Development and Application of the Human Security Index

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***Abstract*—** This research project involves the development of a composite index for the multidimensional analysis of human security in Thailand. The so called Human Security Index (or the HSI) constructed by this study shows its high validity in relation to the selected concurrent criterion of the UNDP's Human Development Index. The pilot test also indicates that the HSI is capable of comparatively assessing human security at the national level. The project, finally, suggests that policymakers and policy analysts should make use of the index in appraising policy alternatives, monitoring policy implementation, and evaluating policy outcomes.

***Keywords*—** composite index, human security, multidimensional analysis, social development, social policy.

I. INTRODUCTION

HUMAN security is a multidimensional issue of which the meaning encompasses not only an economic domain but also includes a socio-political dimension. Analysis in the human security policy, therefore, has to take into account a wide range of statistical indicators at the same time. The problem of multidimensional analysis happens in almost every step of the policy process. Setting up priorities of competitive areas based on their magnitudes of human security, for example, needs to deal with this multidimensional analysis. Apart from this, policymakers cannot avoid the problem of multidimensional analysis in the steps of a trend forecast, appraisal of policy alternatives, and monitoring and evaluation of a human security policy.

Multidimensional analysis of human security by means of using the whole set of statistical indicators is not easily feasible and convenient because of the complexity of multiple analytical outputs. Therefore, policymakers require an appropriate composite index to comply many individual indicators into a single figure which represents the overall human security result. Reduction of various statistical indicators into an aggregated result facilitates the analysis in the whole process of human security policy.

Use of composite indexes in social policy is recognized worldwide. The systems of composite indexes have been established in many fields of social policy and social development such as human development, ecology, health, criminology, and civic competence. However, these composite indexes are not suitable for the analysis of human security in Thailand which requires data processing of more than 50 variables at the same time. Many existing indexes are reliant upon valid external criteria for normalizing the raw data which are very inapplicable because it takes time to find and to validate these external norms. Some of the existing composite indexes ignore data dispersion which results in inaccuracy in the normalization step.

Based on the aforementioned reasons, development of a human security index was initiated. This attempt intended to propose a composite index applicable not only for comparing human security at the national level, but also for the comparative analysis of evidences at the local sphere.

The capability to summarize complex issues into the single big picture seems to be the prominent strength of a composite index [1]. This single overall view can represent the whole magnitude of a multidimensional problem and the performance of policy implementation all of which are important for policy appraisal, formulation, monitoring, and evaluation. Because of these advantages, Hudrlikova [2] argued that this approach was very tempting for all users of statistical information ranging from policymakers to journalists. Despite its recognition at all levels, application of composite indexes in social policy analysis has to be cautious as sometimes it looks like an attempt to merge apples and oranges together [1]. Smith [3] indicated many weaknesses of composite indicators which could lead to seriously dysfunctional outcomes. Sharpe [4] pointed out that a distinction between different levels of indicators had little effect for the construction of an index, but the only relevant factor was data availability. Political disputes due to disagreement on indicator selection and misleading policy are some of the weak points of composite indexes. Saisana, Tarantola, and Saltelli [5] concluded that debate on the application of composite indicators would ever be settled.

The construction of composite indicators including the choice of a conceptual model, the selection of sub-indicators, the weighting of indicators, and the normalization and aggregation of indicator data has to involve subjective judgments [6], [7]. Since there is no universal index, a great variety of composite indicators have been proposed to measure country performances in various policy aspects. As mentioned by the European Commission [8], the construction of a composite index "owed more to the craftsmanship of the modeler than to a universally accepted scientific rule for

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encoding."

