Developing Community Wellbeing Index (CWBi) in Disaster Prone Areas of the Philippines

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"The end of development must be human well-being."

(UNDP, 1990)

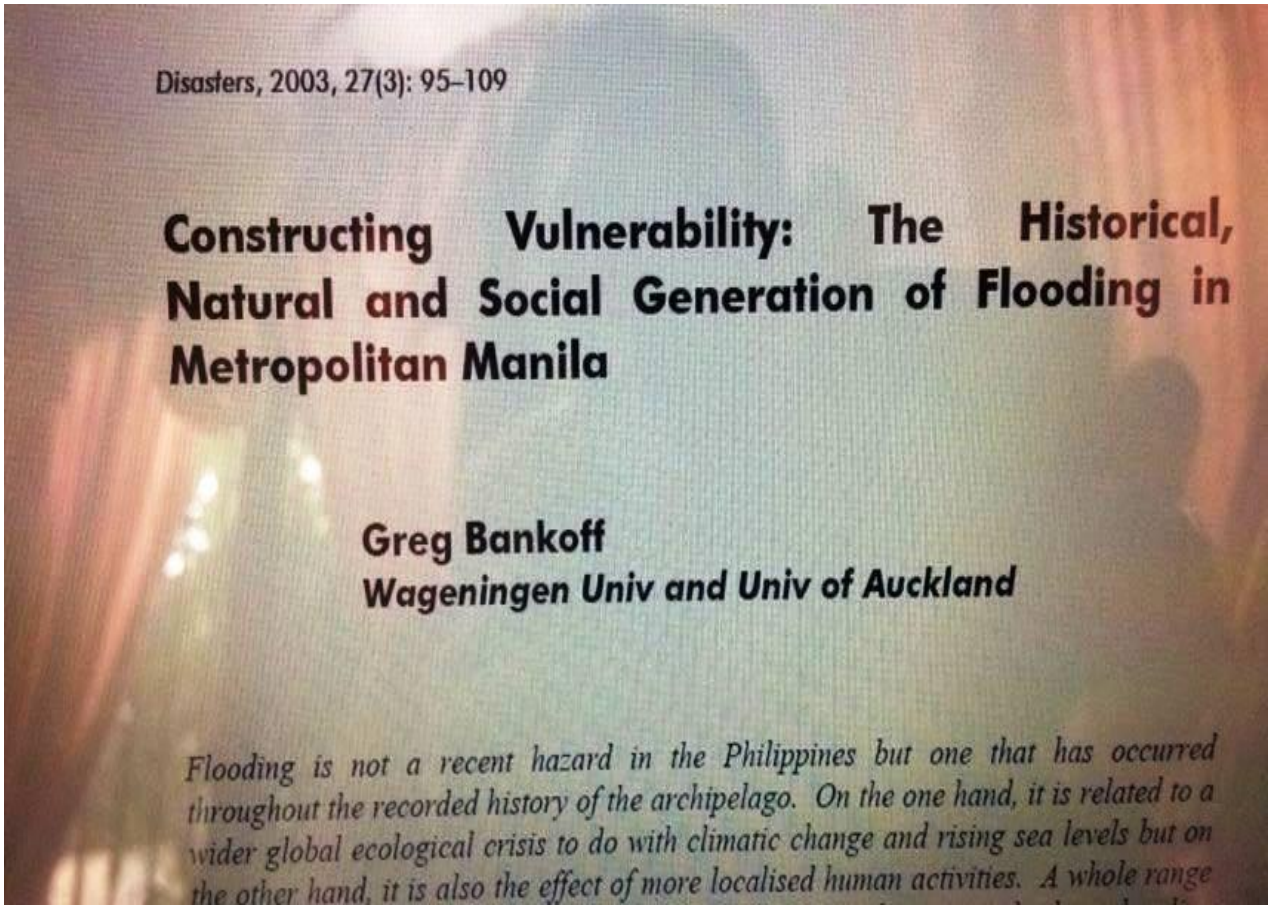
- **Community**
- **in the context of natural disasters**

- **Community wellbeing (CWB) varies with contexts.**
- **Can be strong or moderate or low**

“the state of the Philippine environment in the new millennium is not encouraging”

- with the present inequalities in the society

- the more vulnerable sector suffers more (Bankoff 2003)

