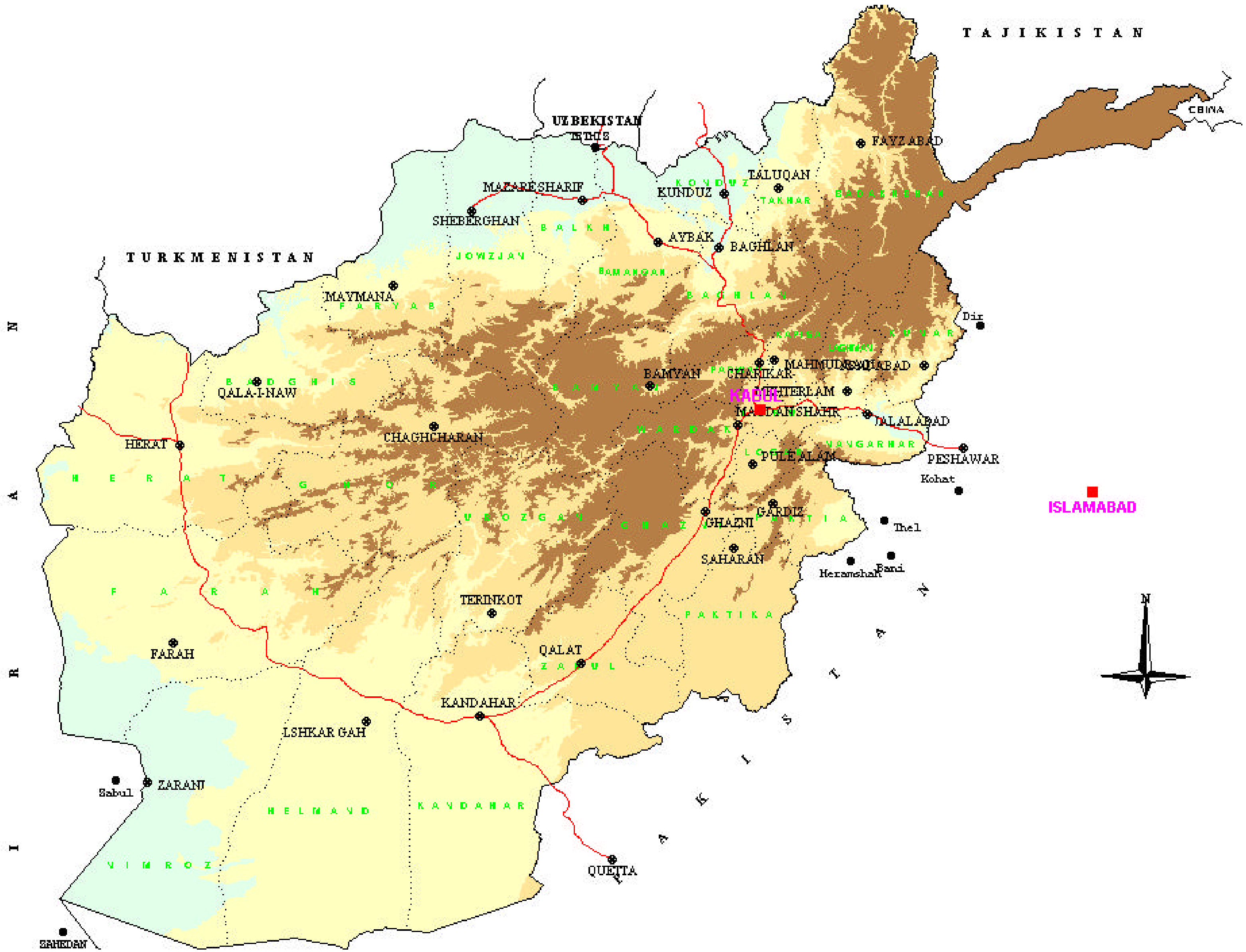
Summer 6-2001

Study of the Socio-economic Impact of Mine Action in Afghanistan

Geneva International Center for Humanitarian Demining
GICHD

Study of the Socio-economic Impact of Mine Action in Afghanistan (SIMAA)

Revised Draft Report
June 2001



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ZABUL
PAKTIKA
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Acronyms

ACBAR:	Agency Co-ordinating Body for Afghan Relief
AETF:	Afghan Emergency Trust Fund
AMVIS:	Afghanistan Mine Victims Information System
AREA:	Agency for Rehabilitation & Energy Conservation in Afghanistan
ATC:	Afghan Technical Consultants
CSO:	Central Statistics Office
DAFA:	De-mining Agency for Afghanistan
DDG:	Danish De-mining Group
DFID:	Department for International Development (UK)
DSA:	Daily Service Allowance
EC:	European Commission
EU:	European Union
FAO:	Food and Agriculture Organisation of the United Nations
GDP:	Gross Domestic Product
GICHD:	Geneva International Centre for Humanitarian Demining
HALO:	Hazardous Area Life Support Organisation
HI:	Handicap International
ICRC:	International Committee of the Red Cross
MACA:	Mine Action Centre for Afghanistan
MAPA:	Mine Action Programme for Afghanistan
MCPA:	Mine Clearance Planning Agency
MDC:	Mine Detection Dog Centre
MDG:	Mine Dog Group
MDS:	Mine Dog Set
META:	Monitoring, Evaluation and Training Agency
MIS:	Management Information System
NCG:	Nordic Consulting Group
NGO:	Non Governmental Organisation
NOVIB:	Netherlands Organisation for International Development and Co-operation
OMAR:	Organisation for Mine Clearance and Afghan Rehabilitation

PRIO:	Peace Research Institute in Oslo
RMAC:	Regional Mine Action Centre
SCA:	Swedish Committee for Afghanistan
SEIS:	Socio-economic Impact Study of Landmines and Mine Action Operations in Afghanistan
SIMAA:	Study of Socio-economic Impacts of Mine Action in Afghanistan.
UN:	United Nations
UNDP:	United Nations Development Programme
UNOCHA:	United Nations Office for the Co-ordination of Humanitarian Assistance to Afghanistan
USD:	United States Dollar
UXO:	Un-exploded Ordnance

Executive Summary

The Study of the Socio-economic Impact of Mine Action in Afghanistan (SIMAA) forms part of the World Bank/ UNDP Afghanistan Watching Brief Project. The study objective is to analyse the problem of mines, the costs and benefits of mine operations and how to deal with the mine problem from an integrated socio-economic perspective. The main focus of the study is on tangible economic impacts of mine action, benefits and costs of clearing units of land of different types and the choice of de-mining techniques.

Afghanistan is among the most mine-affected countries in the world. By the year 2000, the area remaining contaminated by landmines was estimated at over 700 km^2, spread throughout the entire country. Of this over 330 km^2 are assessed to be vitally important areas. National statistics on mine victims are seriously deficient. Different sources give figures for the number of mine victims in Afghanistan varying from 150 to 500 casualties a month.

The Mine Action Programme for Afghanistan (MAPA) started operations in 1989. Hence it is a mature program which has gained a great deal of experience during more than a decade of implementation. MAPA is financed from two main sources, the main one being UNOCHA, but funds are also passed from donors directly to individual NGOs. The amount of funds passed on directly is still only partially known to MAPA. Substantial resources have been devoted to the mine action program over the years, and the total funding of MAPA in 1999 through the UNOCHA Afghanistan Emergency Trust Fund was USD 22 million. Although data on direct funding of mine action NGOs are incomplete, as much as USD 6 million is estimated to have been contributed to mine action in this manner in 1999.

The study estimates benefit-cost ratios for clearance of mines from different types of land using different de-mining techniques, through the use of case studies. The quantified economic benefits from de-mining are related to reductions in the numbers of mine accidents (affecting both people and livestock) and reclamation of mined land for productive use. The cost side includes the costs of MAPA plus the economic loss attributable to accidents suffered by de-miners. Benefits and costs are converted to net present value using a discount rate of 10%.

The economic loss related to a fatal casualty from a mine accident in Afghanistan is estimated at USD 12,000. The loss from a typical mine victim is estimated at USD 9,000. One casualty every year over 15 years will then represent a total economic loss of 69,000 USD in net present value terms.

Three quarters of Afghanistan's land area supports only sparse grazing in mountains and deserts, while the 5% comprising irrigated valley floors produces 85% of all agricultural output. Before the war about 85% of the people lived in rural villages. During the war over one third of the population fled the country.

Afghanistan is an agricultural country, and traditionally around 70% of the labour force has been engaged in agriculture related activities. The net value of production on cleared agricultural land shows wide variations, ranging from USD 13,500 per km^2 annually in the Northern Region to USD 520,000 in the provinces of Kandahar, Zabul and Oruzgan. The benefits from clearing irrigation areas are even more substantial, amounting to as

much as USD 1.5 million per km^2 annually in the provinces with the best conditions for agriculture.

Over 80% of Afghanistan can be classified as pasture. The livestock sector's contribution to the gross domestic product has been estimated at USD 508 million in 1998-99. The net output to the farmer per animal per year is found to vary from USD 9 for sheep and goats to USD 31 for horses and USD 51 for cattle. Net annual output value from livestock rearing on one km^2 of grazing area varies regionally between USD 1,200 and USD 2,000. Loss of animals to mine accidents is estimated at about USD 2,500 per km^2 annually.

The road network in Afghanistan has deteriorated seriously as a result of war activities, and large stretches were contaminated with mines. In certain periods this has contributed to sharply higher food prices. The benefits from clearing mined roads are calculated as cost and time savings for passengers now travelling with vehicles on the safe road link as compared to the longer alternative route. The benefits from clearance of mined roads are considerable, over USD 250,000 annually per 50 km.

Turning to the cost side, MAPA clearance costs of mined areas are estimated to USD 0.77 per m^2 for the year 1999, while clearance of former battlefields costs USD 0.03 per m^2. Agricultural land comes close to the average in area cleared per team hour, while grazing areas are normally much less and residential are far more time consuming.

Dog teams, the most efficient technique overall, on average clear 3.5 times the amount of mined land cleared by manual teams per team hour. This technique cannot be used on all types of land, however. The area of minefields cleared per team hour of work under the MAPA programme has decreased over time. One explanation for this could be the increasing difficulty of tasks, as the easier-to-clear fields may have been taken care of first. However, additional analysis of trends in costs over time may be useful.

Relatively large cost variations have been found to exist between some of the mine clearance agencies. There is a need to look further into the strengths, limitations and cost structures of the different clearance techniques and also the approach and operational routines of the individual agencies engaged. More direct competition among clearance agencies would be a means of increasing cost-efficiency in the mine action programme.

Economic returns from de-mining are estimated to be high in general, especially when it is kept in mind that there are additional, non-quantifiable benefits from mine clearance, for individuals, communities, and societies. The greatest returns are found in the case of clearance of irrigation systems in provinces with good conditions for agriculture, where use of all techniques can be convincingly defended. Returns are also high for agricultural land and roads.

Clearance of grazing areas in general is more difficult to justify in narrow economic terms than de-mining of other types of land, because of the lower productivity of the land concerned. An economic loss will regularly be experienced when techniques other than dogs or community-based methods are applied. The Northern Region of Afghanistan provides the weakest justification for clearance tasks of all types.

Mine dog clearance is overall the most superior technique with the highest benefit-cost ratio; no other technique gives higher return for any specific clearance task. Dogs should consequently be used wherever this technique is applicable.

Currently about half of the area de-mined is cleared by dogs, which substantially reduces the overall average costs of MAPA. Although some types of mined lands are not suitable for clearance by dogs, this is not the constraint on this technique at present. With more dogs available, including larger training capacity for dogs, this technique could be further expanded.

Mechanical clearance is costly to MAPA. This technique should evidently be applied only when no other options are feasible, and economic justification will have to be demonstrated on a case-by-case basis.

A first item on the agenda for socio-economic assessment of a particular clearance task should always be to ascertain that the area will be reclaimed for use immediately. Delays in putting cleared areas to productive use sharply reduce the economic benefits of de-mining.

The net benefits of the MAPA mine clearance programme for 1999 are estimated at 40 million USD, with a solid Benefit-Cost Ratio of 1.5. The largest portion of the net economic benefits originates from clearance of agricultural land with dogs. Clearance of agricultural land and irrigation systems with manual methods as well as roads with dogs also make strong contributions.

It is strongly recommended that MAPA start conducting cost benefit analysis of clearance activities on a regular basis and in particular related to the annual presentation of the programme work-plan to the donor community. In this context, community participation in the planning and prioritisation of mine clearance activities be increased.

1. Objectives of Analysis

The World Bank is currently funding an Afghanistan Watching Brief Project. This project aims at improving the World Bank's and the United Nations Development Programme's (UNDP) understanding of the present economic situation in and the prospects for Afghanistan. The World Bank and UNDP with partners have recognised the need for strengthening by means of analyses of key issues related to the country's economic and social recovery, reconstruction and development.

The World Bank and UNDP likewise want to enhance their ability to contribute meaningfully in areas of their comparative advantage, to initiatives by the international assistance community to better co-ordinate, prioritise and implement aid to Afghanistan. Underlying their objectives is the need for these agencies to become better prepared at an early stage to actively participate when a post-conflict reconstruction and rehabilitation scenario emerges in Afghanistan, including help to prepare a transitional support strategy if/when required.

The Afghanistan Watching Brief Project has three components:

- Economic and sector studies.
- Workshops and conferences.
- Small pilot programs for learning, training and networking for Afghan women and NGOs based in Pakistan.

This Study, analysing the socio-economic cost-benefit impacts of mine action in Afghanistan is one of six projects under the component "Economic and sector studies."

According to its Terms of Reference (ToR) the Study will "analyse the problem of mines, the cost-benefits of mine operations and how to deal with the mine problem from an integrated socio-economic perspective."

In particular the following study areas are mentioned:

- The number and causes of mine victims.
- Socio-economic costs of mine problems.
- Techniques for mine clearance
- Mine awareness and other interventions to reduce mine accidents.

The ToR encompass a wide scope with a number of issues. It has nonetheless been agreed that the main focus of the technical part of the Study will be on tangible economic impacts of mine action, benefits and costs of clearing units of land of different types with the actual choice of de-mining techniques.

These are important aspects, since not many efforts have been launched internationally on the economic evaluation of mine action although its high costs are beginning to be questioned by some donors. Local community involvement too has also often been lacking in mine action programmes. What happens to the land after clearance has not usually been an important concern for the clearing agencies.

Most assessments of mine action programmes still refer to the size of areas contaminated and to the numbers of mines and Un-exploded Ordnance (UXO). In fact this can be a fairly poor indicator of the severity of the threat. It cannot reveal the extent of impact on people's lives and well-being, nor does it consider the impact in the context of the many other post-conflict development priorities. Renewed access to social infrastructure and use of land, food security and reduced transportation costs could provide much better indicators of the success of mine action programmes.

The Socio-economic Impact Study (SEIS) undertaken by the Mine Action Programme for Afghanistan (MAPA) in 1999 was actually one of the first attempts anywhere in the world to examine benefits and costs of mine action in a wider context. Another study has been launched recently by UNDP to be carried out by the Geneva International Centre for Humanitarian Demining.

2. Afghanistan – Society and Economy

Afghanistan's topography ranges from snow-covered high altitude peaks of up to 7,500 m, to deeply incised fertile valleys and large desert plains. Climate varies from arid in the South and Southwest to semi-arid in most other parts of the country. Irrigation dates back to more than 4500 years.

Three quarters of the land supports only sparse grazing in mountains and deserts, while the 5% comprising irrigated valley floors accounts for 85% of all agricultural output. In 1978 the last year of peace, the country was largely self-sufficient in food and a significant exporter of agricultural products.

There is evidence suggesting that the natural vegetation of large parts of Afghanistan was originally woodland and forest. The present steppes have resulted from cutting of wood by man and grazing and browsing by domestic animals over millennia. Trends towards resource depletion thus started long ago. Still, the forest cover reduction over the last 20 years has been severe. In 8 provinces the forest cover seems to have disappeared completely.[1]

In Afghanistan a severe drought appears to be a consequence of low winter rainfall in two consecutive years. Rainfall records suggest that low winter rainfall in two successive years occurs at least every 28 to 30 years.

In 1979 the total population of Afghanistan was estimated at 14 million, while 18-20 million has been indicated for today. Before the war about 85% of the people lived in rural villages, including 1.5 million nomads. Most of the other 15% were also connected indirectly with rural enterprises.

About 70% of the total labour force were engaged in agriculture, livestock and livestock based handicrafts, making woollen carpets and rugs. There was some industrial development, mostly linked to the processing of agricultural products or the production of farm inputs such as fertiliser from newly found gas fields.

Even before the war Afghanistan was one of the world's least developed countries. The past 20 years of continuing conflict have further exacerbated poverty, deprivation and suffering. Local and national institutions of governance have collapsed, the economy has

[1] Source: FAO 1997, Afghanistan Agricultural Strategy.

been devastated, and basic productive and social service infrastructures have been shattered. For the past several years Afghanistan has remained at the bottom of the UN Human Development Index.

During the war over one third of the population fled the country with Pakistan and Iran sheltering about 3 million refugees each. Probably another million of internally displaced persons moved into and around urban areas within Afghanistan. By 1995 about 1.4 million Afghans still remained in Pakistan and 2 million in Iran.

Since 1980 output in all sectors has fallen substantially because of the war and the resulting disruption and destruction of production infrastructure, as well as transport and trade opportunities. Afghanistan is now highly dependent on farming, wheat in particular and livestock, raising of sheep and goats etc. Large parts of the population suffer from insufficient food, clothing, housing and medical care.

Still the agricultural production system of Afghanistan can be described as robust and resilient, continuing to supply the remaining rural population under conditions of extreme difficulty during the war.[2]

The situation of the Afghan economy in 1991 has been described as follows:[3]

- Exports amount to USD 188 million, consisting of fruit and nuts, hand-woven carpets, wool, cotton, hides and pelts, precious and semi-precious gems.
- Imports of USD 616 million consist of food and petroleum products together with other consumer goods.
- The country has an external debt of USD 2300 million.

For the year 1995-96 the contribution of the livestock sector to the gross domestic product (GDP) has been calculated at USD 469 million, rising to USD 507 million in 1998-99.[4]

Many activities with considerable economic impacts tend to by-pass official statistics. There is a large-scale influx to Afghanistan of remittances from Afghans abroad. Although the actual amounts mostly remain unknown as yet, this source of revenue is considered indispensable for the survival of many local households.

The illegal and internationally condemned trade in drugs, mainly opium from poppy plantations inside the country, is the basis of wealth and power for groups of Afghans and foreigners and constitutes a boost to the economy in general. Farmers that have their land cleared of mines under the Mine Action Programme for Afghanistan are obliged to sign a document stating that this area will not be used for poppy growing.

The forest regions of the country currently experience large-scale cutting of wood on a non-sustainable basis, for domestic consumption and for exports. A trade in antiques persists, in precious objects some of them looted from museums, depriving the country of its national heritage.

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[2] UNDP 1993: Afghanistan Rehabilitation Strategy
[3] Source: ABC Country Book of Afghanistan.
[4] Source: Role and size of livestock sector in Afghanistan, World Bank 2000, page 22.

Inflation remains a serious problem throughout the country. In May 1996 the local currency the Afghani (Afs) had an exchange rate of 12,000 to the dollar. By November the same year the rate was 15,000 Afs. In September 2000 the rate of exchange was about 60,000 Afs to the dollar.

Table 2.1: Development of the Afghan currency (Afs) over the years, exchange rate towards one USD.

Year	Afs exchange rate To one USD
Dec 2000	70,000
Sept 2000	60,000
1998	32,000
Nov 1996	15,000
May 1996	12,000
1994	3,000
1993	1,000
1990	400

3. The History of Mines in Afghanistan

Afghanistan is among the most mine-affected countries in the world. During the Soviet occupation 1978-89 and the subsequent war between Afghan government troops and the mujahedin, landmines were used indiscriminately by all sides in the war. Mines were used for conventional military purposes, and also as part of the Soviet strategy to depopulate villages to prevent local support for the mujahedin. Mines were therefore placed in houses, irrigation systems, agricultural land and grazing areas, as well as being used for conventional military purposes on roads and around military establishments.

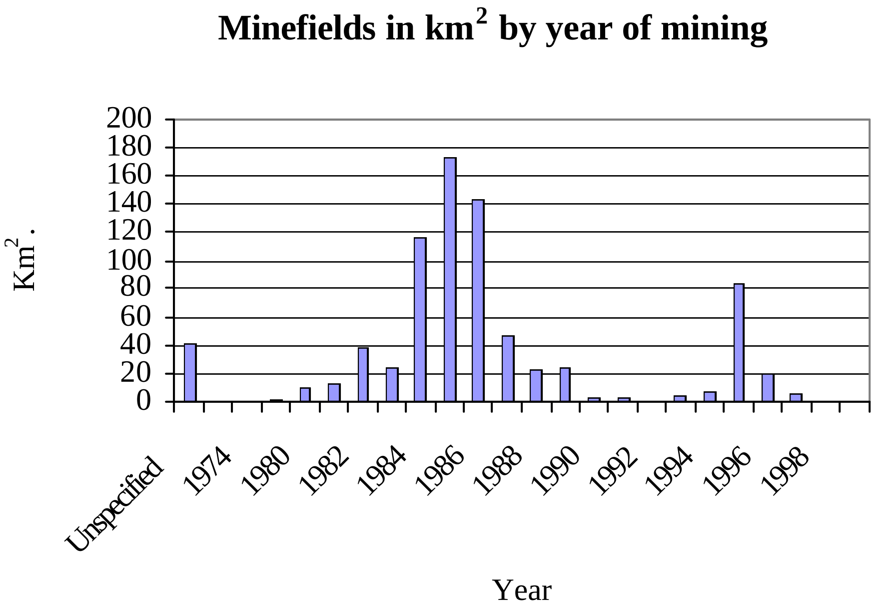


Figure 3.1: Minefields in km^2 by year of mining, high and low priority areas. Source: MIS Survey Database.

Large areas were contaminated in the mid-1980s, with new deployment taking place in the mid-1990s. Local people are the main source of information here.

Conventional forces used mines to force people off the land and to reduce potential support for their enemies. Guerrilla forces used mines to block roads and to harass opponents. Modern delivery systems enabled mines to be scattered by helicopters and other aircraft.

Landmines and UXO are scattered throughout the country in urban and commercial areas, towns and villages as well as on farmland. Mine and UXO contamination affects 28 out of the 29 provinces with heavier concentrations and greater impact in the eastern region, including Kabul and in the southern and western regions.

By end of October 2000 the remaining area contaminated by landmines is estimated at 718 km^2, spread throughout the whole country. Of this 339 km^2 are assessed to be vitally important residential areas, commercial land, roads, irrigation systems and primary production land. An equally significant problem is posed by UXO littered throughout the country.

