A STUDY ON THE EVALUATION OF DEMINING PROJECT IN CAMBODIA FOR THE INFRASTRUCTURE REHABILITATION BASED ON BENEFIT COST ANALYSIS

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1. INTRODUCTION

Removing landmine and UXO is a dangerous, time consuming and cost demanding project. Due to budget is usually a problem for post-conflict country like Cambodia; demining project could be conducted only after the careful study and analysis. This paper will show the study on the evaluation of demining project for the infrastructure rehabilitation by putting into account two analysis factors: cost and benefit.

2. DEMINING PROJECT ANALYSIS

The history of landmine

In 14th century a "Fougasses"- the first explosive type landmine- had been developed that spray rock and gravel upon detonation toward enemy (see Fig. 1). The next generation of landmine is called Torpedos. This transportable device could be seen during American civil war (see Fig. 2). However, it was until early 20th century that landmine was mass produced from factory; first to encounter French and British tank in the western front during World War I (see Fig. 3). Modern landmine is a portable and is filled with high explosive that could kill or injure target at great distance (Fig. 4). It is estimated that since World War II more than 600 types of landmine had been produced worldwide.

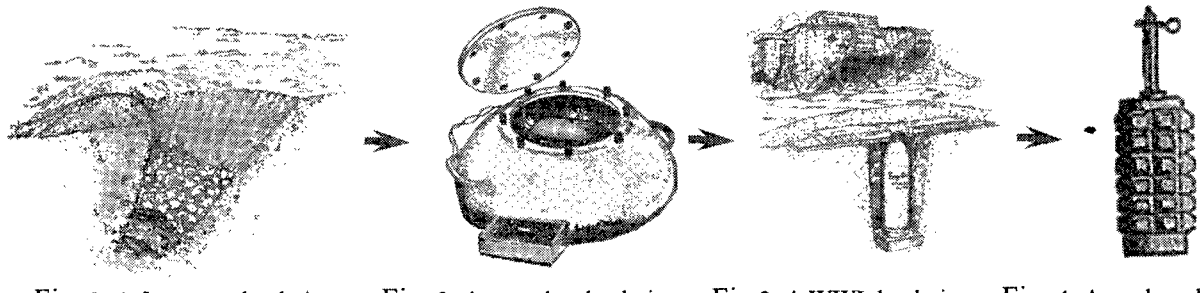

Fig. 1 A fougasses landmine Fig. 2 A torpedos landmine Fig.3 A WWI landmine Fig. 4 A modern landmine

Present landmine, UXO in Cambodia

Cambodia fell into civil war in 1970 and it lasted until the disintegration of Khmer Rouge movement in 1998. It is estimated that more than 4 millions landmines are thought to be existed in Cambodia. More than 644 square kilometers of land is known to be mined and another 1,400 square kilometers of land is suspsected to be mined. In a country where 85 percent of the population is dependent upon agriculture or related activities, such a contamination represents a massive restriction of Cambodia's economic base.

Necessary of Demining

Demining will not only stop people from being killed or maimed (more than 600 people were killed in year 2000 alone), but it also spearhead economic development in Cambodia because demining will open safe route to be used for development.

3. DEMINING PROJECT ANALYSIS

Demining Project i could be written as a function of benefit and cost:

$$E_i = f(B_i, C_i) \quad \text{.....(1)}$$

where,

E_i: an Evaluation Index Value of project i

B_i: a Benefit Index Value of project i

C_i: a Cost Index Value of project i

The Benefit Index Value of Project *i* is the function of saving life and Potential Economic Growth:

$$B_i = f_b(SL_i, PEG_i) \quad \text{.....(2)}$$

where,

SL_i : a Saving Life Index Value.

PEG_i : a Potential Economic Growth Index Value.

Life must be converted into monetary term for this calculation of SL_i. To be able to obtain the value of life, compensation statistics according to age, sex, professions...etc must be used. PEG_i Value could be obtained from the growth of the economic prediction in the area after the completion of mine and UXO project.

The Cost Index Value of Project *i* is the function of the

$$C_i = f_c(\sum_j PC_{ij}, \sum_j AC_{ij}) \quad \text{.....(3)}$$

where,

j : a type of preparation

PC_{ij} : a Pre-Clearance Cost.

AC_{ij} : the Actual-Clearance Cost.

Before the demining project could be taken place, there are three major expenses: a) Training Cost (TRC_i): to spend on Training of Deminers or Mine Detection Dog; b) Survey Cost (SVC_i): to spend on Survey to identify the location and boundary of minefield; c) Equipment Cost (EQC_i): to purchase expendable and non-expendable equipment to be used for clearance operation. therefore,

$$\sum_j PC_{ij} = f_{pc}(TRC_i, SVC_i, EQC_i) \quad \text{.....(4)}$$

The cost during demining operation is closely related to a) Environment of the clearance area (ENV_i). Environment could be said as the type of bush (affect to time for clearing it), type of soil (sand, rocky or clay) because of the fact that soil affects detectability of the mine detection machine and prodding effectiveness; b) Demining standards (DST_i). There are two major demining standards, military and humanitarian standards, that have been used for infrastructure rehabilitation in Cambodia. Military standard enable to clear fast with low safety record for deminer and its clearance quality is also low in comparison with Humanitarian standard (slow, expensive but very safe); c) Fragments (FR_i): is the number of fragments exist in the demining area. This tiny magnetic pieces give a wrong signal to the machine resulted to time lost during demining operation. Therefore:

$$\sum_j AC_{ij} = f_{ac}(ENV_i, DST_i, FR_i) \quad \text{.....(5)}$$

Replacing the expression (4) and expression (5) in expression (3) we have:

$$C_i = f_c(f_{pc}(TRC_i, SVC_i, EQC_i), f_{ac}(ENV_i, DST_i, FR_i)) \quad \text{.....(6)}$$

4. CONCLUSION

Based on the above analysis, selecting the most suitable project for demining is based on many factors. Some of which are hard to be interpreted into monetary index value. To maximize the accuracy of the analysis, more relevant criteria must be selected.

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