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Cost Effectiveness of the Ethiopian and Eritrean Demining Programs

The United States provided funding for demining programs in both Ethiopia and Eritrea. Based on an analysis of the results, it is clear that some demining programs are more cost-effective than others.

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Introduction

Long after AP were planted to gain military advantage in battle, they continue to destroy lives by killing and maiming civilians and livestock, inhibiting productivity and preventing economies from developing in poor, third-world countries. Landmines contribute to political instability in regions vital to the United States. The U. S. Department of State (DOS) claims that there are approximately 85 to 200 million mines in 63 countries, producing approximately 15,000 casualties per year, an average of 70 people per day, or 500 people every week, most of them innocent civilians (DOS 1994). Of these, an estimated 9,500 people are killed each year (GHE 1995). Both Ethiopia and Eritrea have approximately 500,000–1,000,000 landmines according to the Department of State's "Hidden Killers." According to Mintz, "20 percent of mine victims are children, with about half the victims of the world's estimated 100 million landmines non-soldiers" (Mintz 1996), although Bonnie Benwick claims that the estimated number of landmines may be overinflated (Benwick 1998). This paper will attempt to analyze the available data to perform a cost-

effectiveness study of the U.S.-sponsored Ethiopian (ET) and Eritrean (ER) Demining Programs. This analysis may eventually be used as evaluation criteria to help determine if the United States should maintain its current level of operations or continue to expand demining into more countries.

Introduction and Goals of U.S. Demining Programs

In 1993, the National Security Council directed the DOS to establish an Interagency Working Group on Landmines and Demining. This directive marked the beginning of a coordinated U.S. government program to address the problems landmines pose to the stability and development of nations recovering from conflict (USG 1997).

The overall goal of the demining program was to relieve suffering from the adverse effects of landmines while promoting American interests. There are two main goals:

(1) Promote human welfare through mine awareness and training, which focuses on the health, safety and economic well-being of the host nation's population; and

(2) Promote U.S. foreign policy, security and its economic interests.

A key objective of the first goal was to encourage international cooperation and participation. Currently, little flexibility exists in

the international community for ridding the world of AP landmines in order to protect innocent civilians from the social and economic dangers of landmines. One hundred forty-one countries have now signed the 1997 Treaty to Ban Landmines. It calls for an immediate stop in production and deployment of AP landmines. The U.S. policy provides protection for civilians who are threatened from landmines by implementing humanitarian demining programs. In this way, America proposes to fulfill its international obligations associated with protecting life and property and prevents injury to innocent civilians.

Mines can be easily made with inexpensive materials and are not difficult to acquire. They are currently being located and destroyed by the old slow "probing" method. If the ban on existing landmines remains permanent, the landmine problem could continue to exist for the next 100 years. Demining programs are an option to rid the world of many of these mines. America has been involved with demining programs that have eliminated hundreds of thousands of landmines. As technology is being developed by the United States that would serve as substitutes for landmines in combat, new technology is also being developed that will make it easier to demine areas. The United States has implemented demining operations in some of the countries suffering the most from landmines in regions that are vital to U.S. interests, i.e., the Horn of Africa (Ethiopia and Eritrea) and the Middle East.

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Characteristics of Countries Experiencing Landmine Problems

Traditionally, landmines have been used to protect military bases, missile sites and demilitarized zones. During the last two decades, they have been used increasingly by belligerent groups to achieve political and economic objectives. Most landmine injuries are the result of increasingly indiscriminate use of small AP mines by irregular or poorly disciplined armies in the developing world rather than between nation-states.

As conflicts intensify, parties in the conflict tend to seek and acquire the means to forcefully resolve the situation in their favor. These conflicts kill and injure thousands of people. They are manifested by the deliberate use of inhumane weapons against civilians (Strada 1996). While producing an expansion of civilian casualties, landmines tend to generate large numbers of displaced persons and refugees (Clements and Wilson 1994).

Bourantonis and Weiner believe that in-action by the United States and the international community could make matters worse. The refusal of the largest states to extend their commitment and leadership in trying to resolve these problems contributes to global instability (Bourantonis and Weiner 1995). These internal conflicts in developing nations could also have far-reaching consequences. As an example, they may eventually affect American national security and economic interests in such vital areas as the Middle East.

Regional and Global Importance

In close proximity to the Middle East, the Horn of Africa (specifically Ethiopia and Eritrea) sits astride one of the world's key shipping lanes, the Red Sea. This route for Middle Eastern oil to Europe and America is of considerable geopolitical interest to Western powers. "The East African

coastline is similarly important for communications with the Indian Ocean. African ports and bases, particularly those close to the major sources of Middle East oil, are growing in importance" (Jordan and Taylor 1985).

Another matter of regional interest in the Horn of Africa is the fact that Ethiopia currently has by far the largest army on the African continent. The United States has recently begun training this army to assume a leading role in peacekeeping and humanitarian assistance operations for all of Africa. The U.S. involvement has persuaded the Ethiopians to accept this peacekeeping role (Bartholomew 1997). America has also sought to use Ethiopia and Eritrea as front-line states to contain the expansion of Islamic fervor from Sudan to the oilfields of Saudi Arabia and the Persian Gulf (Singlaub 1996).