Table 3.1: Mine contamination in Afghanistan, situation by year 2000[5].

	Area km^2
Total mine contaminated area identified to date	938
– of which high priority area	560
Area cleared to date – all high priority	220
Remaining area to be cleared	718
Remaining high priority area to be cleared	339
– Agricultural areas	153
– Residential and commercial land	14
– Irrigation systems and canals	3
– Roads	32
– Grazing areas	137

National data on the rate of mine and UXO casualties are not available, but the limited data that have been collected show a grim picture. Non-combatant casualties may still be as high as 150 to 300 a month, but many more are believed to die before receiving medical treatment.

It is estimated that access to 87,500 houses has been blocked by landmines[6], constituting one of the major obstacles to the return of refugees and internally displaced persons to their villages.

Current assessments indicate that if the remaining 339 km^2 of high priority mined area can be cleared, most Afghans could resume a normal, productive life. This will take some 7-10 years if current funding levels for mine clearing are maintained. The extent of new mining throughout the country was investigated in 1998 and again in late 1999 by MAPA and, while a concern it does not appear to be substantial.

It is clear, however, that minefields are still being discovered, at a rate of 12-14 km^2 a year. These areas were mined years ago, but are discovered by MAPA when different parts of the country become accessible. In Afghanistan the actual extent of known minefields is increasing.

[5] Source: MAPA Survey Database.
[6] Source: SEIS page 16.

Table 3.2: New minefields found, in km^2.

Year	2000-Oct.	1999	1998	1997	1996
km^2	12.5	16.4	14.0	15.6	13.6

In table 3.2 both high and low priority mined areas are included.

During the years of war from 1978 onwards, up to one third of the population fled the country or was internally dispersed. Many farming areas were depopulated. In 1993 the UN launched an emergency relief and rehabilitation programme for Afghanistan, to enable and encourage people to return to their homes. A key element of this programme was to bring agricultural land back into production, to provide food and employment for the returnees. This required significant efforts in removing mines and UXO from access roads and agricultural land, and restoring abandoned irrigation systems.

In many countries it is observed that the number of dead and injured from mine accidents tends to peak as refugees and displaced persons return to their homesteads. It then descends rapidly over the following months and years, even in quite severely affected countries.

The peak years for mine incidents in Afghanistan is believed to correspond with periods of large-scale repatriation. One peak year could have been 1988, when the Soviet army began its withdrawal. There was an upsurge of mujahedin activity and some Afghans repatriated voluntarily. No survey or clearance had taken place by that time and minefields were active and unmarked. In 1990, the year after the final withdrawal of Russian troops there was also some repatriation into the country.

During the period 1992-1994 some 2.5 million Afghans returned home. Following this spontaneous repatriation, a considerable increase in the number of victims is believed to have taken place. The deficient victims' statistics can, however, not provide any confirmation here.

4. The Mine Action Programme for Afghanistan

The Mine Action Programme for Afghanistan (MAPA) started operations in 1989. Since then the programme has expanded from a few hundred de-miners assisted by a dozen foreign experts to a workforce of some 4800 Afghans and fewer than 10 expatriates.

MAPA comprises the UN Mine Action Centre for Afghanistan (MACA), four UN Regional Mine Action Centres (RMAC), and 15 implementing partners (NGO). In the absence of an indigenous national co-ordinating body, MACA plans, manages and oversees all mine action activities for Afghanistan as well as providing technical support and ensuring the proper integration of mine action into the humanitarian assistance programme of the country. The 15 NGOs implement most of the physical activities associated with mine action, including awareness raising, technical training, survey and clearance.

MAPA's field of activities comprises:

- Surveying and clearing of minefields and former battlefields.
- Mine and UXO awareness and education.
- Technical training and programme development.
- Advocacy: The Afghan Campaign to Ban Landmines.
- Landmine survivors rehabilitation and reintegration.
- Programme management.

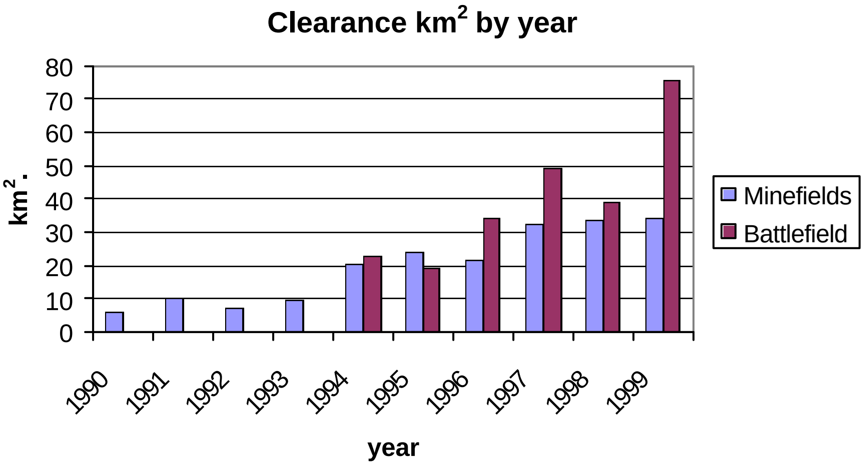


Figure 4.1: Clearance of minefields and former battlefields, in km^2 by year.

MAPA has pioneered the development of a number of innovative techniques to enhance the output of humanitarian de-mining teams, including the use of backhoes in urban areas, and the large-scale deployment of mine-detection dogs.

During its 10 years of activity the programme has cleared 220 km^2 of minefields and over 300 km^2 of contaminated former battlefields, removing over 220,000 mines and 1.2 million pieces of un-exploded ordnance (UXO) in the process.

Table 4.1: Clearance of minefields and former battlefields, 1990-2000, km^2.

year	1990-2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990
Minefields	220.6	34.2	33.5	32.6	21.6	23.9	20.7	9.9	7.4	10.2	6.4
Battlefields	303.7	75.7	39.1	49.2	34.1	19.5	22.7				

Despite political divisions within the country MAPA has been able to operate successfully in all areas. The programme continues to have strong support and recognition from the conflicting factions in the Afghan population in general as well as from the international community.

The major part of the NGOs' funding is channelled through the UNOCHA Afghan Emergency Trust Fund (AETF), which is administered by UN Geneva. Some NGOs, however, obtain financing directly from donors.

Table 4.2: Mine Action Programme for Afghanistan, AETF funding in million USD and cost per m^2 of minefields cleared over the period 1991 to 1999.

Year	1999	1998	1997	1996	1995	1994	1993	1992	1991
USD mill.	22.1	22.2	20.2	17.7	15.6	16.9	17.4	11.1	7.9
USD/m^2 minefield	0.6	0.7	0.6	0.8	0.7	0.8	1.8	1.5	0.8

Table 4.2 shows the development of the MAPA funding through AETF for the period 1991 to 1999. It also gives the cost of clearing in USD per m^2. Costs have come down significantly over the period. The figure USD 0.6 per m^2 is frequently used in MAPA information as cost of mine clearance.[7] Still, some other factors should be taken into account to give a more complete picture:

- AETF is not the only source of funding. Some NGOs receive support, financial and in kind, directly from donors. Information about this support has not been collected for the MAPA annual reports for previous years, while all cleared areas are reported as MAPA activity.
- Table 4.2 gives costs as USD per m^2 minefield cleared. MAPA activities, however, also comprise clearance of former battlefields, over 300 km^2 in the period 1990-2000 as compared to about 220 km^2 of minefields. The time (in team-hours) it takes to clear a former battlefield is less than 1/30 of the time to clear a minefield of equal size. Still, clearance of former battlefields is not a negligible part of the activity and must have some influence on the cost of the programme.
- MAPA is also engaged in other activities financed under the same budget, mine awareness in particular. Some of the NGOs supported by MAPA are engaged in mine awareness only, a few are active in both mine clearing and mine awareness. Mine awareness constitutes USD 1.8 million out of the total USD 26.3 million (about 7%) requested by MAPA as funding for the year 2000.

After survey (level 2), minefields and former battlefields are given priority as to which ones should be cleared first. Taking the decision on this is normally the responsibility of MAPA's four Regional Mine Action Centres (RMAC) in accordance with the following guidelines:

[7] See for example MAPA: Annual Workplan for Year 2000, page 32.

1st Priority: Agricultural land, road, housing/ residential area and irrigation system, expected to be reclaimed immediately by users.

2nd Priority: Do. In use after 6 months.

3rd Priority: Do. In use after 2-3 years.

4th Priority: Grazing area, some agriculture or roads.

5th Priority: Grazing area only.

The areas declared to be of high priority in table 3.1 will correspond to 1st Priority here, some grazing areas have also been considered high priority.

5. Human loss

5.1 Mine victims in Afghanistan

The devastating toll on human lives and health is unquestionably the most cruel impact of mines and UXO. Still, information on the human loss is to a large degree deficient, as most data collection on mine victims in Afghanistan suffers from lack of reliability and co-ordination.

Studies exist and data continue to be collected regularly by various agencies like ICRC, MAPA, Save the Children and local NGOs. The question is to what degree the data are representative and provide information about the situation in the whole country. They can not constitute a total count, since there is evidence that many accidents involving dead and wounded people are not reported anywhere. The data collection is not based on any well-conceived sampling technique, and double counting may occur among the agencies involved.

As a result different sources give widely varying figures for the number of mine victims in Afghanistan:

– The MAPA Annual Workplan for the year 2000 states that the number of mine accident casualties may still be as high as 150 to 300 a month, but it adds that many more are believed to die before receiving medical treatment.[8]

– The SEIS study's estimate for recent years (1997) is 10-12 a day or 300-360 a month, decreasing from 20-24 people a day or 600-720 a month in 1993.

– ICRC (Red Cross) in Kabul's assessment is of 300 to 500 a month based on mine casualties arriving at their hospitals.

The AMVIS initiative estimates the total accumulated number of victims (dead and survivors) to be around 60,000 by year 2000. SEIS presents estimates for the total number of landmine victims amounting to 90,000-104,000 as of the end of 1997.

[8] MAPA: Annual Workplan for Year 2000, page 16.

The SEIS study, based on data from 5140 victims, gives the following information:

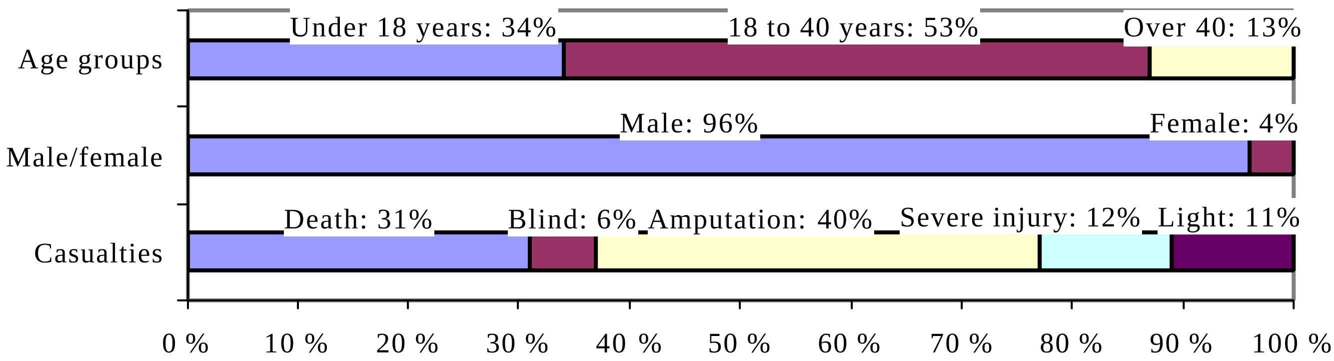


Figure 5.1: Mines/UXO caused injuries, % of injured persons in reported accidents.[9]

From the SEIS study it appears that the vast majority (96%) of civilian mine and UXO casualties is male. Afghan men may be more exposed to mines than women in their daily activities. It might also be the case that women casualties are severely underreported, and that they are less likely than men to present themselves for treatment at hospitals.

The death rate among the reported casualties is about 30%, and a further 40% have to undergo amputation. The serious categories of injuries make up altogether about 90% of the registered casualties. It can be suspected that light injuries seldom are reported.

The SEIS study also observes that a considerable share (about 40%) of the victims were educated, with at least completed primary education. About half of the victims were responsible for supporting their families.

The ICRC Orthopaedic Project in Afghanistan is located in 5 centres, situated in Kabul, Mazar-e-Sharif, Herat, Jalalabad and Gulbahar. Since the beginning in 1988 over 36,000 patients have been registered. Due to the large demand and the almost complete absence of other structures, the assistance was extended in 1995 to non-amputees and non-war wounded patients as well.

Out of the total number of amputees at the ICRC centres, 78% are registered as victims of mines, 70% are civilians, 82% adult males, 8% boys less than 14 years of age, 7% women and 3% girls less than 14 years. The ICRC figures thus likewise emerge with a small proportion of females among the mine victims.

An attempt is made to estimate the total number of mine victims by combining the ICRC and SEIS data:

[9] MCPA: Socio-Economic Impact Study 1999 (SEIS).

- The patients registered with ICRC also comprise non-civilians and non-mine victims. This has been corrected on account of information from ICRC.
- ICRC informs that patients include amputees and to some extent non-amputees. In the SEIS survey, amputees constitute 40% of all registered mine victims on the average, other severe injuries 12%. It is assumed here that the ICRC patients comprise all amputees and half of the severely injured from mine accidents.

On this basis the total number of civilian mine victims can be estimated for the period 1995 to 2000 as shown in table 5.1.

Table 5.1: Mine victims 1995-2000, Calculated figures based on ICRC and SEIS information.

	2000-April	*1999*	*1998*	*1997*	*1996*	*1995*
Civilian mine victims	2062	7553	6089	5872	5989	3661
Mine victims/month	515	629	507	489	499	305
- Deaths/month	155	189	152	147	150	92

The number of mine victims remains at about 500 per month for most of the years in the period, including a forecast for the year 2000 based on 4 months registration. In 1999 there was a marked increase and in 1995 the number of patients registered at ICRC was lower than for other years in the period.

In the Report of the National Survey of Mines Situation from 1993[10] a total of 339 districts in all 29 provinces of Afghanistan were surveyed. Mine problems were reported in 162 of these districts. Surveys could not be carried out in 17 districts due to security problems and 177 districts were reported free of mines.

In the surveyed communities it was found that over 20,000 people had been killed and about 16,000 disabled through mine accidents. With this background the survey report states that 20-25 mine incidents involving the civilian population occur in Afghanistan every day, or about 8000 every year. The percentage of deaths in this survey is 55%, that is to say higher than the 31% recorded in the SEIS study from 1999.

A (rapid) regression analysis of the data from the 1993 National Survey gives a clear indication that the number of mine victims is causally related to the extent of high priority mined areas and population (number of families) in the area. The extent of low priority areas seems to be of little significance, as could be expected. A problem with the 1993 survey from an analysis point of view is the lacking information about the period of time when accidents took place, while information about the specific mined area (extent, type etc.) where the accident took place lacks in the SEIS.

For further analysis it would be most convenient to apply an Accident Risk concept, meaning the danger represented by an active minefield, expressed in terms of the expected number of casualties per year and per km^2 of mined area. Given the deficient

[10] MCPA 1993: Report of the National Survey of Mines Situation.

statistics on mine victims in Afghanistan, such calculations will, however, be largely speculative.

Not only the number of mine victims will be uncertain here, but also the extent of the mined areas the accidents refer to. New areas still continue to be identified with their share of high priority fields. While the high priority areas identified as of the beginning of the year 2000 amounted to 530 km^2, the real area could be as much as 600 km^2. Out of these 200 km^2 are cleared, leaving 400 km^2 as the actual high priority mined area in Afghanistan in year 2000.

The corresponding number of mine victims can be estimated at 4000 as of the year 2000. This figure is not meant to comprise the total civilian mine and UXO victims in Afghanistan, but only victims from accidents taking place within the 400 km^2 of high priority minefields assumed to exist by year 2000. Mine accidents taking place elsewhere, on low priority areas and victims from UXO accidents on former battlefields come in addition. The 4000 mine victims per year thus constitute the casualties that could be avoided if all the 400 km^2 high priority areas were cleared. This assumption gives an Accident Risk of 10 victims annually per km^2 in high priority mined area in Afghanistan.

Table 5.2: Basic assumptions for calculation of accident risk.

Year	*2000*
Identified high priority mined area km^2.	530
Actual high priority mined area km^2.	600
Cleared minefields km^2.	200
Existing, active high priority minefields km^2.	400
Total number of victims/year	4000
Victims per day	11
Victims/km^2 mined area/year	10

Different types of mined areas will generate various accident risks, and those close to populated areas will normally be the most exposed. It is often found that mined residential/commercial areas, irrigation canals, and roads carry the largest risk, whilst agricultural areas carry somewhat less and grazing areas the least risk of mine accidents, but more substantial information is lacking here. It will be assumed that agricultural land is 2 times, and residential areas 3 times more prone to mine accidents than grazing areas. The minefields considered here are all presumed to qualify as MAPA high priority areas.

This provides the basis for the risk calculations presented in table 5.3 on the number of victims annually per km^2 mined land of different types. The accident risks for each type of land are conceived so that when multiplied with the actual distribution on types of areas, the total number of victims on the 400 km^2 remaining mined land will amount to 4000, that is to say an average of 10 victims per km^2 per year.

Table 5.3: Risk of mine accidents. Number of victims annually per km^2 on types of mined area.

Type of area	Victims/km^2
Residential/commercial	17
Roads	17
Irrigation systems	17
Agricultural land	11
Grazing areas	6
Average/total	10

5.2 Valuation of lost quality of human life, welfare and production capacity

In principle the methods for valuation of human loss from accidents are based on the resources needed to correct the effects of the accident. Estimates are made for what it would cost society to restore the victim or his/her relatives and friends to the situation in which they found themselves before the accident. The Human Capital Approach measures the loss to society when one of its members dies or becomes disabled, based on the value of working time or value of production the individual is responsible for.

According to this method the cost of death and disablement is calculated on basis of the lost future productive potential of the victim. Production for future years is discounted to the present date, by means of a discount rate, suggested as 10% in this study.

Production may be calculated in gross or net terms. In the latter case expenditure on consumption is deducted, leaving the production loss to society *excluding* the victim. The Value of Lost Lifetime Years method attempts to determine also the value of the leisure time, in addition to the cost of the working time. The loss of enjoyment suffered by the victim on his death is not limited to deprivation of consumption. It extends to cover the fact that he can no longer undertake other activities promoting his well being.[11]

Many European countries, Australia and USA apply methods for valuation of human life and injuries to humans in connection with road accident prevention programmes. A fatality can be evaluated to as much as USD 2 million and a very serious injury as USD 1.5 million. This can contribute to justify a large amount of road safety initiatives, some of them quite costly to the road transport sector.

The method selected for evaluating damage to human life and health from mine accidents in Afghanistan will be close to the Value of Lost Lifetime Years approach. It will include loss of productive capacity to society and reduced opportunities for the victim to conduct activities important for personal welfare, concerning for example private consumption and quality of leisure time. The calculations presented here will constitute a first approach to introducing the value of reduced human loss as benefits from mine clearance activities in Afghanistan. Both the method applied and the data input should be subject to further development and revision as part of the planned continuation of work on social and economic studies in this field.

[11] European Commission Transport Research Cost 313: Socioeconomic cost of road accidents, 1994.

The starting point for these calculations will be an estimate of the social value of production for an individual mine victim. Information about age structure and social status of the mine victims is extracted from figure 5.1. The SEIS study observes that a considerable share (about 40%) of the victims were educated, with at least completed primary education, and that about half of the victims were responsible for supporting their families. It can thus be assumed that most mine victims belonging to the economically active age groups (18-65 years) are contributing positively to the Gross National product (GNP). Nonetheless an unemployment rate of 40% will be applied. The economic situation of mine victims is thus different from refugees or internally displaced persons returning to reclaim land cleared of mines, who generally will be assumed to have no alternative possibilities for employment (see chapter 6.3).

The GNP of a poor country can be as little as USD 200 per inhabitant per year. For Afghanistan as of to day no such statistics exist, and for this analysis forecasts of a more normal, non-war situation expected in future years would also be needed.

It can be assumed that the larger part of the GNP is created by people in the age-group 20-65 years. By applying estimates for the number of persons in that age group in Afghanistan[12] and an unemployment rate of 40%, it can be shown that each active, employed person in a poor country could contribute about USD 750 annually to the GDP. This will be used as an estimate of the potential annual economic contribution from a mine victim (96% of them males) in the age groups 18 to 40 years and above 40 years, but also for young persons, once they come of productive age.

The GNP comprises private consumption, but is limited to marketed goods and services only. The value of non marketed activity and production for own use will have to be added, which could increase the production value estimate to USD 850 per person and year.

The victim's personal loss of welfare can be assumed to be at least equal to the individual's productive contribution. The estimate used here will be another USD 850 per person per year, while estimates from industrialised countries often constitute a much larger additional percentage.

Table 5.4: Estimates of productive contribution and loss of welfare for mine victims.

	USD/year
Contribution to GNP	750
Value of non-marketed, subsistence production	100
Productive contribution from an economic active mine victim	850
Victim loss of welfare	850

A 30-year-old male can be used as representative for the middle of the age group 18-40 used for mine victims. His remaining life expectancy is about 35 years in Afghanistan[13].

[12] Mohammad Ershad: Paper on the population of Afghanistan, IIPS Bombay, June 1983.
[13] Ibid

There is also a risk of loss of a person's productive capacity for other reasons than death and mine accidents. An average productive lifetime of 30 years will thus be assumed for the age group 18-40 years. For the age group over 40, the productive lifetime is set at 10 years and life expectancy at 15 years. Victims under 18 are attributed a remaining life expectancy of 50 years and a remaining productive life time of 40 years when they come of productive age, on the average after 10 years. Future contributions are all discounted at a 10% rate.

The individual age groups of the population in Afghanistan will contribute to the production value and welfare loss as of their share among the mine victims, which is known from figure 5.1. For calculation of the production value an unemployment rate of 40% is assumed.

Total loss is calculated in table 5.5, that is to say when the victim can no longer contribute anything to production in society or experience personal welfare any more. This will be the case with fatal casualties only, while the loss for other categories of victims depends inter alia on their degree of disability (see chapter 5.4).

Table 5.5: Production and welfare loss per person, fatal casualty, USD.