One of the critical debates regarding the construction of a composite index is the normalization of indicator raw data. Normalization transforms indicator data with different measurement unites into a new set of information based on the same scales of quantification. After normalization, these data can be aggregated or processed by a mathematic formula. Many methods for normalizing data are available. Distance from the group leader, distance from the mean, distance from the best and worst performers, and use of Z scores or the standard deviation from the mean are common approaches to normalization [9],[10]. Although each method has its advantages and disadvantages, some studies indicate that the methods that take into account the standard deviation of the data are appropriate for data normalization because these techniques reduce the effect of extreme values on the composite index. Freudenberg [11] suggested that the standard deviation approach was most commonly used because it had desirable characteristics when it came to aggregation. Little and Mabel [12] showed in their study more than four decades ago the distortion of data caused by the methods of distance from the mean and of distance from the best and worst performers which ignored the effect of extreme values. As a result, Little and Mabel [12] constructed a particular formula which made use of the standard deviation in normalizing the data.

II. METHODS

A. Basic Assumptions

The study had predetermined that the composite index to be constructed must have the following properties:

1. Validity: The developed index had to produce valid results when applied in normalizing the data with different scales of measurement. In other words, the composite index must indicate accurate ranking scores of the competitive areas or of the points of time based on the selected indicator data of human security.

2. Convenience: The composite index must be convenient to use for data analysis. This should reflect through the reduction of analytical steps in data normalization and aggregation. Its convenience and simplicity would help to reduce time and financial resources for data analysis.

3. Reflection of Social Policy**:** As the index would be primarily used in the field of human security; it should show a particular identity or a major characteristic of social policy. The index construction; therefore, attempted to make the formula illustrate the implication of resource redistribution which is one of the most important social policy principles.

B. Test of Validity

The study needed to make sure that the composite index would be valid enough to measure human security; therefore, its validity was tested by a reliable method. After investigating the literature, the study decided to employ the Human Development Index (HDI) as the standard concurrent criterion with which the measurement by the constructed index would be brought to compare. The study chose the HDI because it is also a people-centered index although its measurement relies only on three indicators of life expectancy, education, and GDP per capita compared with more than 50 variables for the case of the constructed index. Another reason was that raw data for deriving HDIs, which needed to be the same set of information required for computing comparative results by the constructed index, were publicly accessible.

The validity test, finally, utilized the same set of raw data employed by Haq to compute HDIs of the 174 countries around the world [13] for computing comparative results by the constructed index. The correlation coefficient between the HDIs and the comparative results would become the concurrent validity level of the constructed index.

C Pilot Test of the Constructed Index

To assure the applicability of the constructed index in indicating the human security evidences in competitive areas in Thailand, the study conducted a pilot test by using the index formula to process the available secondary data of 56 selected statistical indicators representing human security in the 64 provinces of Thailand. These 56 indicators were grouped into ten domains of health, housing, education, employment & income, personal security, rights and equity, socio-cultural participation, family relations, social support, and political governance. The pilot test would show the comparative degrees of human security of the 64 provinces in the same manner as the country ranking by the HDI

III. RESULTS

A. The Index

The constructed composite index is called the Human Security Index (or the HSI) of which the formula is defined as:

$$HSI = \sqrt{\frac{Z_T + \left| M_Z + \frac{f_2}{f_1} \right|}{2\left| M_Z + \frac{f_2}{f_1} \right|}}$$

Where

Z_T is the summation of standardized scores of all the indicators

M_Z is the absolute value of the maximum Z score of the person or area assessed

f_2 is the frequency of persons (or areas) whose standardized scored are higher than zero

f_1 is the frequency of persons (or areas) whose standardized scores are lower than zero

For the case of perfect human security, then the HSI = 1. On the other hand, the HSI of a person or an area without security at all will be equal to zero (0). Normally, the formula produces an index value higher than 0; but the index never reaches the perfect human security of 1.

The HSI takes into account dispersion of the data because it makes use of a standard deviation in converting or normalizing raw data into standard scores (or Z scores). This helps reduce the effect of extreme values of raw data on distorting the normalized results as previously discussed in the literature review [11].

Another advantage of the HSI is that it shortens the analytical procedure in two respects. First, the index does not need any external criteria, which normally require theoretical support and peer acceptance, to normalize the indicator data. The HSI has solved the problem of finding acceptable criteria as it relies on the mean and standard deviation of each indicator data set. Secondly, the HSI has combined data normalization and index aggregation into a single step. As a result, the HSI is convenient to apply and can save costs for data analysis.