Jordan and Taylor believe that the growing consumption of oil throughout the world, particularly in industrialized nations, has made this region one of the most important areas of the world in terms of U.S. interests. American interests in the Middle East were elevated to the level of vital national interests in the last decade (Jordan and Taylor 1984). These authors suggest that the Middle East is by far the most important source of world oil.

U.S. Policy for Demining Assistance

The purpose of American

demining programs is to "relieve the plight of civilian populations of developing countries experiencing adverse effects from uncleared landmines while providing valuable training benefits to U.S. military personnel . . . [to] educate civilian populations on the dangers, identification and notification of landmines; [and to] promote economic stability by returning mined areas to a condition that can support infrastructure, transportation and agricultural needs" (Office of Humanitarian and Refugee Affairs 1994–95).

The entity responsible for developing, coordinating and setting U.S. policies for demining initiatives is the Interagency Working Group (IWG). The IWG approves a list of candidate countries for assistance, and the DOS determines the level of U.S. interest in countries nominated for demining assistance. The IWG also establishes the priority of those countries eligible for U.S. humanitarian demining assistance (Office of Humanitarian and Refugee Affairs 1994–95). In 1995, Ethiopia and Eritrea satisfied the criteria for U.S. demining assistance. That is, both countries have a functioning government, hostilities had ceased, landmines were recognized as a problem for economic recovery, they asked for assistance, they lacked necessary resources to conduct an organized program, and they had the capability and willingness to support a demining program.

Table 1: Comparison of cost effectiveness in Ethiopia and Eritrea

Ethiopia	Eritrea
Costs: \$ 6,089,000	Costs: \$ 6,005,000
Benefits:	Benefits:
325,625 mines destroyed	4,750 mines destroyed
159 villages cleared	43 villages cleared
285 km roadway cleared	35 km roadway cleared
15,102 acres cleared	645 acres cleared

Source: Special Operations Command, Central, MacDill Air Force Base, Tampa, Florida, 1995–1999.

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Implementing Demining in Ethiopia and Eritrea

General William Tangney, the former commander of Special Operations Command Central (SOCCENT), established a Demining Operations Cell at MacDill Air Force Base (AFB) that planned and executed the CENTCOM Demining Program. National Demining Headquarters were established in Ethiopia and Eritrea, which directed the demining program and allocated all demining assets. SOCCENT deployed a Special Forces Company, augmented by Army Combat Engineers and Explosive Ordnance Disposal Detachments, that implemented demining training and executed demining operations throughout the HN. An Information Fusion Cell established and maintained a database on mine fields. It contained Public Awareness, Historical Research and Technical Data Collection Teams (Tangney 1994). The Public Awareness (Psychological Warfare) team from Fort Bragg, North Carolina, operated in conjunction with the HN information and defense ministries, established and operated a mine awareness campaign. They used print, radio, television and other media to warn and educate the population about mines and their location, informed the population of the hazards of mines and how to detect and avoid mine fields, and solicited information from the population on mine field locations. The Historical

Research (Military Intelligence) team from Fort Hood, Texas, conducted analyses of existing maps, battlefields and fortifications plans, and mine field recording forms conducted interviews with appropriate participants on all sides of the conflict, conducted reconnaissance of mined areas and gathered pertinent information on the employment of mines in the host country (Tangney 1994).

Cost-Effectiveness Analysis of Demining Programs

This section analyzes data to perform a Cost-Effectiveness Analysis (CEA) of the U.S.-sponsored Ethiopian and Eritrean Demining Programs. Eventually, CEA may be used as a methodology to help determine whether the United States should continue its existing demining programs. The Ethiopian and Eritrean demining programs can serve as a model for the expansion of future demining programs in other areas that are important to American interests.

Enumerated costs and their effectiveness, which are compatible with any demining effort, will be listed and quantified as much as possible. The United Nations and NGOs have been involved in landmine programs, and some research has been completed on the effects of landmine injuries on personnel in a few of the countries with landmine problems, e.g., Cambodia, Mozambique, Afghanistan and Angola. However, there has not been a study of the cost-effectiveness when the United States has solely

initiated, sponsored and maintained a humanitarian demining program.

The demining operations in Ethiopia and Eritrea were significantly different from the experience of previous efforts in Afghanistan (Operation Safe Passage). In Ethiopia and Eritrea, the instructors implemented a longer and more complete training program from the outset. The U.S. demining efforts in Eritrea and Ethiopia were strictly a matter between the United States and the host nations, without UN assistance. The programs were long-term, continuous processes that required a substantial transfer of equipment from the United States to the two countries. Demining training programs in these two countries provided a way for America to establish demining programs without UN assistance.

This study analyzed costs and effectiveness of the U.S.-sponsored Ethiopian and Eritrean Demining Programs. The purpose was to determine its applicability as a model and to assess how the United States should decide to expand demining into other countries.