Production loss	Years	Loss USD over lifetime	% of victims	Loss USD relative share
Age group under 18	40 (+10)	3 211	34	655
Age group 18-40	30	8 013	53	2 548
Age group over 40	10	5 223	13	407
Welfare loss				
Age group under 18	50	8 434	34	2 868
Age group 18-40	35	8 198	53	4 345
Age group over 40	15	6 465	13	840
Economic loss per person fatal casualty				11 663

5.3 Medical costs

Mine victims constitute a heavy burden on the scarce resources available for medical treatment in Afghanistan. The International Committee of the Red Cross (ICRC) reports that over 80% of all amputations performed at their hospitals are victims of landmines. Patients having sustained injuries from a landmine will need hospital treatment for about 30 days on the average. The cost per patient-day at an ICRC hospital is around USD 120, excluding salaries for expatriate staff. The average cost for treating a mine-injured person in hospital will then be around USD 3500.

For most Afghan families this would be an unattainable amount. At ICRC hospitals all treatment is free of charge, still treatment capacity will be diverted from other patients, which means employment of resources that have an alternative use. The victim and his/her family may also have to cover additional expenses like transport etc.

Still, many victims do not receive professional medical treatment, which contributes to increase the death-toll and severity of invalidisation from accidents. Medical costs per victim can thus be reduced somewhat compared to the hospital rates. It is assumed here that medical costs will amount to USD 2000 per victim for casualties leading to blindness, amputation and severe injuries.

5.4 Total human loss in economic terms

The economic loss set out in table 5.5 will constitute the loss from a fatal human casualty, while mine accidents in Afghanistan has a death toll estimated at 31% of the victims. The proportion of different types of casualties will thus have to be taken into account, with their respective degree of disability.

The contribution of each category of mine victims to the economic loss from human casualties is shown in table 5.6. This will depend on the degree of disability of each category and its share among the mine victims. Medical costs are also added with USD 2000 per victim for casualties leading to blindness, amputation and severe injuries. The economic loss for a typical mine victim is calculated to about USD 9000.

Table 5.6: Economic loss for a typical mine victim, USD.

Categories	Disability %	Victims %	Loss USD
Death	100 %	31 %	3 616
Blind	70 %	6 %	610
Amputation	60 %	40 %	3 599
Severe injury	50 %	12 %	940
Light injury	20 %	11 %	257
Economic loss for a typical mine victim			9 021

The total human loss in economic terms can now be distributed by the various types of mined area according to the accident risk estimates presented in table 5.3. As long as the areas are not cleared, the risk of mine accidents will persist and incidents with human casualties may continue to reoccur every year. A period of 15 years into the future will be considered here, over which the human loss will be calculated and discounted at 10%.

Experience shows, however, that accidents risk from active mined areas may decrease somewhat over time, even when no clearance has been conducted. Local people may be able to adapt themselves in some ways to the danger, taking precautions and modifying their behaviour. Mine awareness campaigns will have significant impact here, as well as survey, delimitation and marking of the minefields. There might thus be some costs related to the risk reduction. Return of refugees will often counteract the trend and increase accident rates.

It is assumed here that the accident rates will decrease by 5% every year over the 15 years period considered in case of no mine clearance.

Table 5.7: Human loss in USD 1000 from risk of accidents on different types of mined area per km^2, annually and over 15 years discounted at 10%.

Type of area	Accident risk victims/km^2	Annual loss USD 1000	Total human loss over 15 years, USD 1000*
Residential/commercial	17	154	914
Roads	17	154	914
Irrigation systems	17	154	914
Agricultural land	11	103	610
Grazing areas	6	51	305
Average for all mined areas	10	90	535
One victim each year over 15 years**	1	9	69

* A reduction in accident risk of 5% per year over the 15 years period is assumed.
* * No risk reduction assumed.

Wit an accident risk of 10 victims per km^2 minefield, the total human loss as an average for all types of areas is calculated here at USD 90,000 annually. This amounts to more than USD 0.5 million when the area remains uncleared during a 15 years period (loss discounted at 10% annually). Each type of mined area represents different degrees of accident risk, and the human loss from accidents varies accordingly. The total human loss over 15 years from mine accidents constitutes one of the benefit components to be compared with the cost of clearing mined areas in the further analysis.

5.5 Alternative assumptions

Although mine accidents unquestionably lead to major human welfare losses, these are difficult and somewhat arbitrary to ascertain and inevitably a source of contention no matter what estimates or methodology are used. More thorough analysis will be needed to show whether the welfare loss estimate of USD 850 per person per year is appropriate for a country in Afghanistan's situation.

The welfare losses can be excluded for the purpose of sensitivity analysis, not because these are unimportant or necessarily overstated by the study, but rather to come up with a conservative estimate of the economic benefits of de-mining that are directly attributable to economic activities. Table 5.8 shows the resulting changes in assumptions as compared to table 5.7.

Table 5.8: Alternative assumption excluding welfare loss. Human loss in USD 1000 from risk of accidents on different types of mined area per km^2, annually and over 15 years discounted at 10%.

Type of area	Accident risk Victims/km^2	Annual loss USD 1000	Total human loss over 15 years, USD 1000*
Residential/commercial	17	61	364
Roads	17	61	364
Irrigation systems	17	61	364
Agricultural land	11	41	243
Grazing areas	6	20	121
Average for all mined areas	10	36	213
One victim each year over 15 years**	1	4	27

* A reduction in accident risk of 5% per year over the 15 years period is assumed.
* * No risk reduction assumed.

6. Agricultural land blocked by mines

6.1 The agricultural sector's role in the Afghan economy

Afghanistan is an agricultural country, and traditionally around 70% of the labour force was engaged in agriculture related activities. Agricultural produce was also one of the main components of the Gross Domestic Product (GDP). Before 1979 the contribution from agricultural products made up more than 50 % of total GDP.

In 1978, the year of the Soviet invasion, the country was largely self-sufficient in food and a significant exporter of agricultural products. Official Afghan statistics from the period 1971-89 show an annual exportation of agricultural products of more than USD 100 million, constituting over 30% of the total export of the country. The main export items were fresh and dried fruits, citrus and oil seeds. After the intensification of war activities, agricultural production decreased considerably

In Afghanistan 85% of the agricultural output comes from about 5% of the land, that is the fertile and productive river valleys, which to a large extent consist of irrigated areas. Three quarters of the land on the contrary supports only sparse extensive grazing in mountains and deserts.

Table 6.1: Land area and use of land in Afghanistan, 1972[14]

	km^2	%	%
Irrigated land			
– Orchards	802	2	
– Cereal crops, 2 times a year	4,514	14	
– Cereal crops, once a year	7,337	22	
– Intermittently cropped	20,230	62	
Total irrigated	32,883	100	5
Rainfed-only 20-25% cropped every year	48,357		8
Forest area	19,870		3
Rangeland and other	541,285		84
Total land area	642,395		100

Table 6.2 gives the production of principal crops and estimated productivity in tonnes per km^2.

Table 6.2: Principal types of crops and yield in Afghanistan, estimates for 1996.[15]

	Area km^2	*Productivity*
		tonnes/km^2
Wheat	36,000	170
Barley	3,100	115
Maize	4,850	170
Rice	2,150	210
Cotton	800	145
Sugar cane	45	2
Sugar beet	20	2
Fruit orchards, citrus	700	43
Vegetables	900	790

Sharecropping has traditionally been a characteristic feature of agriculture in Afghanistan. Dupree (1973) explains the principle as follows:

"Basically, agricultural production in Afghanistan involves five elements: land, water, seed, animal or mechanical power, and human labour. Theoretically, whoever contributes one of the elements receives one fifth of the resulting crop." These five elements may be concentrated in a varying number of hands. Modern agricultural methods have complicated the agreements. A key element, however, seems to be supplementary labour, still tending to constitute its traditional one fifth of the crop value.

[14] Source: FAO Land Use Statistics 1972
[15] Source: FAO Integrated Crop Programme estimates.

6.2 Mines in agricultural areas

A total of 89 km^2 of agricultural land has been cleared of mines during the period 1990 to 2000. According to MAPA's estimates[16] a total of 153 km^2 of high priority agricultural land still remained to be cleared by the end of the year 1999. Another 26 km^2 of mine infested agricultural land were identified and assigned lower priority.

Table 6.3: Mines in agricultural areas, km^2.

Year	*1990-2000*	*1999*	*1998*	*1997*	*1996*	*1995*	*1994*
Cleared land km^2	89.1	17.6	14.1	11.8	8.1	6.6	6.6
Remaining by 2000							
– High priority	153.2						
– other area	26.2						

6.3 The Case Studies

Ideally the statistics used in this Study should be comprehensive and detailed enough to cover all of Afghanistan, and to give a representative picture of the various areas relevant in a mine-clearance context. There is, however, a recognised shortage of up-to-date information about Afghanistan.

It has therefore been necessary to collect and analyse socio-economic data in a limited number of Case Studies. The individual cases have been designed so as to represent a wider range of areas in Afghanistan in the best possible way.

Still some concessions were made:

- The areas to be covered by each Case Study will, at this stage, have to coincide with the boundaries of one or a group of provinces. District level will be too detailed.
- A restricted number of cases will be selected, while extension to more cases may come at a later stage when the Study is updated.

In the agriculture and livestock sectors a need for minimum 8 Case Studies has been identified, in order to cover climatic zones, main cropping and livestock holding patterns, and cultivation practices.

The case studies are based on farming models, developed from the Swedish Committee on Afghanistan's agricultural survey of 1991. They describe the farming systems prevailing in agro-ecological zones, which can be considered representative of the climatic variations across the country. The basic features of these models are described in terms of location, altitude, precipitation, type of irrigation, farm and household size, crop production, farm inputs, draught power and livestock production.

Cropping intensity will vary among the 8 case studies. Depending on microclimate and availability of water, some areas with fertile soil and high temperature can be cultivated

[16] Source: MAPA Annual Workplan for Year 2000.

more than once, while other agricultural land can be used every two to three years only. Some districts of Laghman and Nangarhar for example can be cropped up to three times per year, whereas some large areas in the Northern Region, rain fed land in particular, must remain fallow for 3-4 years and even more. The irrigated agricultural lands, which are not being cropped every year can be used as grazing areas or remain unused so as to accumulate increased nitrogen content.

Together the model Case Studies are considered to be representative for over 95 % of irrigated agricultural and 85% of rain fed land. Case Study I covers a mixed extensive rain fed and irrigated cropping system, whereas the others II-VIII are concerned only with irrigated cropping systems.

Out of the 29 provinces in Afghanistan only two provinces are not covered by the Case Studies, that is Bamyan and Ghor. The topography, climate and other characteristics of these provinces differ widely from the case studies, and further analysis has not been carried out at this stage. Furthermore these provinces are not densely mined, no clearance report has yet been received from Ghor, and less than 0.5 km^2 have been cleared in Bamyan.

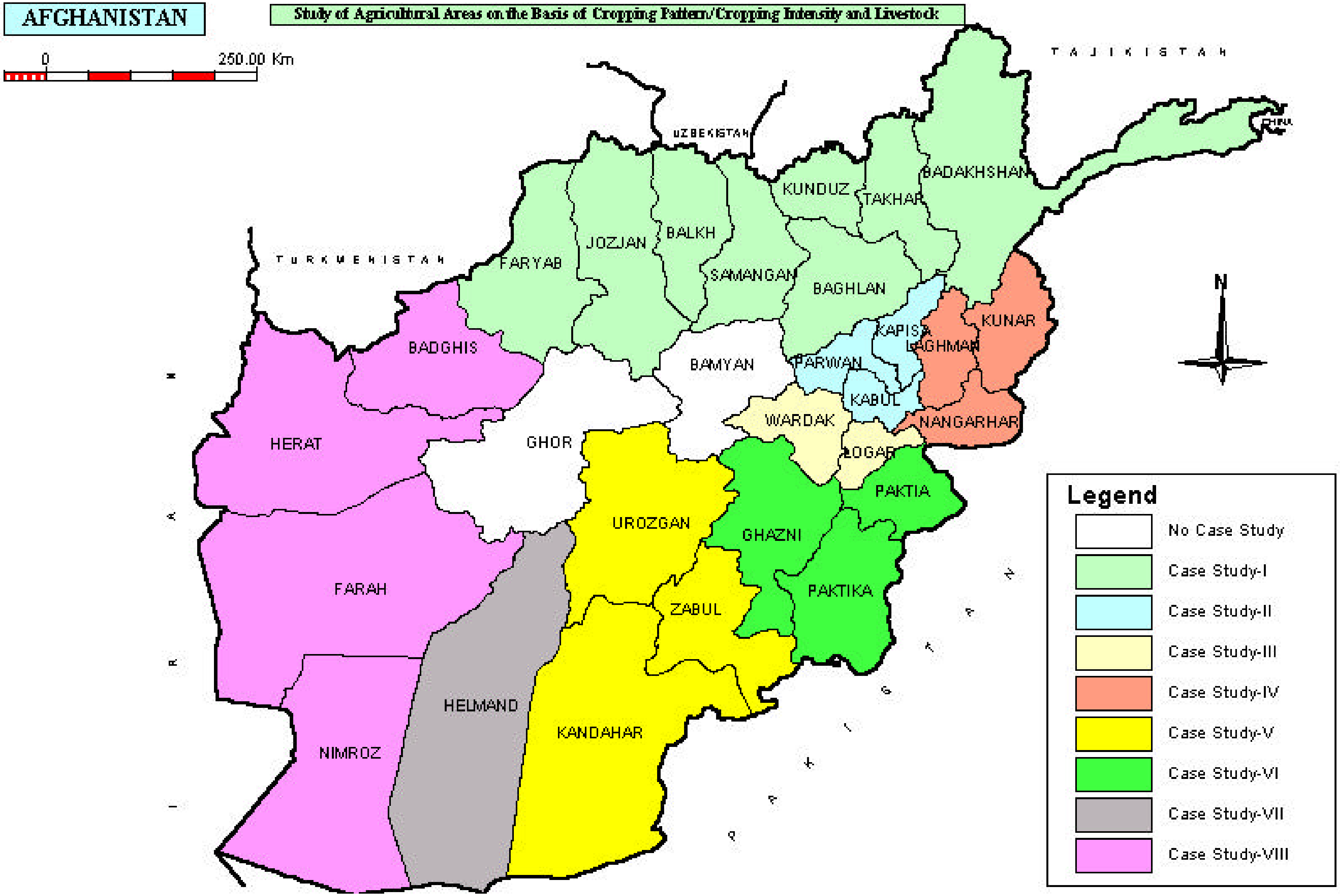
The Case Studies for the agricultural and livestock sectors cover the following areas:

Table 6.5: Case Study Areas

Case Study	*Provinces, regions*
I	Northern Region all provinces*
II	Parwan, Kabul, Kapisa.
III	Logar, Wardak.
IV	Nangarhar, Laghman, Kunar
V	Kandahar, Zabul, Oruzgan
VI	Ghazni, Paktika, Paktia
VII	Helmand
VIII	Herat, Badghis, Farah, Nimroz

* The Northern Region consists of the provinces of Faryab, Jawzjan, Balkh, Samangan, Kunduz, Baghlan, Takhar, Badakhstan.

The 8 Case Study areas together with the areas not covered are also shown on the following map of Afghanistan.


AFGHANISTAN
Study of Agricultural Areas on the Basis of Cropping Pattern/Cropping Intensity and Livestock
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FARYAB
SAMANGAN
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KAPISA
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Case Study-VI
Case Study-VII
Case Study-VIII

6.4 Economic benefits from de -mining agricultural land

It is assumed that agricultural areas once cleared of mines will be put directly into effective use. There is a considerable demand for agricultural land in the country, to feed its population and to receive returning refugees. Besides, according to the MAPA priority rules an area will not be given 1st priority for clearance if there is a chance that it will not be reclaimed for use immediately.

The benefits from agricultural areas consist of the net revenue to the farmer from the production, which in this report will be calculated on an annual average basis and per km^2 of area. For each of the 8 agricultural Case Studies a crop pattern assumed to be representative for the region has been identified, as types of production and their percentage share of the area.

Regional variations have also been identified in agricultural practices. The cropping intensity varies, in particular as a consequence of rainfall and access to irrigation water. Cropping intensities above 1 signify that more than one crop can normally be harvested a year. In some regions of Afghanistan certain types of cultivation can be grown every other or third year only, while other crops may intervene or the area can be used for grazing.

Regional variations in harvest output have been taken into account, and also in the output price to farmer to some extent. Factor inputs and their price have been considered standard for different crops and regions.

It is assumed that cleared land will constitute a means of living for Afghan people who formerly lacked means to support themselves and their families, as jobless or substantially underemployed, receiving help either from friends and relatives or from international organisations, living inside Afghanistan or as refugees in other countries. For this reason no deduction has been made for farm labour input to agricultural production, as this input is considered to have no alternative employment as a rule. In cost-benefit analysis it makes no difference whether the refugees were actually working abroad, as conventionally benefit and cost counting stop at the national border.

The agricultural practices described in this study are assumed to represent typical patterns rather than recommended or ideal practice. Still it is not necessarily the actual situation in Afghanistan today that should taken into account, but the conditions that could be expected to prevail under more normal and stable conditions and as they could develop in the future years. In the further analysis the production value over a 15 years period will be counted as benefits from agricultural land.

On the chapter on agriculture the Study Team has benefited in particular from co-operation with the FAO office in Islamabad as well as different FAO reports and publications and the survey undertaken by the Swedish Committee of Afghanistan (SCA). The Team is, however alone responsible for the use of the collected information for the purpose of this specific Study and the conclusions drawn, in cases when the source of information is not referred to.

The calculation method applied in the following tables 6.6 to 6.13 for the 8 different Case Studies can briefly be described as follows:

- The selection of crops is assumed to be typical for the region contained under each of the 8 Case Studies.
- Information was gathered from different sources on harvest yield in tonnes per km^2 area for different types of crops, and the average yield per km^2 agricultural land is calculated on the basis of figures given in FAO agricultural models. Some regional variations in output are found.
- The prices used in the calculation of yield in tonnes per km^2 are the market prices for May/June 2000, which are reported through FAO sub-offices from different regions. A certain regional variation is found in prices of agricultural produce.
- Harvest yield times price gives the gross revenue of production from one km^2 of agricultural land. (This is not shown in the tables 6.6 to 6.13).
- In order to find net revenue the value of the input factors will have to be deducted. In the tables 6.6 to 6.13 this has been calculated as the amount of input factors needed for the given output of agricultural crops on one km^2 of land. In the case of irrigated wheat in table 6.6, USD 10,700 worth of input factors is needed in order to produce 150 tonnes of output. Farm inputs include seeds, chemical fertilisers, manure, pesticides, hired oxen or tractor draught power. Labour input was excluded for the reasons discussed above.
- The use of fertiliser and chemical protection material and all other inputs are estimated according to availability of materials, affordability by the farmers and accessibility of facilities, while the inputs recommended by the Ministry of Agriculture and FAO will be much higher than the farm inputs estimated in this report. Irrigation cost has not been taken into account, because usually river or Karez water is being used for irrigation purposes except in drought-affected areas. The cost of management of the farm is also not taken into account, neither is the farmers' daily use of farm products such as fruit, vegetables or firewood.
- For the cost of fertiliser we consider the total active irrigated land and the amount of fertiliser distributed in the country. A total of 157,700 tonnes of fertiliser were distributed to farmers in 1986 while the active irrigated land was 26,000 km^2 in 1993. Considering the fertiliser use constant in the period, the average use of fertiliser will be 6.1 tonnes per km^2. A bag of 50 kg white fertiliser (UREA) costs around USD 16, so the fertiliser cost per km^2 cropland will be USD 1620.
- Power cost: Usually oxen and tractors are used as power for cultivation of land. The cost of both types of power is on average USD 2000/km^2.
- It has to be taken into account that the provinces covered by the Case Studies all have cropping intensities different from 1. This means that either more or less than one crop can be harvested each year. The intensity varies from 0.35 in Case 1 or about one crop in the course of 3 years, to 1.92 in case study IV, that is almost 2 crops a year normally.

- When the cropping intensity is lower than 1 it is assumed that the land is available for grazing animals in years without agricultural planting. The annual forage value from a km^2 of land is assumed to be in line with the outputs described in chapter 8 on grazing areas.
- The recent exchange rate of 1USD= Afs. 60,000 has been used for converting monetary values of yield or farm inputs.

Table 6.6: Case Study I, Northern Region*
Annual net revenue from agricultural land, USD per km^2.

Crops	Harvest yield	Price	Input factors	Land use	Revenues
	tonnes/km^2	USD/tonne	USD per km^2		USD
Irrigated wheat	150	252	10700	24 %	2276
Rainfed wheat	94	250	5500	33 %	2079
Barley	80	200	5000	19 %	732
Rice	186	500	8650	24 %	7085
Grazing (remaining part of time)					1349
Annual net revenue USD per km^2 agricultural land					13521
Cropping intensity		0.35			
Grazing time		0.65			

* The Northern Region consists of the provinces of Faryab, Jawzjan, Balkh, Samangan, Kunduz, Baghlan, Takhar, Badakhstan.

In each of the tables 6.6 to 6.13 the revenues for each type of crop (last column) is calculated in the following way: The harvest yield is multiplied by price and the cost of input factors is subtracted. The remaining net revenue is then multiplied with each crop's share (%) of land use and with the cropping intensity specific for each Case Study region.

Table 6.7: Case Study II, The provinces of Parwan, Kabul, Kapisa.
Annual net revenue from agricultural land, USD per km^2.

Crops	Harvest yield	Price	Input factors	Land use	Revenues
	Tonnes/km^2	USD/tonne	USD per km^2		USD
Irrigated wheat	189	252	10700	40 %	23634
Maize	88	170	7050	20 %	2531
Beans	175	670	8600	30 %	52152
Forage crops	350	34	4850	10 %	1128
Annual net revenue USD per km^2 agricultural land					79445
Cropping intensity		1.6			

Table 6.8: Case Study III, The provinces of Logar, Wardak.
Annual net revenue from agricultural land, USD per km^2.

Crops	Harvest yield	Price	Input factors	Land use	Revenues
	tonnes/km^2	USD/tonne	USD per km^2		USD
Irrigated wheat	189	250	10700	23 %	11601
Potato	2275	136	15950	18 %	72893
Fruits	1750	261	8750	18 %	102155
Forage crops	360	35	4850	35 %	3743
Rice	175	250	8650	6 %	2906
Annual net revenue USD per km^2 agricultural land					193298
Cropping intensity		1.38			

Table 6.9: Case Study IV, The provinces of Nangarhar, Laghman, Kunar.
Annual net revenue from agricultural land, USD per km^2.

