4.5 Irrigation sub-projects

4.5.1 Introduction

The irrigation sector within NSP III forms a significant part of the programme, in line with earlier phases of NSP, accounting for around 26 percent by investment value. Some 3,801 communities under NSP IIIA voted that their priority was for more reliable irrigated water supply for their land.

The survey sample consisted of 22 irrigation projects with a mixture of technical solutions; including canal and aqueduct construction, water reservoirs and water dividers. Canal construction made up 59 percent of the sample, with aqueduct construction 18 percent, and water reservoirs 14 percent. The survey sample covered 5,256 families, with an average community size of 239 and a total population of 26,870.

Out of the sample 36 percent were in defined hilly areas. The average cost per sub-project was US$22,144 across all regions. The average time to complete a sub-project was 15 months, with a time since completion of 30 months.

4.5.2 Nature of impacts

Based on discussions with beneficiaries, NSP irrigation sub-projects provided families with positive economic impacts, along with wider benefits arising from improved water management. Table 4.5.1 outlines the types of benefits reported by communities.

Table 4.5.1: Types of benefits from irrigation projects

Category of impacts	Benefit description reported by beneficiaries
Economic	▶ Improved yield from better water supply ▶ Wider variety of crops produced and double cropping ▶ Increased off land sales of extra crops produced ▶ Cost savings from bagging sand to protect land from flood water
Social	▶ Time saved from shorter distances to access to water ▶ Time saved from reduced efforts in maintaining canals ▶ Increased produce for home consumption/wider variety ▶ Reduction in community conflict associated with waiting for access to irrigation water and tending to canal cleaning duties
Other	▶ Improved transport connectivity from water flow control ▶ Lower incidence of malaria from reduction in stagnant water

Source: BRD NSP III Beneficiary Survey 2014

The primary benefit of NSP investment was viewed as improved yields, leading to increased off-farm/land sales and produce for home consumption. Beneficiaries also reported social benefits from the reduction in the time to water fields and maintain canal structures, as well better connectivity as a result of improved water control minimising damage to roads. Another aspect of better water management of irrigated land is improved social cohesion. This results from reduced family conflicts over

access to water for irrigation and disputes over undertaking their fair share of canal cleaning.

Table 4.5.2 sets out selected impact indicators for the sector. Compared to before NSP investment, beneficiaries indicated that yields on their main crop, wheat, improved by an average of 11.2 percent and the amount of land irrigated rose by 26 percent (an average increase of 23 hectares or 117 Jeribs per community).

NSP investment also enabled communities to grow a wider variety of crops predominately vegetables, such as tomatoes and onions, and staples such as rice and corn. In a small number of cases crops regarded as more water intensive, such as cotton, were also grown.

Table 4.5.2: Irrigation impact indicators

Impact indicators	Without NSP investment	With NSP investment
Land irrigated	9,504	11,970
Yield of main crop wheat	93.6	103.6
Home consumption (KG/week/family)	-	2.7
% reporting increase in costs to achieve yields	-	29%
% reporting formal O&M systems in place	-	50%

Source: Atos Consulting analysis 2014

The attribution of the changes in yields, income and home consumption to NSP's investment was generally very high across the sample. In response to a question on the factors influencing the changes in land productivity, almost 100 percent stated that it was due to better irrigation brought about by NSP investment. In order to achieve this, 29 percent of the sample reported incurring additional costs, primarily increased inputs of seed and fertilizers. Overall the irrigation investment had, in their view, improved family income relative to the period before NSP investment.

The approach to O&M of irrigation systems varied across the sample. A significant proportion, 50 percent, reported having established supervision committees or employed dedicated resources to maintain structures (paid through Aid Box collections or payment in kind by way of food produce).

More formal O&M arrangements included the allocation of families to maintain particular stretches of the irrigation system. For those communities without a formal maintenance system in place, the view of community representatives was that they would be able to collect contributions as and when required.