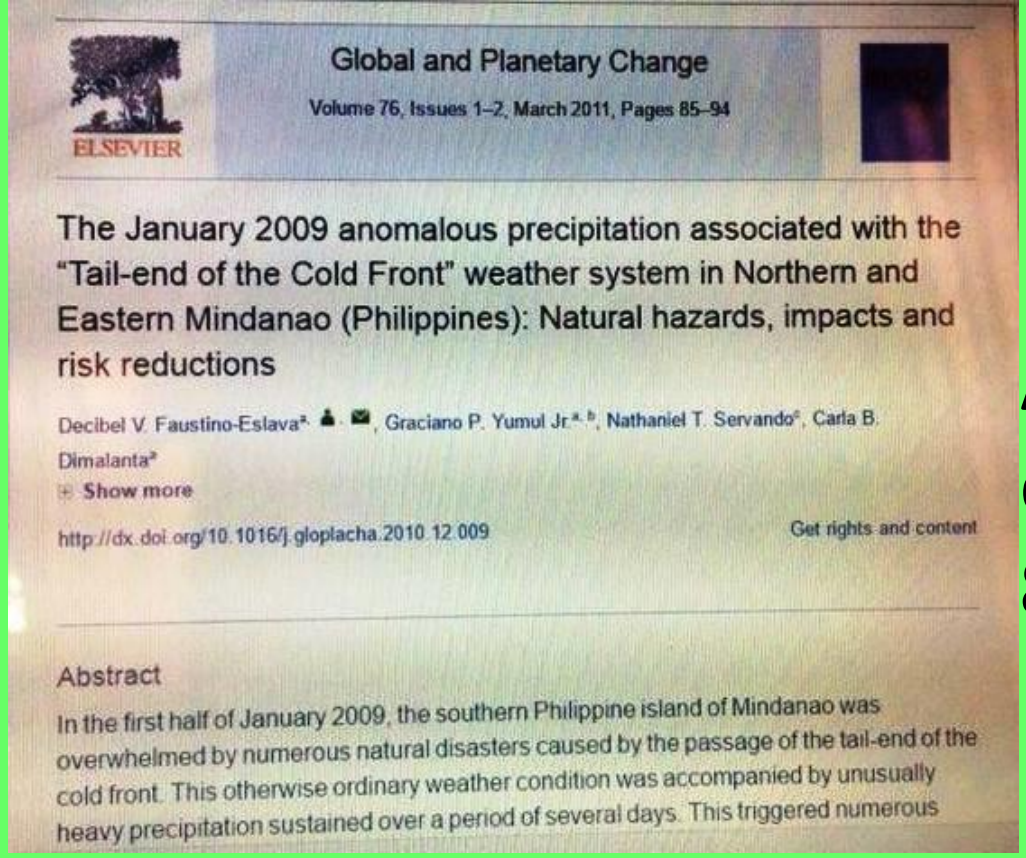


Disasters, 2003, 27(3): 95–109

Constructing Vulnerability: The Historical, Natural and Social Generation of Flooding in Metropolitan Manila

Greg Bankoff
Wageningen Univ and Univ of Auckland

Flooding is not a recent hazard in the Philippines but one that has occurred throughout the recorded history of the archipelago. On the one hand, it is related to a wider global ecological crisis to do with climatic change and rising sea levels but on the other hand, it is also the effect of more localised human activities. A whole range



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ELSEVIER

The January 2009 anomalous precipitation associated with the "Tail-end of the Cold Front" weather system in Northern and Eastern Mindanao (Philippines): Natural hazards, impacts and risk reductions

Decibel V. Faustino-Eslava[a], Graciano P. Yumul Jr.[a, b], Nathaniel T. Servando[c], Carla B. Dimalanta[a]

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http://dx.doi.org/10.1016/j.gloplacha.2010.12.009

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Abstract

In the first half of January 2009, the southern Philippine island of Mindanao was overwhelmed by numerous natural disasters caused by the passage of the tail-end of the cold front. This otherwise ordinary weather condition was accompanied by unusually heavy precipitation sustained over a period of several days. This triggered numerous

Average of 20 tropical cyclones
8 or 9 made landfalls

- **The Philippnes is considered as**
- **one of the most susceptible countries to natural calamities or disasters (Eslava et al., 2011; Yumul et at., 2008, Bankoff, 2003)**

What is Community Wellbeing?

the combination of social, economic, environmental, cultural, and political conditions identified by individuals and their communities as essential for them to flourish and fulfill their potential

(Lee et al., 2015; Wiseman and Brasher,2008)

By establishing baseline conditions

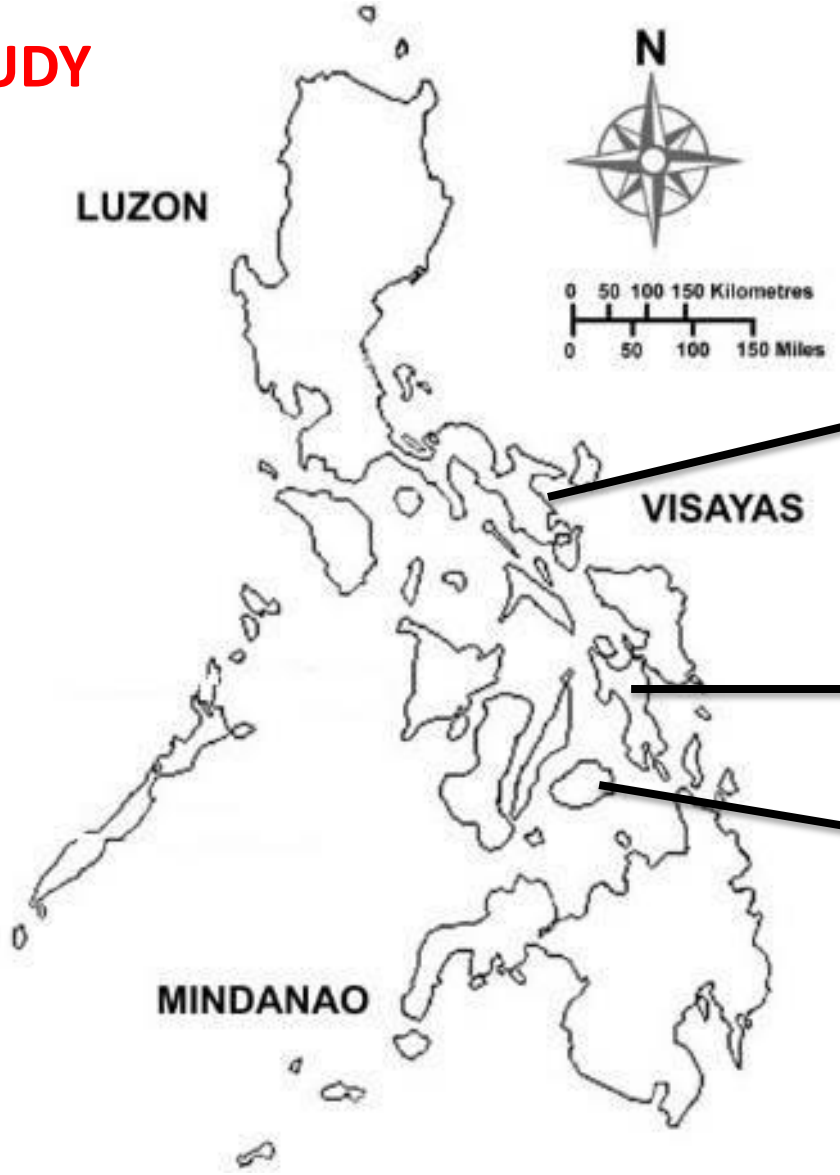
- it becomes possible to monitor changes in CWB
- in particular places and maybe compare one place to another within similar context

