Thimphu District Court and the High Court have, in the present case, made a promising, if imperfect, start which, on the whole, augurs well for the healthy development of defamation law in the future. Quite clearly, a number of crinkles need to be ironed out and a range of both conceptual and practical issues need to be clarified fairly quickly. The Bhutanese political and judicial leadership would do well to look at the experience of media law reform in comparable jurisdictions elsewhere, and also seek expert advice from those with an understanding of the needs and aspirations of transitional societies. Recent years have seen remarkable developments in defamation law and practice all over the world, and this branch of the law is still evolving.

Bhutan National Values Assessment

Steve Evans[*]

Introduction

His Majesty King Khesar, The 5th Druk Gyalpo of Bhutan, recognised in his coronation address on November 7, 2008 that core values form a common thread that binds and guides the nation, especially in the wake of current democratic processes. His deepest concern, he said, is that as the world changes Bhutan may lose its fundamental values on which rest its character as a nation and people.

His Majesty said:

> "Our generation of Bhutanese have been gifted a strong, dynamic nation by our forefathers. I am confident that as long as we are willing to work with their commitment and dedication and follow their example we can bring greater peace, happiness and prosperity to our country. I am confident because I know the worth and character of our people. You are the true jewel of this nation. As citizens of a spiritual land you treasure the qualities of a good human being – honesty, kindness, charity, integrity, unity, respect for our culture and traditions, love for our country and for God. Throughout our history our parents have upheld these values and placed the common good above the self. My deepest concern is that as the world changes we may lose these fundamental values on which rest our character as a nation and people. It is critical that we are able to recognise Bhutanese character irrespective of how far we look back into the past or into the future. The Bhutan we see is vastly different - unrecognisable even - when compared to the Bhutan in the time of our first King. Yet, the character of our people and the nature of our fundamental values have remained unchanged. Henceforth, as even more dramatic changes transform the

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> world and our nation, as long as we continue to pursue the simple and timeless goal of being good human beings, and as long as we strive to build a nation that stands for everything that is good, we can ensure that our future generations for hundreds of years will live in happiness and peace."[1]

The *Bhutan National Values Assessment*[2] confirms that the nation and its people are, indeed, healthy when it comes to personal and national values. The survey was conducted by the International Center for Ethnographic Studies (ICES) in partnership with the Barrett Values Centre, the Centre for Bhutan Studies (CBS), East Tennessee State University (ETSU), and the Brimstone Grant for Applied Storytelling. Results were released on January 9, 2009. The author of this paper coordinated the study.

Research focused on three key areas – Bhutanese' personal values, the values and issues perceived to drive the current national culture, and the values that Bhutanese want their society to embrace. Demographic information collected in the survey includes gender, region, education, and age. 403 people from western and central Bhutan participated in the survey during the year 2008. Volunteers affiliated with ICES and CBS conducted the survey using a standard form developed by The Values Centre, and then transferred the information to an online database maintained by the Barrett Values Centre. Consultants of The Values Centre ran and interpreted the data, then produced the report.

The *Bhutan National Values Assessment* reveals those values that unite the nation in shared understanding, direction and purpose, while providing clarity to any challenges ahead. The data is invaluable for informing government, public agencies,

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[1] Coronation Address of His Majesty King Khesar, The 5th Druk Gyalpo of Bhutan, 7th November, 2008. Retrieved January 29, 2009 from http://www.grossnationalhappiness.com//

[2] For the full report go to http://www.bhutanstudies.org.bt/main/index.php

non-profit organisations and corporations about what is most important to Bhutanese. Results are to be used to inform public policy and strategic initiatives and to help bring resulting efforts into alignment.

Seven Values Levels of Personal and National Consciousness

To fully understand the *Bhutan National Values Assessment*, this report, and the implications of the data, it will be necessary to first comprehend the concepts of *The Seven Levels of Personal Consciousness* and *The Seven Levels of National Consciousness* developed by Richard Barrett of the Barrett Values Centre.[3]

The Seven Levels of Personal Consciousness

Individuals and nations do not operate from any one single level of consciousness. They tend to be clustered around three or four levels. Individuals are usually focused at levels 1 through 5, with a particular emphasis at level 5.

Level 1: Survival

This level focuses on physical survival and safety. It includes values such as financial stability, health, nutrition and self-discipline. The potentially limiting aspects of this level are generated from fears around not having enough and not being able to survive. Limiting values include greed, control and caution.

Level 2: Relationships

The second level focuses on the quality of interpersonal relationships in an individual's life. It includes values such as open communication, family, friendship, conflict resolution and respect. The potentially limiting aspects of this level are generated from fears around not belonging and not being

[3] For an overview of the Barrett Values Centre go to http://www.valuescentre.com/index.php

acknowledged. Limiting values at this level include rivalry, intolerance and being liked.

Level 3: Self-esteem

This level focuses on an individual's need to feel a sense of personal self-worth. It includes such values as being the best, ambition, career focus, and reward. The potentially limiting aspects of this level are generated from fears about not being enough in the eyes of others, and a lack of positive self-regard. Potentially limiting values include status, arrogance and personal image.

Level 4[4]: Transformation

This level focuses on self-actualisation and personal growth. It contains values such as courage, accountability, responsibility, knowledge, and independence. This is the level at which individuals overcome the anxieties and fears they are holding onto from the first three levels. It is also the level where individuals begin to find balance in their lives and source their decision-making from their values rather than their beliefs.

Level 5: Internal cohesion

The fifth level focuses on the individual's search for meaning. Individuals operating at this level no longer think in terms of a job or career, but of aligning their work with their personal sense of mission. This level contains values such as commitment, creativity, enthusiasm, humour, fun, excellence, generosity, and honesty.

Level 6: Making a difference

This level focuses on actualising the individual's sense of mission by making a positive difference in the world. Individuals operating at this level seek to cultivate their intuition as their principal means of making decisions. They

[4] There are no potentially limiting values in levels 4 through 7.

also recognise the importance of working with others to leverage their impact on the world. This level contains values such as empathy, counselling, community work, and environmental awareness.

Level 7: Service

The seventh level is attained when making a difference becomes a way of life. It reflects the highest order of internal and external connectedness and shows up as selfless service to others or to a cause. Individuals operating at this level display wisdom, compassion, and forgiveness, and are at ease with uncertainty. They have a global perspective. They are concerned about issues such as social justice, human rights and future generations.

The Seven Levels of National Consciousness

All human group structures grow and develop in seven well-defined stages. Each stage focuses on a particular existential need that is common to the human condition. These seven needs are the principal motivating forces in all human affairs. The level of growth and development depends on the ability of the leaders to create conditions that enable the members of the group to satisfy these seven existential needs. If these needs are not met, then the consciousness of the people in the group will stay focused on these needs until they are met.

Level 1: Survival

The three major areas of focus or concerns in nations that are operating from this level are: defense and the protection of borders; economic health and prosperity of the masses; and the health and nutrition of all citizens. Dysfunction at this level leads to unemployment, corruption, environmental degradation, and large income disparities between the rich and poor. Crime and violence ensue as those who are closest to survival attempt to meet their needs in any way they can.

Level 2: Relationships

At this level there is a focus on: the peaceful resolution of conflicts between individuals and groups; the creation of a sense of belonging that embraces all citizens; and the loyalty of citizens to the government of the nation. Dysfunction in this area leads to inter-ethnic or inter-religious violence, and the victimization or unfair treatment of minorities or sub-groups based on gender, sexual preference, race, etc.

Level 3: Self-esteem

The areas of focus or concerns in nations that are operating from this level are: establishment and enforcement of law and order; creation of institutions of governance based on efficient systems and processes; and provision of public infrastructure and services that enhance the productivity of the nation and the well-being and prosperity of the people. Dysfunction in this area leads to a higher incidence of criminal activity and a lack of public protection from unscrupulous businesses.

Level 4[5]: Transformation

The focus of the fourth level is on the consolidation of internal stability by creating a multi-cultural, non-discriminatory, egalitarian society that respects the rights of all citizens. This is the level of democracy and freedom, where citizens act responsibly for the good of the whole with a focus on continuous improvement and renewal.

Level 5: Internal cohesion

At this level the focus is on the deepening of the internal resilience of the nation by focusing on fairness, openness, and transparency, thereby creating a climate of trust. At this level there would be a sense of a shared vision and values where citizens can play a part in building the nation.

[5] There are no potentially limiting values in levels 4 through 7.

Level 6: Making a difference

The sixth level concerns building mutually beneficial strategic alliances with other nations that share similar values, as well as deepening the sense of internal cohesion in the nation that began at level 4 with materialising the values of freedom and equality, and continued at level 5 with the practice of fairness, openness and transparency. There is an awareness of the importance of nature and the environment.

Level 7: Service

The seventh level builds upon level 6 by expanding the depth and breadth of international cooperation with regard to solving the problems of humanity, and at the same time deepening the sense of internal cohesion in the nation by supporting the self-actualisation of the people and expanding the focus on social and environmental sustainability to include ecological sustainability.

