Development of a Matrix based Statistical Framework (MSF): New Approach for Computing Weights in Composite Hazards and Risk Assessment

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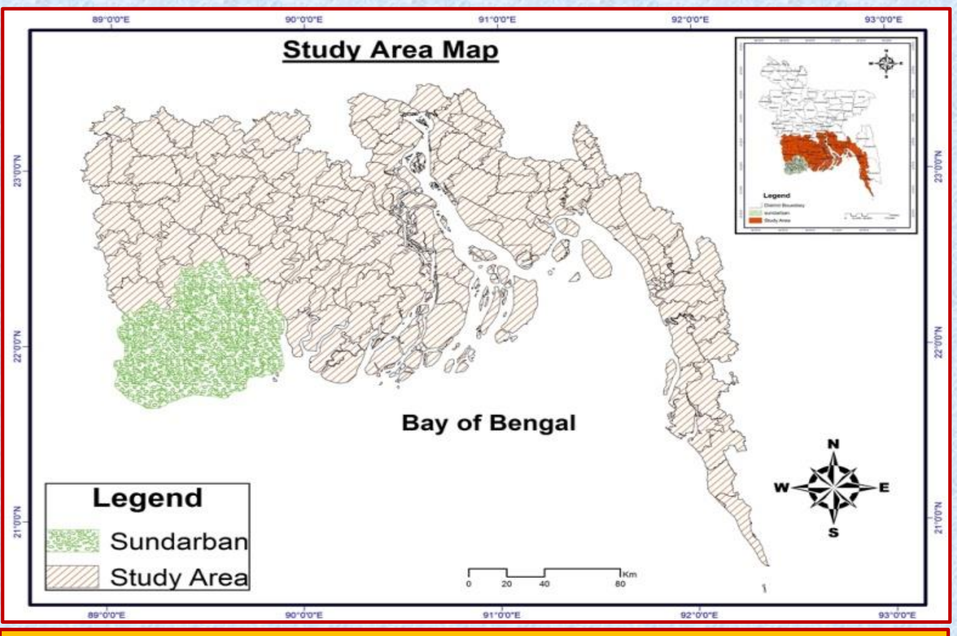
IDENTIFICATION OF MSF APPROACH'S CONSISTENCY

- Accurate Validation of MSF approach
- Comparison with other Current Weight Assignment methods

Current Practices of Weight Assignment

- Equal Weighting
- Expert Weighting
- Survey Weighting
- Using Eigenvalue as Analysis Factor
- Correlation Analysis