Cost effectiveness was calculated for ranking program alternatives since they were relatively similar and there is a single dominant objective whose attainment can be measured directly. Cost encompassed all those items valued in money terms, such as its inputs and outputs.

In the case of the demining program, the prime benefit was to eliminate landmines in order to

Table 2: Cost, Effectiveness and Significance for Eritrea

Operation	Total Cost*	Effective Index (eq. 1 / eq. 2)	Significant (eq. 1 / eq. 2)
DE	\$522,000	1.462 / 1.879	yes/no
PA	\$45,000	1.775 / 3.229	yes/no
HR	\$65,000	.481 / 3.146	no/yes
DE/HR	\$587,000	2.082 / 6.620	yes/yes
PA/HR	\$110,000	3.604 / 1.576	no/yes

*Cost based on cumulative fiscal years of 1995-1999.

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Table 3: Cost, Effectiveness and Significance for Ethiopia

Operation	Total Cost*	Effective Index	Significant
DE	\$513,000	1.041	Yes
PA	\$111,000	0.523	No
HR	\$60,000	1.598	Yes
DE/HR	N/A	N/A	N/A
PA/HR	N/A	N/A	N/A

* Cost based on cumulative fiscal years (1996-1997).

prevent injury and death to the populace. To accomplish these objectives, the United States provided funds (inputs) to help restore a national infrastructure (benefits) that had been rendered unusable by landmines. The objective was to return mined areas—including villages, farmland and roads—to productive use.

The Cost-Effectiveness Analysis sought to measure:

(1) costs of two or more program operations, i.e., demining, public awareness, historical research in each country; and

(2) the cost effectiveness of demining in Ethiopia compared with Eritrea. In terms of comparing the cost effectiveness of the demining programs in Ethiopia and Eritrea, the benefits or outputs of the programs were much greater in Ethiopia than Eritrea, as Table 1 clearly indicates.

The Ethiopian demining efforts were more cost-effective than Eritrea's. Both countries received almost the same amount of dollars, but the benefits were much greater in Ethiopia than in Eritrea. Eritrea had started a costly (in terms of deminers lost) program in the early 1990s, at the time when U.S. assistance was requested. The conclusion is that benefits are going to be much less for a country that had an existing demining program such as Eritrea. The analysis suggests that equity in funding may not be cost effective.

Regression Results

Table 2 summarizes the total cost of each program and its effectiveness, where effectiveness means the B coefficient associated with the program components for each of the estimated regressions is significant.

For the above results, although demining/historical research (DE/HR) costs more, it was the most effective operation. It was highly significant for both estimated regressions. When using any of these independent variables (demining (DE), public awareness, historical research (HR), DE/HR, public awareness/historical research (PA/HR)), only DE/HR has a significant impact on villages affected (cleared and surveyed). When all five independent variables were included, DE/HR had the greatest impact on the villages.

For the country of Ethiopia, because of data limitations, one regression model was estimated. For Ethiopian demining, there were little or no recorded combined demining operations. There is a limited integration of Ethiopian demining operations.

The coefficient for DE is 1.041 in Table 3 and is considered highly significant. For every demining operation, at least one village was cleared. For PA, the B coefficient is .523 and is not significant. HR's coefficient is 1.59 and is considered highly significant.

Results from the demining programs in Eritrea indicate that

combining demining and historical research produces the greatest impact on the overall mission of the program. Although the ideal dependent variable would be the population affected directly by the demining, public awareness, or historical research operations, the number of villages cleared was shown to be a good proxy of the population affected.

Concluding Comments

This paper has emphasized that the worldwide landmine policy and demining operations consist of two main issues: humanitarian and security. Humanitarian efforts are concerned with saving lives and preventing injuries to innocent civilians. Three goals of humanitarian demining and landmine policy include: reducing the death of innocent civilians, reducing injuries, and restoring land that was mined in order to expand the nation's agriculture economy.

Deploying landmines is considered by the United States as a legitimate military objective to be used in combat situations. There exist overlapping concerns that converge both humanitarian and military objectives. A non-quantifiable measure of effectiveness, for example, is the altruistic benefit of humanitarian intervention. This intervention casts the United States and other industrial nations (e.g., Canada) in the role of global good citizens. The concept of international

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“good citizens” is critical for the development of a secure global community (Clements 20 April 2001).

This paper suggests the United States has a role to play in demining operations. America is good for the action role, such as starting up the demining programs. Equal funding of an existing program and new programs appear not to be cost-effective. The United States should begin contracting out some of the training and logistics during the demining programs' sustainment phase. It could gradually integrate the program using other key players, such as the United Nations, NGOs and private contractors. Finally, demining efforts combined with historical research are more effective than public awareness.

Demining is more expensive than public awareness and historical

research, but the landmines are destroyed forever. Public awareness of the locations of landmines is less expensive, but the mines are still present and could eventually harm or kill.

Although DE/HR was the most costly, it was clearly the most effective operation for both the Ethiopia and Eritrea demining programs. ■

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