An overview of Bhutan

Current strengths of Bhutan

The personal values of the people of Bhutan show that they demonstrate:

- Support for and connections with others
- Focus on enriching their knowledge and understanding
- A positive outlook
- Inner drive and strength

Their top value is "friendship," and the Bhutanese have a high number of relationship-type values, indicating that people and their connections to them are notably important. The study indicates these values are concentrated at level 2 of the values scale, relationships, while their overall values are concentrated at level 5, internal cohesion. Level 5 shows that the people of Bhutan seek meaning and purpose in their lives.

The current culture of Bhutan is driven by values that promote:

- Access to information and knowledge and a commitment to the betterment of society
- Intelligent stewardship of resources
- Being guided and united by a common set of values and a common direction
- Protection for the rights of the people to make political choices
- Moral structure that provides guidance and encourages comfort

Bhutan's top national value perceived by its people is "continuous improvement," and there is a strong concentration of organisational-type values showing that the people have a powerful focus on governance that is based on efficient systems and processes, along with a provision of public infrastructure and services that enhance the productivity of the nation and the well-being and prosperity of the people. The nation's top values are grouped at levels 3, 4 and 5 (Self-esteem, transformation, and internal cohesion), but the strongest concentration is at level 4 – transformation. Level 4 focuses on democratic processes, institutional accountability, renewal and development. The people of Bhutan see the nation as open to change.

Key issues for Bhutan

The entropy in Bhutan is notably low at 4% and could possibly be one of the lowest in the world. As with any nation, there are issues that could be addressed in order to create greater stability and prosperity within the nation.

The way forward for Bhutan

The participants in this survey experience six values in the current culture of the nation that they would like to see remain in the culture they desire. This shows that they have confidence in the current direction of the country. These values are education, continuous improvement, social justice,

contentment, environmental protection, and strict moral/religious codes. Education and social justice received the most significant increase in the desired culture, showing that these are of rising importance to the people. The desired values show that the people want to be able to freely express their views and seek a stronger focus on growing the economy and on creating opportunities for them to thrive and support themselves. They want their personal sense of compassion to be a guiding value in their nation.

Personal values of the Bhutanese

What is important to the people of Bhutan?

Personal values in order of predominance are: friendship (180 votes, level 2), continuous learning (160 votes, level 4), compassion (128 votes, level 7), caution (122 votes, level 1), sincerity (121 votes, level 5), social justice (118 votes, level 7), self-discipline (102 votes, level 1), optimism (95 votes, level 5), helpfulness (94 votes, level 2), and caring (92 votes, level 2).

From an analysis of the personal values chosen by the people of Bhutan it can be determined what are the principal values that guide their decision making (top values), and how their values are distributed across the seven values levels (all values). Every value chosen can be classified as an individual, relationship or societal value (IRS). As stated in the overview of Bhutan, key themes from the Bhutanese' top values include: 1) support for and connections with others; 2) seeking to enrich their knowledge and understanding; 3) having a positive outlook; and 4) inner drive and strength.

In the people's top personal values, the values are located in five of the seven levels with a concentration at level 2 - relationships. This concentration shows that many in this group have a focus on the quality of interpersonal relationships. In considering all of the values chosen, the greatest focus is at level 5 - internal cohesion (25%). Level 5 represents personal cohesion, maturity and/or a search for

meaning. The distribution of all values shows where the most energy is concentrated for this group, not just where there is consensus on specific values.

A values gap occurs where one or more of the seven levels has no top values. This can mean one of three things: that the levels 1) are unconsciously taken care of, 2) are a blind spot, or 3) represent the next area of growth. Here, there are no top positive values in the following levels: level 3, self-esteem, focusing on performing to a high standard, and level 6, making a difference, focusing on creating positive change through awareness and contribution from a personal and community perspective. It is important to consider all values at the levels where there are no top values to see if the percentage of total votes at that level is significant. A high percentage at a level with no top values indicates that there is focus in this area but there is little agreement as to which values are important. Here, while self-esteem and making a difference are not top personal values of any respondents, 10% of respondents indicated that each of them is of some value.

Of the top positive values chosen four are individual values, four are relationship values and one is a societal value. It is common in the personal values to see a concentration of individual-type values. However, this group shows a high number of relationship-type values, indicating that people and their connections with them are notably important to the citizens of Bhutan. There is one potentially limiting value in the top ten list, and that is "caution."

Current culture values of Bhutan

What is shaping the Bhutanese' experience?

Current culture values reflect citizens' perceptions of the nation's culture and the day-to-day living environment – both the positive aspects of their experiences and the potential problem areas. In addition to the values types for personal

values (IRS), there are also organisational-type values (IROS). These values in order of predominance are: continuous improvement (195 votes, level 4), environmental protection (104 votes, level 1), strict moral/religious codes (104 votes, level 3), political rights (102 votes, level 3), education (100 votes, level 4), nature conservation (91 votes, level 6), shared vision (90 votes, level 5), information availability (88 votes, level 3), shared values (88 values, level 5), contentment (87 votes, level 5), and social justice (87 votes, level 4).

Key themes from these top values include: 1) access to information and knowledge, as well as a commitment to the betterment of society; 2) intelligent stewardship of resources; 3) being guided and united by a common set of values and a common direction; and 4) a moral structure that provides guidance and encourages comfort.

In the current culture, top values are distributed in five of the seven levels with concentration at level 5 (internal cohesion), level 4 (transformation), and level 3 (self-esteem). This shows that much of the people's energy goes toward building a sense of openness, trust, transparency, shared values and vision, democratic processes, institutional accountability, renewal and development, institutional efficiencies, system performance, and/or pride in the nation. Considering all values, both positive and potentially limiting, the highest focus is at level 4 - transformation (32%). Level 4 focuses on democratic processes, institutional accountability, renewal and development.

There are no top positive values in the following levels: level 2 – relationship, which focuses on social stability and family or group relationships- and level 7 – service, which reflects a focus on creating a sustainable future for humanity. This indicates a values gap. Of the top positive values that were chosen, one is an individual value, none are relationship values, eight are organisational values and two are societal values. This shows that the people see a powerful focus on governance based on efficient systems and processes, as well

as provision of public infrastructure and services that enhance the productivity of the nation and the well-being and prosperity of the people.

When comparing personal and current culture values, those that match indicate alignment. The greater the number of matching personal and current culture values, the greater degree to which citizens experience a sense of community. In a highly aligned culture, one would expect to see two or three matching personal and current culture values. The presence of only one or two values matches indicate that the people are not highly aligned with the values of the nation, which can cause some level of social unrest. Here there is only one matching value – social justice.

Current entropy of Bhutan

Potentially limiting values create cultural entropy. Entropy is a measure of the degree of dysfunction in a system and represents the proportion of votes for potentially limiting values. Potentially limiting values for Bhutan are found only at levels 1, 2 and 3 of the seven values levels. Specific issues contributing to the entropy at each level are:

- Level 1 – Survival (74 votes, 2% of total): drunkenness (2 votes), crime/violence (6 votes), drug addiction (9 votes), corruption (9 votes), autocracy (9 votes), poverty (10 votes), unemployment (14 votes), and environmental pollution (15 votes).

- Level 2 – Relationships (36 votes, 1% of total): racial/ethnic discrimination (3 votes), gender discrimination (3 votes), inequality (9 votes), conflict/aggression (10 votes), and loneliness/isolation (11 votes).

- Level 3 – Self-Esteem (36 votes, 1% or total): isolationist attitudes (3 votes), information hoarding (5

votes), conservative attitudes (14 votes), and bureaucracy (14 votes)

Only 4% of all votes were for potentially limiting values. This is a low and healthy level of entropy and shows that fear is not predominant in the way Bhutan makes decisions and protects its people. There are no potentially limiting values in the top values of the current culture, and the entropy, while low, is slightly concentrated at level 1. Bhutan's entropy is one of the lowest in the world.

Desired culture values for Bhutan

What values do Bhutanese want for their future?

Desired culture values reflect what participants believe to be important for the well-being of their nation. These values provide insights into the direction participants' want the nation to take, possible antidotes to current problems, and values that need strengthening. The desired culture values expressed by the people of Bhutan for their nation, in order of predominance, are: education (115 votes, level 4), continuous improvement (113 votes, level 4), freedom of speech (113 votes, level 4), economic growth (107 votes, level 1), social justice (100 votes, level 4), contentment (93 votes, level 5), environmental protection (89 votes, level 1), compassion (83 votes, level 7), full employment (82 votes, level 3), and strict moral/religious values (82 votes, level 3).

Key themes from top desired cultural values include: 1) providing more opportunity for people to learn, work and strengthen the economy; 2) allowing people to express their views and have access to fair systems; and 3) demonstrating care and empathy for people.