Study Area

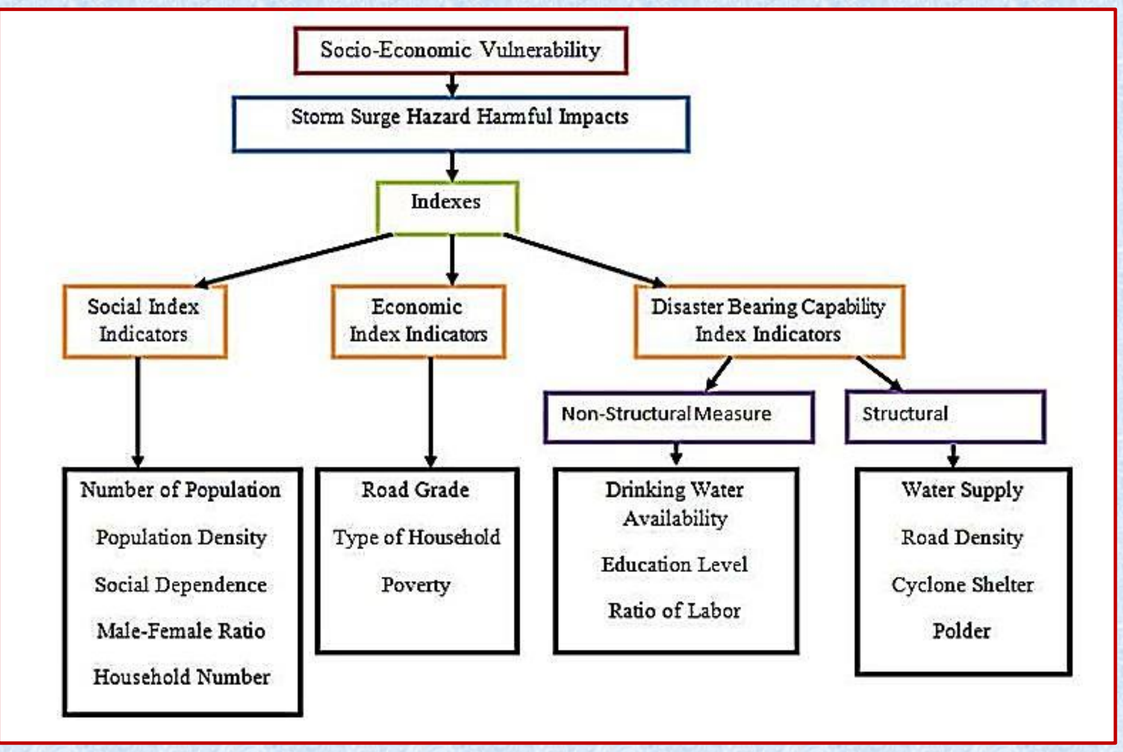


METHODOLOGY

- The specific indicators set can depend and rely on their inter-build up methodology which can easily diminish the double counting effect and dependable relation based regression effect.
- The validation of expert judgment and indicators' individual impacts can easily determine.
- Where there is a very large set of indicator, this customize approach can give the almost accurate result based on a reliable basis.