As far as the final assumption is concerned, the term f2/f1 reflects the redistribution function of social policy. If f2 is greater than f1 or people or areas with high security outnumber their counterparts or f1 (the circumstance that facilitates resource redistribution), the formula will help improve all the human security indexes among people or areas with low human security. On the contrary, the formula assumes that the redistribution function will be less efficient if there are more people or areas with low human security (or f2 is less than f1). For this case, the formula will function in such a way that the indexes among people or areas in the high human-security group will be slightly increased.

B. Validity of the HSI

Based on the same set of data, the results derived from the HSI and from the selected concurrent validity criterion of the HDI are very close (see Table I). The HDI of 0.932 for Canada, for example, is almost equal to its HSI of 0.935. Computing the indexes from the same set of data by the HSI for the US shows a slightly higher value than by the concurrent criterion of the HDI. The ranking of the US according to the HSI is on the top of the list whereas Canada becomes the second. The HSI of 0.703 of Thailand is lower than its HDI of 0.753. Sierra Leone remains at the bottom of the ranking with indexes of 0.254 by the HDI and 0.322 by the HSI. The reader can see that the HSI produces higher indexes for the countries at the bottom of the ranking due to the effect of the greater frequencies of f2 than that of f1 as previously discussed.

A very high coefficient between the human development and human security indexes is very satisfactory. The correlation coefficient of 0.98 indicates that these two people-centered composite indexes are almost interchangeable. Consequently, the study concludes that in relation with the HDI, the HSI is valid enough for determining the degrees of human security.

C. Pilot Test of the HSI

Use of the HSI formula in processing the 56 statistical indicators of the 64 provinces where data were available resulted in the ranking of their human security degrees as shown in Table II. The reader may notice that the capital city of Thailand or Bangkok does not appear in the high human security group. Bangkok where the degree of urbanization is highest; but its indexes of family relations, housing, personal security, and rights and justice are rather low, ranks 46th on the list. The top ten provinces share some common characteristics. These ten provinces are small in size and the people' ways of living are not extremely urbanized.

The + and – signs shown in Table II represent the advantages and disadvantages in terms of human security in each province. A plus sign means the HSI that is greater than the average degree whereas a minus indicates an opposite implication. These signs will help each province to realize its weaknesses and strengths of human security that should be remedied or reinforced.

D. Indication of Human Security

"What constitutes human security or happiness in life?" is still debatable. Findings from the study partly answer this question. Surprisingly, the correlation coefficient computed from the scores of the employment & income domain, which obtained the highest weight from the surveyed sample, and the total scores of human security is not highest. The two highest coefficients belong to the correlations between the total scores of human security and that of the domains of family relations and of health.

The study was further interested in the effects of interaction between the 10 domains of indicators upon the total score of human security. The study, therefore, ran multiple regression tests between all the ten domains and the total score of human security. Table III shows every regression model. Models 1 and 2 show that family relations is the best predictor of human security followed by health. Approximately 68% of change in the total human security can be explained or predicted by the variations of family relations and health. Model 3 indicates that if the domain of employment & income is added as another predictor, the explanation degree improves to as high as almost 85%. Although the other seven domains are not good predictors, their interactions with the three main components of family relations, health, and employment & income tend to improve the coefficient determinations as shown in Models 4 to 10.

IV. CONCLUSION

Human security is an example of the multidimensional social issues that require a composite index to capture the aggregated situation instead of being considered aspect by aspect. The so called "human security index or the HSI" developed by this study has proved its applicability in satisfying this requirement. The HSI has very high concurrent validity in relation to the selected criterion of the HDI. As the HSI does not ignore data dispersion, it reduces the effect of extreme values of raw data in the normalization step. This increases the reliability of the HSI in data analysis. Use of the HSI is also convenient and cost saving because the index formula combines data normalization and aggregation into one step.