Matching values indicate alignment. The greater the number of matching current and desired culture values, the greater the degree to which citizens believe their nation is on the right

track. In a highly aligned culture, one would expect to see six or more matching current and desired culture values. The *Bhutan National Values Assessment* indicates six matching values: continuous improvement, environmental protection, strict moral/religious codes, education, contentment, and social justice. These are the attributes that Bhutanese experience now and want to continue to support in the future. Four to six values matches shows that people have a strong level of confidence in the current direction of the government. Bhutanese have six matches. They would, however, like to see some changes in priorities.

In comparing personal values and desired culture values, there are two matches: compassion and social justice. These are the values that, if chosen to be guiding principles of the nation, could easily be supported by the people, as they are important in their daily lives. There is one across-the-board matching value among the personal, current and desired culture values, and that is social justice. In a highly aligned culture, one would expect to see three or four personal values that are also found in the current and desired culture.

New values in the desired culture are values among the desired culture values that are not included the current culture values. They are values that participants would like to see implemented to improve the overall well-being of the nation and create a sustainable future for everyone. There are four new values in the values plot diagram: freedom of speech, economic growth, compassion, and full employment.

In the desired culture, the top values are distributed in five of the seven levels with concentration at level 4 (transformation), showing that the participants want effort directed towards democratic processes, institutional accountability, renewal and development. In looking at all of the values chosen, the focus continues to be at level 4 (31%). In this case, level 4 indicates that participants want to focus on continuous improvement – learning, researching and modernising. There are no top positive values in the level 2 (relationship), which

focuses on social stability and family or group relationships, and level 6 (external cohesion), which focuses on quality of life issues and/or creating mutually beneficial strategic alliances. Of the top positive values chosen, one is an individual value, one is a relationship value, seven are organisational values and one is a societal value. This shows that the main focus remains on efficient systems and processes, along with provision of public infrastructure and services that enhance the productivity of the nation and the well-being and prosperity of the people.

Distribution of all values

The distribution of all values indicate the percentage of votes for values in three major areas – self interest, transformation and common good. Self Interest is represented by levels 1, 2 and 3, and encompasses basic needs, such as financial and physical health, interpersonal relationships, and systems and processes that support individual and national needs. "Transformation" is represented by level 4. This level is about giving people a voice, beginning to challenge and question ideas, and embracing opportunities for growth and learning. Common good encompasses levels 5, 6 and 7. In these levels, individuals and nations are focused on the well-being of the collective, finding meaning in their lives and work, and how they can support others in building a long-term sustainable future.

Three comparisons are made: 1) between personal values and current culture values; 2) between current culture values and desired culture values; and 3) between personal values and desird culture values. Also, the comparisons are made across four general categories: entropy, self-interest, transformation, and common good.

The first comparison – between personal values and current culture values – reflects 6% cultural entropy in personal values and 4% cultural entropy in current culture values; 27% self interest in personal values and 29% self interest in current culture values; 19% transformation in personal

values and 32% transformation in current culture values; and 49% common good in personal values and 37% common good in current culture values. There is misalignment here between the make-up of the values people hold personally and those they currently experience in Bhutan.

The second comparison – between current culture values and desired culture values – reflects 4% cultural entropy in current culture values and 4% cultural entropy in desired culture calues; 29% self interest in current culture values and 28% self interest in desired culture calues; 32% transformation in current culture values and 31% transformation in desired culture values; and 37% common good in current culture values and 38% common good in desired culture values. There is near exact alignment between the distribution of values people are currently experiencing and those they would like to see in the desired culture. This alignment shows that they support the amount of focus the nation currently has in each area.

The third comparison – between personal values and desired culture values – reflects 6% cultural entropy in personal values and 4% cultural entropy in desired culture values; 27% self interest in personal values and 28% self interest in desired culture values; 19% transformation in personal values and 31% transformation in desired culture values; and 49% common good in personal values and 38% common good in desired culture values. There is misalignment between the group's personal values and the direction they are asking for in their desired culture.

Positive values by level

Once again, the seven values levels are: 1) survival; 2) relationships; 3) self-esteem; 4) transformation; 5) internal cohesion; 6) making a difference; and 7) service. It is important to see the percentage of personal, current and desired culture votes for positive values by level. These indicate values chosen by participants at the levels where they are requesting more new focus. They are significant

since they provide clarity around the desired direction of the nation.

Positive values at level 1 (survival) are 5% personal, 8% current culture, and 8% desired culture. At level 2 (relationships) positive values are 12% personal, 8% current culture, and 8% desired culture. Positive values at level 3 (self-esteem) are 10% personal, 13% current culture, and 12% desired culture. At level 4 (transformation) positive values are 19% personal, 32% current culture, and 31% desired culture. Positive values at level 5 (internal cohesion) are 25% personal, 18% current culture, and 17% desired culture. At level 6 (making a difference) positive values are 10% personal, 10% current culture, and 10% desired culture. Positive values at level 7 (service) are 14% personal, 9% current culture, and 11% desired culture. Clearly, the greatest numbers of votes by participants of the survey are at levels 4 and 5: transformation and making a difference.

On the personal side, level 4 (transformation) focuses on self-actualisation and personal growth. It contains values such as courage, accountability, responsibility, knowledge, and independence. This is the level at which individuals overcome the anxieties and fears they are holding onto from the first three levels. It is also the level where individuals begin to find balance in their lives and source their decision-making from their values rather than their beliefs. The focus of level 4 on the national side focuses the consolidation of internal stability by creating a multi-cultural, non-discriminatory, egalitarian society that respects the rights of all citizens. This is the level of democracy and freedom where citizens act responsibly for the good of the whole, with a focus on continuous improvement and renewal.

On the personal side, level 5 (internal cohesion) focuses on the individual's search for meaning. Individuals operating at this level no longer think in terms of a job or career, but of aligning their work with their personal sense of mission. This level contains values such as commitment, creativity,

enthusiasm, humour/fun, excellence, generosity and honesty. The focus of level 5 at the national side focuses on the deepening of the internal resilience of the nation by focusing on fairness, openness and transparency and thereby creating a climate of trust. At this level there would be a sense of a shared vision and values where citizens can play a part in building the nation.

Values jumps or increases

Here are the values that received the greatest increase in votes from the current culture to the desired culture. Three are top values in the desired culture. These are values the participants consider need to be enhanced for the future well-being of the nation: full employment (a top value) – from 37 to 82, with a jump of 45; human rights – from 14 to 52, with a jump of 38; military strength – from 11 to 49, with a jump of 38; freedom of speech (a top value) – from 80 to 113, with a jump of 33; economic growth (a top value) – from 74 to 107, with a jump of 33; equal opportunities – from 26 to 58, with a jump of 32; peace – from 49 to 73, with a jump of 24; liberal attitudes – from 34 to 55, with a jump of 21; entrepreneurship – from 27 to 46, with a jump of 19; and wisdom – from 34 to 51, with a jump of 17.

Three key requests are reflected in these values jumps: 1) create a strong economy in which all people can support themselves and are given equal opportunities to thrive; 2) protect people's rights and developing strong a strong defence system; and 3) more openness and acceptance – drawing on experience for guidance.

Demographic breakdown

A majority of the 403 participants of the *Bhutan National Values Assessment* survey were urban educated males under the age of 35. It is interesting to note that in all categories (female, male, rural, urban, under 35, age 35 and over, no education to completion of primary school, education beyond primary school) the values level with the highest number of

votes was level 4 (transformation), followed by level 5 (internal cohesion). Entropy was consistently low across all demographics.

The number one personal value for females was friendship, while continuous learning was the number one personal value for males. For those participants under the age of 35 it was friendship, while it was continuous learning for those 35 and over. The highest personal value for those with an education beyond primary school was friendship, while it was continuous learning for those with no education to completion of primary school. Both rural and urban participants rated friendship as their top personal value.

The number one current culture value was continuous improvement for all demographic categories.

The number one desired culture value for females was education, while continuous improvement was the number one desired culture value for males. For those participants under the age of 35 it was education, while it was freedom of speech for those 35 and over. The highest desired culture value for those with an education beyond primary school was education, while it was friendship for those with no education to completion of primary school. For those from the rural areas the highest desired culture value was environmental protection, while it was freedom of speech for urbanites.

A full demographic breakdown of the *Bhutan National Values Assessment* can be seen online, posted by the Centre for Bhutan Studies.[6]

[6] Go to http://www.bhutanstudies.org.bt/main/index.php

Recommendations[7]

1. Develop a plan to disseminate the results of the survey among the population. Set up focus groups to gain greater understanding around specific areas of improvement or policy issues, and determine what needs to be done to implement these changes.

2. While the entropy is low, there are themes present in the potentially limiting values that should be examined with a focus on reducing the cultural entropy in the nation. Ask the focus groups what they see as the causes, limiting behaviours, and negative results of each of these values and the corrective actions that need to be taken.

3. Define the key areas the nation will focus on. Develop specific actions and programs that will foster these changes. Consider repeating the survey process every two to five years to gauge the progress made in these areas.

4. Pay particular attention to any personal values that are being asked for in the desired culture. Talk to the focus groups about what these values mean to them and what they can do in order to better support these values.