Crops	Harvest yield	Price	Input factors	Land use	Revenues
	tonnes/km^2	USD/tonne	USD per km^2		USD
Irrigated wheat	189	255	10700	28 %	20157
Rice	350	450	8650	38 %	108601
Forage crops	380	38	4850	34 %	6260
Annual net revenue USD per km^2 agricultural land					135019
Cropping intensity		1.92			

Table 6.10: Case Study V, The provinces of Kandahar, Zabul, Oruzgan.
Annual net revenue from agricultural land, USD per km^2.

Crops	Harvest yield	Price	Input factors	Land use	Revenues
	tonnes/km^2	USD/tonne	USD per km^2		USD
Irrigated wheat	175	250	10700	10 %	4958
Pomegranates	2500	320	8750	30 %	356063
Apples	1050	335	8750	10 %	51450
Apricots	525	1 200	8750	10 %	93188
Potato	588	140	15950	10 %	9956
Forage crops	370	40	4850	30 %	4478
Annual net revenue USD per km^2 agricultural land					520091
Cropping intensity		1.5			

Table 6.11: Case Study VI, The provinces of Ghazni, Paktika, Paktia.
Annual net revenue from agricultural land, USD per km^2.

Crops	Harvest yield	Price	Input factors	Land use	Revenues
	tonnes/km^2	USD/tonne	USD per km^2		USD
Irrigated wheat	179	250	10700	73 %	19140
Potato	1050	140	15950	5 %	5045
Forage crops	3500	40	4850	22 %	22894
Grazing					296
Annual net revenue USD per km^2 agricultural land					47375
Cropping intensity		0.77			
Grazing time		0.23			

Table 6.12: Case Study VII, The provinces of Helmand.
Annual net revenue from agricultural land, USD per km^2.

Crops	Harvest yield	Price	Input factors	Land use	Revenues
	tonnes/km^2	USD/tonne	USD per km^2		USD
Irrigated wheat	210	245	10700	52 %	35175
Cotton	140	333	7650	14 %	9057
Maize	192	170	7050	17 %	7221
Alfalfa	390	34	4850	5 %	698
Other	181	249	12592	12 %	6450
Annual net revenue USD per km^2 agricultural land					58601
Cropping intensity		1.66			

Table 6.13: Case Study VIII, The province of Herat, Badghis, Farah, Nimroz.
Annual net revenue from agricultural land, USD per km^2.

Crops	Harvest yield	Price	Input factors	Land use	Revenues
	tonnes/km^2	USD/tonne	USD per km^2		USD
Irrigated wheat	189	235	10700	40 %	21578
Maize	160	145	7050	12 %	3101
Bean	155	520	8600	20 %	23040
Clover	350	38	4850	12 %	1622
Rainfed carabie	55	833	5250	16 %	10385
Annual net revenue USD per km^2 agricultural land					59725
Cropping intensity		1.6			

In some areas of Afghanistan poppy and cannabis form integral parts of the cropping pattern, and play an essential role in the economy. Case Studies IV, V and VII comprise districts that are poppy-growing areas, whereas cannabis is grown in Case Study VI areas.

Incomes from illicit crops are not included in this study. Before clearance the landowner will have to give a solemn promise not to cultivate any illicit crop on the cleared land and sign a contract to that effect.

Poppy production gives most farmers a substantially higher revenue than alternative crops. In the year 2000-season the farm-gate price for fresh opium was about USD 50 per kg. The annual net revenue from cultivation of one km^2 with poppy would then be between USD 357,000 to USD 425,000. Revenues from other crops in Case Study IV and VII areas could certainly not compete with that.

A time horizon of 15 years has been selected for the benefits from reclaimed agricultural land after mine clearance. This is a reasonable length of time taking into account the fact that uncertainty will increase over time as to prices, crop patterns etc. Discounted at 10% over the whole period, the benefits gained during the early years will carry a large weight in the total value, while the benefits collected after 15 years will have relatively little importance.

Table 6.14: Agricultural land, net output value in USD 1000 of production from one km^2 annually and discounted over 15 years at 10% discount rate.

	Annual Value USD 1000	Total Value USD 1000 over 15 years
Case Study I	14	103
Case Study II	79	604
Case Study III	193	1 470
Case Study IV	135	1 027
Case Study V	520	3 956
Case Study VI	47	360
Case Study VII	59	446
Case Study VIII	60	454

The net annual value of agricultural production shows wide variations, from USD 14,000 annually in the Northern Region (Case Study I) to over USD 500,000 in the provinces of Kandahar, Zabul, Oruzgan (Case Study V). The Total Value in table 6.14 comprising annual values discounted over 15 years, will constitute one of the benefit components to be compared with the cost of clearing one km^2 of agricultural land.

7. Irrigation systems blocked by mines

7.1 The role of irrigation in Afghanistan

The origin of irrigated agriculture in Afghanistan dates back more than 4,500 years, and today irrigation systems in Afghanistan still remain vital for agricultural production. Between 85% and 90% of all crops are grown under irrigation. The different irrigation systems comprise sources and techniques like streams, canals, springs, karezes and arhats (Persian wheels), depending on availability and farm location. Irrigation systems can be divided into two main categories: traditional and modern systems, each one sub-divided into 3-5 sub-categories.

Traditional Irrigation Systems:

Arhat: Ground water is lifted from shallow wells with the help of a Persian wheel (Arhat), supplying irrigation water for the fields of an individual farmer. The size of the area irrigated by a single arhat does not exceed 0.03 km^2.

Karez (Qanat): This system is used in steep areas. Underground water is brought into free flow through tunnels from alluvial aquifers. Karezes are dug by local craftsmen as shafts at close intervals, they are usually narrow but may be many km in length. Discharge varies between 10 to 500 litres per second. The irrigated land ranges from 1 to 2 km^2. Karez water can also be used for drinking water.

Small-scale water systems are supplied by stream flow diverted with the help of temporary brush weirs. Often situated in remote valleys along a stream or river, they vary in size, irrigating up to 1 km^2. The villagers themselves are responsible for arrangements and maintenance.

Medium-scale surface water systems are supplied by river flow diverted with the help of brush weirs, and can irrigate the agricultural land of several villages. Size can be from 1 to 20 km^2. They are operated by villagers in a similar way as small-scale and large scale irrigation systems.

Large-scale surface water systems are supplied by river flow diverted with the help of temporary brush weirs. Extending over areas up to 2000 km^2, they are located on flat plains and along the main valleys. Their operation and maintenance are highly structured and involve several communities, sometimes of different ethnic origins. Each village has at least one water master (Miraab), delegating his authority to sub water masters responsible for allocation of water to the different plots of the scheme.

Modern Irrigation Systems include:

- Modern (formal) surface water systems without storage;
- Modern (formal) surface water systems with storage;
- Modern (formal) ground water systems.

Cropping intensity varies widely from system to system according to the scarcity of water versus land. It reaches 2 in the upper part of the irrigation schemes while in the lower parts up to 2/3 of the command area is kept fallow each year on rotational basis.

Table 7.1: Irrigated land in Afghanistan by type of irrigation source

Type of irrigation source	Streams and canals	Springs	Kareze	Arhat (Persian wheel)
Number	7822	5558	6741	8595
Area cultivated in km^2.	20180	1870	1670	120

Source: Afghan Agriculture in Figures, 1978

Today more than two thirds of Afghanistan's irrigation schemes are not operating satisfactorily. It is estimated that 10% of all irrigation system in Afghanistan were directly affected by war. In addition come the indirect effects of neglect and abandonment. One principal reason for irrigation systems falling into disuse is the blocking by landmines, during the Soviet occupation as well as after the take over of power by the Islamic Parties in 1992.

7.2 Economic benefits from de -mining irrigation systems

An area of 8 km^2 of irrigation systems has been de-mined under the mine action programme by the year 2000. According to MAPA assessments[17] there is a remaining 3.8 km^2 of high priority irrigation systems still to be cleared. Another 0.6 km^2 of mine infested irrigation systems have been identified and assigned lower priority.

Table 7.2: Mines in irrigation systems, km^2.

Year	*1990-2000*	*1999*	*1998*	*1997*	*1996*	*1995*	*1994*
Cleared land km^2.	8.0	1.2	0.4	0.7	0.5	0.7	1.3
Remaining by 2000							
– high priority	3.8						
– other area	0.6						

The data used for analysis of mine clearance in agricultural areas in chapter 6 will also be applied for irrigation systems. The benefits to agriculture from clearance of irrigation systems, will consist of potentials for improved use of the areas irrigated by the system. These areas are usually much larger than the actual extent of the irrigation system itself. There is not necessarily a connection between the size of the mined irrigation system and the land irrigated, and regional variations in this ratio may at least be expected. From the MIS Socio-economic Database incidences of both very high (average 25 times), and smaller ratios are found.

For the purpose of cost-benefit analysis it will be important to trace the difference in economic output from the land after the irrigation system has been cleared of mines as compared to a situation without clearance. Parts of the agricultural land may also be mined, when a district is mined, different types of areas will normally be contaminated.

[17] Source: MAPA Annual Workplan for Year 2000.

In that case all benefits from increased agricultural production cannot be imputed to the cleared irrigation system alone, it must be shared with clearance of agricultural land.

In cases where the land served by the irrigation system is not mined, there may also be potentials for use, even though output from crops will be much lower than with irrigation water available. Use as grazing areas for animals should at least be possible.

Some water may still pass through the irrigation canals, even though parts of them cannot be maintained because of mine contamination. The farmers may also have alternative sources for irrigation water, and diversion canals may have been made etc.

The actual benefits from clearance of an irrigation system may thus not always be the full production from the agricultural land it is serving. For practical reasons a ratio will be maintained between the size of the mined irrigation system and the benefit area. For the above-mentioned reasons this ratio will, however, be set at a lower level than generally found in the MIS Socio-economic Database. There could still be reasons for looking further into this matter, through literature studies and fieldwork in Afghanistan.

Table 7.3: Benefits from de-mining irrigation systems, USD 1000 per km^2 cleared irrigation system, annually and discounted over 15 years.

	Annual value	Total value discounted over 15 years
Case Study I	34	262
Case Study II	237	1801
Case Study III	578	4399
Case Study IV	404	3069
Case Study V	1558	11853
Case Study VI	141	1071
Case Study VII	174	1324
Case Study VIII	177	1348

The estimated total benefits from de-mining irrigation systems are shown in table 7.3. Basic data for these calculations are the benefits from agricultural production in table 6.14. It is assumed that the irrigated area benefiting from clearance is 3 times larger than the actual size of the mined irrigation system. The main reason for this low ratio is that in cases of mined irrigation systems agricultural areas in the same district will also normally be mined, implying that benefits will have to be shared. In Case Study I the agricultural benefits have been reduced by 10%, indicating that not all areas in that region are dependent on irrigation. Benefits from alternative use of the areas for grazing animals have been deducted (source of data is table 8.6).

The benefits from clearing irrigation areas are substantial, with as much as USD 1.5 million per year in the provinces of Case Study V. Total value discounted over 15 years is large in most cases, and can justify considerable clearance costs.

8. Mine infested grazing areas and damage to livestock

8.1 The livestock sector and its contribution to the Afghan economy

Livestock products contributed 16% to Afghanistan's GNP before 1978, and constituted about 14% of the exports, while an additional 9% of the exports came from livestock related products, mainly carpets and rugs handicrafts. During the war a large part of livestock was destroyed together with other farm assets. Animals in significant numbers also moved with refugees out of Afghanistan.

Livestock population started increasing with the return of Afghan farmers from Pakistan and Iran in the early 1990ies. Currently it is estimated that the number of cattle, horses and camels have attained pre-war levels, while sheep and goats have increased considerably. A World Bank study [18] estimates the livestock sector's contribution to the gross domestic product in Afghanistan at USD 508 million for 1998-99. An increasing trend is reported for the sector's annual growth rates from 1995-96 onwards, varying between 2 and 4%.

Table 8.1: Livestock rearing in Afghanistan, estimates for 1998-99, numbers in 1000.[19]

	in 1000
Cattle	3919
Sheep	24051
Goats	9758
Horses	389
Donkeys	1081
Camels	294

Table 8.1 is based on Food and Agricultural Organisation (FAO) figures from 1995-96, assuming that the number of cattle increased at a rate of 2% annually, and sheep and goats at 3% in the years following.

Livestock production is mainly based on grazing in Afghanistan, and 84% of the country can be classified as pastures or rangeland (table 6.1), where the output in many parts of the country is seriously limited during the winter season. Livestock in the country seem to make maximum use of the existing rangelands as well as crop by-products.[20] In the mountains and at high elevations indoor feeding is almost always practised for all categories of livestock during winter. In northern Afghanistan this is the practice for cattle, while in the southern and eastern parts of the country livestock can be kept outdoors all year round because of relatively warm climatic conditions.

About 40% of the areas are suitable for grazing during winter. In the higher elevations and mountains with low temperatures and long snow cover, indoor feeding is practised during winter for all livestock, and in the uplands and northern Afghanistan for large ruminants only. During the food scarcity periods supplementary feeding is practised all

[18] Source: Role and size of livestock sector in Afghanistan, World Bank 2000.
[19] Source: Role and size of livestock sector in Afghanistan, World Bank 2000.
[20] FAO 1997: Afghanistan Agricultural Strategy, Livestock Production.

over the country in the form of concentrates, hay and other by-products. Some animal food is imported on the initiative of FAO.

Even the smallest and poorest farmer keeps at least one cow. The common pattern all over the country is to have more than one cow. Dry cows, young stock and males are usually sent to the hills during the summer. The community manages the cattle during this period.

Sheep and goats are generally kept together and mainly graze outdoors for the greater part of the year. Sheep and goat flocks migrate from the lowlands to the highlands during summer. During winter and under severe weather conditions sheep and goats are provided shelter and offered supplementary food, hay, straw and tree leaves, but are also occasionally fed on purchased concentrates. In Afghanistan nomads rear sheep and goats in large numbers.

The major products from cattle, goats and sheep are food items, such as beef, mutton, milk and other dairy products like cream, butter, curd, yoghurt, ghee and cheese, but also draught power, wool, hair, pelts and hides. Production of Karakul pelts is estimated to have declined by 50% due to the non-existence of dealers, and despite restoration of the number of Karakul sheep.

Table 8.2: Prices of livestock products (1999)[21] and sector output (1995-96).[22]

	USD/kg	*Production*	*unit*
Cow milk	0.21	680	1000 tonnes
Sheep and goat milk		620	—
Beef	0.93	43	—
Mutton	1.28	104	—
Wool		33	—
Hair		4	—
Cashmere		250	tonnes
Karakul pelts		450	1000
Skins		450	—
Hides		6500	—

Livestock productivity in the country is relatively low. In volume the production of goat and sheep milk is almost on a level with cattle milk. Mutton constitutes a significant part of the total meat production in Afghanistan. There is an exportation of cattle, sheep and goats to Pakistan. All cashmere wool produced in the country is exported, and about 80% of the karakul pelts fetch good prices at markets in Europe.

Afghanistan can be divided into a number of agro-ecological zones (see chapter 6), each with its variety of agricultural production and also with distinctive patterns in livestock rearing, number and types of cattle per household, utilisation of grazing areas etc. The grazing season and the resulting need for supplementary fodder can vary widely, with the

[21] Role and size of livestock sector in Afghanistan, World Bank 2000, page 10.
[22] FAO Livestock Office, Islamabad.

length of cold winter season and of dry periods. The zones form the basis for the 8 case studies in connection with agriculture and livestock rearing in this report.

8.2 Economic benefits from de-mining grazing areas

An area of 67.8 km^2 of grazing areas has been cleared under the mine action programme by year 2000. According to MAPA assessments[23] there remain 136.6 km^2 of high priority grazing areas to be cleared. By the end of 1999 another 344.5 km^2 of mine infested grazing areas are identified, which have been assigned lower priority.

Table 8.3: Mine infested grazing areas, km^2.

year	*1990-2000*	*1999*	*1998*	*1997*	*1996*	*1995*	*1994*
Cleared grazing areas	67.8	10.1	10.3	13.2	7.1	9.3	7.3
Remaining year 2000							
– high priority area	136.6						
– other grazing area	344.5						

The World Bank has undertaken an attempt to calculate the livestock sector's contribution to the gross domestic product (GDP) in Afghanistan.[24] The basic data for the calculation is the number of livestock as presented in this report's table 8.1.

The sector's product is composed of the value of its commodity outputs and of animal draught power. Price information for livestock products was fetched from major markets, and in order to estimate farm gate prices, current market prices were reduced by 10%.

The value of draught power was estimated on the basis of the number of work animals, average days of work and their feed and maintenance cost. In the end it was assumed that the value of draught power and other products constitute 15% of the value of the livestock main products, meat, milk, skin and hides. The number of work animals used in crop cultivation and for draught purposes was estimated at 14% of the cattle population.

For the calculations in the present report, the value of draught power has been set at 9/10 and other by-products (bones, blood, fat, dung etc.) at 1/10 of the above mentioned 15%. The output of hides has been distributed on the basis of number of animals, taking into account that an individual draught animal, horse, donkey, camel, normally will be kept much longer than cattle (5:1).

In the World Bank analysis of the livestock sector's contribution to GDP the value of input factors has been deducted. Input factors to the livestock sector included green and dry fodder, concentrates, grazing from pastures and rangelands, medicines and vaccines. It was assumed that this amounts to 15% of the total value of the livestock products.

The present analysis will have a somewhat different focus, that is an assessment of the contribution from grazing areas (pastures and rangelands) to the output from the livestock sector. First it will be assumed that those areas classified as potential grazing areas in the MAPA database, generally have no alternative productive use than for grazing animals.

[23] Source: MAPA Annual Workplan for Year 2000.
[24] Role and size of livestock sector in Afghanistan, World Bank 2000.

Animals can be sent there for grazing or fodder can be collected for feeding animals indoor during winter or in the dry season.

Fodder can also be collected elsewhere, on agricultural land or bought. The value of all such kinds of input, not coming from the grazing areas in question, should be deducted, but not for that period of the year when livestock can make use of grazing areas.

Medicines and vaccines for animals are seldom used to any degree in poor countries. Some NGOs have distributed livestock medicines for free in Afghanistan. In any case it is a fact that diseases occur most frequently when animals are fed indoors and are obliged to live off a low quality or unvarying diet, and not when they can roam freely outdoors and search a wider selection of plants.

In the present analysis the 15% input cost will therefore not be deducted from the gross value added of the livestock sector. The grazing areas' contribution to the output from the livestock sector will instead vary proportionally with the period of the year animals can be expected to find fodder on the mountainous or barren areas that are classified as grazing areas in the MAPA minefield database.

Table 8.4: Net output value per animal per year, USD

	USD
Cattle	51
Sheep and goats	9
Horses	31
Donkeys	31
Camels	31

On basis of the above assumptions table 8.4 emerges with estimates for net output value in USD per animal per year. For cattle the output value consists of the value of cow milk, cattle meat, part of hides, part of draught power, and part of other products. For sheep and goats the value of their meat, milk, wool, skin, hair, pelts and part of other products are aggregated. Horses, donkeys and camels gain their output value from draught power, hides and a proportional share of other products.

The level of productivity of the Afghan pastures varies significantly between areas and from one year to another. FAO estimates the average production on the country's pastures and rangelands (in total 547,000 km^2) at 70 tonnes of fodder (as dry matter) per km^2 per year, in addition a 50% degree of utilisation by livestock is assumed.[25] Given that the grazing areas cleared of mines under MAPA all are classified as high priority areas, it could be reasonable to assume that they must yield at least 50% more than the average. The degree of utilisation could also be larger than the average, as they are supposedly located close to settlements. With 80% degree of utilisation we end up with a yield of 84 tonnes fodder (in dry matter) per km^2 of grazing area a year.

[25] FAO 1997: Afghanistan Agricultural Strategy, Livestock Production, page 19.

The number of livestock that can be sustained on this amount of fodder depends on the composition of the flock and the consumption of each type of animal. On basis of FAO information a cow consumes annually 2.6 tonnes of fodder (in dry material) a sheep or goat 0.3 tonnes and horses, whilst we have assumed donkeys and camels as equal to the average livestock unit of 3.1 tonne.

The Case Studies will comprise 8 typologies for livestock rearing in Afghanistan. All regions that are of interest in connection with mine clearance are covered. Livestock rearing practices vary considerably between some of these typologies.

Table 8.5: Livestock practices, number of cattle per household in different parts of Afghanistan.

Case Study	Provinces, regions	Cattle	Sheep and goats	Horses, donkeys, camels
I	Northern Region all provinces*	7	230	6
II	Parwan, Kabul, Kapisa, Bamyan	4	3	1
III	Logar, Wardak,	3	3	1
IV	Nangarhar, Laghman, Kunar	3	2	1
V	Kandahar, Zabul, Oruzgan	1	3	0
VI	Ghazni, Paktika, Paktia	3	3	3
VII	Helmand	4	12	1
VIII	Herat, Badghis, Farah, Nimroz	3	25	1
Fodder consumption, tonnes per livestock/year		2.6	0.3	3.1

* The Northern Region consists of the provinces of Faryab, Jawzjan, Balkh, Samangan, Kunduz, Baghlan, Takhar, Badakhstan.

The size of the livestock flock that can be sustained on the annual production of one km^2 of grazing area is then calculated, taking into account these regional variations. Actually the flock in Case Study I will have to move to new areas after about 9 months, whilst in other cases more livestock could be sustained for a whole year on the annual production from one km^2 of grazing areas than the flocks specified in table 8.5. The flocks are then adjusted so as to consume a year's production from one km^2 exactly, while retaining the composition on livestock typical for the region covered by each Case Study.

The resulting flock size is finally multiplied by the net output value per animal per year from table 8.4, so as to find the net annual output value from livestock rearing on one km^2 of grazing area. Regional variations will appear on the basis of the patterns of livestock rearing introduced in Case Studies I-VIII.

Table 8.6: Net annual output value and total, 15 years discounted value from livestock rearing on one km^2 of grazing area USD.

Case Study	Regions, provinces	Annual	Total 15 years
I	Northern Region all provinces*	2076	15791
II	Parwan, Kabul, Kapisa, Bamyan	1556	11834
III	Logar, Wardak	1500	11411
IV	Nangarhar, Laghman, Kunar	1500	11411
V	Kandahar, Zabul, Oruzgan	1905	14487
VI	Ghazni, Paktika, Paktia	1287	9788
VII	Helmand	1707	12986
VIII	Heart, Badghis, Farah, Nimroz	1932	14692

*The Northern Region consists of the provinces of Faryab, Jawzjan, Balkh, Samangan, Kunduz, Baghlan, Takhar, Badakhstan

The net output from a flock of livestock, typical for the Northern Region (Case Study I in table 8.6), consuming exactly the annual production from one km^2 of grazing area will thus amount to USD 2076. This will constitute parts of the benefits when one km^2 of grazing area in the same province is cleared of mines and UXO. Benefits of an equal amount are assumed to be gained from that particular cleared area in future years too. A period of 15 years has been considered, and benefits are discounted at 10% annually over that time, to make up the total benefits.