4.5.3 Economic analysis

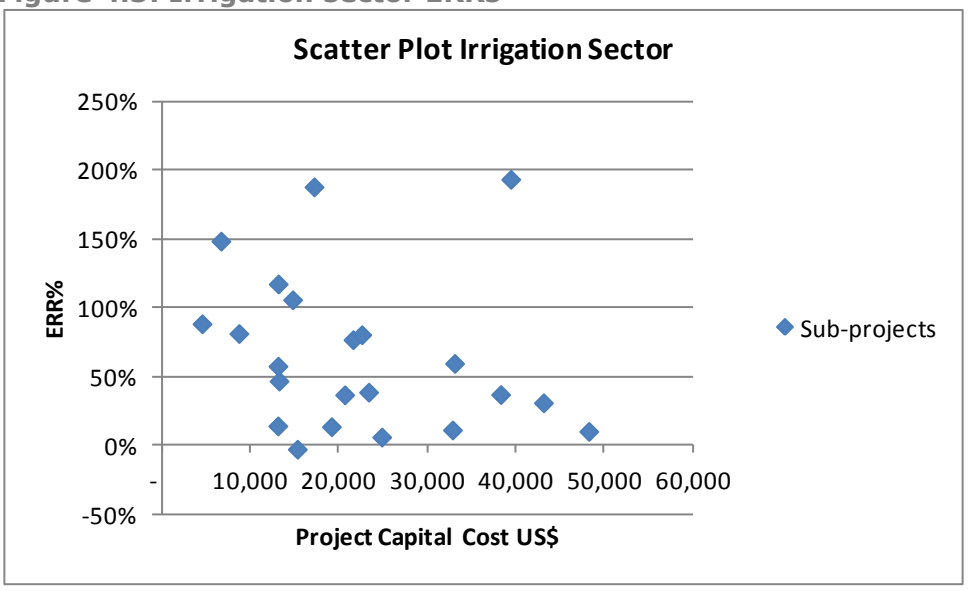
The economic analysis is based on taking into account the monetary value of the extra produce from improved yields (for the main crop, wheat, and additional crops grown) and the impact of the expansion of irrigated land[33]. On average the sub-projects selected had been completed for some 30 months, therefore providing a sample of communities that had experience of two or more cropping seasons.

[33] Only yield and land expansion effects are taken into account in the impact analysis. The value of production uses the baseline period (or before project) reported produce market value.

Capital costs, maintenance and operational charges (in most cases these costs are reduced due to the improved infrastructure) and an allocation of FP/NSP management costs, make up the total investment cost. The time period for the economic analysis is based on a mix of the NSP engineering team's schedule of asset life, and the view of FPs for the different types of technical solutions. In the majority of cases a 10-15 year service life is used.

The economic analysis of the sample projects generated an average Economic Rate of Return (ERR) of 61.5 percent and this ranged from -3 percent to 198 percent. This return is after accounting for one failed project out of the 22, or five percent of the sample projects and netting off additional costs of production[34]. Figure 4.3 provides analysis of sector ERR by project investment size.

Figure 4.3: Irrigation sector ERRs



Source: Atos Consulting analysis 2014

Of the total number of sub-projects reviewed 5 returned an ERR below 12 percent, 5 were between 13 percent and 49 percent and 11 over 49 percent (of which 5 sub-projects were over 100 percent). The characteristics of those projects recording returns of over 100 percent was a combination of a relatively large expansion of irrigated area, positive yield effects, and the planting of new crops or high value added crops (for example producing cotton, rice or tomatoes).

Table 4.5.3 summarises the ERR by region. As outlined in the methodology section, regional sampling was affected by the requirement to assess projects with adequate time since completion and the security situation. These factors constrained the regional coverage of irrigation sub-projects. For the four regions covered the average returns by region were all above 12 percent. These regions maintained an ERR above 12 percent after applying a sensitivity test based on an increase in costs of 10 percent and a reduction in benefits of 25 percent.

The relatively high economic return in the North East region is due the sample being dependent on one project; a relatively low cost water divider scheme that positively impacted on large area of land. The ERR average for

[34] A cost of production factor of between 10% and 50% was used depending on the additional input costs outlined in the sub-project beneficiary survey return. For wheat, the primary crop, where seeds and fertilizer were added a gross to net factor of 25% was used (based on data from a USAID 2011 review of Afghan agriculture).

sub-projects in defined hilly areas was 34 percent compared to 77 percent for those in the plains.