5. Look at the values gaps in the current culture. What does this signify? Is there a strong call for values at this level within the desired culture?

6. Examine the new values requested in the desired culture: freedom of speech, economic growth, compassion and full employment. Determine their

[7] It may be necessary to go to the full report and supplements, posted online by the Centre for Bhutan Studies, to get adequate information to complete these recommendations.

meanings and what changes in behaviour are necessary to implement these values.

7. Discuss how Bhutan can continue to live the values of continuous improvement, environmental protection, strict moral/religious codes, education, contentment and social justice.

8. Consider the values jumps from the current culture to desired culture. Are there values jumps that do not show up in the top ten desired culture values that are significant?

9. Investigate why the various demographic groups differ from each other. Determine if there are groups with higher entropy than others, it is important to uncover the root causes that are creating this situation.

Health Impacts of Traditional Medicines and Bio-prospecting: A World Scenario Accentuating Bhutan's Perspective[*]

Phurpa Wangchuk[**]

Abstract

Life without natural products is unimaginable. It has provided mankind with oxygen, water, fire, food, clothing, shelter and medicine. Its public health impact is considerably high, especially of traditional medicines and nature-based modern drugs. The traditional medicines, despite its limitations, are addressing the health needs of millions of people worldwide. It is estimated that about 65-85% of the world population uses traditional medicines for their primary health cares. It is also estimated that about 39% of all 520 new approved drugs in 1983-1994 were natural products and out of that 74% were discovered as a result of bio-prospecting from plants used in traditional medicines. Traditional medicines are increasingly getting more popular mainly because: a) it is holistic system with less side effects; b) it is evolving as an evidence-based medicine; c) its ethno-medical knowledge is applicable to modern drug discovery programs. As there are many diseases that cannot be cured by the existing drugs and as there are increasing cases of drug resistance, there is urgent need for drugs that are effective against these pathogens. Probably, traditional medicines could provide a solution in fighting them both as a health care delivery mechanism and as a means of chemotherapeutic pool. Bhutan is fortunate to be gifted with rich natural bio-diversity and rich traditional medical knowledge. The positive health impacts of the Bhutanese

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traditional medicines are resoundingly felt by Bhutanese. Besides, there is huge potential for bio-prospecting in Bhutan. This paper highlights world scenario on the health impacts of the: 1) natural product-based traditional medicines, 2) the natural product-based drug discoveries, and 3) Bhutanese traditional medicine and potential of bio-prospecting in Bhutan.

Introduction

With the advancement in science and technology, remarkable progress has been made in the field of medicine including diagnosis, treatments and pharmaceutics. Recent drug discovery techniques based on structure activity relationships, computer modeling, combinatorial chemistry, high throughput screening and spectroscopy (MS, NMR, and IR) have triggered and spearheaded the discoveries of many natural and synthetic drugs. In 1999, world sales of pharmaceuticals (excluding veterinary medicines) were valued at ca. US$ 325 billion.

Despite these developments, of the known 30,000 human diseases or disorders, only one-third can some how be treated symptomatically with drugs and that too at a great economic and social cost. This is because of the fact that the drugs available today are still not very effective particularly with respect to the fight against drug resistant pathogens and newly emerging infections. This includes infectious diseases such as AIDS, influenza, tuberculosis and malaria as well as other chronic disorders like cancer, autoimmune disorders and central nervous system disabilities (e.g. Alzheimer's disease). They are incurable and often fatal causing great suffering and disability.

Hence, these diseases including resistant pathogens are of special concern to communities worldwide. There is an urgent need to find concrete solutions for combating such epidemics. Prevention of famine, drought, poverty, flood, war, political upheaval, economic failure, environmental depletion and pollution would be good solutions to reduce infections and the development of resistance. Strengthening and developing

traditional medicines through evidence-based research for use against the diseases especially the chronic ones and also against drug resistant pathogens is another potential area. Another most important strategy to combat both new as well as the re-emerging infectious diseases is to develop an arsenal of new drugs.

New drugs could be developed synthetically, but experience has taught us that the natural products are rich in structurally diverse bioactive molecules that quite often become potential candidates for new drugs. In fact, in 1996, six out of the top 20 pharmaceutical prescription drugs dispensed were natural products. Therefore, it is very important that mankind value and appreciate the role and impacts of natural products, traditional medicines and modern drugs discovered from natural products.

This paper presents the role and the impacts of the natural products, traditional medicines and the nature-based drug discoveries. It also describes the potential, constraints and future directions in the area of natural product-based traditional medicines and nature-based drug discovery programs accentuating Bhutan's perspectives.

Traditional medicines and their health impacts

Mankind has discovered medicinal plants as indispensable cures for many ailments. Although some cultures used individual natural products as medicines, many traditions propounded powerful combinations with different ingredients known as poultices, tinctures and mixtures. It is reported that the Mesopotamians were the first people to use the herbs like oils of cypress, cedar, liquorice and poppy juice for treating different ailments in 2600 B.C. Buddhist system of medicine known as gSo-ba Rig-pa that is currently practiced in Bhutan, Tibet and Mongolia is 2500 years old and its pharmacopoea records the use of as many as 2200 traditional prescription drugs.

In 1500 BC, Egyptian's developed the Ebers Papyrus that documented some of the 700 drugs including formulas such as gargles, snuffs, poultices, infusions, pills and ointments. The Chinese materia medica Wu-Shi Er-Bing Fang which contains 52 prescriptions date back to 1100 BC and the Indian Ayurvedic Medicine that dates to 1000 BC (Susruta and Charaka) documents the medicinal use of plants like *datura*, *aconitum, canabis* and *sarcostemma*.

From these ancient cultures, some of the knowledge reached Mediterranean countries through traders and migrations, and it was in Hippocrates's time in 460-377 BC that pharmacognosy reached its summit in Greece. In 300 to 322 BC, Theophrastus, who was a philosopher and naturalist, was the first to deal with the history of plants, which later on helped in the classification of plants, including herbs. In 78 AD, Pedanius Dioscorides, a Greek physician produced *De materia medica*, which described more than 500 medicinal plants and their uses in detail.

Galen (*ca* 129-199 AD) founded "Galenics" and taught pharmacy and medicine in Rome. Avicenna (980-1037 AD), a Persian pharmacist, physician, philosopher and a poet, described 1400 drugs and medicinal plants which greatly contributed to the formation of a codified Graeco-Roman Medicine in the 5th century. Paracelsus (1493-1541) administered dosage formulations separating "Arkanum" from non-active ingredients of drugs. Western medicine and pharmacy originated from this medical system.

In the USA, homeopathy that includes hydrotherapy, nutritional therapy, herbal therapy, manual manipulation and midwifery, which were founded by German physician Hahnemann (1755-18-43), became popular in 1830s. The National Centre for Complementary and Alternative Medicine (NCCAM) was established at the National Institute of Health, USA in the 1990s to independently develop and support research on Complementary and Alternative Medicine. The NCCAM categorised seven forms of therapies practiced

worldwide such as mind-body interventions, bio-electromagnetic therapies, alternative systems of medical practice, manual healing methods, pharmacological and biological treatments, herbal medicine and diet and nutrition.

The discovery of antibiotics and vaccines in the 20th century dramatically changed medical practice worldwide, and as a result a separate field of ethno-medicine emerged as an academic specialization focusing on traditional healing systems. Today, traditional medicines effectively addresses the health needs of millions of people including developed nations by completely different strategies and well defined approaches, and generally with minimal side effects. Current WHO estimates show that 75% of the French population, 30% of the Vietnamese population, and 40% of Indonesia's population uses traditional medicines; 77% of pain clinics provide acupuncture in Germany and 72% of registered western style doctors uses kampo medicine in Japan. In Bhutan, traditional medicine is an integral part of the health care delivery system. Almost 100% of Hospitals and some Basic Health Units provide traditional medical services.

Overall, traditional medicines provide primary health care needs to almost 65-85% of the world's population, including developed nations. In terms of economic value, traditional therapies contribute to US $ 60 billion a year, and the USA alone spends US $ 2.7 billion per year followed by China with US $ 1.8 billion and Australia with Aus $ 1 billion a year. In fact, the traditional medicine is gaining popularity worldwide and this is attributable to four of their main salient features: the use of natural products as ingredients, the concept of holism with minimal side effects as opposed to allopathic drugs, the emerging clinical efficacy and the content of reservoir of ethno-medical information.

As required by the WHO regulations, many traditional medicines are strictly monitored for their quality, safety and efficacy. Many traditional medical systems including Japanese Traditional Sino-medicine and Tibetan medicine

(gso-ba-rig-pa) have emerged as evidence-based medicines. For example, the investigation on the principal of drug action of the Japanese Traditional Sino-medicine resulted in obtaining many novel compounds and unknown new mechanisms of drug action. The clinical trials of Tibetan medicine, the PADMA Products also proved successful on treatment of Irritable Bowel Syndrome and fibrinolysis with stable intermittent claudication. It furnished new anti-oxidative mechanisms at the molecular level.

