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APPLICATION OF INTERPRETIVE STRUCTURAL MODELING FOR THE BARRIERS TO INTEGRATED FLOOD RISK MANAGEMENT IN METRO MANILA

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1. Introduction

The Integrated Flood Risk Management (IFRM) is an approach that is a combination of both structural measures, which are the traditional hard engineering measures, and non-structural measures to mitigate flood risks in flood-vulnerable areas[1]. The adaptation of this IFRM approach in the Philippines is a challenging task due to heavy reliance of traditional structural measures in the past. Moreover, there are critical issues or "barriers" that hamper the adaptation of IFRM. The present authors have already a study on the identification of the barriers to IFRM. These barriers encompasses the governance, social, and technological resources aspects in our previous study[2].

After identifying these barriers to IFRM, it is imperative to analyze these barriers in a systematic manner, since barriers are obstacles that can be overcome with concerted efforts, creative management, shift in thinking, prioritization, and provision for financial and human resources. The systematic method applied to this study is the Interpretive Structural Modeling (ISM). ISM is a well-established method for identifying relationship among specific items, which define a problem or issue.

The objective of this study is to create a structural model for the barriers to IFRM in MM by applying a systematic approach such as, ISM model. The ISM approach is to be applied for the first time for barriers related to flood management. Apart part of ISM application, we have also modified the symbology used in the conventional ISM in order to present more meaningful results and at the same time to simplify some of its steps.

2. ISM Approach

The ISM approach, developed by Warfield[3] (1973), is an effective method for analyzing complex and interrelated issues. ISM utilizes some application of some elementary graph theory such that theoretical, conceptual, and computational leverage are efficiently exploited to construct a structural model. Fundamentally, ISM method has six major stepsas shown in Figure 1. The detailed steps are found in Attri et al.[4] paper. Table 1 shows the 12 barriers that belong to three aspects[2]: governance, social, and technological aspects.

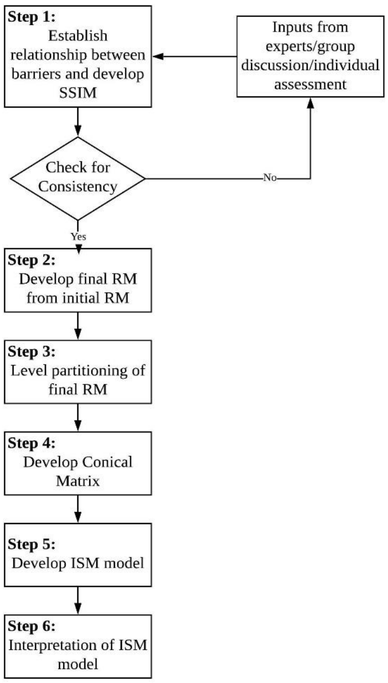

Fig. 1 Flowchart of ISM

3. Results and Discussions

This study reveals that the most influential barrier on IFRM for MM is B_{11} implying that establishment or at least assigning a lead agency in IFRM that supports planning, implementation, and operations and maintenance has to be carried out. Currently, there are too many key players on flood risk management in MM such as, DPWH, MMDA, National Disaster Risk Reduction and Management Council and the Office of Civil Defense, among others, but the lack of a governing body hinders sound, consistent and integrated management. The second

Table 1. Barriers to IFRM in Metro Manila, Philippines[2)]

Aspects	Barriers	
Governance A_1	B_{11}	Lack of sole organizing body
	B_{12}	Lack of communication
	B_{13}	Lack of funding
	B_{14}	Lack of flood control measures
Social A_2	B_{21}	Illegal Settlers
	B_{22}	Poor solid waste management
	B_{23}	Poor social planning
Technological Resources A_3	B_{31}	Lack of technological capabilities
	B_{32}	Sparse data and limited access
	B_{33}	Lack of experts
	B_{34}	Lack of data processing systems
	B_{35}	Deterioration of flood control structures

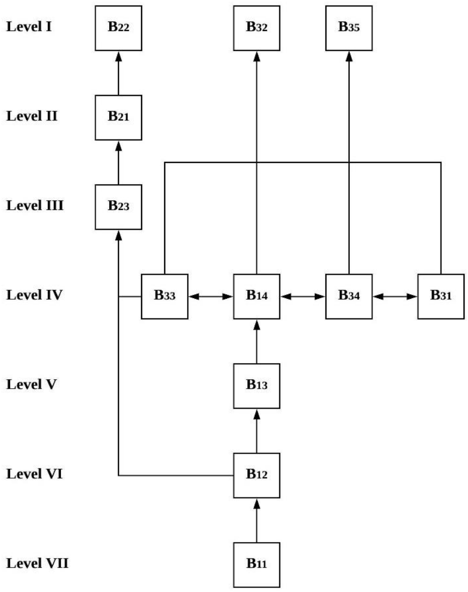

Fig. 2 ISM model for the barriers to IFRM in Metro Manila

most influential barriers is B_{12} which directly influences B_{13} and the social aspect barriers B_{23}, B_{22} and B_{21}. The ISM model also reveals that B_{14} and B_{33}, and B_{34} and B_{31} are directly influencing each other. The improvement of these barriers are actually triggered and influenced by experts. B_{33} triggers the improvement of most of the scientific resources barriers including. Lastly, the least influential barriers are B_{22}, B_{32}, and B_{35}.

The produced ISM for the barriers to IFRM in MM now clearly showed the hierarchy of from the most influential barrier to the least influential barrier. As can be seen in the model, barriers on the governance aspect, A_1, have the most influence to all other barriers especially B_{11}. This manifests that barriers on A_1 can drive change to barriers on the other aspect. The ISM model also provides information on which barriers trigger the refinement or impediment to a sound IFRM.

4. Conclusion

Interrelationships among these barriers and the hierarchy were successfully determined using ISM method. The produced ISM model shows that the lack of sole organizing body that manages flooding is the most influential and important barrier in to an IFRM. Resolving this barrier is presumably to positively affect all other depending barriers especially those in the governance and scientific resources aspect. Categorically, the governance related barriers have a strong driving influence among other barriers. The scientific resources-based barriers followed this. The social barriers are found to be the least influential barriers.

References

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Keyword: Barriers, Integrated Flood Risk Management, Interpretive Structural Modeling, Metro Manila