Application of MSF Approach

SOCIO-ECONOMIC VULNERABILITY INDICATORS

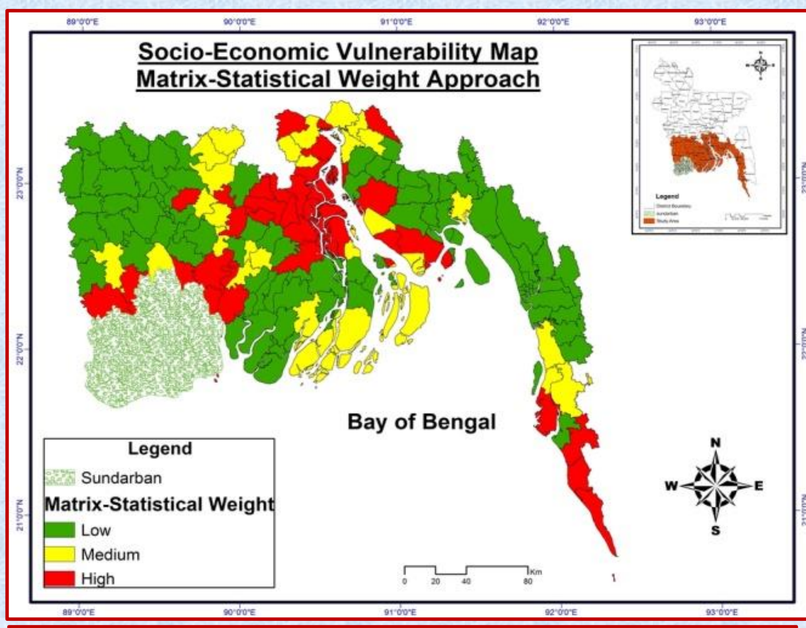


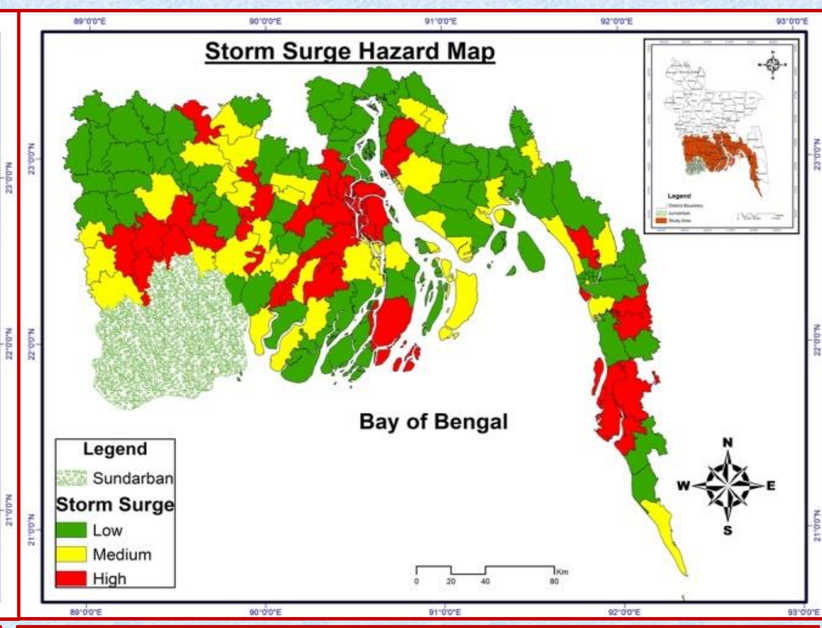
INTRODUCTION

- Selection of relative weights for different indicators is a critical step during assessment of composite hazards and risk.
- A new Matrix based Statistical Framework (MSF) for weight assignment can be considered as an interacting approach for assigning weights for a large number of indicators..
- MSF is based on the valuation of the correlation matrix and Eigenvector associated with Eigen value.
- Relying on the inter-build up methodology, MSF can fulfill the negative impacts of using individual current weight applying methods.

FINDINGS

Validation: Vulnerability Map with Storm Surge Hazard Map





Indicators Weight through MSF Approach

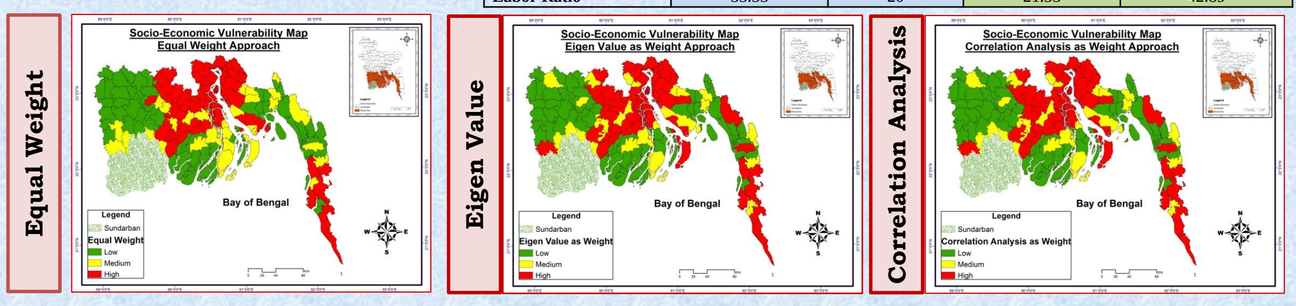
The Largest Eigen Value of Indices

Indices	Largest Eigen Value	
Social Index Indicators	2.955	
Economic Index Indicators	1.355	
Disaster Bearing Capability Index Indicators	Non-Structural Measure	Structural Measure
	1.930	1.599

Indicators Weight for Current Practices

Socioeconomic Vulnerability	Explicit Weighting		Statistical Weighting	
	Equal Weighting	Expert Weighting	Eigen value as Analysis Factor	Correlation Analysis
Social Index				
No. of Population	20	15	39.55	9.84
Population Density	20	25	20.36	23.87
Male-Female Ratio	20	10	16.79	27.95
Social Dependence	20	20	12.33	20.15
Household Number	20	30	10.96	18.19
Economic Index				
Type of Household	33.33	50	39.25	50.40
Road Grade	33.33	20	33.54	0.32
Poverty	33.33	30	27.21	49.28
Disaster Bearing Capability Index				
Structural Measure				
Water Supply	25	10	26.14	74.25
Road Density	25	25	23.28	7.26
Cyclone shelter	25	30	20.02	3.76
Polder	25	35	30.56	14.73
Non-Structural Measure				
Drinking Water Availability	33.33	30	48.83	20.58
Education Level	33.33	50	29.83	36.53
Labor Ratio	33.33	20	21.33	42.89

SOCIO-ECONOMIC VULNERABILITY MAPS



Map Comparison Combined Result

Storm Surge Hazard Map (Base Map)	In Percentage (%)		
	Similar	Semi-Similar	Dissimilar
Base Map – Matrix Based Statistical Approach	49	27	24
Base Map – Equal Method	41	31	28
Base Map – Expert Method	42	29	29
Base Map – Eigen Analysis	39	31	29
Base Map –Correlation Analysis	48	26	26

CONCLUSION

- Matrix based Statistical Framework (MSF) as Weight Approach, gives the best 49% similarities and only 24% dissimilarities in comparison analysis where, no other comparisons could not come forward in this raceway. This proves that MSF method is better compared to other current weight methods.
- MSF weighting approach methodology is understandable, definable and can also produce reliable results. Continuation of risk minimization cycle can be possible by considering next least adaptive response spatially.

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