Thus, all these indicates that traditional medicines caters to millions of peoples worldwide in their primary health care needs.

Bio-prospecting and their health impacts

Other than providing primary health care, the natural products also play significant role in the discovery of the natural product-based drugs. The natural products like plants, animals, microorganisms, marine organisms and the extremophiles have been an important sources of the potential drug leads and this will continue for years to come. Many bioactive molecules have been isolated from these sources applying three main types of search strategies: bio-rational, chemo-rational and random approaches. For example, Conocurvone-an anti-HIV agent was discovered as a result of random approach of screening. Drugs such as artemisinin, morphine, quinine, and ephedrine were discovered using bio-rational approach. Out of these three search strategies, bio-rational approach is the most effective one. Bio-rational approach is mostly guided by the ethno-medical information generated from the traditional medicines. More than 13,000 species of plants are being used in the traditional medicines and herbal cosmetics and about 8000 of these medicinal plants species are known in South Asia alone. These natural products (medicinal plants) contain reservoir of etho-medical and ethno-botanical information, which is an important guide to discovery of many new drug lead molecules.

Recently at the National Cancer Institute (NCI, USA), although random high throughput screening method furnished a large number of testing extracts, it was found by *in vitro* bioassays that medicinal plants from traditional medicines gave greater rates of bioactivity. At the University of Illinois, Chicago, out of 800 medicinal plant extracts collected from Vietnam and Laos, at least 25 biologically active compounds were isolated; of these 13 were new anti-HIV agents and 3 were anti-malarial agents. In the USA, out of 119 plant drugs available from 1959 to 1980, 74% of these were discovered as a result of chemical studies directed at isolating the active substances from the plants used in traditional medicines. In fact, Cragg et al. estimated that 39% of all 520 new approved drugs in 1983-1994 were natural products, and 60-80% of antibacterial and anti-cancer drugs were derived from natural products. Analysing the USA based community prescriptions in 1973, it was found out that 25.2% of the prescription drugs were plant derivatives, 13.3% were microbial derivatives and 2.7% were animal derivatives.

The search for new drugs continues, but mostly using the ethno-directed bio-rational approach. In 1999, the NAPRALERT database recorded more than 88,000 natural product isolates and many of them formed the skeletal framework of many renowned drugs available in the market today. For example, mevastatin (compactin) and lovastatin which were isolated from *Penicillin* spp became the cholesterol lowering drugs. Ivermectins isolated from the *streptomycetes* spp became an anthelmintic and antiparasitic drug. Reserpine was isolated from the plant *rauwolfia serpentine* and was turned into antihypertensive drug. Ephedrine isolated in 1923 from *ephedra sinca* formed the basis for the synthesis of salbutamol and salmetrol which are the anti-asthma drugs (beta agonist). Atropine comes from belladonna and even aspirin was derived from salicin present in willow bark. Teprotide was isolated from the venom of the pit viper, *bothrops jaracaca* and this formed the skeletal framework of the captropril and enalopril, which are used in treating cardiovascular diseases.

In the class of anti-cancer drugs, the vincristine and vinblastine isolated from *catharanthus roseus* are clinically used as the anti-cancer drugs today. Another anti-cancer agent, paclitaxel (taxol) was discovered from pacific yew, *taxus brevifolia*. Semi-synthetic drugs topotecan and irrinotecan were derived from camptothecian that was isolated from Chinese ornamental tree, *camtotheca acuminate*. *A*n anti-tumor agent, podophylotoxin isolated from the roots *podophylum peltatum* is effective in treating skin cancer and the warts. Its semi-synthetic derivatives, etoposide and teniposide, is used against the lung and testicular cancers, lymphomas and leukemia and against the acute lymphatic leukemia, neuroblastoma in children, non-hodgkin's lymphomas and tumors in adults respectively. In the mid 1980s, bryostatin-1 was isolated from *bugula neritina,* a marine bryozoans, and was found effective against ovarian carcinoma and non-Hodgkin's' lymphoma. Aplidine, isolated from *tridid*e*mum solidum,* a marine tunicate is in phase II clinical trials in Europe. Ecteinascidin 743, a metabolite from *ectelinascidia turbinate* tested for *in vivo* activity against the murine B16 malanoma and human MX-1 breast carcinoma models, is currently in Phase II clinical trials in Europe and US. Squalamine isolated from *squalus acanthias* is in phase-I clinical trial.

In the line of antimicrobial and anti-plasmodial drugs, microorganisms have been the popular source of antibiotics, ever since the discovery of penicillin from the filamentous fungus *penicillium notatum* by Alexander Fleming in 1928. Cyclosporins and rapamycin (an immunosuppressive agent), streptomycin, chloramphenicol, tetracyclines and cephalosporin (antibiotics) were isolated from the *streptomyces* and *penicillium* species. Provir, an oral product for the treatment of respiratory viral infections, and virend, a topical antiviral product for the treatment of herpes (both in clinical trials), were very recently developed from plant alkaloids. The sulphonamides were the first group of effective anti-bacterials to be developed following a chance discovery of

antibacterial activity in synthetic Azo-dye-prontosil in 1932 by Dogmak, and since then many antibacterial drugs were developed in between the late 1940s to 1980s. By then most of the infectious diseases were almost eradicated in the developed world, and as a result, almost half the major pharmaceutical companies in Japan and the USA stopped their antibacterial drug development programs. Even today, antibacterial agents make up only 12-15% of the total pharmaceutical business, and thus, there are very few drugs that are effective against the infectious bacterial pathogens especially the resistant bacteria.

As there are many diseases that cannot be treated by the existing drugs and also as the drug resistance by many pathogens are increasing, it is evident that there is need for the development of new arsenal of drugs to combat them be it synthetically or based on the natural products. The World Health Organization has estimated that about 50,000 people die worldwide every year from infectious diseases alone. The lead cause of death is HIV-AIDS, followed by tuberculosis and malaria. In 1996, the approximate figure showed that the HIV virus had infected at least 21,000,000 people worldwide and in 2001, UNAIDS estimated that over 14,000 new infections occur daily, nearly half of them in women and strikingly affecting Africa. While malaria continues to claim 1-3 million lives each year, ca. 2 billion people including at least 15 million Americans are affected by tuberculosis.

These infectious diseases (microbial) will continue to be the leading cause of premature death in human beings of both developed and developing nations as their resistance to many conventional drugs is increasing. For example, *plasmodium falciparum* have already developed resistance to the existing traditional anti-malarial drugs like quinine, chloroquene mefloquene and even to the second line drug pyrimethamine-sulphadoxine (fansidar) and halofantrine. The resistance to the combined drug therapy has been reported in Africa, Thailand, Burma, Laos, Vietnam, Cambodia and China and there is hardly any anti-malarial drugs in line to fight the

resistance. The latest anti-malarial drugs artimisinin and its derivatives, artemether and artether, isolated from *artemesia annua* is the only effective anti-malarial drugs available in the market. This is the only hope of saving millions of lives especially in Sub-Saharan Africa where children are affected worst.

Similarly, many anti-bacterial, anti-fungal and antiviral drugs are becoming obsolete as the microbes have evolved numerous defenses against antimicrobial agents and drug-resistant pathogens are on the rise. The first resistance case was reported as soon as the introduction of chemotherapy in s*taphylococcus aureus* in 1941. *Mycobacterium tuberculosis* that causes tuberculosis emerged resistant to streptomycin in 1940s and by 1950s and 1960s, it also developed resistance to later drugs isoniazid and rifamycins. Streptococci that causes nosocomial infections showed innate resistance to drugs, including cephalosporins, clindamycin and aminoglycoside. The S*taphylococcus aureus* have currently developed into multi-drug resistant strain and threaten to put an end to successful chemotherapy. Vancomycin resistance among enterococci became noticeable in 1987 and has resulted into a true 'super bug'. The summary of bacterial resistance to chemotherapy is shown in table 1.

Table 1. Bacteria that have acquired resistance to some drug therapy.

Resistant type	**Bacteria**	**Disorders**	**Date (approx.)**
Penicillin resistant	*Pneumococci*	Pneumonia & meningitis	Mid 1970s-present
	Legionella	Legionnaire's disease	Mid 1970s-present
	Borrelia burgdorferi	Lyme disease	1980s-present
	Salmonella	Gastrointestinal disorders	1980s-present
	Staphylococci	Toxic shock syndrome	1980s
	E.coli O157:H7	Gastrointestinal	Mid 1980s-

		disorders	present
Multi-drug resistant	*M.tuberculosis*	Tuberculosis	Late 1980s-present
Vancomycin resistant	*Enterococci V.cholerae*	Wound, blood, enteric infections Cholera	Late 1980s-present
Multi-drug resistant	"super bugs"		2002-present

Source: Dax, S.L. Antibacterial Chemotherapeutic Agents. First ed. London, UK: Blakie Academic & Professional, Chapman & Hall. 1997.