Objectives

- Develop Community Wellbeing tools to assess level of CWB in the aftermath of a disaster

- Determine the CWB index (CWBi) in disaster-prone area as affected by different cases

AREA OF STUDY



ALBAY: VOLCANIC ERUPTION

LEYTE: SUPER TYPHOON

BOHOL: STRONG EARTHQUAKE

Methodology

MIXED METHODS (PRAGMATIC APPROACH)

Qualitative approach: FGD and KII
Quantitative approach: community survey
secondary data

- **Selection of Sample Site and Respondents**

- Sites were purposively chosen based on its proximity to cases
- Simple random sampling technique
- Purposive sampling of barangays
- Systematic random sampling in the selection of respondents.

- **Selection of Sample Site and Respondents**

- G*Power Analysis
- The number of respondents were decided upon with the use of GPower analysis and total ***n*** was proportionately divided based on the number of households
- (Faul et al., 2007)

- G*Power Analysis (Faul et al., 2007)
- **t tests -** Means: Difference from constant
- (one sample case)
- **Analysis:** A priori: Compute required sample size
- **Input:** Tail(s)= One
- Effect size d= 0.4
- α err prob = 0.05
- Power (1-β err prob) = 0.95
- **Output:** Noncentrality parameter δ= 3.3466401
- Critical t = 1.6672385
- Df = 69
- Total sample size = **70**
- Actual power = 0.9524114

Techniques in the Field

- Deductive Method in proposing the indicators
- Several FGDs conducted to arrive at the final indicators
- KII with the experts for prioritization
- Construct survey Qs
- Test validity and reliability of the instrument
- Community survey

Results and Discussion

Table 1. The proportional distribution of the household respondents in three barangays of three different disaster types.

SITE	BARANGAY 1	BARANGAY 2	BARANGAY 3	TOTAL
ALBAY	21	19	34	74
BOHOL	44	13	16	73
LEYTE	28	28	17	73
TOTAL				220

Table 2. The characteristics of the different experts for the Key Informant Interviews.

SECTOR	ALBAY	BOHOL	LEYTE
Education	Master Teacher II	Principal I	Assistant Professor
Business	Chairman/founder Cooperative	Owner	Owner
LGU	MDRRM Officer	MDRRM Officer	Barangay Chairman
	Municipal Agricultural Officer	University Professor	Provincial Environment & Natural Resources Officer
Socio-civic	Professional Volunteer	Pastor-Church based Organization	President-Student Organization
People's Organization	Chairman	Secretary	Chairman

1)Proposed Dimension Themes

- Community Capitals Framework
- (Flora & Flora, 2013)
- 5 capitals

Proposed Dimension Themes

- Built capital - the infrastructure in the community
- Financial capital – economic wealth of the community
- Political capital – strength of the institutions
- Sociocultural capital - human labor with its skills and knowledge that enhances community trust, connection and cohesion
- Natural capital – natural environment

2)Selection and Validation of Indicators

- “a reference point for monitoring, decision-making, stakeholder consultations and evaluation”
- (Vincent, 2007, Sandhu-Rojon, 2004)
- extracting and exploring the personal and collective meanings of community wellbeing
- Indicators were validated using **Pearson’s rho**

Selection of Variables as Proxies

- justification based on the **literature** with regard to relevance to CWB,
- the experts' knowledge and recommendations about the construct validity.
- With these two considerations, the initial list of indicators under each dimension was then decided.

Selection of Variables as Proxies

- **law of parsimony**
- simplifying the list of assumptions but maintaining the greater explanation of the current construct was more helpful
- the need for the sub-indicators to be examined for significantly high correlations between individual sub-indicators (e.g. Pearson's $r>0.70$)
- When such high correlations were found, related sub-indicators were eliminated (Vincent, 2007).
- 110 sub-indicators to 62 for final consideration in the analysis

3)Normalization of Values

- All raw data values were transformed into comparable scales of normalization
- Normalizations were essential to avoid problems when mixing measurement units
- a Min-Max rescaling scheme to normalize the variables
- (Yoon, 2012; OECD, 2008)

- Table 3 @ manus

- For indicators that have a positive influence or impact on CWB:

$$y = \frac{X_i - Min\{X_i\}}{Max\{X_i\} - Min\{X_i\}}$$

Where,

y : normalized value

Xi : value of the observation

Min{Xi} : minimum value for all observations

Max{Xi} : maximum value for all observations

A negative influence on the CWB, equation 2 will be used:

$$y = \frac{Max\{X_i\} - X_i}{Max\{X_i\} - Min\{X_i\}}$$

4)Determining weights through Analytic Hierarchical Process (AHP)