TABLE I
VALIDITY TEST OF THE HSI IN RELATION TO THE CONCURRENT CRITERION OF THE HDI (AN ABRIDGED TABLE)

Country	Raw Data*			HDI*	Z Scores Converted from				HSI
	1 Life Expectancy	2 Gross School Enrollment (%)	3 Per Capita GDP (in Dollars)		1	2	3	Total Z Score	
Canada	79.0	99	22480	0.932	1.22	1.73	1.99	4.94	0.935
Norway	78.1	95	24450	0.927	1.14	1.52	2.25	4.91	0.934
United Sates	76.7	94	29010	0.927	1.01	1.47	2.84	5.33	0.950
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Bahamas	73.8	74	16705	0.851	0.75	0.47	1.24	2.45	0.828
Malta	77.2	78	13180	0.850	1.06	0.67	0.78	2.50	0.830
Slovenia	74.4	76	11800	0.845	0.80	0.57	0.60	1.97	0.805
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Thailand	**68.8**	**59**	**6690**	**0.753**	**0.29**	**-0.29**	**-0.07**	**-0.07**	**0.703**
Romania	69.9	68	4310	0.752	0.39	0.16	-0.38	0.18	0.716
Lebanon	69.9	76	5940	0.749	0.39	0.57	-.017	0.79	0.748
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
South Africa	54.7	93	7380	0.695	-0.99	1.42	0.02	0.45	0.731
Tunisia	69.5	70	5300	0.695	0.36	0.26	-0.25	0.37	0.727
Azerbaijan	69.9	71	1550	0.695	0.39	0.31	-0.74	-0.03	0.705
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
Ethiopia	43.3	24	510	0.298	-2.04	-2.06	-0.88	-4.97	0.352
Niger	48.5	15	850	0.298	-1.56	-2.51	-0.83	-4.90	0.359
Sierra Leone	37.2	30	410	0.254	-2.59	-1.75	-0.89	-5.24	0.322

*Raw Data and the HDIs from Karger and Stoesz 2002, pp. 497-502.

TABLE II
HUMAN SECURITY RANKING AMONG THE SIXTY FOUR PROVINCES IN THAILAND WHERE DATA WERE AVAILABLE (AN ABRIDGED TABLE)

Ranking	Category	Province	HSI										
			1	2	3	4	5	6	7	8	9	10	11
1	High	Samut Songkhram	0.75 +	0.81 +	0.80 +	0.89 +	0.72 +	0.73 +	0.74 +	0.74 +	0.73 +	0.75 +	0.87
2		Maha Sarakham	0.80 +	0.73 +	0.82 +	0.69 -	0.78 +	0.75 +	0.83 +	0.74 +	0.81 +	0.66 -	0.85
3		Satun	0.90 +	0.70 +	0.78 +	0.79 +	0.67 -	0.72 +	0.94 +	0.73 +	0.73 +	0.71 +	0.85
4		Mae Hong Son	0.72 +	0.64 -	0.67 -	0.95 +	0.69 -	0.76 +	0.33 -	0.65 -	0.98 +	0.79 +	0.81
45	Moderate	Ayutthaya	0.72 +	0.69 -	0.73 +	0.94 +	.075 +	0.68 -	0.51 -	0.65 -	0.65 -	0.73 +	0.72
46		**Bangkok**	**0.68 -**	**0.71 +**	**0.73 +**	**0.76 +**	**0.43 -**	**0.66 -**	**0.79 +**	**0.47 -**	**0.67 -**	**0.92 +**	**0.66**
47		Nonthaburi	0.80 +	0.70 +	0.67 -	0.81 +	0.66 -	0.63 -	0.71 +	0.27 -	0.65 -	0.97 +	0.66
48		Kamphaeng Phet	0.70 +	0.63 -	0.70 +	0.79 +	0.79 +	0.72 +	0.47 -	0.75 +	0.65 -	0.61 -	0.66
60	Low	Chon Buri	0.88 +	0.73 +	0.37 -	0.95 +	0.65 -	0.51 -	0.54 -	0.52 -	0.62 -	0.76 +	0.55
61		Chachoengsao	0.24 -	0.72 +	0.73 +	0.77 +	0.63 -	0.65 -	0.51 -	0.72 +	0.66 -	0.75 +	0.55
62		Surat Thani	0.73 +	0.18 -	0.74 +	0.69 -	0.63 -	0.60 -	0.88 +	0.72 +	0.57 -	0.72 +	0.49
63		Pathum Thani	0.79 +	0.75 +	0.60 -	0.66 -	0.67 -	0.19 -	0.54 -	0.46 -	0.67 -	0.85 +	0.44
64		Chiang Rai	0.40 -	0.67 -	0.25 -	0.72 +	0.32 -	0.74 +	0.39 -	0.73 +	0.75 +	0.66 -	0.21