Thus, there is immediate need to find new anti-microbial drugs active against the resistant and re-emerging diseases. It would be only wiser and better to turn to nature for finding new and effective drugs. It is estimated that ca. 250,000 to 500,000 species of plants grow on earth but only 10-15% of such species are reported to have been studied phytochemically for medicinal applications. There are 30 million species of insects and very few have been studied for bioactive molecules. Marine world represent 70% of earth's surface but only 5% of the marine organisms are explored. Only an estimated 1% of bacterial and 5% of fungal species have been examined to date. Extremophiles such as alkalophiles, halophiles, barophiles, thermophiles and psychrophiles have been neglected so far. These extremophiles would definitely offer a potentially diverse source of novel bioactive molecules.

All the above reviewed figures suggest only one thing: that is, the natural sources are least explored for medicinal applications despite the huge availability of the natural resources and immense potential for discovery of new drugs. When there is need for the new drugs, it is only befitting to systematically explore the rich natural resources and may be even the drugs for HIV-AIDS can be discovered. This would save millions of lives worldwide and definitely this means positive impacts to the health of the people worldwide.

Bhutanese traditional medicine: Its health impact and the potential of bio-prospecting.

Bhutan is rich in traditional-cultural diversity and natural resources. Probably, the rich natural resources hosted by the un-scalable topography of the country facilitated the growth of luxurious traditions and cultures. Such phenomenal gifts are rare to find in many countries. One of the tangible traditional assets of Bhutan is the traditional medical practices. Bhutan host two forms of traditional medicines: local healing practices and the formalized traditional medical system which is locally known as *gSo-ba-rig-pa* (Bhutanese Traditional Medicine). While local healing practices are an oral medical traditions that lacks proper documentation, *gSo-ba-rig-pa* medical system is highly sophisticated and fully documented. It is based on Buddhist philosophy and adopted principles of Chinese Traditional Medicine, Indian Ayurvedic Medicine and Persian Medicine.

Some sources noted that gSo-ba-rig-pa in Bhutan took shape with the advent of Mahayana Buddhism from Tibet in the 8th century, but there are other sources stating that gSo-ba-rig-pa developed subsequently in Tibet and Bhutan during the coming in of great Buddhist saint called Guru Padma Sambhava from India in the eight century. However, for sure it is clear that gSo-ba-rig-pa in Bhutan originated in the 8th century under the tutelage of Guru Rimpoche. This is substantiated by the fact that Khandro Yeshi Tshogyal, a consort and a disciple of Guru Rimpoche meditated on rdu-rtsi sman-gi-bchued-lan brgya-tsa brgyad at Mon-kha Nye-ring, Singye Dzong. In 1616, during the reign of Shabdrung Ngawang Namgyal, Minister of Religion, Tenzing Drukgyal, who was an esteemed physician started the propagation of gSo-ba-rig-pa in Bhutan. After the year 1885, the Penlops and Dzongpons and Desis patronized the profession by privately employing an esteemed physicians trained in gSo-ba-rig-pa. Drungtsho Pemba was the personal physician to the first King. Drungtsho Penjor and Mahaguru served at the court of the second King. In 1967, the third King, Jigme Dorji Wangchuck ordered the establishment of a separate

traditional medicine dispensary at Dechencholing, Thimphu. In 1971, formal training for Drungtshos (traditional doctors) and sMenpas (traditional compounders) was initiated in Bhutan, providing a solid professional base for gSo-ba-rig-pa. Today, gSo-ba-rig-pa has been integrated with the modern health care system and ultimately broadened the health care choices to the patients. Only few countries support the practices of traditional medical system along side biomedicine and even fewer countries (e.g. Bhutan, China, Mongolia and Vietnam) officially recognize and support one integrated medical system under same Ministry and Health Care Delivery System. This experience of integrating two conceptually very different health care systems within one ministry contain important managerial lessons to be learnt by others.

Currently about 29 traditional medicine units attached to modern district hospitals and the Basic Health Units (BHUs) functions efficiently under the guardianship of the Institute of Traditional Medicine Services (ITMS). The ITMS manufactures about 98 different essential traditional medicines using 300 different medicinal ingredients. The National Traditional Medicine Hospital in Thimphu alone treats more than 30,000 patients annually and the district Traditional Medicine Units treats about 20-30% of the total daily OPD patients of the district hospital. gSo-ba-rig-pa is getting more popular amongst the Bhutanese populace. It is also attracting international interests after it is being recognized by the World Health Organization as one of the important traditional medical system responsible for delivering primary health cares. Such popularities would mean pressure on the supply of traditional medicines thereby emasculating its sustainability. To achieve sustainability in raw materials and traditional medicines, ITMS and the Medicinal and Aromatic Plant Section (MAPS) under Ministry of Agriculture have jointly initiated the inventory development, domestication and cultivation trials of the rare and endangered medicinal plants species.

Beside providing health cares, gSo-ba-rig-pa also forms a unique opportunity for bio-prospecting in Bhutan since it is rich in ethno-medical information. The Bhutanese flora and fauna are characterized by an outstanding bio-diversity and a large number of endemic species, many of which forms part of the gSo-ba-rig-pa pharmacopoeia. Therefore, Bhutan's rich bio-diversity may be hosting cures for many diseases including AIDS, cancer and other infectious diseases.

Recently, a research carried out at the University of Wollongong on two Bhutanese medicinal plants *aconitum orochryseum* and *corydalis gerdae* revealed three new and four known novel compounds with significant antimalarial activities against resistant strains of *plasmodium falciparum*. Further study on this finding would also result in obtaining unknown new mechanisms of drug action.

Many medicinal plants such as *aquilaria agallocha*, *rauwolfia serpentina*, *paris polyphylla*, *sapindus mukorossi, phyllanthus emblica, terminalia bellirica, terminalia chebula, ephedra gerardina*, *taxus bacccata*, *rheum nobile*, *rheum accuminata*, *picrorhiza kurroa*, *podophyllum hexandrum*, *nardostachys jatamansi*, *aconitum* species, *artemisia* species, *panax pseudo-ginseng* sub-species *himalaicus* and *cordyceps sinensis* are in high demand for pharmaceuticals and cosmetics. Commercializing and bio-prospecting these medicinal plants would not only accelerate the Bhutan's economic growth, but also contribute to the global stock of pharmaceuticals. Thus, gSo-ba-rig-pa (Bhutanese traditional medicine) has lots of potentials in terms of the provision of the primary health care as well as in the discovery of new drugs if strategically managed and developed considering the innate intellectual property rights.

Conclusion and future directions

Natural products have been the basis for the formation of traditional medicines and for the discoveries of many modern drugs. Without the natural products, life will cease to function, and almost every cultures and traditions including

the traditional medicines and drug discoveries can be handicapped. This is because the flora and fauna of our planet provide at least 50% of all pharmaceuticals and almost 85% of the world's population depend on traditional medicines for their primary health care needs, which will continue forever.

In many countries, traditional medicines are deeply rooted in their cultures. It has become an indispensable treatment regimens and a subject of interests for the pharmaceutical companies for the following reasons: a) it is holistic in nature and has no side effects as opposed to modern allopathic drugs; b) the traditional medicines are cheap and easily available in the markets (raw materials), especially in developing countries as compared to modern drugs which are very expensive; c) most of the traditional medical systems are supported by long clinical use with properly recorded pharmacopoeias and are being supported by the scientific validation processes; and d) traditional medicines are the reservoirs of ethno-medical and ethno-botanical information which are the keys for opening many new modern drug leads.

As the diseases are increasingly developing resistance to the existing drugs and as there are newly emerging disorders, it is only natural that the natural products, traditional medicines and drug discovery programs will even become more indispensable. In an effort to fight the diseases, disorders and sufferings; there is urgent need for new and effective arsenal of drugs (applies to allopathic as well as traditional medicines). The world still has 80-85% of the natural products unexplored for medicinal applications. The effective medicines can be discovered only through trans-disciplinary co-operations and collaborations among the scientists, medical doctors and traditional physicians. It will not help anybody by professional turf building, working on the professional economic gain and the politicizations of the medical practices and pharmaceutical works. Health care is more likely to be integrative, holistic, safe and effective when medical practitioners (conventional and traditional medicines)

and scientists consider the welfare of the client or patients above their own interests.

There is also immediate need for country to country co-operations and collaborations. Some developing countries are extremely rich in biodiversity and traditional medical knowledge but lacks the technologies and financial resources to meaningfully explore and add value to them. On the contrary, the developed countries are rich in technologies and financial resources but lacks in the natural resources and the traditional medical knowledge. It would be better to come together, bridge these gaps and differences and come up with effective cures for the un-forgiving diseases.