Net annual output value from livestock rearing on one km^2 of grazing area varies roughly between USD 1200 and USD 2000, that is to say much more modest values than were encountered in the agricultural sector.

For the Northern Region e.g. the total future discounted benefits from livestock rearing on one km^2 of grazing area will thus amount to over USD 15,000, which, together with other benefits from clearance of grazing areas can be compared against the prevailing costs of mine clearance.

A large proportion of the Afghan people lives as refugees abroad or as internally displaced persons. It is assumed that the areas cleared of mines will to a large degree provide a means of living for people who otherwise are sustained on aid from the international community or from work in other countries. It can thus be assumed that the labour power input to the cattle-rearing sector will have little alternative value.

8.3 Livestock killed by mines

A considerable number of livestock is lost in mine accidents. The Socio-economic Study (SEIS) found that a total of 242,100 animals were lost in its study areas, which correspond to the areas cleared of mines by MAPA in the period 1990 to the end of 1998, 166 km^2. SEIS additionally assumed that its study areas had remained active minefields and uncultivated for an average period of 10 years.

Table 8.7: Livestock reported killed by mines during a 10 years period.[26]

	SEIS Total
Cattle	83,500
Sheep, goats	155,400
Horses, donkeys, camels	3,200
Livestock killed by mines	242,100

A large number of mines must have been detonated in accidents killing livestock, even though more than one animal could have been killed in each explosion. Comparison can be made with the actual number of mines found during MAPA mine clearance operations, 210,000 on about 200 km^2 of minefields from 1990 until the end of 1999.

From this it could be concluded that about half of the mines are "cleared" by animals blowing them up. Some exaggeration or double counting is suspected; there is also the possibility that reports to the SEIS study of killed livestock cover significantly larger areas than the 166 km^2 designed as the SEIS study area. The extent of those areas is unknown, but could include all mined areas in the districts the SEIS covers. Few other sources are available for estimates of animals killed in mine accidents.

It can be assumed that few livestock accidents occur within mined residential areas and irrigation systems. The number of accidents where animals are killed will therefore be related to mined agricultural areas, grazing areas and roads. It has been assumed that the mined areas causing accidents where animals are killed are roughly 5 times larger than the SEIS study areas, also including low priority areas in the district. This gives an accident rate of 36 killed animals annually per km^2 mined area.

Table 8.8: Risk of livestock loss annually per km^2 of mined land.

	Animals killed	Cattle	Sheep, goats	Horses, donkeys, camels
Agricultural land	36	12	23	0.5
Roads	36	12	23	0.5
Grazing areas	36	12	23	0.5
Value USD per animal		200	40	220

The proportion of types of livestock killed on each type of land is assumed to be the same as for all livestock killed. We have no information about different risks of having livestock killed per km^2 of mined agricultural land, compared with one km^2 of roads or grazing area. Regional variations, for example on the basis of patterns of livestock holding from the Case Studies, have not been introduced at this stage. The source for

[26] Source: MCPA 1999 Socio-Economic Impact Study of Landmines and Mine Action Operations in Afghanistan, page 17.

livestock sales prices is the SEIS study.[27] It should be possible to retain meat value from wounded livestock in some cases, 30% of the economic loss is thus subtracted.

When a minefield remains active and uncleared, animals will continue to be killed there over the years. A period of 15 years is taken into account, and the economic loss discounted at a rate of 10%. Still, it would be logical that the accident risk is reduced over the years, as a larger share of the mines are blown up. It is therefore assumed that the accident risk decreases by 5% annually over the period.

Table 8.9: Economic loss of livestock per km^2 of mined areas, USD annual loss and total loss discounted over 15 years at 10% discount rate.

	Annual	*Total**
Agricultural land	2441	14467
Roads	2441	14467
Grazing areas	2441	14467

* An annual 5% reduction in accident rate over the 15 years is assumed.

The annual and total economic values from loss of livestock constitute the benefit components to be compared with the cost of mine clearance.

9. Roads and transportation systems blocked by mines

9.1 The transportation system in Afghanistan

Roads constitute the backbone of the transportation network in landlocked Afghanistan. The total length of all roads in the country was estimated at about 17,000 km in 1978, of which 2,700 km were paved roads. No railways penetrate into the country, although lines have been built all the way to the border at several locations in Pakistan, Turkmenistan and Uzbekistan.

Table 9.1: Road system in Afghanistan 1978.

	km
Paved roads	2,700
Gravel roads	4,300
Tracks and dirt roads	10,000
Total	17,000

[27] Source: MCPA 1999 Socio-Economic Impact Study of Landmines and Mine Action Operations in Afghanistan, page 17.

The principal agricultural areas and major population centres are linked by roads which circumvent the Hindu Kush mountains in the centre, connecting Kabul in the east with Baghlan and Mazar-i-Sharif in the north, Kandahar in the south and Herat in the west. Distribution of food from surplus to deficit areas has always been an important transport task. Deterioration of the road network from war activities, general lack of maintenance and principal roads closed by mines have in periods contributed to rapidly increasing food prices.

9.2 Economic benefits from clearing roads of mines

In the MAPA databases mine infested road areas have been registered in terms of km^2, to correspond with other mined areas. It is assumed that road areas infested with mines are 20 m wide on the average. The 27.9 km^2 cleared road area will thus correspond to 1395 km of road length.

Table 9.2: Roads blocked by mines.

year	*1990-2000*	*1999*	*1998*	*1997*	*1996*	*1995*	*1994*
Cleared km^2.	27.9	2.1	5.3	4.1	3.2	2.4	2.5
Cleared roads km	1,395	105	265	205	160	120	125
Remaining by 2000							
– high priority km	1,605						
– other roads km	391						

MAPA estimates[28] indicate that a total length of 1605 km of high priority roads remain to be cleared. Another 391 km of mined roads have been identified and given lower priority.

Some basic data are available from the MAPA socio-economic database on road transport in Afghanistan. In the survey connected to the SEIS study, data were collected from a number of 524 cleared high priority minefields, classified as roads. At the time of survey these roads were all cleared and in use. The data are the best available, but some deficiencies are apparent. Many entries with value "0" for example are suspected to be "no reply" rather than the value 0 and can distort calculation of averages.

On the assumption that traffic could make use of other routes or diversions before clearance, the question of saved kilometres of road, saved travel time and saved travel cost was raised in the survey. In table 9.3 this information has been used to calculate some key indicators for road transport:

- Saved road transport distance in km per km of road cleared of mines (Saved km/km road).
- Vehicle speed in km per hour (Km/hour).
- Passengers transported per vehicle (Pass/vehicle).
- Passenger travel cost in US cents per km road (Travel cost USc/km).

[28] Source: MAPA Survey Database.

Information was also collected on traffic and on vehicles per day on the road. Each vehicle will here be considered as a small business, where the passenger fares (passenger travel costs) cover all operational and capital costs.

Table 9.3: Road Transport in Afghanistan*

	Province	Roads no	Roads km	Saved km	Saved km/ km road	Vehicles/ day	Km/hour	Pass/ vehicle	Travel cost USc/km
Case Study IX	Kandahar, Laghman, Kabul	141	946	434	0.5	622	15	2.6	2.9
Case Study X	Other provinces	383	841	1480	1.8	32	11	8.2	3.9
	Total/average	524	1786	1914	1.1	191	12	3.3	3.7

Source: MAPA Socio-economic Database.

Data for the 524 former minefields can be aggregated on a province basis, and a further aggregation of provinces into 2 Case Studies has been made on the basis of variations in traffic volume. Case Study IX comprises three provinces within or around the largest towns in Afghanistan, the capital Kabul and Kandahar. Road traffic is heavy here, with over 600 vehicles per day, saved km of road per km cleared is, however, less than the average. Traffic can move somewhat faster with 15 km per hour due to better roads presumably. There are comparatively few passengers in each vehicle and travel cost is less than the average, which indicates a larger share of short distance journeys.

Case Study X, comprising all other provinces shows the opposite characteristics, in particular with little traffic on the roads, an average of only 32 vehicles per day. Much road transport distance is saved per km cleared, and each vehicle carries many passengers. These are characteristics of road transport that distinguish Case Study X as comprising rural areas from the more urban areas of Case Study IX.

The information in table 9.3 has been collected after the areas have been cleared of mines. In order to calculate the benefits for road traffic from mine clearance, some more information is needed about the before situation, in particular of the road traffic in a situation when a longer and more time-demanding and costly distance had to be travelled. It will be assumed that road transport demand in Afghanistan is relatively inelastic, with an elasticity of 0.5. A 10% travel cost decrease will then cause an increase in road traffic of 5% only. This may be the situation when traffic to a large degree consists of work and necessity journeys and little tourism and leisure.

The analysed length of road will be 50 km, corresponding to 1 km^2 of mined land when the road is 20 m wide. The purpose is to have all costs calculated per 1 km^2 minefield.

It will have to be assumed that the road distance travelled after clearance consists of the cleared road only, which may be wrong. Other stretches of not previously mined roads could be included, but we have no information about this. Additionally the information on saved road lengths in the database may contain inaccuracies. The material actually consists of many entries with 0 km saved and a smaller number of entries with large savings.

Employed persons are assumed to earn 1 USD a day, which constitutes the basis for valuing their travel time. Unemployed and non-active persons may also value prolonged travel time negatively, here quarter of the cost for an employed person will be adopted as an estimate. Unemployment is assumed to be 50% of persons in the active age group 20-65 years. This age group constitutes 44% of the total population.

By applying these assumptions it is found that travel costs on previously mined roads have decreased by 30% in the mainly urban areas included in Case Study IX, and by 60% in the areas of Case Study X. This should have caused an increase in road traffic by 15% and 30% respectively, with the assumed elasticity of 0.5.

Traffic after clearance is set at 450 and 25 vehicles per day. Some of the counted traffic may be strictly local and very short distance, for which the cleared road link does not necessarily play an important part.

Table 9.4: Travel cost per passenger and traffics on links of road, before and after mine clearance.

	Case Study IX	*Case Study X*
Travel cost decrease %	30 %	60 %
Elasticity	0.5	0.5
Traffic increase	15 %	30 %
Traffic before clearance, vehicles per day	383	21
Traffic after clearance vehicles per day	450	25

The benefits from clearing mined roads are calculated as cost savings for passengers now travelling with vehicles on the safe road link as compared to the longer alternative route, which had to be used before clearance. The savings will comprise reduced direct travel costs or fares paid by passengers, which are assumed to fully cover the vehicle operation costs. In addition the reduction in passengers travel time has been evaluated, as explained above.

The passengers and vehicles that used to traffic the longer alternative road link before clearance will draw full benefits from time and cost savings. Additionally some new traffic will be generated, as a direct consequence of the drop in travel cost and time on the reopening of the shorter road link. The benefits for this new traffic can be calculated as half the amount of savings in travel cost and time.

The basis for this method is that all new travellers in theory could be ranked by their willingness-to-pay for trips they undertake. It would then be found that some of the new travellers were barely willing to pay even the new, reduced costs or take on the reduced travel time, while others would almost be willing to pay the cost and spend the travel time necessary for the longer journey before clearance. A good estimate of willingness to pay for all the new travellers together would then presumably be the average, or half way between the new and the previous costs. Their willingness to pay minus what they actually have to pay for the journey then constitutes the benefits for these new travellers. Benefits for new traffic thus amounts to the number of new travellers multiplied by half the value of time and cost savings.

Table 9.5: Benefits from clearance of mined roads, 1000 USD annually and discounted at 10% rate over 15 years (for 50 km roads=1 km^2).

	Case Study IX	Case Study X
Existing traffic, savings USD/year		
- Travel cost - Travel time valued	237 29	215 25
New traffic, savings USD/year		
- Travel cost	21	19
- Travel time valued	3	2
Annual benefits all passengers USD 1000	290	261
Total benefits over 15 years, USD 1000	2 207	1 983

The benefits from clearance of mined roads are considerable, over USD 250,000 per year both for urban areas (Case Study IX) and more rural regions (Case Study X). Different characteristics between the two case studies are blurred out, so that savings appear to be of much the same order. Less traffic on rural roads is compensated by larger road transport distance saved per km cleared, and more passengers carried by each vehicle in Case Study X as compared to more urban areas in Case Study IX.

The annual benefits and the total benefits discounted over 15 years from table 9.5 form components to be compared with the costs of mine clearance in road areas in the further analysis.

10. Mines in Residential Areas

10.1 The housing sector in Afghanistan

It has been estimated that access to 87,500 houses has been blocked by landmines, constituting one of the major obstacles to the return of refugees and internally displaced persons to their villages. A rapid assessment in 6 districts of Afghanistan in October 2000 showed that close to 40% of all houses had been destroyed by war activities, and only some 30% remained undamaged.

A traditional Afghan homestead, the quala is used for residential purposes and for storing of agricultural products. Parts of it can also be used for keeping animals. The size of a quala is on average about 500 m^2.

10.2 Economic benefits from clearing residential areas of mines

Table 10.1: Residential areas blocked by mines.

year	*1990-2000*	*1999*	*1998*	*1997*	*1996*	*1995*	*1994*
Cleared land km^2.	27.7	3.1	3.4	2.8	2.7	4.9	2.9
Houses cleared	55400	6200	6800	5600	5400	98000	5800

Remaining by 2000	
– high priority	27400
– other houses	250

Estimating the average area of an Afghan family homestead (a Quala) at 500 m^2, means that access to about 55,400 houses has been cleared of mines in the period from 1990 to 2000. According to MAPA assessments[29] 27400 high priority housing areas still remain to be cleared. By the year 2000 another 250 mined residences have been identified and given lower priority.

The houses cleared of mines under MAPA include private homes as well as public buildings such as schools, health clinics, hospitals, government and administration offices.

Information on property prices was collected from different locations in Afghanistan on fieldwork in October 2000. The material is not extensive, but shows some variation in patterns, which could be expected. Kabul comes out as the most expensive area, with other eastern provinces somewhat below. Logar, which is a rural area to the south of Kabul has the lowest property prices.

It was found during the fieldwork that a number of cleared housing areas were only partially in use or had not been reclaimed at all. The explanation given was often that the owner could not afford to meet the cost of reconstruction. In some cases the owner still lived as refugee abroad. These observations indicate a need for more comprehensive information collection before priority is given to clearance of residential areas, as clearance techniques applied here tend to be expensive (see chapter 11). More information on prices and rent of property is also needed. A presumably conservative estimate of benefits from clearance of residential areas will be applied in the meantime.

This limited material provides the basis for two case studies on property values. Case Study XI includes provinces with the major towns of Afghanistan, where property values are assumed to be high, while Case Study XII comprises the remaining provinces of the country.

Table 10.2: Property land values in Afghanistan, USD per m^2 or USD million per km^2.

	Province	*USD/m^2*
Case Study XI	Kabul, Kandahar	5
Case Study XII	Provinces except XI	2

The information in table 10.2 is assumed to reflect values of land, which has been declared as high priority residential areas for mine clearance by MAPA.

[29] Source: MAPA Survey Database.

11 Clearance Operations and Costs

11.1 Programme Financing and Cost Information

The Mine Action Programme for Afghanistan (MAPA) is financed from two main sources. The main stream of funding from donors is channelled through the UNOCHA Afghan Emergency Trust Fund (AETF), which then distributes the funds by activities and to different NGOs. A smaller, but still considerable part of the funds is passed from donors directly to individual NGOs. Donors can then avoid paying the fixed 13% charge designed to finance UNOCHA overhead costs.

As regards some of the NGOs the size of the funds passed on directly is still only partially known to MAPA. It is, however, possible to single out the clearance tasks undertaken on UNOCHA/AETF funds. For 1999 this appears to be 85% of the total mined areas cleared under MAPA and 54% of the former battlefield areas.

Some contribution, both through and outside AETF, is made by donors in kind, equipment, technical assistance, training etc. The real value to the programme of these contributions can be difficult to assess. Most of them are purchased in high-cost countries at elevated prices, while MAPA in an untied situation could probably have found more economical options.

The information on MAPA funding as it appears in its Annual Reports will thus have to be corrected in order to estimate the real costs of the programme. For this study information about other financing has been gathered mainly through information supplied to MACA by the NGOs. Still it is clear that some elements are lacking for the cost of the mine clearance programme in Afghanistan.

For the NGOs engaged in mine clearance it can be stated, however, which parts of their activities are financed through AETF. On that basis a split of activities has been made in order to correct the estimates of unit costs, like cost per clearance team hour and cost per km^2 cleared.

A number of factors are considered important for the cost of mine clearance. The following information can be obtained from the MAPA Minefield Database:

- Size of area to be cleared.
- Minefield or former battlefields.
- Types of mined area: agricultural, residential, road, irrigation system, grazing land (former battlefields are not classified on types of area).
- Surface of soil in area.
- Clearing techniques applied: manual teams, mine dog teams, mechanical teams (currently backhoe), community based clearance.
- Number of mines and UXO detected (known only after clearance is completed).

Minefields and former battlefields are cleared by teams using various techniques. Actually the mechanical option consist of backhoes, but other machines have been applied previously and new ones are about to be tried. Each technique implies different composition of the clearance team in terms of manpower and equipment. One of the NGOs, AREA is engaged in community based clearance as a pilot project.

Cost data for the year 1999, the latest available, have been applied for this study. The main source of information is the MAPA Annual Report, which presents information both on funding through AETF and distribution of funds by agency (NGO) and activity. Corresponding information is also presented in the Annual Report for 1998, while earlier annual reports from MAPA contain less detailed information on costs of programme. For detailed cost information about earlier years, MACA archives and the individual NGOs will have to be consulted.

Statistics on areas cleared in km^2 for types of area are also presented in the Annual Report, the source of these data being the MAPA Minefields Database. Information on clearance team hours has been found most useful for the unit cost calculations. The NGOs register the number of hours spent by each of their teams (manual, mechanical, dogs) on individual clearance tasks. This information is entered into the MAPA Minefields Database. For the most recent years the data sets are complete, while not all NGOs supplied satisfactory data for earlier years.

11.2 Productivity of operations

Information on area in m^2 and clearance time in team hours for each individual minefield and battlefield is available in the MAPA Minefield Database. The area in m^2 cleared per team hour could be a first approach to measure clearance productivity. For the year 2000 the months from January to July are included.

Table 11.1: Clearance productivity in m^2 cleared per team hour.

All areas and techniques	1993-2000	1999	1998	1997	1996	1995	1994
Minefield m^2/team hour	314	267	299	297	337	413	464
Battlefield m^2/team hour	6168	6307	4355	6154	6564	5585	20284
Battle-/minefield ratio	20	24	15	21	20	14	44

From table 11.1 it appears that the area of minefields cleared per team hour work has decreased over time, from 464 m^2 in 1994 to 267 m^2 in 1999. One explanation for this could be that the tasks are getting more difficult as the easier tasks were cleared first. Generally it is much more time-consuming to clear minefields than former battlefields. On average for the period 1993-2000 about 20 times more battlefields than minefields were cleared per team hour work.

Table 11.2: Clearance productivity for different land types, m^2 cleared per team hour.

All techniques	1993-2000	1999	1998	1997	1996	1995	1994	1993-2000
Land type:								Average=1
Agricultural land	343	299	392	368	354	351	481	1.1
Grazing area	519	361	491	604	478	720	989	1.7
Residential areas	123	93	71	67	146	285	243	0.4
Roads	470	532	759	486	741	457	292	1.5
Irrigation system	258	295	262	174	139	192	492	0.8
Average mined area	314	267	299	297	337	413	464	1.0

Minefields are classified by land types when the areas are surveyed. Land types describe possible use of the area after clearance. Distinctive variations appear in clearance efficiency for various types of areas.

Agricultural land comes close to the average in m^2 cleared per team hour for the period 1993-2000 in total (last column in table 11.2). Grazing areas are normally much less time-consuming to clear, and this has also, for most of the years been the case with roads. Residential areas are far more time consuming to clear than the average.

Clearance tasks on grazing land and in residential areas have both experienced significant drops in output per team hour over the last years. Former battlefields are not distributed by land type.

Manual teams work on all types of land. Dog teams started operations in 1994, and their teams compositions differ very much from manual teams. The backhoe is used in particular where layers of rubble, ruins of houses or earth cover the mines, making manual excavation dangerous and often impossible.

Table 11.3: Productivity for clearance techniques on land types, ratios between m^2 cleared per team hour. Average for manual clearance of mined area is here set equal to 1.

period 1990-2000	Manual	Dogs	Backhoe	Flail
Land type:				
Agricultural land	1.0	4.0	0.1	1.8
Grazing area	2.0	4.0	0.1	3.8
Residential areas	0.5	2.7	0.1	3.3
Roads	0.8	2.9	0.2	0.3
Irrigation system	1.0	3.4	0.4	
Average mined area	1.0	3.5	0.1	1.4
Battlefield	27	58		

One important conclusion is that clearing minefields by means of dogs is on the average 3.5 times more efficient than manual teams in terms of m^2 cleared per team hour. Dogs are actually more efficient in all types of areas than both manual and backhoe techniques.

Still, specialised teams may be needed on the various types of land. Dogs can be used on open land with free visibility where trees or bush do not hamper operations. The backhoe is the least efficient method, but is used exclusively when other techniques are dangerous or impossible. Flail has proved efficient on certain types of areas, but technical difficulties have been experienced. Use of dogs has in certain areas seasonal restrictions because of sandstorms. For former battlefields almost only the manual technique is used.

The efficiency of mine clearing operations has changed over time. An average for recent years including 1998, 1999 and January-July 2000 of m^2 cleared per team hour will be applied for the further cost calculations. The actual techniques comprise manual teams, dog teams and backhoe. Flail has been little used in recent years.

Table 11.4: Areas cleared in m^2 per team hour, average for the period 1998-2000.

Land type:	Manual	Dogs	Backhoe
Agricultural land	156	918	68
Grazing area	330	802	30
Residential areas	60	637	23
Roads	129	691	53
Irrigation system	204	785	79
All mined areas	169	817	39
Battlefield	6036		

In table 11.4 the area cleared in m^2 per team hour is listed for all techniques. In practice, as mentioned above, there are technical and economical restraints on use of the different techniques. Table 11.5 shows recent practice. Mined areas cleared in the period 1998-1999 and until end of July 2000 are distributed here in percentage by techniques and types of land.

Table 11.5: Mined areas cleared in the period 1998-2000, distributed in percentage on techniques and types of land.