Table 4.5.3: Economic Rates of Return by region

Regions	Average sub-project cost (USD)	ERR (Percent)	Sensitivity Analysis (Benefits fall by 25%/costs increase by 10%)
Central	13,247	47%	31%
East	23,690	58%	38%
West	19,348	74%	50%
North East	13,158	117%*	82%
Total	**22,144**	**61%**	**37%**

Source: Atos Consulting analysis 2014 (*only 1 project in sample)

Irrigation sub-projects account for the second highest failure rate prior to implementation or 17 percent of 88 projects under NSP III[35]. However, once projects have been completed, the NSP PIM report shows that irrigation projects function relatively well, having the second highest level of reported functionality after buildings[36]. Seven percent of sub-projects were reported as not functioning or functioning with defects based on NSP's analysis. The types of technical solutions more likely to report defects were canals, kariz cleaning and intakes.

This survey found five percent of projects not fully functioning, slightly lower than that recorded by the NSP PIM system. There were some sub-projects found with design related issues. For example one canal project, which was generally regarded as a success post completion, had been washed away by a recent flood and was no longer functional. Also the processes being used by communities for the maintenance of schemes were found to be variable; from reactive systems to more formal committees, with Aid Boxes, employing local people to maintain systems.

4.5.4 Wider impacts

The case study in Box 4.3 illustrates the type of benefits of improved irrigation infrastructure. The case study highlights improved social cohesion as an important wider benefit, in addition to the primary impact on food production and food security. The value of these wider benefits is not captured in the ERR presented, which only takes account of improved yields and reduced operating costs.

The survey found that nearly a third (29 percent) of schemes only directly benefited some landholders/households within the beneficiary communities. Generally, broader based community access was more likely where the scheme had enabled better water flow through a network irrigation system. However, in the majority of cases communities reported that the benefits of irrigation were viewed as being available across the community. This was because landless families used other people's land to grow crops and the greater availability of local produce.

[35] NSP Sub-Project Data List as of December 2013, NSP MIS department.

[36] NSP Project Implementation Monitoring (PIM), Quarter 3, 2013.

Box 4.3 Case Study of an irrigation project

Project: Canal Construction			
Region	East	District	Kot
Province	Nangarhar	Sector	Irrigation

Background: Sarai located in Kot District, 80 km from Jalalabad City, has 260 families whose primary source of income is agricultural produce. However, there was an urgent need for irrigation in the land as the community faced food shortages during the dry season. The existing canal was in poor condition leading to substantial water wastage. The community through NSP program prioritized 3 projects; the construction of irrigation canal, protection wall and also the construction of shallow wells.

The priority project selected by the community, through CDC consultation, was the construction of an irrigation canal providing improved water supply to 100 Jeribs of land and increasing irrigated land by another 20 Jeribs.

Project implementation: The CDC with the support of NPO/RAA Facilitating Partner designed the project. The CDC managed the implementation and the provided technical assistance. The total length of the canal is 140 metres, at a cost of AFN 975,000 and the project has been successfully constructed. The direct beneficiaries of the project are 140 families.

Operations and Maintenance: The project does not require regular operation and maintenance, but in the case of damage to the canal from flooding or other factors, the community has a system in place to collect contributions for repairing the structure.

Benefits: Before the project the community was using 40 days labour per year to maintain the canal, which has now been reduced with associated cost savings. The limited capacity of the previous canal made it difficult to irrigate the 100 Jeribs of land. The new system not only meets the irrigation need of the 100 Jeribs, but also increased the land under irrigation and extends water to other villages.

One major social benefit is a reduction in water disputes and conflict arising from sharing of water for irrigation. Before the project the community was restricted to cultivating crops that required less water, which limited their income. Now they are able to cultivate different crops (now growing corn, rice and tomatoes on 10 hectares in addition to wheat) and substantially increase income from the new crops by US$16,450 annually. The community also reported reduced maintenance costs by around US$220 per annum from the improved infrastructure and increased home consumption of 1kg per family per week.