Bhutan is fortunate to be gifted with rich biodiversity and traditional medical knowledge that could pioneer successful bio-prospecting. However, like any other developing countries, Bhutan lacks technical expertise and financial resources to explore them meaningfully. The only option Bhutan have is to collaborate with the developed nations and interested pharmaceutical companies alike and jointly explore them strategically and wisely. In doing so, the model of collaboration should be such that it builds the science infrastructure within, preserve and protect the local traditional medical knowledge reducing the brain drain, and equally share the outcome of the joint projects. While bio-prospecting should gear up, strengthening the Bhutanese traditional medicine should be a simultaneous effort since it has multi-pronged benefits. First, it has significant contribution to the health of the Bhutanese; second it is manufactured in Bhutan using the country's luxurious medicinal plants and other raw materials benefiting many businesses and farmers; third, it provide employment opportunities; and fourth, it uses more than 300 medicinal materials that could be useful for bio-prospecting. In fact, it is the nerve centre with many development networks that promotes ethical and sustainable utilization of bio-resources to benefit farmers, business people, human health and the environment in Bhutan. This traditional medical system

embraces all the four pillars of Gross National Happiness. Also, it will be a yardstick for the discovery of new drug leads that could save millions of lives. It is therefore important that there is continuing support for protecting, promoting, and propagating this traditional medicine and also in preserving our rich biodiversity. Perhaps, our biodiversity may be hosting cures for HIV-AIDS, Cancer, Hipatitis B and many other chronic diseases.

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A Study on Knowledge, Attitude and Practice about Malaria Awareness and Bed Net Use

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Abstracts

The purpose of the KAP Study was to determine the community perceptions in terms of malaria cause, prevention and treatment, and also to find out the extent of bed net use and the factors associated with the net use.

The study was carried out in two malaria hyper-endemic districts of Sarpang and Samdrup Jongkhar covering four rural areas and two urban areas with 250 households and 1415 members.

92% of the household members sleep under a mosquito net. 87% of the nets are treated with insecticides. And 35.6% of the respondent had encountered some problem in using the treated nets, primarily as skin irritation. A total of 81 persons (5.7%) were diagnosed and treated for malaria in 2001. On an average 19.6% of the households had at least one member who had malaria in the past 12 months. The gewogs of Chuzagang and Bangtar had one third of their households with at least one member contracting malaria. Farmers and household with more than 6 members had more than two times the risk of having a household with malaria compared with other variables. Also households where they know malaria can be dangerous, if they are sure neighbour had malaria and using preventive measure other than nets then the risk of getting malaria is comparatively high. Probably this indicates that people must be living in high incidence areas except from usage

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other than nets. The results are also significant when tested in a multivariate statistical model.

35.6% of the respondents had encountered some problem in using the treated nets, primarily as skin irritation. This survey points that it should be possible to reduce side effects substantially in Bhutan too. This may be very critical to the program if it means that people will stop using nets because of the side effects.

It is suggested that awareness and prevention should be more differentiated on how to protect, and when to protect at all places.

It should be considered whether delay plays an important role for malaria morbidity and mortality in Bhutan, and if more efficient measures could be implemented to prevent mortality and severe morbidity especially in localities where falciparium incidences are increasing.

Background

Malaria is an age-old problem for the Bhutanese community and the cause many felt was because of intensive heat. Even today, many of our people do not know that the malaria is caused by the infected mosquito bites. To mitigate the malarial deaths a survey was conducted which resulted in the establishment of the National Malaria Eradication Program (NMEP) in 1964. NMEP was later renamed as National Malaria Control Program (NMCP) on realization that malaria cannot be eradicated.

Malaria is a public health problem with the Annual Parasitic Incidence (API) ranging between 66.2 to 19.9 per thousand over the five-year period from 1995 to 1999. What is more alarming is the rising trend of *Plasmodium falciparum* from 1998 onwards. This parasite *falciparium* is the most fatal malarial parasite known so far. Also the latest genetic analysis of the largest survey carried so far on *Plasmodium falciparium* lends weight to the argument that the parasite is

worryingly adaptable to anti-malarial efforts. This is of a major concern, as malarial treatment in the coming years might increasingly become more complex. And the fact that more than half of the country's population is at varying risk of malaria also justifies the National Malaria Program (NMCP) to develop preventive strategy. The preventive strategy is how to inform, educate and communicate (IEC) on the disease awareness. Little is known if this strategy had worked in the past. But there has been substantial reduction of malaria morbidity and mortality since 1995. With the inception of 9th Five Year Plan where Health Department is gearing towards quality assurance and standardization of health services, it is time to reassess, evaluate and also to consolidate the achievements made thus far. This will also help to understand the problems and seek for appropriate and cost effective solutions. This calls for an assessment to be carried out. Therefore this study is not only timely but a necessity in the wake of scarce resources.

Methods

The study was carried out in two malaria hyper-endemic districts of Sarpang and Samdrup Jongkhar covering four rural areas and two urban areas. The district and the blocks were chosen randomly. The rural areas covered 200 households while urban covered 50 households. This is a cross sectional study and the unit of enumeration is household.

The households were selected using the systematic skip interval with replacement. The first household was chosen using the simple random number table. For urban centers where complete household listing was not available, blocks (5-10 households) were formed. Using the same procedure as above blocks and households were then selected for enumeration respectively.

Concurrent to this survey (1st May 2002-20th May 2002), anemia survey was also taking place. Both the survey needed malaria technician. Therefore the need to have malaria

technician as survey enumerators could not be realised. So the lab data (blood sample for malaria test) proposed in the study protocol could not be carried out.

The quantitative data were collected through structured questionnaire interview by the enumerators who were mostly health personnel trained for two days (29th & 30th April 2002). The qualitative data was collected using Focus Group Discussion. In total four FGDs were conducted; two each in urban and rural. The discussion was conducted in local dialect by the team coordinator.

Data entry, data cleaning and data analysis was done using Epi Info 6, SPSS, Statistix and SAS.

Results

The survey covered a total of 250 households with 1415 members. The respondents preferably were the head of the households and the most appropriate substitutes were made where the head of the households were not available. 67% of the respondents were male with significantly higher male prevalence in the two urban centers (82% versus 62%, p=0.01).

The mean age of the respondents were 42.9 years. The head of the households were older in Orong and Bangtar compared to the rest of the gewogs. The average size of the households was 5.7 persons. Almost three quarters of the respondents were farmers. People working in government and business were mainly located in the two urban centers.

92% of the household members sleep under a mosquito net. 87% of the nets are treated with insecticides. And 35.6% of the respondents had encountered some problem in using the treated nets, primarily as skin irritation.

A total of 81 persons (5.7%) were diagnosed and treated for malaria in 2001. On an average 19.6% of the households had at least one member who had malaria in the past 12 months

from the date of survey. The gewogs of Chuzagang and Bangtar had the highest prevalence of malaria (see figure 1). About one third of the households in these two gewogs had at least one member contracting malaria during the same year (see figure 2).

Figure 1: Annual prevalence of household members with malaria in 2001.

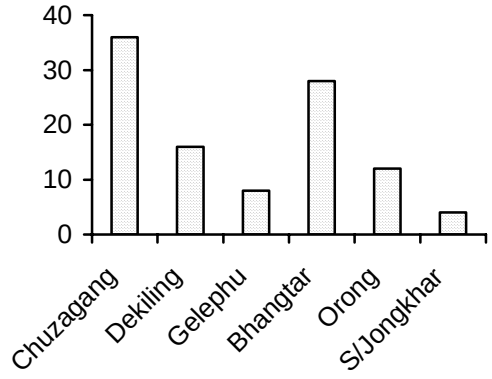
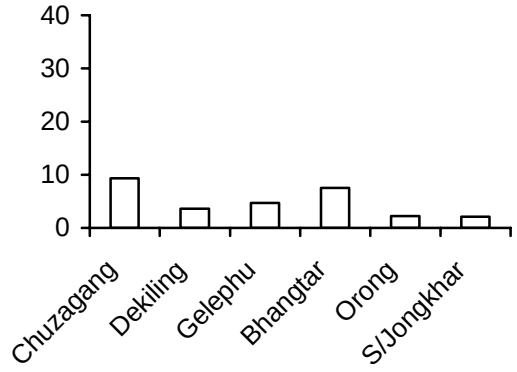


Figure 2**:** Prevalence of households with at least one member who had malaria in 2001



a) Relation between background variables and malaria

The relation between a household where there had been at least one case of malaria in the preceding twelve months and a set of explanatory variables are shown in table 1. The farmers have 1.8 times higher risk of getting malaria compared to other occupation. Odds ratio is equivalent to risk ratio. (OR 2=double risk, 1=equal risk, 0.5=half risk and so on)

Table 1. Variables having significant co-relation with household experiencing at least one malaria case in preceding 12months

Variable	Odds Ratio (OR)	U-CL	L-CL	p-value
Farmer vs. other jobs	2.8	1.2	6.6	0.018
Household > 6 persons	2.2	1.1	4.3	0.015

There are no bi-variate relation between age and gender of the respondents and the prevalence of malaria.

b) Relation between knowledge and causes of malaria

Three quarters of the respondents correctly believed that malaria was caused by mosquito bites. But there was no difference in malaria prevalence compared with those who did not relate malaria to mosquitoes (OR=1.1). Not knowing the cause of malaria at all, were also not associated with malaria prevalence. Most people were aware of the symptoms of malaria, and almost everyone would contact the modern health care facility because they think they can cure the disease.

c) Relation between prevention and malaria

23.6% of the households additionally used other than net to protect themselves from malaria. And they have a lower prevalence of malaria compared with people not using any preventive measures. From table 2 we observe that knowledge about the severity of malaria and if at least one member of a neighbour household had malaria is positively associated with the prevalence of malaria.