- based on pairwise comparisons of elements in the decision hierarchy with respect to the parent element at the next higher hierarchy level
- for each level, a pairwise comparison matrix is generated to evaluate the relative importance of the elements within that level of the hierarchy

- **Key informants** were asked about their judgements on which among those indicators and dimensions were much more important over the other.
- Judgement was given based on a **scale of 1 to 9** with 1 being of equal importance and 9 of extreme importance

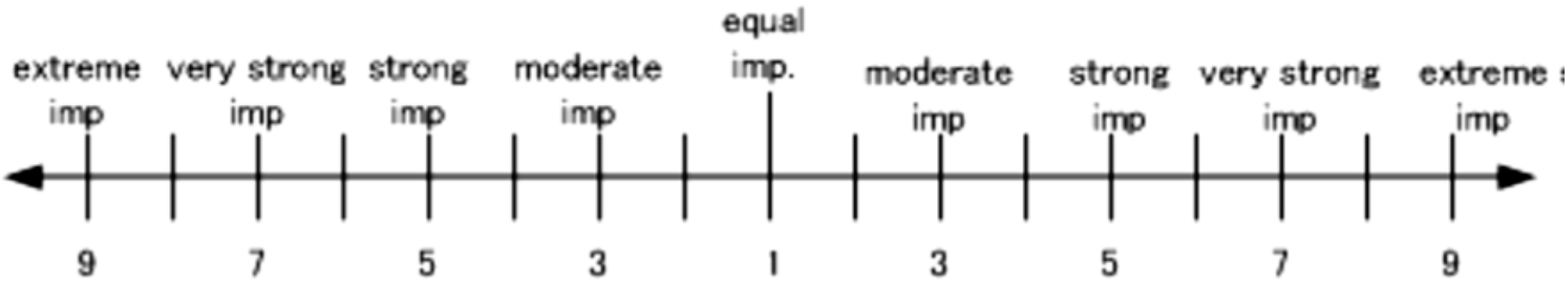


Table 4. Scale of expert's judgement showing the relative values of certain attributes.

INTENSITY OF IMPORTANCE	DEFINITION	EXPLANATION
1	Equal importance	Two factors contribute equally to the objective
3	Moderate importance	Experience and judgement slightly favor one over the other
5	Strong importance	Experience and judgement strongly favor one over the other.
7	Very strong importance	Experience and judgement very strongly favor one over the other. Its importance is demonstrated in practice.
9	Extremely importance	The evidence favoring one over the other is of the highest possible validity.
2,4,6,8	Intermediate values	When compromise is needed.

(Saaty, 1987)

- In order to determine the sets of pairwise comparison matrix, the number of unordered subsets called a combination of n objects taken r at a time was followed:
- where n! = n (n-1) (n-2) ... (3)(2)(1)

Thus n=5 and r=2. Then, nCr = C(n,r) = n! / ((n-r)! * r!)

5C2=C(5,2)=5!/((5-2)!*2!)= (5*4*3*2*1) / 3! * 2!= 120 / (3*2*1)

*(2*1)=120/ (6*2) = 120/12 = 10

- There were 10 combinations produced from 5 dimensions (appendix_AHP)
- Consistency ratio to check whether these weights were consistent
- A Consistency Ratio (CR) of 0.10 or lower is acceptable and weights were therefore acceptable
- A higher value of 0.10 at any level demands a reassessment of the judgement.

Consistency Ration (CR)

- the consistency ratio, CR, which is a proportion of the consistency index, CI of an n x n pairwise comparison matrix, with respect to the average consistency index of randomly generated n x n pairwise comparison matrices, or random index RI:

$$\mathrm{CR} = \frac{\mathrm{CI}}{\mathrm{RI}}$$

CI, which is the Consistency Index, is computed as follows:

$$CI = \frac{(\lambda - n)}{n-1}$$

where λ the average value of the consistency vector

n is the total number of factors

5) Additive Aggregation Method

- the aggregation of weights of indicator
- the dimension to come up with the CWBi