Beneficiary Comments: ***'Earlier we had only one choice for cultivating wheat. Yield was not too high, and did not meet our family needs for the whole year. Now we are growing enough to sell to the market. We have also started growing different vegetables and crops.'*** **Source: BRD research 2014**

4.5.5 Impact summary

This review has found that the irrigation sub-projects are providing benefits to communities after 30 months of operation. Crop yields show an improvement of 11 percent on average with some high impacting sub-projects (as evidenced by high ERR). The benefits go beyond improvements in yields, with reductions in conflict over access to water being an important externality.

This review found high levels of functioning sub-projects consistent with the NSP PIM monitoring reports. Nonetheless, a significant percentage of sub-projects (25 percent) were delivering returns below 12 percent, and beneficiaries reported limited use of new seeds and fertilizers. There is also evidence of lower returns in hilly locations compared to the plains.

Complementary support through stronger linkages to agricultural advisory services is an area for consideration by NSP. This could provide more technical input at the design stage, providing an additional boost to productivity - helping underpin land production sustainability. Further, communities are using a variety of methods to maintain infrastructure, some more formal than others, and sharing experiences of which methods work best would be a useful topic for dissemination. NSP is in discussions with MAIL about closer co-operation in planning community level investments.

4.6 Transport sub-projects

4.6.1 Introduction

Transport has been the most important sector in the NSP portfolio with investment accounting for 33 percent under NSP IIIA by value (31 percent by volume). Out of a total of 8,627 completed sub-projects in NSP IIIA, 2,842 are in the transport sphere. The two dominant scheme solutions are gravelled tertiary roads and basic access roads (each accounting for 31 percent of the portfolio). Other significant interventions include culvert and pathway construction schemes.

This survey sample consisted of 33 NSP IIIA transport sub-projects across all six regions completed more than a year ago. The average time to complete a project was 22 months and the average time since completion was 17 months. These 33 projects covered 7,617 beneficiary families with an average community size of 223 families.

Transport projects cost on average US$27,051 across all regions, with higher average costs in the North East and North-West. The average cost for the sampled tertiary road schemes was US$27,290, US$29,713 for pathways and US$16,705 for culverts.

The average investment per family for transport sector schemes is approximately US$121. Eleven percent of the sub-projects in the survey sample were delivered in hilly areas.

4.6.2 Nature of impacts

Based on discussions with beneficiaries, NSP transport sub-projects have provided communities with important social as well as economic impacts. Table 4.6.1 outlines the types of benefits being reported by communities. The most common reported quantifiable benefits were journey time savings (to markets, schools and clinics), reduced transport cost and

increases in the volume of agricultural goods traded. These benefits are the predominant impacts used in the cost-benefit assessment.

Table 4.6.1: Types of benefits from transport projects

Category of impacts	Benefit description reported by beneficiaries
Economic	▶ With proper roads, beneficiaries reported time saved to reach markets ▶ Reduction in transport cost means reduced prices for goods brought from outside and sold in local markets ▶ Cost savings as families no longer have to use donkey for transport of goods and people ▶ Cost savings in maintenance as without projects, houses next to roads suffered from water logging ▶ Better access has led to significant increase in land prices for some villages. ▶ Ability to bring construction materials on motorised vehicles meant increase in construction of houses in the villages ▶ No road blocks during snow or monsoons ▶ Tractors are able to drive right up to the agricultural farms in the villages
Social	▶ Time saved for children who are often the ones carrying agricultural produce to the local market, better utilised in going to school. ▶ Increased enrolment of girl students in villages once schools became more accessible and better access to schools in the nearby areas. ▶ Easier to hold government sponsored or community projects in the villages as doctors and NGO workers are now more willing to visit these villages. ▶ Increased communication among neighbouring villages ▶ Proper waste water drainage reduced conflict among community members ▶ During harvest season families worked overtime to transport produce to markets before it perished, leaving less time for personal leisure
Health	▶ Along with roads, proper drainage also reduces cases of malaria and throat diseases ▶ Ease of transport to the nearest clinic ▶ Vehicles can be brought right up to the village for emergency cases, instead of using donkeys to carry patients to the main road

Source: BRD NSP III Beneficiary Survey 2014

Table 4.6.2 details the changes in selected impact metrics reported in the beneficiary survey. Before the NSP investment beneficiaries indicated that 32 percent used donkeys as their main means of transport. On average people spent 65 minutes in making a trip to the nearest market, and this fell to an average of 47 minutes after the investment. With the construction of tertiary roads and culverts connecting villages to nearby town centres and others hubs, beneficiaries reported an increase in volume of goods transported and passenger traffic to markets, clinics and schools.