Table 2. Household experiencing at least one malaria case in the past 12 months dependent on knowledge attitude and behaviour.

Variable	**OR**	**U-CL**	**L-CL**	**p-value**
Fully agree that you can die from malaria vs. less/not agree	2.4	1.2	5.1	0.01
Sure that at least one neighbour household had malaria last year	4.8	2.3	9.9	<0.001
Using other things than nets: coil, fire, smoke	0.4	0.1	0.9	0.02

Only 168 households were able to tell when they were last informed on how to protect themselves from malaria. 47 of these were informed more than one year prior to the survey. However, there are no association between time of information and prevalence of malaria. Likewise, there is no statistical association between malaria prevalence and if the surveyors found that the household actually applied with the recommendations or not.

d) Bed-net use and malaria

Since more than 90% of the household members were using nets, there are limited possibilities to contrast net usage and malaria. The prevalence of malaria is not related to using bed nets in the household (OR=0.9).

There was no association between malaria prevalence and whether the nets were treated more than two months ago or recently. Many had irritation of the skin, especially in the face and on the hands, but irritation is not related to a higher prevalence of malaria.

The overall picture of the influence of factors on the prevalence of malaria is shown in figure 3 below. The odds ratios are transformed to a risk scale where positive and negative factors have the same scale, and 0 means the factor has no influence on the outcome. Now a preventive influence

is shown to the left of the no effect line, and risk factors with negative influence are shown to the right.

Figure 3

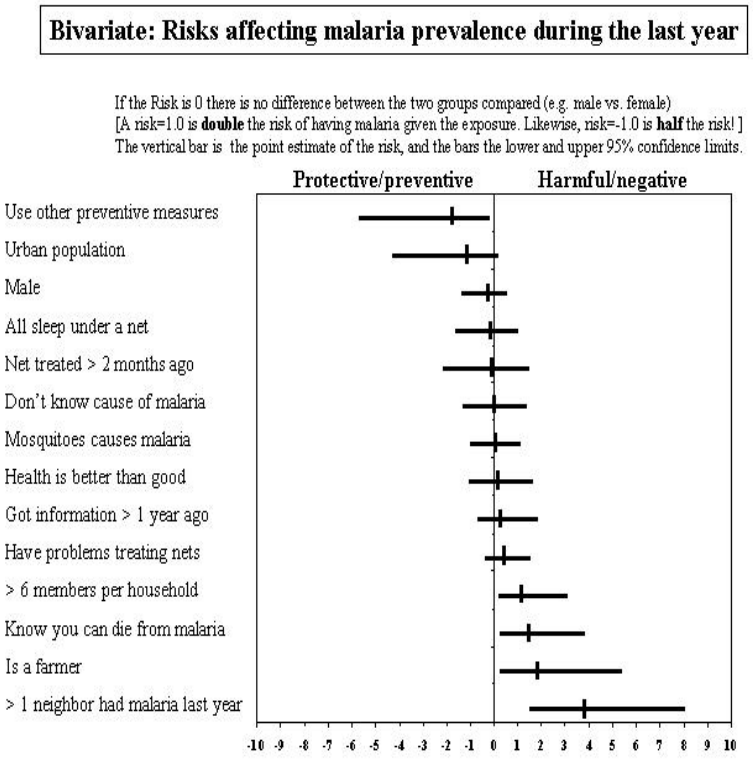
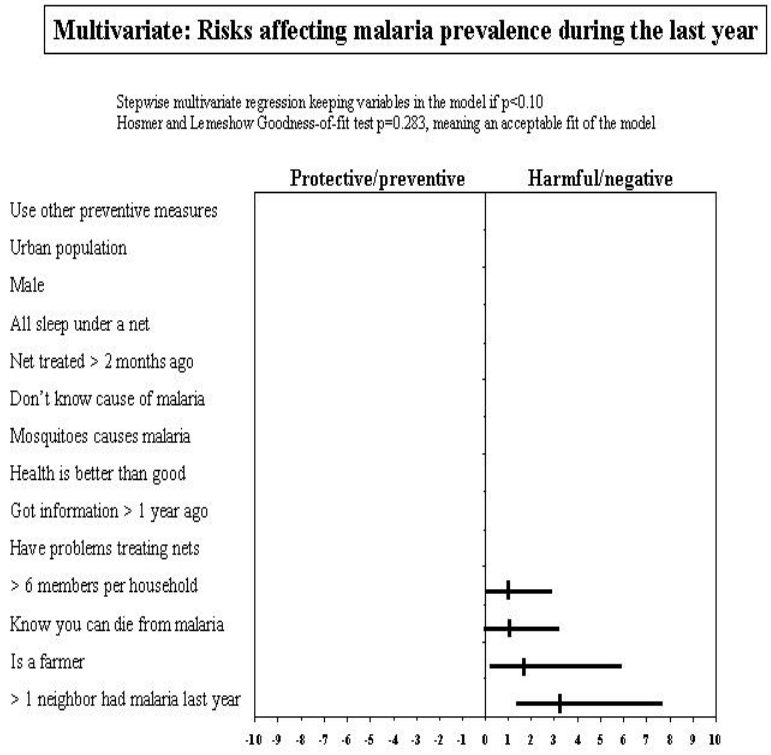


Figure 4



To find out how these factors might influence the 12 months malaria prevalence, a multivariate logistic regression was performed. The full model included all the factors from the figure above. The factors that did not influence the outcome were eliminated from the model (stepwise elimination). The final model is the ones that are statistically significant.

The factors with a $p<0.1$ stays in the model. Only four factors (household with members more than 6, know you can die from malaria, farmer, knows at least one neighbour had malaria last year) stayed in the model (see figure 4). The

parameter estimates and confidence limits are shown in the figure.

In conclusion the most important factor predicting if family members have had malaria was if at least one member in one of the neighbouring households had malaria. Farmers were more often in a risk of getting malaria. Factors like net use, problems with insecticide treatment of nets, gender, age, had no influence on the 12 months malaria prevalence. The majority were using preventive precautions and the few who didn't were not enough to show any effect on the incidence of malaria. One third had problems with treated nets. Is it because people are not applying the insecticide correctly? Or is it because of insecticide itself?? It should be considered to repeat this survey to get information on other preventive measures, and to follow the development of malaria.

Discussion

One third of the respondents got skin irritation using synthetic pyrethroid (deltamethrin) treated nets. Similar side effects have also been reported where pyrethroid (deltamethrin) was used to treat bed sheets and blankets thereby directly coming in contact with the skin. So pyrethroid (deltamethrin) is actually skin irritating in practice. Bioassay results showed that deltramethrin is better to kill anopheles mosquitoes with an effect of 99.7 to 100% while other insecticides showed a lower efficacy from 80-89%. Field trials conducted in Kenya and Ghana using pyrethroid treated nets showed reduction in child mortality by one sixth in Ghana and by one third in Kenya. Therefore we know that pyrethroid are the most effective impregnation protecting from mosquito bites. However a low rate of side effects were found if nets were initially treated with the high dose of deltramethrin, followed by more frequent but lower dosage and the efficiency was found to be same. An explanation to the problem of skin irritation may be that people are not following the optimal treatment requirement with insecticides. This survey points that it should be possible to reduce side effects substantially in Bhutan too. This may be very critical

to the program if it means that people will stop using nets because of the side effects. Therefore there is a need to find out if nets can be treated with pyrethroid in a way where there are fewer side effects.

The net usage is high in Bhutan and non-compliance was not associated with increased malaria prevalence since malaria is also contracted when not covered by a net. Therefore other exposures must also be considered in the preventive strategy design. This survey actually points at the structure of houses as a cause for being exposed to mosquitoes since majority (97%) has had major crevices. Studies in northern Malawi have shown that children living in improved housing were 44% less likely to have respiratory, gastrointestinal or malaria. It is suggested that awareness and prevention should be more differentiated on how to protect, and when to protect at all places.

The problem with the increased incidence of *Plasmodiun falciparium* is that it is much more severe with faster effect and is clearly the most fatal one. This means people should be aware of early treatment especially when severe symptoms appear. A study carried out in the region also points that most falciparium death are encountered where there is delay in clinical diagnosis and pre-hospital phase. People should be made aware on the needs of early treatment especially for places where falciparium incidences are increasing. Therefore it should be considered whether delay plays an important role for malaria morbidity and mortality in Bhutan. And if more efficient measures could be implemented to prevent mortality and severe morbidity especially in localities where falciparium incidences are increasing.

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