Data Analysis

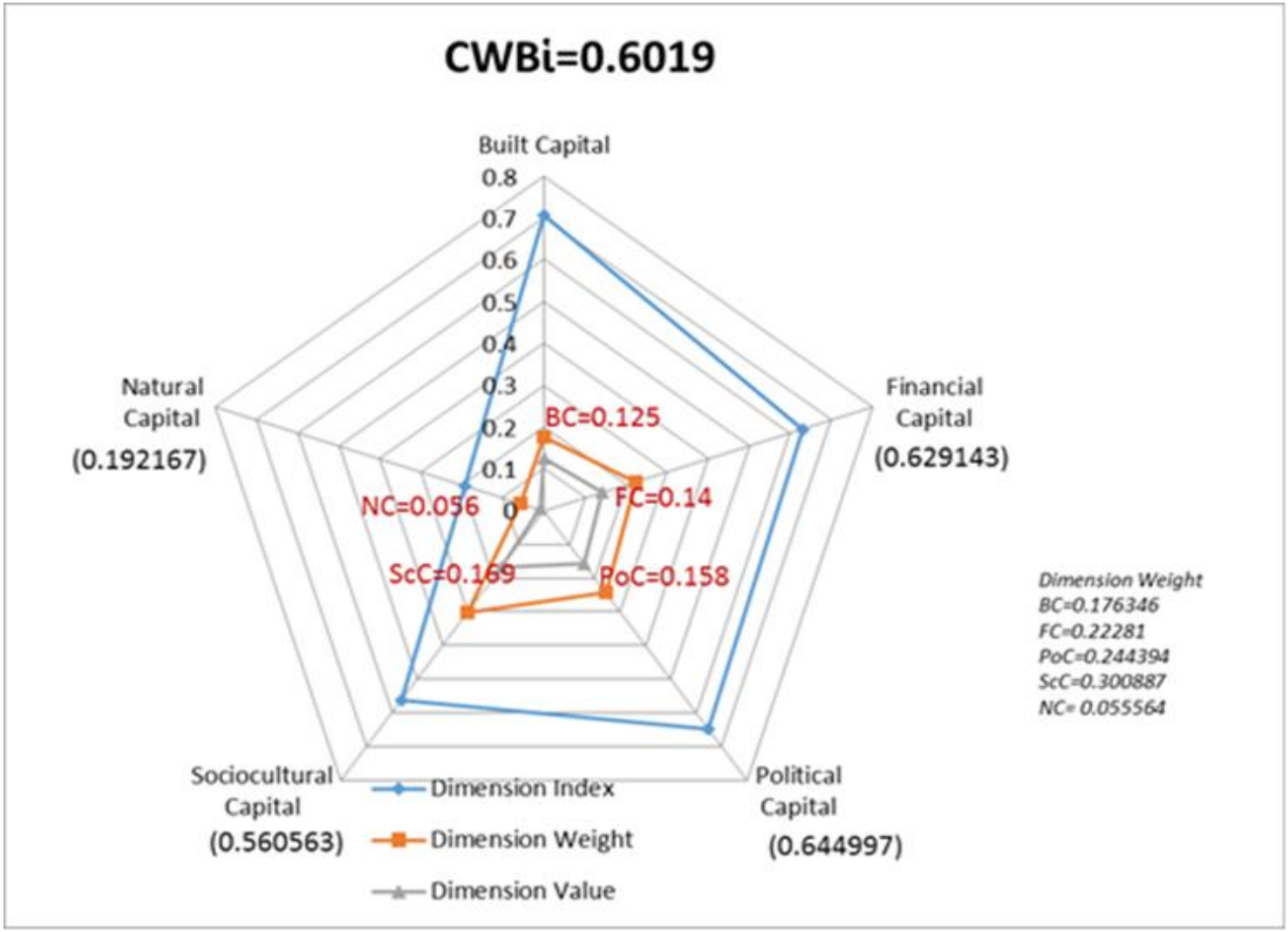
-
- $\mathbf{CWBi} = (\mathbf{B} \cdot \boldsymbol{w_{d_1}}) + (\mathbf{F} \cdot \boldsymbol{w_{d_2}}) + (\mathbf{Po} \cdot \boldsymbol{w_{d_3}}) + (\mathbf{SC} \cdot \boldsymbol{w_{d_4}}) + (\mathbf{N} \cdot \boldsymbol{w_{d_5}})$

- where B is built capital;
- F, the financial capital;
- Po, political capital;
- SC, sociocultural capital and
- N, the natural capital;
- W_{d1} to W_{d5} are the respective weights of the 5 dimensions.