The most common monetary benefits arose from time saved per trip and reductions in transport costs for goods. Compared to before NSP investment, commuter costs fell by an average of 24 percent for those villagers paying for transport. The cost of transporting 1 seer of farm produce fell from 4.8 AFN to 3.2 AFN, with a reported uplift of nine percent by volume for goods sold.

Table 4.6.2: Impact indicators

Impact indicators	Without NSP investment	With NSP investment
Time per trip (market) per family	65 minutes	47 minutes
Transport costs (commuters) AFN	39.0 per trip	29.8 per trip
Transport costs (goods) AFN	4.8 per seer	3.2 per seer
Agricultural goods sold by sample	15,001 seer	16,426 seer

Source: Atos Consulting analysis 2014

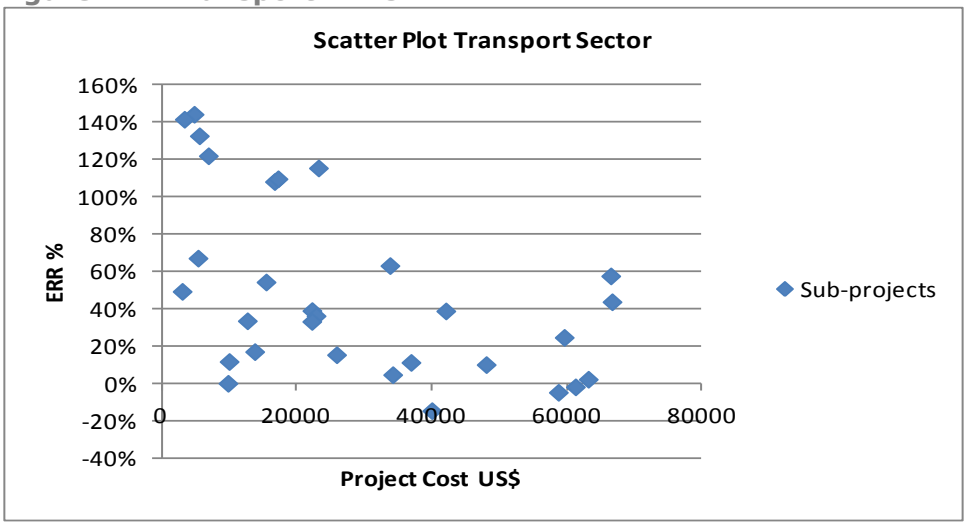
Sixteen sub-projects (48 percent) reported having formal supervision committees in place to sustain road schemes. Generally, repair and maintenance is being undertaken through contributions collected on a needs basis. Only four of the sub-projects had a regular fee collection system in place, with contributions per family ranging from 50 AFN to 200 AFN per month (US$1 to US$4). These user charges represented between 10 and 40 percent of the average cost of a transport sub-project (at US$27,000). For the remaining projects either there was no formal plan to sustain the project, or groups of families are made responsible for the section of road in front of their houses.

4.6.3 Economic analysis

The economic analysis is based on the monetary value of (i) time savings due to better connectivity (including time savings to local markets and time saved by children getting to school), (ii) transport cost savings, and (iii) the value of increased volume of agricultural produce.

Capital costs, user charges (where applicable) and an allocation of FP/NSP management costs make up the total investment cost over time. The economic analysis is undertaken over three years for gravelling sub-projects and 15 years for other sub-projects. Although the asset life of gravelling projects in the NSP asset life register is expected to be six months to one year, this survey found that after an average of 17 months the infrastructure schemes continued to sustain benefits. The sample sub-projects generated an average Economic Rate of Return (ERR) of 30.8 percent, and this ranged from -15 percent to 144 percent. Figure 4.4 provides analysis of ERRs by project investment size.

Figure 4.4: Transport ERRs



Source: Atos Consulting analysis 2014

Tertiary road gravelling schemes generated an average ERR of 29 percent. