

## ANNEX THREE: LITERATURE REVIEW

This literature review provides an overview of work to date in the field of adding economic principles and modeling to the decision making process in mine action. Any practical advances achieved by this project are built on the successes, and shortcomings, of these earlier works and the authors of this study gratefully acknowledge these efforts and add this study, with its successes and shortcomings, to the evolving work in this field.

There are two main conclusions that can be drawn about the relevant literature. These are:

- None of the academic papers (or current techniques) provide what may be regarded as the single solution to the task of strategic planning and resource allocation in mine action. Each approach (including those set out in this project) have their own assumptions and limitations.
- Nevertheless, all of the literature and techniques have contributed to the current body of knowledge, and the work done under this project would have been far more difficult without recourse to these earlier works.

### ORGANIZATION OF THE REVIEW

The review is broken into two main sections: these are:

- Section One - Review of Key Texts This section of the review looks at some of the key economic and decision-making texts which underpin the analysis used in the report. This is included in the report to provide an academic 'audit' trail of the techniques and principles adopted, whilst enabling the more complex material to be kept out of the decision support tool package itself. It also includes the main academic papers written about the use of economic processes in humanitarian mine action.
- Section Two. Assessment of 'Best Practices' The second element of the review concerns an assessment of material currently circulating in the mine action sector, which can be considered 'best practice'. As well as assisting in the overall literature review, analysis of this material will indicate where the greatest need is for the development of the Decision Support Tool. This section also includes an examination of any similar tools used by other development agencies operating in parallel to mine action.

## SECTION ONE - REVIEW OF KEY TEXTS

The general economics and decision-making literature is, of course, huge. Nevertheless, there are a number of core texts. There are also a number of texts which have provided useful background to the framing of this research: all references are summarized in the bibliography and reference section which is set out at the end of this report. There are also a number of 'how to' field guides published that provide direction on how various economic tools might be applied in development programs. Examples of these are included below.

### COST BENEFIT ANALYSIS (CBA)

There are many handbooks on the use of CBA. The two that have been particularly useful in framing the methodology used in this work are:

- **Cost Benefit Analysis for Engineers and Planners**<sup>1</sup> This book is useful in that it sets out how to frame a CBA problem in an engineering context. Mine surveying and clearing are basically engineering tasks and thus this approach was particularly helpful.
- **Project Analysis in Developing Countries**<sup>2</sup> This book sets out the principle of assessing the net return on investment in infrastructure work by comparing the results 'with' and 'without' the project in question. This is a vital component to addressing the costing problem referred to in the report.

### MULTI-CRITERIA ANALYSIS (MCA)

Most practical references to how to use MCA tend to set out how MCA can be used to compare alternatives for selection in a binary (yes/no) manner rather than allow the division of resources. There have been a number of papers that have looked at the use of MCA in mine action and these are referred to below in the section on mine action literature below. One general reference document on MCA that is particularly useful in setting out some of the variations in MCA techniques is the publication by the Office of the Deputy Prime Minister (formerly the Department for Transport, Local Government and the Regions) of the United Kingdom: **Multi Criteria Analysis: a Manual**<sup>3</sup>.

The material on analytical hierarchical processes (AHP) referred to by James Madison University\* in their work (which is discussed in more detail below) can be considered in the same light as MCA, in that it primarily helps select the optimum course of action from a number of alternatives, through measurement of

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\* Specifically, *Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference*, Judea Pearl, AT&T Bell Laboratories, 1988

their relative advantages and disadvantages. Whilst AHP could be useful in selecting different equipments to purchase, it would be difficult to use it in prioritization processes, not least because each case would have to be included in the model, thus requiring large data-entry and data-processing costs. It is not considered in any more detail in this report.

### ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

There are two field guide publications that have been helpful in framing the approach to this research. These are:

- ***Economic Analysis of Environmental Impacts***<sup>4</sup> This book sets out the concept of ‘scoping’ a problem to focus on the key issues for consideration. This might be regarded as a modern, practical development of the Ricardian principle of assuming away any peripheral variables to concentrate on the key issues.
- ***The Economic Appraisal of Environmental Projects and Policies: a Practical Guide***<sup>5</sup> This book provides a simple guide about how to select different economic tools for project appraisal. What is interesting about the approach set out in this book is that it suggests that different economic tools are alternatives (“in this case, tool ‘X’ is best”), whereas the findings of this research suggest that the different tools are complimentary and best used in a holistic approach

### OTHER RELEVANT DEVELOPMENT PUBLICATIONS

***Alliances between science and development: managing risk and reducing vulnerability***<sup>6</sup> This short (10-page) paper documents the development of procedures within Catholic Relief Services (CRS) to insert a risk-management perspective within development programs to minimize the impact of natural disasters, where “gains in development are threatened by emergencies that erase decades of work within days or weeks”. The paper is a summary – it does not provide guidance as to how risk management concepts are actually employed, for example – but it is interesting because it draws a link between rural development and emergency relief activities. Mine action is viewed as a development activity, and it certainly takes place over the longer time lines of development projects, but it often maintains the perspective of an emergency program, especially, as the CRS paper notes in the way that it prompts donors to “want to do something now”. Taking the principles espoused in the paper, it seems appropriate to measure the effect of landmines as a shock on the livelihoods of the most vulnerable people, and therefore in targeting clearance at land most likely to produce the best crops. As will be seen in the discussion of the literature on Informal Village Demining, the mine action community is beginning to grapple with the issue of vulnerabilities in poor communities.

## SECTION TWO - OVERVIEW OF THE MINE ACTION LITERATURE

As mine action is still comparatively new, opinions vary whether it is a sector of humanitarian aid, a cross cutting issue involving, development, peacekeeping and emergency relief, or a service industry [albeit with dedicated funding]. However defined mine action has comparatively little academic literature and what literature exists is dominated by the technical/engineering aspect of mine clearance. Indeed, Dr Russell Gasser, an early researcher, notes:

The largest annual learned society conference on demining, whose proceedings form a significant part of the published-on-paper literature on mine detection, is organized by the SPIE (The International Optical Society), under the title 'Detection and Remediation Technologies for Mines and Mine like Targets'. An analysis of their 1999 conference clearly reveals research foci at the time; of the 120 papers presented just four covered aspects of how human deminers work, in a session entitled 'Human Cognitive Processing\*.

Much of the literature given to mine action is based on a limited, technical perspective. Dr Gasser is complaining about the lack of focus on the human end of the process: however four papers out of 120 is a somewhat higher proportion than the zero papers given on the economic issues of mine action. Even where these technologies are intended to improve productivity (which is of course an economic concept) rarely do the researchers ask whether the technology being considered will represent a more cost-effective way of producing a useful result. For example, the recent publication of a CEN (European Commission for Standardisation) workshop agreement on the testing of machines for mine clearance includes no measure of productivity (and indeed no measures of any criteria that could be used to measure productivity) in the test regime, even though it notes the role of machines in improving productivity in its own introduction. However, in the last five years there have been a number of works that raise an economic perspective. These are reviewed below.

### RISK MANAGEMENT

- ***A Risk Strategy for Mine Action***<sup>7</sup>. This report, by the consulting arm of Serco Assurance, a UK-based company hired for this research by the British

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\* Dr Russell Gasser, PhD Thesis "Technology for Landmine Clearance" submitted to the University of Warwick, 2000. Dr Gasser is also quoting from Professor James P Trevelyan of the University of Western Australia: "Technology needs for Humanitarian Demining," February 2000. See <http://www.mech.uwa.edu.au/jpt/demining/needs/intro-needs.html>.

Department for International Development (DFID) is useful in that it sets out a case for the use of formal risk analysis processes in mine action. Mine action has been criticized by some observers because whilst it takes a 'zero-risk' attitude to clearance the concentration of mine action resources on comparatively small work areas at any one time (compared to the general contamination) means that much of the affected population remain without any risk remediation measures. However, the Serco report is less useful as an actual practical guide to employ risk management practices to address this issue. It does not consider economic issues in any form, and has several major flaws in its own internal logic. For example, it states that the more mines found, the greater the probability of residual contamination. This is a rather heroic assumption as it takes no account of variance between contamination, terrain or the technical confidence of the clearance organization. It also only mentions area cancellation (a key potential way ahead to improving productivity and reducing risk) in passing.

- ***Operational Risk Management (ORM): Essential Tool for the Bomb Technician***<sup>8</sup> This is an essay introducing the concept of operational risk management in the Journal of the International Association of Bomb Technicians and Investigators. The essay sets out the steps of a risk assessment in detail but only refers in passing to actual risk management.
- ***Risk Management in Mine Action Planning***<sup>9</sup> This useful book, initially its author's M.Sc. dissertation, includes a good explanation of risk management theory and sets out a case as to how it is relevant to mine action. The book includes some interesting analyses of mine action data in Bosnia and Herzegovina, notably one that determines how much land can be released by a technical survey process to cancel land in the overall Suspected Hazard Areas.

The book also makes a comparison of the number of landmines found per square meter of clearance, with the intention of establishing the relative efficiency of different programs. However, whilst it is recognized that such analysis may have something to say about the efficiency of different clearance activity, this analysis does not in itself say anything about effectiveness, and hence the ability to mitigate risk through good targeting. It may also be difficult to make such comparisons between different countries where the pattern of mine laying is different.

The book does not explore the difference between 'risk' and 'uncertainty' (which may have important statistical bearing on predicting contamination) and it says less about the implications of a risk management approach that might leave significant areas of SHAs uncleared. Indeed, the prioritization processes explained at the end of the book are similar to the Community Integrated Mine Action Planning approach adapted from the Task

Assessment and Planning\* pilot project carried out by the Bosnia and Herzegovina Mine Action Center as part of the Bosnia and Herzegovina Landmine Impact Survey.

More could have been made on the use of economic criteria to develop filters for prioritization (which is of course one of the main objectives of this study). The book benefits from its author's intimate knowledge of the mine action program in Bosnia and highlights the inadequacies of NATO's initial 'mine lifting' scheme and the poor results of relatively inexpensive mine marking schemes. More could have been made of analyzing the role of technical and general surveys as components of a fully developed land release or cancellation program of which clearance is but one – and the most time consuming and expensive – part. The book does not investigate the implications of the periodic proposals to adopt 'quick and dirty' solutions to mine clearance and therefore loses the opportunity to consider the potential (or otherwise) for risk management techniques to deal with the likely resulting contractual problems. However these limitations are likely to be due to the size requirements for the author's M.Sc., rather than any other reason, and any further publications (that address these current gaps) from the author would be welcome. In short, this book is an important contribution to mine action literature.

## **COST BENEFIT ANALYSIS**

- ***A Study of Social Economic Approaches to Mine Action***<sup>10</sup> This report includes a Cost Benefit Analysis carried out on the United Nations Development Program mine action program in Lao People's Democratic Republic (UXO Lao). The conclusions are significantly different from those calculated using the model used as part of this study. Inspection of the source document shows that the main issue is the costing methodology, notably the treatment of the cost of expatriate technical advisors and donated equipment. If these costs are internalized (as they are in the model used in the SAC study) then the internal rate of return is much less impressive.
- ***The Socio-Economic Impact of Mine Action in Afghanistan: A cost-Benefit Analysis***<sup>11</sup>. This report documents a Cost Benefit Analysis of mine action in Afghanistan, conducted on behalf of the World Bank. This is the most serious and through work to date applied to a mine-affected country. The methodology is transparent and assumptions well documented. The report noted several caveats about the source of costing data when

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\* "Task Assessment and Planning" by Ted Paterson, Sara Sekennes, and Greg , (Survey Action Center, Takoma Park, MD, USA 2002)

describing its own findings. The use of the accounting ‘prudence principle’ in assessing a conservative opportunity set for mine clearance is addressed in the model described in this report and used in this study. The authors also note a number of caveats about the accuracy of their own calculations; especially on the costing data they have been provided. Indeed, with higher costs their calculations would again show a less impressive benefit-cost ratio.

- **Three papers by Professor Geoff Harris: CBA in Cambodia\*, Mozambique† and Afghanistan<sup>12</sup>** These three papers set out the analytical framework used in Cost Benefit Analysis (CBA) and are a useful document in explaining the concepts that might be used in CBA in mine action. Nevertheless they drew some considerable criticism from some quarters of the mine action sector when published. It is felt however that Harris was correct to draw attention to the fact that not all land is worth clearing from an economic perspective, and the techniques used in this study build on this basic finding. Even so, the criticisms leveled have some justification: CBA relies on three elements: understanding the costs, calculating the benefits and establishing an appropriate analytical framework. Whilst others criticized Harris’ conservative estimate of benefits (an admission that Harris himself made) there may be more substantial criticism of the estimate of costs, especially in Afghanistan (a problem also encountered by the World Bank study referred to above) which may explain how – according to Harris – it may be more beneficial to clear a comparatively arid and infertile country like Afghanistan than two fertile countries of Cambodia and Mozambique. It is difficult to fault Harris in this circumstance – as a non-insider to mine action he (like the World Bank team) are relying on costs presented to them, whereas the attribution of costs, particularly overheads and the treatment of in kind contribution seems to make it comparatively common to underestimate the costs of mine action programs.

## ASSESSING IMPACT

- **Reassessing the Impact of Humanitarian Mine Action: Illustrations from Mozambique<sup>13</sup>** This is a report of research carried out by the Norwegian Peace Institute (PRIO) on the impact of mine action programs. The report makes a case for the need for a “fundamental strengthening of the capacity to perform broad socio-economic impact assessments within HMA (humanitarian mine action) agencies,” which is a statement that supports the validity of the requirement for the research covered by this study. Indeed, the

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\* “The Economics of Landmine Clearance: Case Study of Cambodia” Journal of Economic Development, Dec 2000.

† “A cost-benefit analysis of landmine clearance in Mozambique” (with Gareth Eliot), Development Southern Africa, December 2001.

report goes on to critique the dominant, technocratic measure at the time of the report (and still relevant some years later), “The number of devices lifted or the size of the area cleared says little or nothing about socio-economic impact.”

- ***Reclaiming the fields of war***<sup>14</sup> This report covers some further PRIO research on mainstreaming mine action. The report states:

“While the development dimension of mine action is increasingly recognized, only limited research and policy work is available on the subject to date”.

The second chapter of the PRIO report provides a review of the evidence on the socio-economic impact of landmines and ERW, and the impact of mine action, with an emphasis on quantitative studies and cost–benefit analysis. It makes the claim that “existing studies demonstrate that mine action can often be justified on economic grounds alone”, though, as stated above (and in the report itself), there is some room for debate about the methodology that has been used in some of these studies. In discussing mainstreaming, the PRIO report makes the case for economic analysis of mine action in terms of resource allocation:

“Funding modalities serve to encourage certain policies and projects at the expense of others. This may be achieved through the earmarking of resources for particular purposes or through specifying minimum criteria that help ensure that the relevant dimension (in this case, developmental ) is addressed”.

## **MULTI-CRITERIA ANALYSIS**

- ***DSS for humanitarian mine action – case study Croatia***<sup>15</sup> and ***Bosnia and Herzegovina Mine Problem and Priority Setting***<sup>16</sup> Both papers set out a means by which MCA could be used in resource allocation in the Balkans. Both discuss ‘ranking’ contaminated areas for prioritization. Unfortunately, it appears that none of the methods used in either paper have been adopted or seriously tested. Whilst there are many possible explanations for this, one highlighted during the feedback was that the papers were “too complicated” for the mine action sector. If this is the case, it raises the point that if economics is to be applied in mine action it must be accessible.
- ***Selecting land mine detection strategies by means of outranking MCDM techniques***<sup>17</sup> This paper is another documented use of MCA in mine action: the paper attempts to use MCA in the ‘classic’ sense of a means to make a binary decision between competing alternatives: in this case the selection of mine detection technologies. Unfortunately, whilst the selection of the

technique is appropriate for such a decision, the paper is marred by problems of imperfect information about mine action and about the effectiveness of the technologies being discussed.

- ***The Future of Humanitarian Mine Action***<sup>18</sup> This special edition of the journal “Third World Quarterly” includes a number of interesting essays that highlight some of the debates in the humanitarian mine action sector. Perhaps most interesting, in light of the context of this project, is the essay by Christopher Horwood, which in the words of the abstract:

“...suggests that the ideological and analytical foundations and steering mechanisms of mine action are at present less than adequate, resulting in failure to optimize impact and efficiency. The article present[s] the argument for the incorporation and adoption of a rights-based approach. It will also discuss the urgent and continuing need to prioritize mine action through an increased level of community participation and more rigorous impact measurement, while highlighting the limitations of using socioeconomic analysis as the basis for operations and decision making”.

The essay makes a passionate critique of the use of CBA as a suitable analytical tool for meeting these requirements, though is perhaps less robust in setting out viable alternatives.

## **INFORMAL VILLAGE DEMINING**

The literature includes a series of reports on the phenomenon of ‘village demining’ (i.e. where untrained villagers attempt to clear their own fields) in Cambodia. There have been several studies on village demining and related phenomena in Cambodia - ***Crossing the Divide: Landmines, villagers and Organizations***<sup>19</sup>, ***Tampering: deliberate handling and use of live ordnance in Cambodia***<sup>20</sup>, and ***Operational Study on Informal Village Demining***<sup>21</sup>. In addition Michael Fleischer conducted further research on Informal Village Demining in Afghanistan and Angola for the Survey Action Center in 2007.

The findings of these reports are largely outside the scope of this project. However, the key point suggested by these reports is that - at some level – there is an active economic demand for this land, and villagers are prepared to take the risk (as a livelihood strategy) in order to address the impact of not having access to the land. This phenomenon suggests there is a limit to the efficacy of MRE as a means of limiting such behavior (the optimum amount of resources to be allocated to MRE is covered by one element of the tool used in this project).

The literature also discusses the reaction of the professional demining organizations (and the government mine action coordination body in Cambodia) in a way that is recognizable to economists as the reaction of a ‘guild’ creating

barriers to entry of local deminers who are not employed by any recognized agency but who are charging a fee for their perceived substandard service. The scoping mechanisms used in the model developed as part of this project includes a mechanism for the pragmatic recognition of land cleared by such techniques without necessarily endorsing their use.

## OTHER DOCUMENTATION

As mentioned in the main text of the report, the research for this project draws on the research conducted by one of the authors, Robert Keeley, for his PhD thesis at Imperial College London between 2003 and 2006. This thesis was subsequently published by the German academic publishing house, [www.dissertation.de](http://www.dissertation.de) as "**The Economics of Landmine Clearance**"<sup>22</sup>. The thesis is considered to be noteworthy for its identification of eight policy and planning questions which, when considered together, provide a holistic overview to resource allocation in mine action; the thesis goes on to recommend possible economic tools that could be used to address these eight questions. A summary of the 'eight questions' is set out separately in this report as Annex Eight – The Eight Questions of Mine Action. The thesis is, by definition, an academic work: it contains an extensive background to humanitarian mine action which was included to make the subject matter accessible to other economists – it may not however be as accessible to readers without some training in economic principles. It is therefore not 'operational' and it is not possible for a mine action manager to pick up the thesis and use it directly as a mine action planning tool.

There have also been a number of papers appearing in the **Journal of Mine Action**<sup>23</sup> published by the Mine Action Information Center at James Madison University, Virginia, and on the **European Union on Humanitarian Demining (EUEM) project website**<sup>24</sup>. Both programs provide a valuable source of documentation on the mine action Sector.

Finally, the current paradigm for mine action is reflected in existing international law, particularly the 1997 Mine Ban Treaty\* (MBT) essentially adopts a rights-based approach in that it allows for no exceptions for clearance (though it limits itself to anti-personnel mines). The main economic implication of this law is that mine action – if it is to remain faithful to the MBT paradigm - cannot currently use a CBA approach to determine an 'acceptable level of pollution' by identifying those areas that are not economically worth clearing. This study therefore adopts a pragmatic compromise. The authors of this paper do not take a position

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\* Formerly called, The Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction.

regarding the Treaty. They do note, however, that the work of this paper should provide a powerful contribution to the universal desire to better prioritize the work of mine action to best relieve the impact on affected populations.

## SECTION THREE ASSESSMENT OF 'BEST PRACTICES'

### TASK IMPACT ASSESSMENT (TIA)

The TIA approach was developed by the Norwegian People's Aid (NPA) to establish a means of assessing the full costs and benefits of mine clearance tasks before a decision is made to clear a particular area.

According to the NPA Bosnia website:

“Task Impact Assessment is the analysis of the likelihood that mine clearance of a prioritized site will impact positively, directly or (and most likely) indirectly through facilitating for other humanitarian initiatives, on the socio-economy of the targeted community.

The purpose of task impact assessments is to help you make more informed decisions about prioritizing mine clearance activities. It does so by identifying the justification for mine clearance in terms of benefiting the defined target group and beneficiaries. It allows you to identify the capacities and vulnerabilities in assessed communities and thereby their additional needs, to ensure appropriate post-demining land use and avoid prioritizing an unsustainable mine clearance task.

To provide qualitative base information for decision-making of mine clearance operations and for better planning, directing, monitoring and evaluation of the process of priority setting and task selection for clearance”.

The website then goes on to describe the general methodology of the TIA process:

Through interviews and discussions with the villagers, landowners and land users and the municipal and county authorities and other non mine-action, humanitarian and development sectors, the following five main questions should be to be answered.

1. *Who are the target groups and beneficiaries and why?*
2. *What are the capacities and vulnerabilities of these groups? (considering physical/material, social/organizational and attitudinal/motivational factors)*
3. *What are the planned post-demining activities?*
4. *Who will implement these post-demining activities?*
5. *What is the likelihood that these plans may change (i.e.. what are the other factors upon which realization of post-demining activities depend?*

The TIA process is meticulous and it does address one important issue: the loss of efficiency when land that is cleared is not actually returned to productive use.

This is a common problem in mine action, particularly when the planning processes are remote from the end users of the land. However, there are a number of systemic issues with the TIA process that need to be considered in evaluating it.

Firstly, it requires a time investment. Personnel conducting TIA have to adopt almost an anthropological approach to data gathering, spending days on any one task assessment and more time, potentially, for the whole community. This is exacerbated by the fact that, on its own, the TIA process cannot identify which community to engage, and it relies on there being another, more strategic planning and prioritization process in place. Such investment in time may pay off in more effective work, but it needs to be examined critically from a strategic point of view.

Secondly, there are diminishing marginal returns of information from any such detailed data gathering process. Such surveys are effectively a transaction cost on the land release/clearance processes and as such, the more detailed they are, the greater is the cost/m<sup>2</sup> of the cleared land. This can mean that communities in marginal land do not get their land cleared at all. The issue of marginal land and the effect of increased or reduced costs is addressed in one section of the decision support tool created as part of this study and is described in more detail later in this report.

Thirdly, the existing TIA processes assess the existence of post-clearance activity in a binary (i.e. yes/no) way, and do not provide the robustness of a cost-benefit analysis structure. It does provide a more qualitative analysis that is very useful, however.

Fourthly, there is the problem of data specificity and longevity. The more detailed the data gathering, the more sensitive it is to changes in plans. A simpler, more broad-brush, strategic perspective is more likely to remain 'broadly right' as time passes than a more detailed, in depth analysis of a small area, which could soon be 'exactly wrong' if anything changes at the comparatively small areas being examined.

In short, whilst the TIA approach is a useful way of examining a mine field that is due for imminent clearance it is not particularly helpful in more strategic planning process of determining which village to select for clearance. This is addressed in the decision support tool developed as part of this project,

## **GENEVA INTERNATIONAL CENTRE FOR HUMANITARIAN DEMINING (GICHD) RISK MANAGEMENT STUDY\***

This study has recently been renamed the Land Release Study. In the words of the GICHD website, the GICHD is

*undertaking a study into the use of risk management processes to improve efficiency of mine clearance. This work will include analysis of existing processes in Cambodia, the development of a new model in Sudan and the development of a model for the mitigation of Explosive Remnants of War in the Lao PDR.*

This work is, at the time of writing, a ‘work in progress’. The final version of the LAO work has been completed, and a *description* of the model is also available at the GICHD website<sup>†</sup>.

The GICHD is in the process of developing a risk management/mitigation model for use in the Lao PDR – where the problem is essentially and primarily one of UXO.

Some of the specific objectives for the project are to:

- Analyze methodologies of countries where land release and technical survey processes have been formalized and refined to an effective process;
- Develop a risk matrix based system allowing the assessment of tolerable risk, based on the examination of national/international laws and standards, the intended use of the land, peoples’ general exposure to risk and wider hazard consequences.
- Make recommendations for the implementation of a system that will allow national authorities, based on national needs and norms, to make significant inroads into reducing the national Suspect Hazardous Areas.
- Make recommendations for the implementation of a system that will allow operators to effectively yet methodically reduce areas with an audit trail that allows secure, justifiable decisions to be made.
- Develop a series of protocols that will form the basis for a rational methodology for land release protocols.

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\* <http://www.gichd.org/operational-assistance-research/risk-management/>

† [http://www.gichd.org/fileadmin/pdf/risk\\_management/Land\\_release\\_risk\\_management\\_26June06.pdf](http://www.gichd.org/fileadmin/pdf/risk_management/Land_release_risk_management_26June06.pdf)

The work was not without criticism when it was first developed in Lao PDR, although recent anecdotal evidence suggests that the stakeholders are happier with the approach now being taken. Initial criticism included:

- Suggestions that the work was too generic (one respondent referred to it as “Risk Management 101”) and did not focus in enough on the situation in Lao PDR.
- The presentations given on the methodology included an assumption on the behavior of local populations that was identified as incorrect when it was first raised in the initial work by GICHD on this subject in 2004. The calculations in the initial work included an assumption that populations in the target country (in the initial case, this was Cambodia) would not modify their behavior around mined areas (whereas analysis of available casualty statistics says that they do)\* and that there was therefore a justification for a ‘quick and dirty’ approach to clear ‘most’ of the mines (presumably by mechanical means). Not only do the casualty data not bear out this assumption, but independent work† taken out at around the same time in Cambodia refutes the idea that the beneficiary populations will accept the ‘quick and dirty’ concept.
- Finally, the paradigm adopted in the GICHD model concentrates on only one element of risk, i.e. the risk of encountering a UXO in the target area. This can be criticized in two ways. Firstly, a more holistic risk management approach to this issue would examine other risks being faced, such as the risk of not having access to particular land for cropping. A cost-benefit analysis of land and crop types would enable a very simple risk management approach, i.e. to prioritize land types on the basis of their productivity

As mentioned above, the stakeholders in Lao PDR are reported to be more comfortable with the most recent work being carried out by GICHD, although there remain problems with the actual implementation of the model. UXO Lao personnel are reported to have run the model against data gathered from locations where clearance had already been undertaken‡. In some cases the model generated false negative returns, whereas in others it apparently

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\* Calculations from every Landmine Impact Survey indicate dropping victim rates even where there is no formal mine action program. See also, “Landmines and Local Community Adaptation” by Aldo Benini et al published by the Journal of Contingencies and Crisis Management, Vol 2, No 2, June 2002.

† Fleischer, Michael “Informal Village Demining in Cambodia, published by Handicap International, 2005

‡ Discussions with Mr. John Dingley, Senior Technical Advisor to UXO Lao, May 2007.

generated false positives. Table One below sets out the relationship of these concepts with the expected practical result on the ground.

In statistical terms, these are akin with the concepts of Type I and Type II errors, where a Type I error is the result of a risk averse decision making process avoiding an action that could have been taken without negative effect, and where a Type II error (failing to reject a false hypothesis) will result in a risk-taking attitude that results in an action being taken that results in harm\*.

**Table 1 Relationship of false negative and false positive results with practical results**

Ser	Model Result	Ground Truth		Remarks
		Not Contaminated (negative)	Contaminated (positive)	
(a)	(b)	(c)	(d)	(e)
1	Model Says Contaminated (positive)	False Positive (predicts UXO but none are found)	True Positive (predicts UXO and some are found)	(1c) is Type I Error
2	Model Says Not Contaminated (negative)	True Negative (predicts no UXO and none are found)	False Negative (predicts no UXO but some are found)	(2d) is Type II Error

In the situation in Lao PDR, a model exhibiting a Type I error will *consistently* lead to risk-averse results where it tells people that uncontaminated land is contaminated, so producing a sub-optimal result in terms of improving efficiency (the aim of the GICHD project). Conversely, a model exhibiting a Type II error will *consistently* lead to unwitting risk-taking behavior, by telling the users that contaminated land is clear, so producing a result that does not conform with the national standards for the UXO program for Lao PDR.

In modeling terms, it could be comparatively simple to fix a consistent bias towards either error, by recalibrating the parameters of the model. Unfortunately it has been reported that the model has produced a mix of all four possible

\* Formally speaking, a "Type I error occurs when one rejects the null hypothesis when it is true" whereas a "Type II error occurs when one...fails to reject [a false] null hypothesis. Taken from the University of Northern Iowa website <http://cns2.uni.edu/~campbell/stat/inf5.html>

results on different data sets, i.e. false positive, true positive, true negative and false negative. This does not appear to be a simple issue of calibration. There are some concerns that the problem is more fundamental, revolving around the ability of a statistical model to predict accurate results under uncertain\* conditions. It is to be hoped that this issue of accuracy will be resolved as work on the model continues.

Whatever, the criticism, the GICHD effort is a significant contribution to the ongoing work of improving the efficiency and effectiveness of mine action.

### **THE CAMBODIAN LAND CANCELLATION PROCESS**

The Cambodian land cancellation process has developed since a recommendation was made as a result of an evaluation into the Cambodian Mine Action Program<sup>†</sup> in December 2004. The report recommended that land that was found to be in use by the local population, and where no casualties had occurred in at least three years since its being put into use, should be regarded as presenting no problem to the local community and thus 'cancelled' from the list of outstanding tasks. A scoping exercise carried out as part of the evaluation showed that by eliminating this land, alongside that land already cleared, and land that was unsuitable for agricultural development (i.e. mountaintops, swamps, ponds etc) the suspect hazard area identified by the Level One Survey conducted in Cambodia between 2000 and 2002 could be *reduced by as much as 90%*.

Whilst this approach was not uniformly popular in Cambodia a version of this approach has now been approved by the Cambodian Mine Action Authority and cancellation is now an accepted process in Cambodia. It is an effective approach from a national strategic planning perspective, as it can greatly assist with the scoping process. However, it is not without limitations. The first being that there was little more than intuition behind the choice of a three year delay – further research may be able to determine the relative risks and benefits of increasing or decreasing the delay between land being put into use by local means and its formal cancellation. The second – and perhaps the most important – is that it can only be brought into play after the local communities have

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\* Simply put, mathematicians recognize a difference between risky conditions (where the chances of all possible outcomes are predictable) and uncertain conditions (where one or more parameters are unknown). It may be that the disposition of UXO are too uncertain for this risk-based model to be accurate. The comparison of risk and uncertainty was first made by Frank Knight in his book "Risk, Uncertainty, and Profit" (1921). See <http://www.econlib.org/LIBRARY/Knight/knRUP.html>

<sup>†</sup> Robert Griffin and Robert Keeley "Joint Evaluation of Mine Action in Cambodia" 2004

effectively taken the risk of using this land. However, in this sense it shares a common disadvantage of all mine action programs in general, namely the long time between the contamination being laid and a coordinated response being put in place.

### **COMMUNITY LIAISON (CL) BY MINES ADVISORY GROUP (MAG)**

MAG teams prioritize sites for clearance using the process outlined below.

The first step in the MAG prioritization process starts with a Community Liaison (CL) visit to a target village. Once in the village, the CL staff facilitate village meetings and discussions with villagers about the purpose of MAG's work in the village, approximately how many hectares of land can be cleared of UXO and whose land in the village should be considered a priority, for example families that have high levels of food insecurity and not enough available land to meet their food requirements and where UXO contamination prevents land from being safely opened up. The CL staff then facilitate discussions with the villagers regarding who fits this criteria and individual families are suggested. This may generate a list of possible areas which are then prioritized further taking into consideration:

- Level of Risk the UXO Pose and Possibilities of Accidents Occurring
- UXO Contamination
- Current Land Use
- Beneficiaries

The outcomes of the above prioritization process ensures that the community work with MAG at every step in the prioritization process to identify households who are chronically food insecure and where UXO impact prevents the safe opening of additional farming land. To maximize the possibility of post clearance land use, where MAG agrees to clear land, MAG also asks landowners to sign a post clearance land use agreement prior to commencing clearance and asks families to show commitment through preparing the land and assisting with vegetation removal prior to the MAG clearance teams arriving on site.

As with the NPA TIA process, the MAG CL process does a good job of putting the community at the center of the mine action process, once an independent decision has been made to prioritize the village in the first place. Both programs are useful as long as they are not confused with higher level prioritization requirements.

## **DECISION TOOLS MODEL HUMANITARIAN MINE ACTION PROJECTS BY JAMES MADISON UNIVERSITY\***

The James Madison University (JMU) project makes a good case for the use of Cost-Benefit Analysis (CBA) as a means of resource allocation. It also makes good observations on the apparent disconnect between rhetoric and actual planning processes in some mine action programs, especially at the time of its writing in 2004. However, it talks about using CBA as a tool for detailed task prioritization, which is where it might actually be the hardest to use it as it will require more detailed data than is usually available in a mine action centre (or centrally in other ministries). This is likely to lead to diminishing marginal returns of information as users try to gather more and more complex data about individual tasks. CBA is likely to be more useful in the general way it was employed in the earlier Afghan study referred to above, providing the cost data and attribution of benefits are more accurate.