+ indicates a strength or the index higher than the average level
- indicates a weakness or the index lower than the average level
1 = Family 2 = Health 3 = Education 4 = Employment & income 5 = Housing 6 = Personal Security
7 = Political Governance 8 = Rights & Equity 9 = Social Support 10 = Socio-cultural Participation 11 = Overall

TABLE III
MULTIPLE REGRESSION MODELS INDICATING THE CORRELATIONS BETWEEN THE TOTAL SCORES OF HUMAN SECURITY AND ITS DOMAINS

Model	Correlation Coefficient (R)	R Square	Sig. F Change
1a	0.683a	0.467	0.000
2b	0.825b	0.681	0.000
3c	0.921c	0.849	0.000
4d	0.949d	0.901	0.000
5e	0.967e	0.936	0.000
6f	0.982f	0.964	0.000
7g	0.989g	0.979	0.000
8h	0.993h	0.986	0.000
9i	0.996i	0.933	0.000
10j	0.997j	0.994	0.000

a. Predictors: (Constant), family
b. Predictors: (Constant), family, health
c. Predictors: (Constant), family, health, employment
d. Predictors: (Constant), family, health, employment, personal security
e. Predictors: (Constant), family, health, employment, personal security, education
f. Predictors: (Constant), family, health, employment, personal security, education, housing
g. Predictors: (Constant), family, health, employment, personal security, education, housing, political governance
h. Predictors: (Constant), family, health, employment, personal security, education, housing, political governance, rights and equity
i. Predictors: (Constant), family, health, employment, personal security, education, housing, political governance, rights and equity, socio-cultural participation
j. Predictors: (Constant), family, health, employment, personal security, education, housing, political governance, rights and equity, socio-cultural participation, social support
Dependent Variable: Weighted HSI

The pilot test with statistical indicators at the national level suggests that the HSI is capable enough to compare or to rank human security evidences among the competitive areas. The multiple regression analysis shows that family relations and health seem to compose into the core or foundation of human security. The other eight domains, although less important, can become compatible parts that strengthen the whole human security.

This paper will finally raise some policy implications in relation to the HSI. As the two domains of family relations and health can best determine change in human security, they should become both a means and an end of social development. Regarding the other eight domains of employment & income, education, personal security, housing, rights and equity, social support, socio-cultural participation and political governance; policymakers may consider them as only a means of social development. For this reason, policies on income generation and educational promotion must not stimulate people to compete too hard for high incomes and high educational status because these directions will adversely deteriorate the ultimate development ends of good family relations and health security among the people.

The analysis of human security by the HSI also suggests that policymakers should be concerned with the weaknesses and strengths of each competitive area. Comparison of area indexes provides policymakers with the directions of development for each particular locality. Bangkok, for instance, needs development in the aspects of family relations, housing, personal instance, needs development in the aspects of family relations, housing, personal security, and social support whereas health, employment & income, and education are its strong points. By basing his/her judgment on HSIs, policymakers can tailor development strategies to suit the conditions of particular areas.

Resource allocation, which is another significant aspect of the social policy management, can be also dependent upon the HSI. Since the HSI suggests the development degree of human security of the area under consideration, rational allocation of resources can be proportional to the inversion of the index value. In addition, increases or decreases of human security indexes are indications of development performances; therefore, the HSI can be an effective tool for both policy monitoring and evaluation.

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