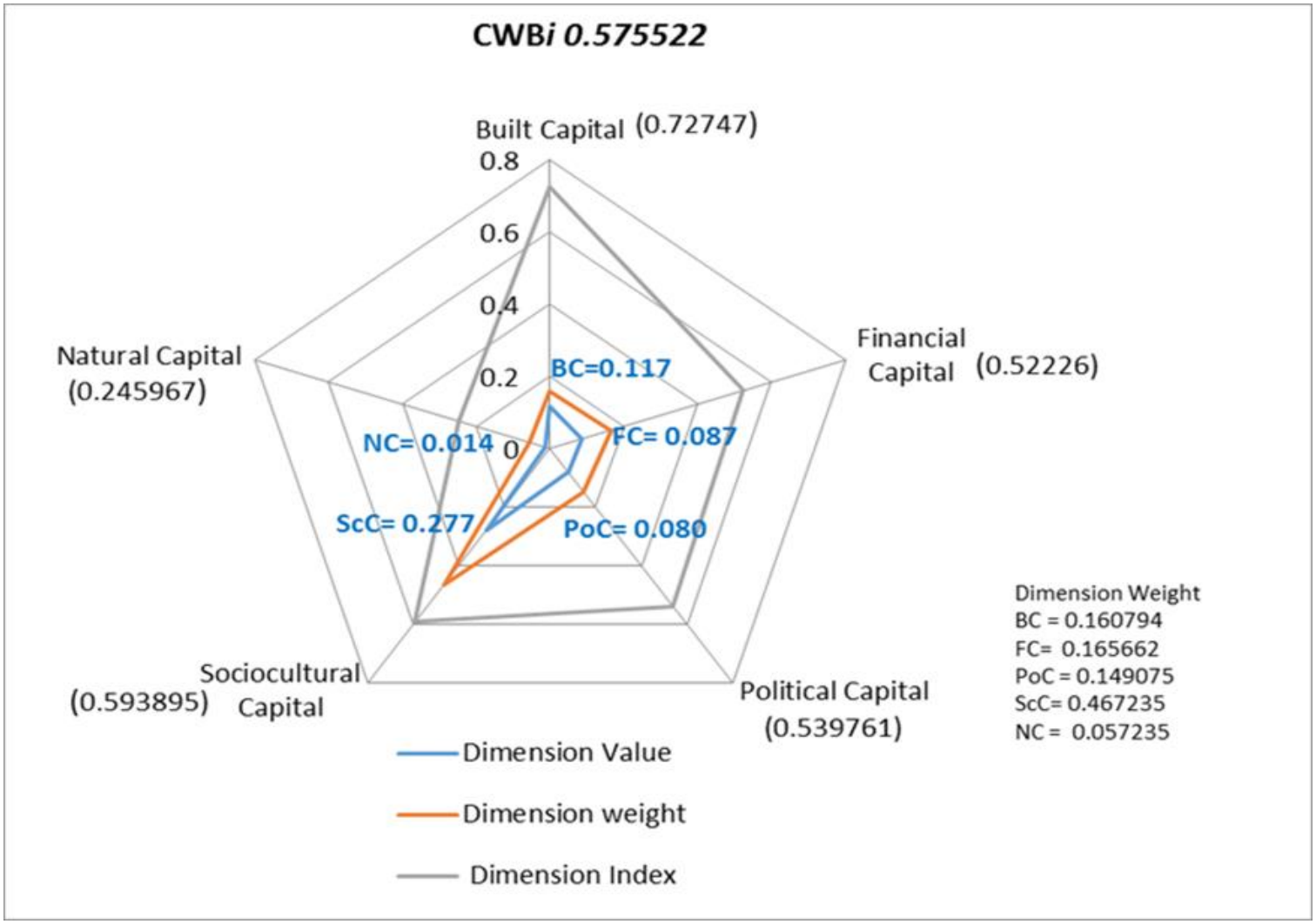
Table 5. Indicators and sub indicators

LOCATION	DIMENSION	INDICATORS	SUB-INDICATORS VALUES	INDICATOR WEIGHTS	INDICATOR VALUE
a	BUILT CAPITAL	Road Infrastructure	0.851598	0.50108225	0.426721
		Quality Evacuation Center	0.698108	0.07683983	0.053642
		Communication Accessibility	0.534132	0.15909091	0.084975
		Water and Light Infrastructure	0.6165	0.26298701	0.162131
b	FINANCIAL CAPITAL	Income stability	0.553916	0.55338935	0.306531
		Housing quality	0.722114	0.07640468	0.055173
		No. of assets	0.520589	0.20485895	0.106647
		House ownership	0.6575	0.04033247	0.026519
		Credit support and insurance	0.219091	0.12501455	0.02739
c	POLITICAL CAPITAL	Aid from government and NGOs	0.53089	0.37205819	0.197522
		Disaster preparation and management	0.594178	0.08980531	0.05336
		Provision of basic resources	0.513699	0.45539153	0.233934
		Availability of evacuation center	0.664019	0.08274497	0.054944
d	SOCIOCULTURAL CAPITAL	Household Attributes	0.689521	0.30395363	0.209583
		Organization membership	0.42	0.06129656	0.025745
		Sense of Community	0.558843	0.38288215	0.213971
		Emotional Connection	0.574098	0.25186766	0.144597
e	NATURAL CAPITAL	% of forest cover to total land area	0.245967	1	0.245967