Furthermore, JMU make the case for the use of Analytical Hierarchical Processes (AHP) as a means of decision making. AHP is a comparatively straightforward way of selecting a course of action (such as where to build a new provincial airport) but is less readily helpful in prioritization *processes*, though it could have a future in selecting mine clearance equipment, providing it was adapted to use a form of cost-effectiveness analysis to take account of costs and productivity. Unfortunately, the literature does not provide a simple means of showing how to use AHP without some background training in MCA techniques in general. There is encouraging evidence building up in Cambodia on using MCA techniques to at the village level by the Mine Action Planning Units.

## **THE LANDMINE IMPACT SURVEY (LIS) PROTOCOLS**

The LIS conducted in a number of countries are perhaps the single biggest data source for the analysis conducted as part of this project, and there is no doubt that indeed the LIS data provide a major source for any such analysis of the landmine problem in the countries in which LIS have been conducted. However, LIS have attracted a number of criticisms within the mine action community.

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\* "Decision Making to Prioritize Mine Clearance Projects", Mine Action Information Center, James Madison University, submitted to the US Department of State PM/WRA March 2004. See <http://maic.jmu.edu/research/services/items/Cost-Benefit%20Report.pdf>  
- <http://maic.jmu.edu/research/services/items/Cost-Benefit%20Manual.pdf>

Some of these criticisms appear rather subjective, however there are some substantive issues raised, and these are noted below.\*

The LIS process is expensive. The data gathering process, using as it does a community based appraisal technique, requires time, training and logistic resources. Some observers criticize the resulting surveys to be 'slow,' whilst others complain that the results are not detailed enough (observations that appear to be mutually exclusive!). There is some substance, however, in that some implementing agencies have tended to train up their own workforce rather than making use of existing academic institutions, for example. Furthermore, the costs of surveys have been exacerbated by the large number of intermediary institutions that have taken a 'cut,' although at least one stage of this process has funded the independent quality assurance monitors provided by UNMAS which have helped confirm the objectivity of the process.

Furthermore, the value of the LIS has unfortunately been underestimated because the use of the LIS as a means of scoping the problem (and actually contributing to the reduction of the perceived problem) has been under-appreciated, although some estimates are available about the success of this LIS in this regard in Afghanistan. The comparative under-utilization of the LIS data in an analytical framework may be partially explained by the endemic problems faced by agencies struggling to use the Information Management System for Mine Action (IMSMA) which continues to attract sustained criticism, including in the two countries covered in detail in this report. IMSMA Version Four is apparently able to address these criticisms, and its launch is awaited accordingly.

The LIS protocols are transparent, and freely available at the SAC website<sup>†</sup>. The protocols are authorized by the Survey Working Group (SWG). The SWG is the advisory body of the Survey Action Center and is composed of the major NGO operators, the UN mine action agencies and several international organizations involved in mine action. There are a number of criticisms about the protocols. The criticisms are set out below.

- There is perhaps an over-emphasis on casualties. A single casualty can take a community from 'low' to 'high' impact; this does not take account of the random nature of many mine accidents, overemphasizes the impact of casualties at the expense of 'blocked' land (see below) and has an unintended side effect that it penalizes communities that have learned the safe behavior message included in MRE. To be fair to the SWG, the protocols allow for the impact scoring mechanism to be adjusted by the user,

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\* A major, independent evaluation of the LIS was undertaken in 2002 by ScanTeam, a Norwegian consulting firm. The full report is available from the Survey Action Center, [sac@sac.na.org](mailto:sac@sac.na.org)

<sup>†</sup> [http://www.sac-na.org/resources\\_lisprotocols.html](http://www.sac-na.org/resources_lisprotocols.html)

but observations suggest that they have developed a life of their own, and users are heard to refer to *the* impact scores as if they had an absolute value.

- The treatment of blockages is simplistic. The LIS will refer to a 'blockage' of access to water, for example, but do not take into account the number of households affected by that particular blockage.
- The LIS methodology is designed to measure the social *impact* of landmine and UXO contamination on a country; it does not fully map the geographical *extent* of the problem. The data is based on community perceptions and these are often conservative and thus overestimate the size of the problem. However, land not used because of fear of mines has the same impact on the community as mined land. Further survey by mine action operators is required to help communities sort out the difference. This has certainly been borne out by recent findings in Afghanistan.
- The final limitation with the LIS process is that they do not take much account of secondary data from other, relevant domains, such as geographical land cover analysis. As will be seen in this report, such data is key to any attempt to making a CBA of mine clearance based on the clearance of agricultural land.

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