Land type %:	Manual %	Dogs %	Backhoe %	All techniques %
Agricultural land	18.4	27.1	0.27	46
Grazing area	23.9	7.4	0.08	31
Residential areas	5.5	3.4	0.24	9
Roads	0.3	10.0	0.00	10
Irrigation system	1.4	1.5	0.20	3
All mined areas	50	49	1,1	100

Manual teams (50%) and dogs (49%) are now the main techniques in mine clearance within MAPA. Clearance of roads is almost exclusively carried out by dogs, and this has also become the most frequently used technique on agricultural land. Manual clearance is still the main method for grazing areas, and close to 100% of all former battlefields (not included in table) are cleared manually.

The backhoe is applied on a small scale for specific tasks in residential areas, irrigation systems and on agricultural land. It has only incidentally (1998-2000) been used for clearing other land types. Backhoe teams will normally be supported by manual teams, and a clear-cut separation of activities is often not possible.

11.3 Clearance costs

In table 4.1 an estimate of the cost of mine clearance was presented by dividing the annual cost of MAPA by the area of minefields cleared. For 1999 costs calculated in this way amounted to USD 0.6 per m^2 or USD 600.000 per km^2.

This first approach cost estimate needs, however, to be revised on several points:

- MAPA undertakes other activities in addition to mine clearance.

Monitoring, evaluation, training and minefield survey are preparation for and thus integral components of mine and UXO clearance. Mine awareness and advocacy for a ban on the use of landmines are however separate activities and their costs need to be excluded.

Mine awareness is the most costly of these components. MAPA has dedicated about 7% of its funds for mine awareness purposes in the budget for the year 2000. Some NGOs are engaged in both mine clearance and mine awareness, but it is possible to separate activities in the MAPA funds.

- Clearance activities comprise former battlefields in addition to minefields.

Actually more km^2 of former battlefields are cleared each year than minefields. In the year 1999 about 75 km^2 of former battlefields were cleared as against 34 km^2 of minefields. As shown in table 12.4 over 30 times more battlefield area can be cleared per hour of work than minefields. This observation gives reason to conclude that minefields are about 30 times more costly to clear than battlefields, when manual methods are used. And manual methods are now used for almost all battlefield tasks.

- As discussed above in chapter 12.1 the funds supplied directly to NGOs from donors will have to be added to the AETF financing.

In cases when information about additional financing is lacking, clearance tasks not financed through AETF will have to be deducted from the MAPA activity list, so that costs and activities correspond. Still questions may be raised whether contributions in kind are included fully and correctly.

- Investments.

The UNOCHA logistics and procurement section provides support to the mine action NGOs, including procurement of capital goods. In cases when non-expendable equipment is supplied, vehicles, communications equipment etc, costs should not be attributed to the year of supply only, but treated properly as investments, subject to depreciation over a number of years dependent on the duration of the item. Depreciation costs for investments undertaken in earlier years should likewise be included as expenses for 1999. This has not been possible to correct for at this stage.

The cost calculations in this study are based on the table “AETF expenditure breakdown by agency and activity” from the MAPA Annual Report 1999. This table gives expenditure for each agency. The agencies involved in mine clearance activities were the following:

- ATC (manual and mechanical teams).
- AREA (manual, community based).
- DAFA (manual and mechanical teams).
- OMAR (manual and mechanical teams).
- MDC (dogs)
- HALO (manual and mechanical teams, survey).
- MCPA (survey, some manual clearance).
- META (training and monitoring).
- DDG (this agency started operation on a small scale in year 2000).

Only a few of these NGOs are, however, competing for the same type of tasks.

AREA is engaged in a pilot community based mine clearance programme. Utilising the local communities’ human resources and know-how, the program enables ex-resistance fighters and other villagers to become involved with humanitarian mine clearance activities.

The community based mine clearance programme is unique in the world. It is low cost and payment to village de-miners is in the form of food-for-work or a nominal salary. There are few logistics costs as the de-miners do not work outside their villages and can return to their homes at night. Technical and safety issues still create problems (no incidents reported in 1999). The project has been assigned to work in low-priority areas only, on fields not containing anti-tank or minimum metal mines. The program started in 1997 and is still clearing less than 0.5 km^2 of minefields annually (0.38 km^2 in 1999).

In 1999 OMAR cleared 3.48 km^2 of minefields. This NGO did not receiving funding from UNOCHA/AETF for mine clearance, only for mine awareness. Information is, however available on direct funding from other sources, from EC, NOVIB and Germany. OMAR is using de-miners from the local villages and costs of DSA are thus avoided.

HALO is engaged in surveying as well as mine and battlefield clearance. In 1999 this agency cleared 3.6 km^2 of minefields and 51.6 km^2 of former battlefields. HALO is working in the districts of Kabul, Baghlan and Wardak on designated areas where they do both survey and clearance operations. HALO is also self-sufficient in terms of training, META is not involved. HALO does not pay DSA, since recruitment of people is from the area in which operations are ongoing. HALO (and DDG) apply working procedures which are to some extent different from MAPA.

For the year 1999 HALO received financing from USA through UNOCHA/AETF for clearance and survey activities in the Wardak Province. This is the financing included in the MAPA Annual Report 1999. By means of these funds HALO cleared 1.7 km^2 of minefields and 17.2 km^2 of former battlefields. The amount of funds HALO receives directly from donors for its other clearance activities is not known.

MDC is working with mine dogs clearance techniques only. No other NGO is working with dogs, so MDC costs will give a complete picture of mine dog clearance costs in Afghanistan. MDC is assisting MCPA on survey tasks with mine dog sets (MDC). The costs of operating these mine dog sets (in 1999 about USD 905.000) have therefore been deducted from MDC clearance activities and added to MCPA survey activities. MDC has since the start in 1994 received support from the German government, some of it in kind.

MCPA's principal activity is the survey of minefields and former battlefields. Some mine clearance is also undertaken, mainly as part of survey activities. Thus in 1999 0.3 km^2 of minefields and another 0.3 km^2 of former battlefields were cleared.

In this study all MCPA activities will be regarded as integral to the mine and battlefield clearance activities of MAPA. The MCPA survey costs have thus on a per km^2 basis been added to the clearance costs of other agencies. Exception is made for HALO, which is undertaking its own surveys.

META is in charge of training and surveying the other NGOs. The budget of this organisation is added to the costs of the clearance and surveying agencies on a per team hour basis. HALO is also excepted in this respect.

For each of the above listed agencies the UNOCHA funding has been increased by 13%, corresponding to the fixed UNOCHA overhead rate, to cover administration at MACA etc. Direct/in kind contribution is assigned to the NGOs on basis of team hours performed. A tentative correction for depreciation is undertaken by reducing the costs of non-expendable equipment to 1/8, assuming that this equipment is depreciated over 8 years. For earlier years no correction has been made. This method is unsatisfactory, and the cost calculations need to be revised in this aspect.

Table 11.6: Clearance Cost in USD per Team Hour, agencies 1999.

	Manual-mechanical	Manual/ community	Manual-mechanical	Manual-mechanical	Dogs	Manual-mechanical
	ATC	AREA	DAFA	OMAR	MDC	HALO
Cost per Team Hour	180	59	199	205	154	84

Table 11.6 gives the cost of clearance in USD per team hour on the basis of the assumptions listed above. Team hours will presumably be the best available basis for distribution of costs, better than per km^2 cleared, since performance in the latter is found to vary much with both type of area, technique and over time. Team hours are assumed to vary principally with clearance technique employed.

MDC is quite efficient in cost per team hour worked. Additionally mine dog clearance is more effective in m^2 cleared per team hour than all other techniques (see table 11.4). It can therefore be stated that mine dog teams are strong contenders for all tasks where this technique is technically feasible.

It can be observed that ATC, DAFA and OMAR come out with comparatively similar costs per team hour, from USD 180-200. All those three agencies operate both with manual and mechanical teams.

At DAFA and OMAR the mechanical teams (backhoe) work an integrated way with manual teams. Operations can therefore not easily be sub-divided. In ATC manual and mechanical clearance methods can be separated, since operations are separated by different teams. Further efforts to distinguish costs of different clearance techniques will therefore be pursued with this agency.

HALO's operations seem very cost efficient, and their figures even include the cost of surveying, which will have to be added for the other agencies (calculated on a per km^2 basis). HALO's costs of USD 84 per team hour are extraordinarily low, taking into account the fact that they are operating on a similar basis to ATC, DAFA and OMAR. It is valid to ask to what extent all HALO's costs, for instance overhead are included for the clearance tasks undertaken with UNOCHA/AETF funds.

The community based approach seems cost efficient, but it is still rather early to draw conclusions here, since AREA is operating a pilot project on a very much smaller scale than the others.

There is a need to separate manual and mechanical clearance costs. This has been undertaken by considering the costs of one single NGO, ATC, where such a split was feasible.

It was found that manual methods in general are 1.5 times more expensive than mechanical methods. Personnel costs are twice as high for manual teams, while capital and maintenance costs are not very much lower, in spite of the expensive backhoe machine used by the mechanical team (cost 134,000 USD).

Table 11.7: Manual versus Mechanical Clearance Methods, Cost ratio per Team hour.

	Ratio manual/mechanical
Personnel cost	2.1
Capital cost	0.8
Maintenance cost	0.6
Total Manual/Mechanical	1.5

It seems that actual cost of mine clearance by manual and mechanical teams can explain about 65% of ATC's cost level, UNOCHA overhead costs and META services form another 15%. The remaining 20% can be considered agency overhead (see Annex 2 on detailed calculations of clearance cost).

By assuming that manual clearance is generally 1.5 times more expensive than mechanical, costs can be distributed by both these clearance techniques.

Mine action also takes its toll in the form of accidents during clearance operations. The number of de-miners killed and injured in service for MAPA has decreased over the last two years compared to the mid-1990s. As the diagram below shows, 4 de-miners were killed during operations in 1999 and 21 injured.

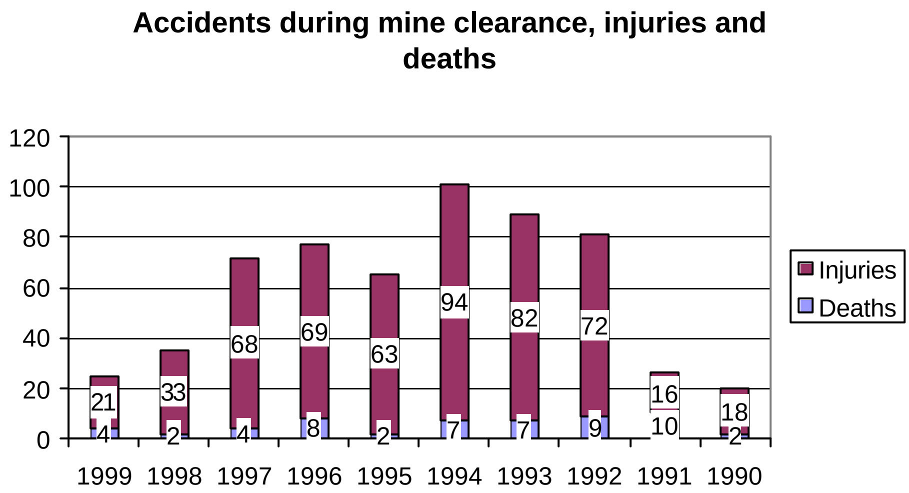


Table 11.1: De-mining accidents, persons injured and killed 1990-1999.

De-mining accidents represent a loss to the victims and to society, and its economic value can be evaluated by applying the same methods as for mine accidents in general, described in chapter 5 of this report. A de-miner presumably belongs to the age group 18-40 years, he experiences no unemployment and in case of accident his medical costs will be fully covered (with USD 4000). Injured de-miners are distributed on categories of casualties in the same way as mine accidents.

Table 11.8: Economic loss from de-mining accidents, USD.

	Cost per incident USD	Incidents 1999	Loss in USD per team hour
Loss with injuries	12 552	21	3.6
Loss with fatal casualties	16 210	4	0.9
Total loss			4.5

With these assumptions the economic loss for an injury is estimated to about USD 12,500 and USD 16,000for a fatal casualty. MAPA accident rates for 1999, 4 deaths and 21 injured de-miners will be applied in the following and the cost of these accidents added to the de-mining costs.

Risk of accidents for de-miners will be largest with application of the manual clearance technique. It is consequently assumed that the accident costs will vary with the input of manual team-hours. For the year 1999 this will constitute an additional cost of USD 4.5 per team hour for manual clearance technique.

Costs per team hour can now be combined with data on team hours needed to clear different types of areas from table 11.4.

Table 11.9: Clearance costs in USD per m^2 or USD million per km^2 on land types.

Land type:	Manual	Dogs	Mechanical	Community
Agricultural land	1.3	0.3	2.0	
Grazing area	0.7	0.3	4.4	0.3
Residential areas	3.3	0.4	5.7	
Roads	1.6	0.3	2.6	
Irrigation system	1.0	0.3	1.7	
All mined areas	1.2	0.3	3.4	
Former battlefields	0.03			

Clearance by dogs appears to be the most cost efficient method for all types of areas, and will be used wherever feasible. Mechanical clearance is the most expensive, and is generally used only when other techniques are too dangerous, in particular for collapsed buildings. Manual clearance is still relatively cost efficient on grazing areas, and in practice the only technique used for former battlefields.

Mine dogs clearance is keeping MAPA costs down. Dog clearance is cost effective and also efficient in clearance time per km^2. A large share of MAPAs tasks is now cleared by dogs and without this method quite another level of costs would have been experienced. Dogs cannot be used in all conditions and for all types of areas. Still the limitation is currently not with the amount of clearance tasks or types of land suitable for dogs, but with the number of dogs and the capacity of training within MDC. Questions are asked, however, to what extent efficiency in mine dogs clearance is stressed too much at the expense of safety and quality of work.

While this remains a pilot project it is difficult to draw too many conclusions regarding the community-based approach. Still, costs with this method are remarkably low.

Relatively large cost variations have been found between some of the clearance agencies. There is thus a need to look further into strengths, limitations and cost structures of the different techniques and the approach and operational routines of the individual NGOs involved. AREA's community based approach would be of special interest, but also HALO's achievements should be monitored more closely and compared to the more standard MAPA set up, represented by ATC, DAFA and OMAR. DDC should be included once fully operational. HALO's seemingly low cost approach did not influence the calculations in table 11.8, since no split between manual and mechanical operations was possible there.

Out of 13 NGOs involved with the MAPA programme in 1999 only 4, ATC, DAFA, OMAR, and HALO were undertaking similar types of activities in mine clearance. Of these OMAR was totally and HALO partially financed directly from donors. In addition HALO was loosely integrated in the MAPA programme.

From this it seems that the NGOs may have managed to reserve secluded areas of activity for themselves. More direct competition between clearance agencies has been mentioned as a means of increasing cost-efficiency of the mine action programme. In order to achieve this, the rather restricted access to the MAPA programme will have to be opened up, with tasks which are now to a large extent assigned on a command basis being put out on some kind of competitive tender.

12. Evaluation of Mine Clearance in Cost-Benefit Terms

12.1 Methodology

The Cost-Benefit analysis of mine clearance activities in Afghanistan aims at including all relevant benefit and cost components to the extent that information access permits them to be quantified and evaluated in monetary terms. The following components evaluated in chapters 5-11 of this report will form part of the analysis:

- Reductions in human loss to mine accidents (tables 5.7 and 5.8 in particular).
- Productive output from cleared agricultural land (table 6.14).
- Productive output from areas that have benefited from clearance of irrigation systems (table 7.3).
- Benefits from cleared grazing areas (table 8.6).
- Less livestock lost in mine accidents (table 8.9).
- Reduced transport cost and travel time from renewed access to de-mined roads (table 9.5).
- Benefits from mine clearance in residential areas (table 10.2).
- Regional variations in benefit components have been identified in the Case Studies I-XII.
- Cost of mine clearance on various types of land and with techniques currently in use (table 11.9).

A main evaluation criterion to be applied in this study will be the Benefit-Cost Ratio.

$$\textbf{Benefit-Cost Ratio:} \qquad \frac{\textbf{Benefit} - \textbf{Cost}}{\textbf{Cost}}$$

Benefits minus costs or net benefits will obviously be relevant as economic criteria. Dividing by costs as in the Benefit Cost Ratio facilitates comparison of projects, or clearance tasks of different sizes.

The higher the Benefit-Cost Ratio the better is the project. A negative rate indicates that clearance of this the particular task cannot be justified in economic terms alone. In case he budget restricts activity the least beneficial tasks may have Benefit-Cost Ratios above 0.

Break-even point will be when the Benefit-Cost Ratio is 0. Then benefits will be equal to costs for the given discount rate, which is generally set at 10% in this study. A clearance task with a Benefit-Cost Ratio of 0 thus produces just enough benefits to meet its costs at a discount rate of 10%. Lowering the discount rate would increase the Ratio, by assigning more importance to future benefits. The discount rate will depend among others on the general level of interest on credits in a country, net of the inflation rate.

A high discount rate means that few projects will come out with a satisfactory rate of return. Still it is generally wrong to think that projects in the developing world should be subject to a low discount rate. Capital is scarce, and competition should be high among a large number of important purposes.

There is evidence of prevailing high rates of interest in Afghanistan. Farmers have to accept significantly lower prices for their crops if they wish to receive payment 5-6 months in advance. Farm gate prices during the harvest season may be as much as 40-50% higher than what farmers actually get during the planting season. Such deals imply a considerable rate of interest, even when the prevailing inflation is taken into account.

An alternative evaluation criterion used in this study will be the Internal Rate of Return (IRR). The IRR constitutes a more intuitive measure of gain, by presenting a percentage rate of return on costs, much like the rate of interest on bank deposits.

Internal Rate of Return (IRR)

Generally the IRR is defined as the discount rate, which makes the value of discounted future benefits equal to costs. The IRR can be compared for example to the prevailing rate of interest net of inflation in a country. In this study a discount rate of 10% has been chosen as standard, and the minimum or break even IRR should consequently be in the order of 10%. This will normally correspond to a Benefit-Cost Ratio of 0 in the way this ratio has been defined above.

The time-horizon for benefits and costs in this study is set at 15 years. After that time benefits are considered too uncertain to be reckoned with. Benefits are discounted over that time when relevant, while all clearance costs are assumed disbursed the first year.

Clearance of mined areas is considered indispensable for increasing food production in Afghanistan and for the repatriation of refugees to the country. MAPA is giving first priority only to areas that will be reclaimed for use immediately (see chapter 4). It has therefore been assumed in general that all areas are taken into use and benefits start to accrue immediately after clearance.

Nonetheless it has been found (see chapter 10) that some residential areas for varying reasons have only partially or not at all been reclaimed for use a long time after being cleared of mines. It is clear that few other factors can cause the Benefit-Cost Ratio or the IRR to dwindle as much as lacking or not fully realised benefits the first years after costs have been disbursed. A first item on the agenda for socio-economic assessment of a particular clearance task should therefore be to ascertain to what extent the area will be reclaimed for use immediately.

The Case Studies introduced previously will now be developed into cost-benefit analyses for a number of model clearance tasks considered typical for MAPA. The following characteristics will be combined:

- Regions in Afghanistan as of Case Studies I-XII.
- Types of land (5)
- Clearance techniques (3)

The Benefit-Cost Ratios will provide the basis for ranking of the individual tasks and can be calculated from input data on per km^2 –basis. The actual size of area to be cleared in each task will not have to be introduced until there is a need to consider costs and benefits separately, in connection with evaluation of the whole MAPA programme or with budget restrictions for example. The Benefit-Cost Ratios will here sometimes be calculated for hypothetical cases, in the sense that no actual clearance task has been performed or can be performed for practical reasons, which may be the situation for certain techniques on some types of land.

12.2 Costs-benefit analysis of Case Studies

The main results for the cost-benefit analysis of clearance tasks on different types of mined land, with techniques currently in use with MAPA and for groups of provinces in Afghanistan are shown in table 12.1.

Clearance of irrigation systems gives large returns generally and in particular for the provinces under Case Studies III, IV and V, which correspond to provinces in the Eastern and Southeastern parts of Afghanistan. Irrigation systems in those provinces constitute the clearance tasks that most convincingly can defend use of all kinds of techniques, also mechanical when that is the only feasible option. The provinces belonging under Case Study V in particular, but also III and IV give very convincing returns for clearance of agricultural land when dogs can be used. Clearance of roads yields solid returns, rural areas in Case Study X not much less than the urban areas in Case Study IX.

Mine dogs clearance is overall the superior technique with the highest Benefit-Cost Ratios. No other technique gives higher return for any case study; dogs should consequently be used wherever this technique is applicable.

Mechanical clearance is costly for MAPA. Still there is clearly a scope also in economic terms for applying this technique when needed for irrigation systems in selected provinces, for agricultural land in Case Study V-areas mainly, and marginally for roads. Mechanical technique is currently applied for clearance of residential areas. Justification for this will have to be demonstrated from case to case, taking into account the value of the property and in particular the risk that the property may remain unutilised or underutilised after clearance. Scarce data on benefits makes it difficult to draw definite conclusions at this stage.

Clearance tasks on grazing areas have difficulties with meeting their costs. An economic loss will regularly be experienced when other techniques than clearance by dogs are applied. All regions show uniform small returns here.

The Northern Region (Case Study I) provides the weakest justification for clearance tasks on all types of lands.

Table 12.1: Benefit-Cost Ratios for Case Studies of clearance tasks.

Region		Agriculture			Grazing			Irrigation		
		Manual	Dogs	Mech.	Manual	Dogs	Mech.	Manual	Dogs	Mech.
Case Study I	Northern Region all provinces	-0.4	1.7	-0.6	-0.5	0.1	-0.9	0.1	2.8	-0.3
Case Study II	Parwan, Kabul, Kapisa, Bamyan	-0.1	3.5	-0.4	-0.5	0.1	-0.9	1.7	7.9	0.6
Case Study III	Logar, Wardak	0.6	6.7	0.1	-0.5	0.1	-0.9	4.2	16.4	2.1
Case Study IV	Nangarhar, Laghman, Kunar	0.3	5.0	-0.2	-0.5	0.1	-0.9	2.9	12.0	1.3
Case Study V	Kandahar, Zabul, Oruzgan	2.5	15.8	1.3	-0.5	0.1	-0.9	11.5	40.7	6.4
Case Study VI	Ghazni, Paktika, Paktia	-0.3	2.6	-0.5	-0.5	0.1	-0.9	0.9	5.5	0.1
Case Study VII	Helmand	-0.2	2.9	-0.5	-0.5	0.1	-0.9	1.2	6.3	0.3
Case Study VIII	Herat, Badghis, Farah, Nimroz	-0.2	2.9	-0.5	-0.5	0.1	-0.9	1.2	6.4	0.3
	Roads	Manual	Dogs	Mech.						
Case Study IX	Kandahar, Laghman, Kabul	1.0	8.3	0.2						
Case Study X	Other provinces except Case IX	0.9	7.6	0.1						
	Residential									
Case Study XI	Kabul, Kandahar	0.8	15.4	0.0						
Case Study XII	Other provinces except Case XI	-0.1	7.1	-0.5						

The individual clearance tasks forming the background for table 12.1 are listed In Annex 3. The relative weights of the different benefit and cost components appear there and all tasks are sorted on descending Benefit-Cost Ratio. For cases with high Benefit-Cost Ratio it is regularly the productive output from land that makes the difference. Human loss appears to be less fluctuating, but clearance tasks on grazing areas can often be justified on account of avoided human loss alone.

An intention behind the study of selected clearance tasks is that they as much as possible should provide representative cases, so that conclusions on benefits and costs among others can be applied to a wider range of similar tasks. The Case Studies conducted in this report, and the results from table 12.1 in particular should thus be able to provide estimates of the economic return from other particular clearance tasks at different locations and for future years.

12.3 Cost-benefit evaluation of the MAPA programme

The data analysis carried out will also permit a cost-benefit evaluation of the whole MAPA programme. So far calculations have been carried out only for the year 1999.

Table 12.2: Net benefits of the MAPA mine clearance programme 1999, USD millions.

	Agriculture	Grazing	Irrigation	Residential	Roads	Total
Manual	6.5	-2.5	5.8	2.1	0.0	11.9
Dogs	17.6	0.1	1.9	3.1	5.6	28.2
Mechanical	0.0	0.0	0.0	-0.1	0.0	-0.1
Total	24.1	-2.5	7.7	5.1	5.6	40.0

The net benefits of the MAPA mine clearance programme for 1999 amount to USD 40 million. Benefit-Cost Ratio is a solid 1.5. The largest portion of benefits originates from clearing of agricultural land with dogs. Clearing of agricultural land and irrigation systems with manual methods as well as roads with dogs also make significant contributions.

Manual technique for clearance of grazing areas is more expensive than benefits can justify. Clearance of residential areas by mechanical technique also contributes negatively.

Table 12.3: Internal Rate of Return of the MAPA Programme 1999.

	Agriculture	Grazing	Irrigation	Residential	Roads
Manual	22 %	-1 %	161 %	16 %	25 %
Dogs	101 %	12 %	165 %	124 %	125 %
Mechanical	5 %	-20 %	15 %	5 %	14 %
Total MAPA Programme 1999: 34 %					

The internal rate of return (IRR) of the total MAPA mine clearance programme for 1999 is calculated to 34%, which constitutes a substantial return. Clearing of irrigation systems, roads, residential areas and agricultural land with dogs, as well as irrigation systems with manual technique show particularly large economic returns. Clearance of grazing areas constitutes marginal cases, and positive IRR is in general found only when dogs can be used.

Dog clearance again appears as the superior technique. Manual and in particular mechanical methods depend on large economic benefits from reclaimed areas, output from crops and reduced numbers of mine accidents to defend high clearance costs.

Total costs of the MAPA programme for 1999, exclusive of mine-awareness are here calculated at USD 28 million, revised from the USD 22 million in the Annual Report 1999, which covers the AETF funded part of the programme only. On this basis the MAPA clearance costs of mined areas for 1999 will be USD 0.77 per m^2. Cost of battlefield clearance is estimated at USD 0.03 per m^2, with a total cost for the year 1999 of USD 2.6 million.

The reasons for this cost revision are set out in chapter 11. The fact that AETF funding only covers 85% of the mine clearance and 54% of the battlefield clearance costs, accounts for much of this difference in costs (USD 5 million). De-mining accidents costs have also been added. On the other hand, costs of mine clearance are adjusted downwards, by removing mine awareness costs from the AETF budget.

Another cause for the high estimates is that the costs applied for manual and mechanical techniques are based on data from ATC. In general these deviate somewhat from DAFA and OMAR on the low side but substantially from HALO's costs on the high side, as can be seen in table 11.6. In Wardak province at least, HALO is operating with much lower costs than the ones applied here.

There is a need to look into the cost structure of the different agencies to explain variations. The cost model used in this Study may subsequently have to be corrected on the basis of new findings.

12.4 Sensitivity analysis

An alternative assumption where welfare loss is excluded from the calculation of human loss from mine accidents has been introduced in paragraph 5.5. This assumption entails a general decrease in benefits from reduced human loss in proportion to the accident risk stipulated for different types of mined areas. The value of human loss in connection with de-mining accidents will be reduced likewise.

Table 12.4: Alternative assumptions: Benefit-Cost Ratios for Case Studies of clearance tasks.

Region		Agriculture			Grazing			Irrigation		
		Manual	Dogs	Mech.	Manual	Dogs	Mech.	Manual	Dogs	Mech.
Case Study I	Northern Region all provinces	-0,7	0,3	-0,8	-0,8	-0,5	-1,0	-0,4	1,0	-0,6
Case Study II	Parwan, Kabul, Kapisa, Bamyan	-0,3	2,2	-0,6	-0,8	-0,5	-1,0	1,1	6,1	0,2
Case Study III	Logar, Wardak	0,3	5,3	-0,1	-0,8	-0,5	-1,0	3,7	14,6	1,7
Case Study IV	Nangarhar, Laghman, Kunar	0,0	3,7	-0,4	-0,8	-0,5	-1,0	2,4	10,2	1,0
Case Study V	Kandahar, Zabul, Oruzgan	2,2	14,4	1,1	-0,8	-0,5	-1,0	10,9	38,9	6,0
Case Study VI	Ghazni, Paktika, Paktia	-0,5	1,3	-0,7	-0,8	-0,5	-1,0	0,4	3,7	-0,2
Case Study VII	Helmand	-0,5	1,6	-0,6	-0,8	-0,5	-1,0	0,7	4,5	0,0
Case Study VIII	Herat, Badghis, Farah, Nimroz	-0,5	1,6	-0,6	-0,8	-0,5	-1,0	0,7	4,6	0,0

	Roads	Manual	Dogs	Mech.
Case Study IX	Kandahar, Laghman, Kabul	0,6	6,7	0,0
Case Study X	Other provinces except Case IX	0,5	6,0	-0,1
	Residential			
Case Study XI	Kabul, Kandahar	0,6	13,9	-0,1
Case Study XII	Other provinces except Case XI	-0,3	5,6	-0,6

The main conclusions from table 12.1 still appear to be valid. For the majority of the clearance tasks the alternative assumption has a somewhat marginal impact, and economic returns remain sound for clearance by dogs on agricultural land, irrigation systems and roads. Manual clearance is to a somewhat less extent an economical option for irrigation systems, roads, and for a selection of agricultural case study areas as table

12.4 shows. The most conspicuous difference is that the clearance of grazing areas now appears entirely on the negative side for all techniques and in every case study region.

Table 12.5: Alternative assumptions: Net benefits of MAPA clearance programme 1999, USD millions.

	Agriculture	Grazing	Irrigation	Residential	Roads	Total
Manual	3.9	-3.9	5.5	1.1	0.0	6.7
Dogs	13.8	-0.4	1.6	2.5	4.4	21.8
Mechanical	0.0	-0.1	0.0	-0.1	0.0	-0.2
Total	17.7	-4.3	7.1	3.5	4.4	28.3

The alternative assumption would reduce net benefits from clearance under the MAPA programme in 1999 to under USD 30 million. The cost benefit ratio would decrease to 1.1. Benefits from clearance of grazing areas will now generally fail to cover costs, while clearance of other types of areas still contributes positively where dogs or manual methods are used.

Table 12.6: Alternative assumptions: Internal Rate of Return of the MAPA Programme 1999.

	Agriculture	Grazing	Irrigation	Residential	Roads
Manual	17 %	-10 %	152 %	13 %	20 %
Dogs	79 %	-1 %	135 %	99 %	98 %
Mechanical	1 %	-25 %	10 %	3 %	10 %
Total MAPA Programme 1999: 27 %					

The alternative assumptions in the sensitivity analysis reduce the IRR of the MAPA programme from 34% to 27%, which is still a convincing return. In general the IRR declines by a percentage related to the role reduced human loss play among the benefits from the clearance tasks. Clearance of grazing areas will now show a negative contribution overall.

13. Economic evaluation of other mine action programme activities

13.1 Introduction

In addition to survey and clearance of mined areas the MAPA field of activities comprises among others (see chapter 4):

- Survey and clearance of former battlefields.
- Mine and UXO awareness and education.

Data is available on the cost side of these components; The cost of battlefield clearance is discussed in chapter 9 of this report. Benefits of these components have, however, not so far been appropriately evaluated, at least not in monetary terms. Further data collection and analysis will be needed on benefits from battlefield clearance, in particular on the frequency of UXO accidents, and on the impact of mine awareness campaigns on rates of accidents of different types.

Survey and marking of minefields and former battlefields are integral parts of clearance; all areas will normally be surveyed and marked as preparation for clearance. Still it is possible that surveying and marking, or sealing off mined areas with fences, in some cases could constitute an alternative to clearance, in combination with targeted mine awareness campaigns.

13.2 Clearance of former battlefields

In addition to minefield clearance the mine action programme also comprises clearance of former battlefields. These areas, which were the location of major clashes and actions at different stages of the war, regularly contain a high number of unexploded ordnance (UXO) as well as vast amounts of fragments of a large variety of ammunition, weapons and other equipment.

MAPA started clearance of former battlefields in 1994. By the end of 1999 more battlefield areas, actually 240 km^2, have been cleared than minefields (about 200 km^2).

The main areas for battlefield clearance are the central and eastern parts of the country, with Kabul on top every year since 1995. Nangarhar (with Jalalabad) had large areas cleared in 1994, Wardak situated in the same part of the country, comes third. Additionally there has been activity in the North, in the provinces of Baghlan and Kunduz as well as in the West on the border with Iran, in Herat and Farah. Activity seems to be picking up, with 11 provinces included in year 2000.

Table 13.1: Clearance of former battlefields in km^2.

Province	Total	2000-July 31	1999	1998	1997	1996	1995	1994
Kabul	188.6	19.8	51.6	35.9	36.8	33.4	10.9	
Nangarhar	33.5	1.8			2.8		6.2	22.7
Wardak	25.7	8.1	16.4	1.2				
Baghlan	7.3	2.0	3.4	0.6	1.3			
Kunduz	6.1	2.1	3.3	0.7				
Herat	5.7	0.6			5.1			
Farah	4.6	2.9			1.8			
Helmand	2.7		0.1	0.2	0.0	0.7	1.8	
Samangan	2.0	2.0						
Logar	1.9	0.1	0.6	0.4	0.8			
Kandahar	0.8		0.2				0.6	
Parwan	0.6				0.6			
Paktika	0.6	0.6						
Nimroz	0.4	0.4						

Badghis	0.2			0.2	0.0			
Faryab	0.1				0.1			
Total	280.9	40.4	75.7	39.1	49.2	34.1	19.5	227

Former battlefields have not so far been included under the efforts to assess economic benefits from the mine action programme. SEIS did not attempt any calculation of benefits from clearance of these areas, and no socio-economic data are being gathered on former battlefields in the current surveys for the MIS databases. These areas are not classified as of type of potential use.

Former battlefields do not contain mines, while UXO and fragments may be found in large numbers. These will usually not explode unless tampered with or forcibly removed. Former battlefields are therefore not blocked from all use by UXO to the same extent as active mines can block an area.

UXO are mainly a threat to people who pick them up to experiment with them or collect them for sale as scrap metal. It is allegedly assumed that many of the mine victims reported in Afghanistan are in reality UXO victims, but deficient data makes estimates of any percentages somewhat difficult.

The cost of clearance is significantly lower on former battlefields than for minefields. The amount of team-hours it takes to clear a given battlefield area is about 1/30 of what it takes to clear a minefield of equal size. The estimates presented in chapter 11 indicate a cost of 3.4 US cents per m^2, or 34,000 USD per km^2. Almost all battlefields are currently cleared by manual technique. The MAPA cost of former battlefield clearance for 1999 is estimated at USD 2.5 million.

On basis of these costs and the benefit calculations presented in previous chapter, some estimates can be presented on the minimum amounts of economic benefits sufficient to justify clearance of a one km^2 of former battlefield area. Benefits in excess of this would make a positive Benefit-Cost Ratio.

Table 13.2: Clearance cost of former battlefields as compared with possible benefit components.

	1000 USD
Cost of battlefield clearance per km^2.	34
Economic loss at one fatal casualty	12
Economic loss of an average mine victim	9
One victim each year over 15 years	69
10% of benefits for agriculture Case Study VI	36

The economic loss associated with a risk of 3 fatal casualties in the immediate future would correspond to the clearance costs of one km^2 former battlefield, the loss of 4 average mine/UXO victims likewise. An accident risk of one victim each year over 15 years constitutes a loss of USD 69,000, which is far beyond the clearance costs of USD 34,000 per km^2.

Economic loss can also be considerable in cases where UXOs create problems for land use. Net revenue from one year's cultivation of a km^2 agricultural land for example exceeds USD 36,000 in all cases studied except Case Study I (table 6.14).

Further analysis will be needed to draw conclusions on benefits here. Allegations have recently been made, however, that a larger share of the number of victims could be related to UXO accidents rather than mines. In case this turns out to be the fact, it would certainly imply a recommendation that larger parts MAPA's clearance activities be directed from costly mine clearance to the much less expensive clearance of former battlefields.

13.3 The role of mine awareness

Mine awareness is an integral and important part of all UN mine action programs, including MAPA. It can be highly effective in reducing the number of victims, and as such the risk of accident from active minefields and UXO. Mine awareness is regularly considered as an integral part of mine clearance. Still, the goal of mine awareness is to train and inform civilians so that they can live and work with active minefields in the neighbourhood. Most likely a considerable risk of encountering mine incidents will remain in Afghanistan long after the identified high priority mine areas have been cleared.

A conclusion from the SEIS study and other observations is that a remarkably small percentage of the mine victims report that they have received mine awareness training, while more than 6 million Afghans have attended mine awareness courses under MAPA, with 1.5 million in 1999 alone. A large share of this figure, however, consists of people who have attended courses repeatedly.

It has been assumed that victims could be reluctant to admit having ventured into marked minefields or tampered with UXO, after having received mine awareness training. Still there is reason to look into what it would require in the way of extra resources and skills to make mine awareness initiatives better targeted and more efficient.

A comprehensive analysis will be needed in order to identify the effects of mine awareness activities in terms of reduced frequency of mine and UXO accidents. Mine awareness would certainly be assigned a crucial role if surveying, marking and sealing off mined areas is adopted as a self-contained mine action strategy and an alternative to clearance.

The mine awareness component constitutes about 7% of the total MAPA programme costs, or USD 1.8 million of the USD 26.3 million identified as funding requirements for the year 2000. The cost effectiveness of mine awareness as *alternative* to clearance will depend on the amount and the time horizon for necessary future inputs of mine awareness activities connected to such a strategy.

14. Economic Analysis with Local Community Involvement

14.1 The role of cost-benefit analysis in the mine action planning process

It is strongly recommended that MAPA start conducting cost benefit analysis of clearance activities on a regular basis, and in particular related to the annual presentation of the programme work-plan to the donor community. Some donor agencies have apparently already been considering the presentation of more comprehensive socio-economic analyses a condition for support to the mine action programme.

Socio-economic analysis can henceforth be based on the tools presented in the SIMAA report where also a considerable amount of data is compiled. There will nevertheless be a need for continuous information collection, for updating of the study report and databases and specifically related to fact-finding for evaluation of individual clearance tasks. In such cases the more generalised assumptions in the SIMAA study report could be replaced with site-specific data, to a larger extent based on information about local conditions.

For analysis purposes the Benefit-Cost Ratios from table 12.1 in this report can constitute a first approach, while data from Annex 3: Cost-Benefit Case Studies, are consulted when modification of assumptions on an aggregated level is required. In case a more tailored analysis is needed, details can be extracted from the tables presented in chapters 5-10 on benefits and chapter 11 on costs. It is also possible to a certain extent, to make amendments directly in the numerous spreadsheets, which form the background of the SIMAA study.

Project-related fact-finding fieldwork and literature search should be undertaken to the extent permitted by budget and time frames for individual clearance tasks or work-programmes. In such cases the data presented in this report could still be consulted and constitute a reference-frame for check of consistency and reliability.

14.2 The scope for mobilisation of local communities

The analysis conducted in this study aims at presenting a basis for dealing with the mine problem in Afghanistan from an integrated socio-economic perspective. Mine action will take place in a local community context, and it is important to provide opportunities for the local people to express their wishes and priorities on mine action in the context of development programmes in general. The local community involvement should be initiated at an early stage of the planning process.

Local people will be in a position to provide valuable information needed for conducting mine action operations, and in particular data on socio-economic issues. The aim of the present study is to provide basic data and methods for analysis. This information can, however, always be improved by access to more site-specific data and consultations with the local community should thus form an important part of all fact-finding efforts.

A large degree of local participation rather than a top-down approach will also reduce the potential of conflicts and contribute to transfer the ownership of the mine action programme to the local community. Local people should be given the opportunity to bring their influence to bear by providing information and by arguing their case. For this there may be a need to create new institutions or strengthen existing ones. In each case, participation from otherwise marginalized groups; women, land-less people etc may need to be secured in particular.

14.3 Priorities on which areas to be cleared

The most straightforward issue on which local participation is needed will be related to priority making on which areas to clear first and how to distribute scarce resources efficiently. Other factors than economic return may be of importance in the priority process, and local preferences may take precedence over a ranking on purely economic terms. Discussions at open meetings where different interests are represented and have the opportunity to present arguments will decide on the weight to be attributed to each factor.

The local community may have viewpoints on various aspects of the programme, also on technical questions like the clearance technique to be used, in particular since mine action is a major employer in Afghanistan. People's opinion for example on community-based clearance could be an important issue. Resource persons with special qualifications might be identified locally, so that they can be assigned roles in the programme.

Co-operation with the local community is of course important in all aspects of mine clearance, for smooth operations, so as to avoid conflicts, thefts of equipment and damage to installations. A feeling of local ownership of the programme is often a guarantee for good co-operation, and this attitude can be created and sustained through active involvement by the local people all the way from the start of the programme.

14.4 Priorities on mine clearance versus assistance for other purposes

As a condition for an efficient planning process, an option should be kept open for the local community to bring its influence to bear on priority-setting also among the main sectors of development and support, like health, education, water supply etc. Ideally it should be possible to divert funds from mine-action to other sectors and vice-versa, when the local community expresses well-conceived priorities on that account.

In most cases to day this will not be possible, as funds are firmly tied to programmes. Within the existing context rational behaviour on the part of the local community will rather be to seek every opportunity of external funding that emerges, and leave the responsibility for overall planning to outside forces and authorities.

15. Conclusions and Recommendations

The economic returns to de-mining have been found to be high in general, particularly since not all benefits could be quantified and included in the calculations. This study has focused on the individual economic benefits resulting from reduction in mine accidents and the economic benefits resulting from making the cleared land available for productive use.

The economic loss related to a fatal casualty from a mine accident in Afghanistan is conservatively estimated at USD 12,000. The loss from a typical mine victim is estimated at about USD 9,000, when the proportion of different types of casualties have been taken into account with their respective degree of disability.

Turning to the productive value of cleared land, the net value of agricultural production appears to exhibit wide variations, from USD 13,500 per km^2 land annually in the Northern Region to over USD 500,000 in the provinces of Kandahar, Zabul and Oruzgan.

The net annual output value from livestock rearing on one km^2 of grazing area varies roughly between USD 1,200 and USD 2,000, that is to say values are much more modest than those encountered in the agricultural sector.

The benefits from clearance of mined roads are considerable, over USD 250,000 annually per 50 km (corresponding to 1 km^2 mined roads area), both for urban areas and for more remote rural regions of Afghanistan.

The highest returns as estimated in the case studies are for clearance of irrigation systems in provinces with good conditions for agriculture. These clearance tasks can most convincingly defend use of all kinds of techniques. Economic returns also are high for clearance of agricultural land and roads.

One crucial factor is whether the land being cleared will be brought back to productive use shortly after being de-mined. If this does not occur, economic returns are lowered, and would turn negative if there is a significant delay.

On the other hand, clearance tasks on grazing areas have difficulties with meeting their costs. Techniques other than dogs or community-based methods would be expected to earn negative economic returns when applied to grazing areas. All regions show uniform small returns here.

The broader, difficult-to-quantify benefits from mine action would make clearance of grazing lands more justifiable than is indicated from the case study findings. Nevertheless, it would be desirable to develop and try out less expensive clearance methods if MAPA is to include substantial amounts of grazing areas in its programme, and in particular if areas of lower priority should be considered in the future. Expansion of the community-based approach could be one option.

Clearance using mine detection dog teams is overall the best technique, with the highest benefit-cost ratios under all conditions where use of dogs is feasible. No other technique generates higher returns for any clearance task. Dogs consequently should be used wherever this technique is applicable. Dog teams on average clear 3.5 times the amount of mined land cleared by manual teams per team hour.

Currently, dog teams are responsible for clearing about half of the area being de-mined, but the binding constraint is not the type of land suitable for dog clearance. With more dogs available, including larger training capacity for dogs, use of this technique could be further expanded.

Increased reliance on dogs will have implications for employment in de-mining, which is very significant. However, the resources saved could be reallocated to other high-priority, employment-generating activities, including expansion of the mine action program.

Mechanical clearance is costly to MAPA. This technique should be applied only when no other options are feasible, and the economic justification will have to be demonstrated from case to case.

The net benefits of the MAPA mine clearance programme for 1999 are estimated at 40 million USD, with a solid Benefit-Cost Ratio of 1.5. The corresponding internal rate of return is calculated to 34%. These results are robust to sensitivity analysis (for example, excluding the welfare benefits of reduced mine accidents) and in any case do not include important non-quantifiable benefits. The largest portion of net economic benefits is attributable to clearance of agricultural land with dogs. Clearance of agricultural land and irrigation systems with manual methods as well as roads with dogs also make strong contributions.

MAPA clearance costs of mined areas are estimated to USD 0.77 per m^2 in 1999, while clearance of former battlefields costs USD 0.03 per m^2. The area of minefields cleared per team hour work under the MAPA programme has decreased over time. Generally it is far more time-consuming to clear minefields than former battlefields. Agricultural land comes close to the average in area cleared per team hour, while grazing areas are normally much less and residential areas far more time consuming to clear.

It is strongly recommended that MAPA conduct cost-benefit analysis of clearance activities on a regular basis and in particular related to the annual presentation of the programme work-plan to the donor community. Such analysis can be based on the methods developed in the SIMAA report, where a considerable amount of data is compiled. There will nevertheless be a need for continuous information collection, for updating of the study report and databases, and specific fact-finding for cost-benefit evaluation of particular clearance tasks.

The local community should be actively involved in the mine action planning process, with opportunities to express their wishes and priorities for mine action in the context of local development programmes in general.

A coordinated initiative to improve mine and UXO victims' statistics in Afghanistan is urgently needed. A survey should form part of such an initiative. The regular collection of statistics on accidents must be better coordinated among the agencies involved. Mine and UXO victims' statistics are highly deficient at present. For example, different sources give figures varying from 150 to 500 casualties a month.

Some observers have suggested that large numbers of victims could be associated with UXO accidents rather than mines. This might imply that MAPA mine clearance activities should be shifted at least at the margin from costly mine clearance to the much less expensive clearance of former battlefields. This issue illustrates the importance of improving the information base on mine/UXO accidents and victims.

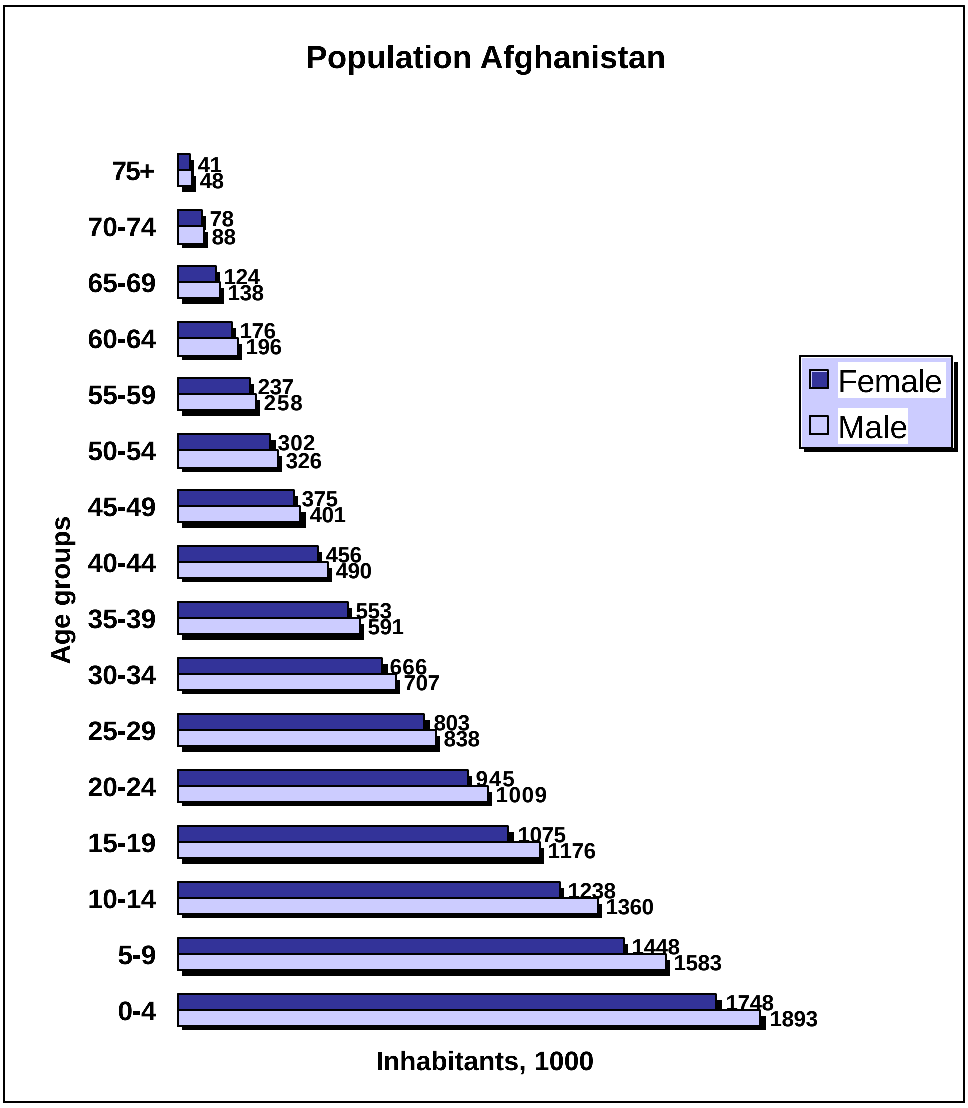
Surveying, marking and fencing off minefields, together with well targeted mine awareness campaigns, could be developed as an alternative approach to mine clearance, especially for lower-priority areas where the economic returns to de-mining are doubtful. Collapsed buildings – where mechanical de-mining would normally be used, manual de-mining would be dangerous, and dogs unusable – might be a good example.

Relatively large cost variations have been found between some of the clearance agencies. There is a need to look further into the strengths, limitations and cost structures of the different clearance techniques and also the approach and operational routines of the individual agencies engaged.

More direct competition among clearance agencies could be a means of improving the cost-efficiency of the mine action programme. In order to achieve this, the rather restricted access to the MAPA programme will need to be opened up. Tasks now to a large extent assigned on a command basis could be put out for some kind of competitive tender, to encourage competition among technically well-qualified bidders.

MAPA is currently financed mainly through UNOCHA, but considerable funds are also passed from donors directly to individual NGOs. The amount of funds passed on directly is still only partially known to MAPA. It is recommended that MAPA start collecting this information on a regular basis.

Annex 1: Population of Afghanistan (1000) by age groups



Source: Mohammad Ershad: Population of Afghanistan, IIPS, Bombay 1983.

Annex 2: Clearance costs – Detailed Explanation

Table 1: Cost calculations year 1999.

	1999	Mine and former battlefield clearance								Survey	
1		man-mec	man	man-mec	man-mec	dogs	man-mec	man	Total		
2	Agency	ATC	AREA	DAFA	OMAR	MDC	HALO*	MCPA	ex MCPA	MCPA	HALO
3	Minefield km2	6.63	0.38	2.95	3.48	16.88	1.65	0.28	31.97	31.99	5.01
4	Battlefield km^2	23.81		0,06			17.24	0.28	41.11	23.79	54.15
5	Team hours, 1000	32.22	3.48	14.73	9.84	19.84	17.40	1.23	97.51	983.49	204.45
6	- manual clearance	28.08	3.48	14.73	9.84		15.48	1.23			
7	- mechanical/dog	4.14				19.84	1.92				
	USD 1000										
8	UNOCHA fund	5717.39	167.96	2581.35		3440.28	1375.60		13282.58	1 447.38	
9	UNOCHA overhead	741.68	21.79	334.86		446.28	178.45		1723.06	187.76	
10	In kind contribution	0.12	0.00	0.06		0.07	0.03			0.03	
11	Mine Dog Sets					-904.78				904.78	
12	Other fund				1965.50				1965.50		
13	Total cost USD 1000.	6459.19	189.76	2916.26	1965.50	2981.86	1554.08		16066.64	2539.95	
14	- non expendable equipment	925.00	2.23	74.33		33.00	109.18			40.00	
15	+ depreciation	115.63	0.28	9.29		4.13	13.65			5.00	
16	+ earlier years depreciation										
17	Operations costs USD 1000	5649.81	187.81	2851.23	1965.50	2952.98	1458.55			2504.95	
18	Cost USD per Team Hour	175.35	53.97	193.57	199.75	148.84	83.83		502.57		
19	Monitoring, Training	5.17	5.17	5.17	5,17	5.17					
		man-mec	manual	man-mec	man-mec	dogs	man-mec				
	Clearance Cost USD per Team Hour	ATC	AREA	DAFA	OMAR	MDC	HALO*				
20	Manual and mechanical teams, dogs.	180.53	59.14	198.74	204.92	154.01	83.83				
21	Manual clearance cost USD per Team Hour	188.18									
22	Mechanical clearance cost USD per Team Hour	130.64									

Annex 2, Table 1 gives the basic data for clearance cost calculations. Data are for 1999 and information concerns both the mine and former battlefield clearance, and survey operations for different agencies.

1. Techniques in use comprise manual, mechanical and dogs.
2. Agencies involved, AREA is using community based approach.
3. Data on minefields cleared and
4. Battlefields cleared and surveyed is mainly from MAPA Annual Report 1999, but corrections have been made for HALO, comprising only MAPA financed activities in the Wardak province.
5. Information on Team hours is collected from the MAPA Minefield Database. Team hours are corresponding to the areas cleared.
6. Team hours are distributed on Manual Clearance and
7. Mechanical/Dogs clearance.
8. Information about UNOCHA funds is fetched directly from Annual Report 1999, page 27 AETF expenditure by agency.
9. UNOCHA overhead is added, 13%.
10. Annual Report 1999 also gives information about In Kind Contribution, this has been distributed on agencies on basis of work performance in team hours.
11. The cost of Mine Dog Sets working on survey tasks has been deducted MDC and added to MCPA survey operations.
12. On other funds directly from donors to agencies, there is information only from OMAR, which is funded entirely outside UNOCHA/AETF for its clearance operations.
13. Total cost of agencies are here corrected for the above mentioned items. Total cost for MCPA in this row will be considered as total survey costs. These costs will be divided by the amount of areas surveyed in km^2 and distributed on agencies on basis of areas cleared.
14. The cost item Non Expendable Equipment in Annual Report 1999, page 27 AETF expenditure by agency, comprises investments and should be treated like that. It has therefore been deducted from Total costs.
15. Depreciation on basis of 8% per year is added, comprising capital equipment procured in 1999 only (Non Expendable Equipment).
16. For Non Expendable Equipment procured in earlier years information is not yet available (this should be looked into).
17. Costs are corrected once more on basis of 14-16.
18. Costs are calculated per team hour performed by the various agencies. Team Hours will presumably be the best available basis for distribution of costs, better than per m^2 cleared, since performance here is found to vary much with both type of area, technique and over time. Team hours are supposed to vary with clearance technique mainly.
19. META's costs for monitoring, evaluation and training are added on per team hour basis.

20. Clearance costs per team hour is here listed for the different agencies and techniques. Cost data on clearance by MDC dogs are complete and are used directly in calculation of costs per km^2 cleared of different types of land in table 11.8 of the report, with survey costs added. Data for AREA's community based approach are also considered complete. A split of cost for the agencies applying manual and mechanical techniques will, however, need another approach, which will be explained in the following.

21. The results from those calculations are shown as manual clearance cost USD per Team Hour and

22. Mechanical clearance cost USD per Team Hour. These calculations have been based on data from ATC only.

The split of costs for manual and mechanical teams is based on data from ATC:

Table 2: Manual Teams

Team Personnel Cost	
USD/year	155520
Team hours worked year	1578
Personnel cost USD/hour	99

Capital costs	Cost USD	Life time years	Capital cost/hour	Maintenance	Maintenance USD/ hour
Mine detectors (13)	32500	2	10	10 %	2,1
Helmet (15)	3750	2	1	10 %	0,2
Vizor (15)	3750	0,5	5	10 %	0,2
Truck 4x6 Kamaz (1)	31500	5	4	10 %	2,0
Ambulance 4x4 Land Cruiser (1)	25000	5	3	10 %	1,6
Pick up Twin Cabin 4x4 Toyota (1)	17000	5	2	10 %	1,1
Apron (12)	9000	5	1	10 %	0,6
Total	122500		27		7,8

Cost USD/Team hour	USD/Team hour
Team Personnel Cost	99
Capital cost	27
Maintenance cost	8
Team cost/Manual Team hour	133

Table 3: Mechanical Teams

Team Personnel Cost	
USD/year	69540
Hours worked	1508
Personnel cost USD/hour	46

Team Equipment Cost	Total cost USD	Life time years	Capital cost/hour	Maintenance	Maintenance USD/hour
Mine detectors (4 partic + 2 spare = 6)	15000	2	5,0	10 %	0,99
Ambulance 4x4 Nissan Patrol (1)	24000	5	3,2	10 %	1,59
Pick up 4x4 Nissan (1)	18500	5	2,5	10 %	1,23
VHF Hand Sets (3)	1800	2	0,6	10 %	0,12
Helmet (6)	1500	2	0,5	10 %	0,10
Visor (6)	1500	0,5	2,0	10 %	0,10
Apron (4)	3000	5	0,4	10 %	0,20
Backhoe Machine	134000	5	17,8	10 %	8,89
Total			31,9		13,22

Cost USD/Team hour	USD/Team hour
Team Personnel Cost	46
Capital cost	32
Maintenance cost	13
Team cost/Mechanical Team hour	91

The ratio between costs for a manual and a mechanical team hour will on basis of this be about 1.5. The total costs of ATC as of table 1 in this Annex 2 will be distributed on this account. Information on ATC team hours, manual and mechanical techniques is available form MAPA Minefield Database.

Average cost per team hour from table 1, (row 20) USD 180 will on this basis be split as follows:

Table 4: Manual and Mechanical Teams Costs in USD per Team Hour

Clearance cost	Total cost	Accident cost	Team cost	Overhead	Overhead %
Manual Teams	188	4.5	133	50	38
Mechanical Teams	125		91	34	38

Total costs are here significantly higher than the team costs obtained from ATC. Costs are distributed so that the overhead percentage will be identical. About 13% of the overhead consists of the UNOCHA cost; another 2-3% will be META expenses. ATC overhead could thus be 20-23%. De-mining accidents costs are added to ATC costs on top of this with USD 4.5 per team hour for manual teams. These are the basic data for the calculations in table 11.8, where also survey costs are included.

Annex 3: Cost-Benefit Case Studies

Case Study	Provinces, regions	Land type	Human loss	Land output	Animal loss	Clearance cost	Technique	CB-Ratio
Case Study V	Kandahar, Zabul, Oruzgan	Irrigation	914	11853		306	Dogs	40.7
Case Study III	Logar, Wardak	Irrigation	914	4399		306	Dogs	16.4
Case Study V	Kandahar, Zabul, Oruzgan	Agriculture	610	3956	14	273	Dogs	15.8
Case Study IV	Nangarhar, Laghman, Kunar	Irrigation	914	3069		306	Dogs	12.0
Case Study V	Kandahar, Zabul, Oruzgan	Irrigation	914	11853		1023	Manual	11.5
Case Study IX	Kandahar, Laghman, Kabul	Roads	914	2207	14	338	Dogs	8.3
Case Study II	Parwan, Kabul, Kapisa, Bamyan	Irrigation	914	1801		306	Dogs	7.9
Case Study X	Other provinces except Case IX	Roads	914	1983	14	338	Dogs	7.6
Case Study III	Logar, Wardak	Agriculture	610	1470	14	273	Dogs	6.7
Case Study VIII	Herat, Badghis, Farah	Irrigation	914	1348		306	Dogs	6.4
Case Study V	Kandahar, Zabul, Oruzgan	Irrigation	914	11853		1736	Mechanical	6.4
Case Study VII	Helmand; Nimroz	Irrigation	914	1324		306	Dogs	6.3
Case Study VI	Ghazni, Paktika, Paktia	Irrigation	914	1071		306	Dogs	5.5
Case Study IV	Nangarhar, Laghman, Kunar	Agriculture	610	1027	14	273	Dogs	5.0
Case Study III	Logar, Wardak	Irrigation	914	4399		1023	Manual	4.2
Case Study II	Parwan, Kabul, Kapisa, Bamyan	Agriculture	610	604	14	273	Dogs	3.5
Case Study VIII	Herat, Badghis, Farah	Agriculture	610	454	14	273	Dogs	2.9
Case Study VII	Helmand, Nimroz	Agriculture	610	446	14	273	Dogs	2.9
Case Study IV	Nangarhar, Laghman, Kunar	Irrigation	914	3069		1023	Manual	2.9
Case Study I	Northern Region all provinces	Irrigation	914	262		306	Dogs	2.8
Case Study VI	Ghazni, Paktika, Paktia	Agriculture	610	360	14	273	Dogs	2.6
Case Study V	Kandahar, Zabul, Oruzgan	Agriculture	610	3956	14	1314	Manual	2.5
Case Study III	Logar, Wardak	Irrigation	914	4399		1736	Mechanical	2.1
Case Study I	Northern Region all provinces	Agriculture	610	103	14	273	Dogs	1.7
Case Study II	Parwan, Kabul, Kapisa, Bamyan	Irrigation	914	1801		1023	Manual	1.7
Case Study V	Kandahar, Zabul, Oruzgan	Agriculture	610	3956	14	1986	Mechanical	1.3
Case Study IV	Nangarhar, Laghman, Kunar	Irrigation	914	3069		1736	Mechanical	1.3
Case Study VIII	Herat, Badghis, Farah	Irrigation	914	1348		1023	Manual	1.2
Case Study VII	Helmand; Nimroz	Irrigation	914	1324		1023	Manual	1.2
Case Study IX	Kandahar, Laghman, Kabul	Roads	914	2207	14	1573	Manual	1.0

Case Study	Provinces, regions	Land type	Human loss	Land output	Animal loss	Clearance cost	Technique	CB-Ratio
Case Study VI	Ghazni, Paktika, Paktia	Irrigation	914	1071		1023	Manual	0.9
Case Study X	Other provinces except Case IX	Roads	914	1983	14	1573	Manual	0.9
Case Study XI	Kabul, Kandahar	Residential	914	5000		3308	Manual	0.8
Case Study III	Logar, Wardak	Agriculture	610	1470	14	1314	Manual	0.6
Case Study II	Parwan, Kabul, Kapisa, Bamyan	Irrigation	914	1801		1736	Mechanical	0.6
Case Study I	Northern Region all provinces	Grazing	305	16	14	256	Community	0.3
Case Study VIII	Heart, Badghis, Farah	Grazing	305	15	14	256	Community	0.3
Case Study V	Kandahar, Zabul, Oruzgan	Grazing	305	14	14	256	Community	0.3
Case Study VIII	Heart, Badghis, Farah	Irrigation	914	1348		1736	Mechanical	0.3
Case Study VII	Helmand, Nimroz	Grazing	305	13	14	256	Community	0.3
Case Study II	Parwan, Kabul, Kapisa, Bamyan	Grazing	305	12	14	256	Community	0.3
Case Study III	Logar, Wardak	Grazing	305	11	14	256	Community	0.3
Case Study IV	Nangarhar, Laghman, Kunar	Grazing	305	11	14	256	Community	0.3
Case Study VII	Helmand; Nimroz	Irrigation	914	1324		1736	Mechanical	0.3
Case Study VI	Ghazni, Paktika, Paktia	Grazing	305	10	14	256	Community	0.3
Case Study IV	Nangarhar, Laghman, Kunar	Agriculture	610	1027	14	1314	Manual	0.3
Case Study IX	Kandahar, Laghman, Kabul	Roads	914	2207	14	2552	Mechanical	0.2
Case Study I	Northern Region all provinces	Irrigation	914	262		1023	Manual	0.1
Case Study VI	Ghazni, Paktika, Paktia	Irrigation	914	1071		1736	Mechanical	0.1
Case Study X	Other provinces except Case IX	Roads	914	1983	14	2552	Mechanical	0.1
Case Study I	Northern Region all provinces	Grazing	305	16	14	302	Dogs	0.1
Case Study VIII	Heart, Badghis, Farah	Grazing	305	15	14	302	Dogs	0.1
Case Study V	Kandahar, Zabul, Oruzgan	Grazing	305	14	14	302	Dogs	0.1
Case Study VII	Helmand, Nimroz	Grazing	305	13	14	302	Dogs	0.1
Case Study II	Parwan, Kabul, Kapisa, Bamyan	Grazing	305	12	14	302	Dogs	0.1
Case Study III	Logar, Wardak	Grazing	305	11	14	302	Dogs	0.1
Case Study IV	Nangarhar, Laghman, Kunar	Grazing	305	11	14	302	Dogs	0.1
Case Study VI	Ghazni, Paktika, Paktia	Grazing	305	10	14	302	Dogs	0.1
Case Study III	Logar, Wardak	Agriculture	610	1470	14	1986	Mechanical	0.1
Case Study XI	Kabul, Kandahar	Residential	914	5000		5726	Mechanical	0.0

Case Study	Provinces, regions	Land type	Human loss	Land output	Animal loss	Clearance cost	Technique	CB-Ratio
Case Study II	Parwan, Kabul, Kapisa, Bamyan	Agriculture	610	604	14	1314	Manual	-0.1
Case Study XII	Other provinces except Case XI	Residential	914	2000		3308	Manual	-0.1
Case Study IV	Nangarhar, Laghman, Kunar	Agriculture	610	1027	14	1986	Mechanical	-0.2
Case Study VIII	Herat, Badghis, Farah	Agriculture	610	454	14	1314	Manual	-0.2
Case Study VII	Helmand, Nimroz	Agriculture	610	446	14	1314	Manual	-0.2
Case Study VI	Ghazni, Paktika, Paktia	Agriculture	610	360	14	1314	Manual	-0.3
Case Study I	Northern Region all provinces	Irrigation	914	262		1736	Mechanical	-0.3
Case Study II	Parwan, Kabul, Kapisa, Bamyan	Agriculture	610	604	14	1986	Mechanical	-0.4
Case Study I	Northern Region all provinces	Agriculture	610	103	14	1314	Manual	-0.4
Case Study VIII	Herat, Badghis, Farah	Agriculture	610	454	14	1986	Mechanical	-0.5
Case Study VII	Helmand, Nimroz	Agriculture	610	446	14	1986	Mechanical	-0.5
Case Study XII	Other provinces except Case XI	Residential	914	2000		5726	Mechanical	-0.5
Case Study I	Northern Region all provinces	Grazing	305	16	14	661	Manual	-0.5
Case Study VIII	Herat, Badghis, Farah	Grazing	305	15	14	661	Manual	-0.5
Case Study V	Kandahar, Zabul, Oruzgan	Grazing	305	14	14	661	Manual	-0.5
Case Study VII	Helmand, Nimroz	Grazing	305	13	14	661	Manual	-0.5
Case Study II	Parwan, Kabul, Kapisa, Bamyan	Grazing	305	12	14	661	Manual	-0.5
Case Study III	Logar, Wardak	Grazing	305	11	14	661	Manual	-0.5
Case Study IV	Nangarhar, Laghman, Kunar	Grazing	305	11	14	661	Manual	-0.5
Case Study VI	Ghazni, Paktika, Paktia	Grazing	305	10	14	661	Manual	-0.5
Case Study VI	Ghazni, Paktika, Paktia	Agriculture	610	360	14	1986	Mechanical	-0.5
Case Study I	Northern Region all provinces	Agriculture	610	103	14	1986	Mechanical	-0.6

Annex 4: References

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