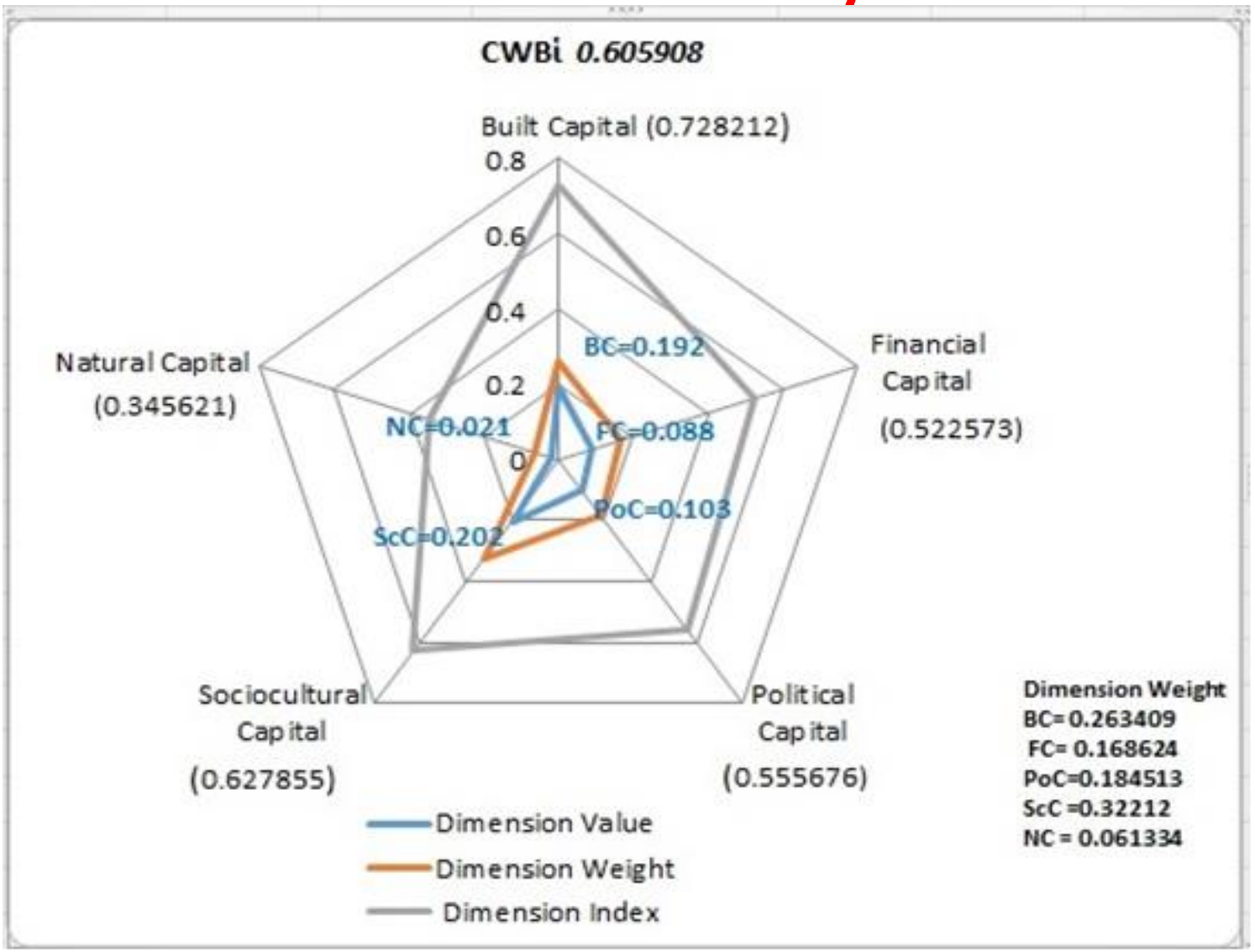
CWBi of Albay



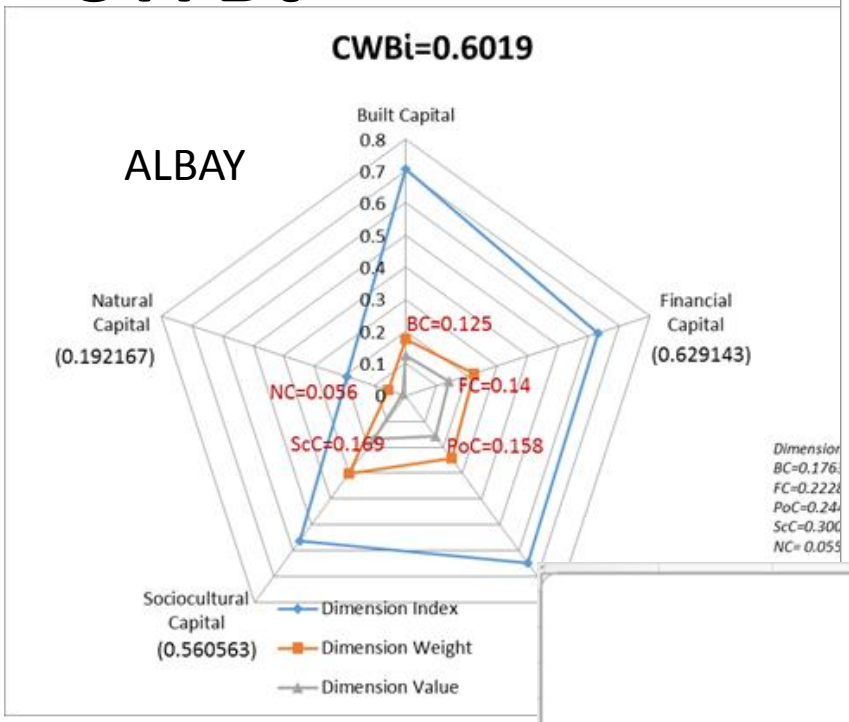
CWBi of **Bohol**

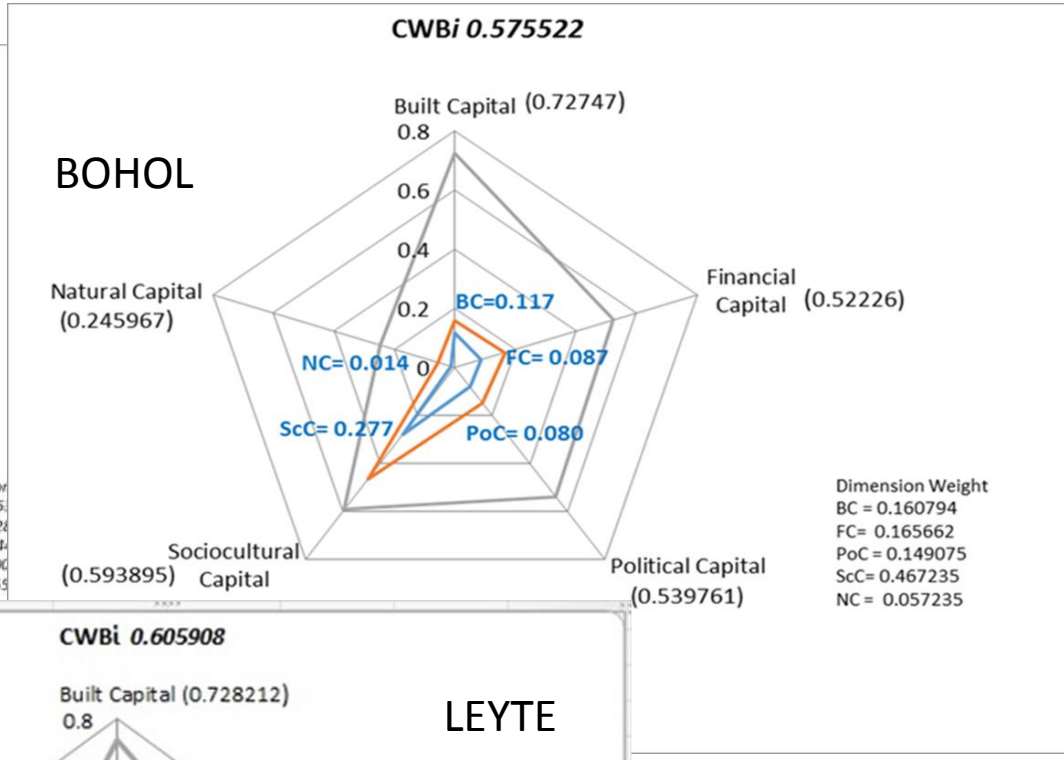


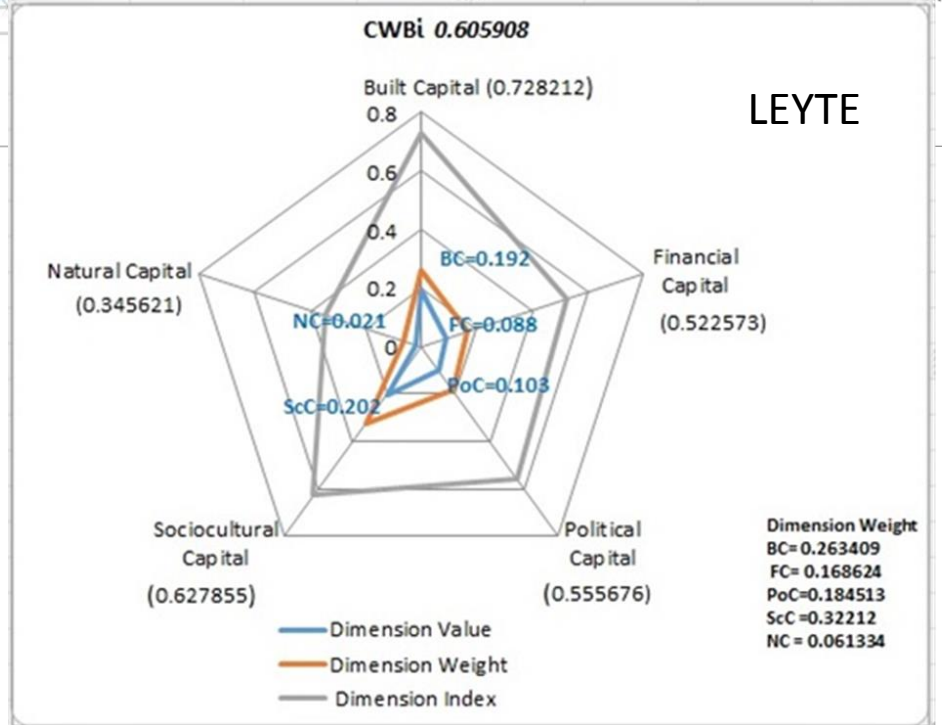
CWBi of Leyte



CWBi


CWBi=0.6019
ALBAY
Built Capital
Financial Capital (0.629143)
Sociocultural Capital (0.560563)
Natural Capital (0.192167)
BC=0.125
FC=0.14
PoC=0.158
ScC=0.169
NC=0.056
Dimension Index
Dimension Weight
Dimension Value


CWBi 0.575522
BOHOL
Built Capital (0.72747)
Financial Capital (0.52226)
Political Capital (0.539761)
Sociocultural Capital (0.593895)
Natural Capital (0.245967)
BC=0.117
FC= 0.087
PoC= 0.080
ScC= 0.277
NC= 0.014
Dimension Weight
BC = 0.160794
FC= 0.165662
PoC = 0.149075
ScC= 0.467235
NC = 0.057235


CWBi 0.605908
LEYTE
Built Capital (0.728212)
Financial Capital (0.522573)
Political Capital (0.555676)
Sociocultural Capital (0.627855)
Natural Capital (0.345621)
BC=0.192
FC=0.088
PoC=0.103
ScC=0.202
NC=0.021
Dimension Value
Dimension Weight
Dimension Index
Dimension Weight
BC= 0.263409
FC= 0.168624
PoC=0.184513
ScC =0.32212
NC = 0.061334

CWBi values	Qualitative Category
0.81-1.00	Very strong
0.61-0.80	Strong
0.41-0.60	Moderate
0.21-0.40	Weak
0.00-0.20	Very weak

Interpretations

- Albay = 0.6019
- Bohol = 0.5755
- Leyte = 0.6059

Dimension Values

- Albay

- Built capital = 0.125
- Financial capital = 0.14
- Political capital = 0.158
- Sociocultural capital = 0.169
- Natural capital = 0.056

Dimension Values

- Bohol

- Built capital = 0.117
- Financial capital = 0.087
- Political capital = 0.080
- Sociocultural capital = 0.277
- Natural capital = 0.014

Dimension Values

- Leyte

- Built capital = 0.192
- Financial capital = 0.088
- Political capital = 0.108
- Sociocultural capital = 0.202
- Natural capital = 0.021

Conclusion & Recommendation

- The culture of disaster preparedness must be enhanced and sustained by looking into the CWB of a community in the aftermath of a disaster.
- It is best to examine the CWB as to which dimension needs improvement and enhancement.
- Natural capital has to be given right priority.

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The objective of development is to create an enabling environment
For people to enjoy long, healthy and creative lives.
-Mahbub ul Haq (http://hdr.undp.org/hd/)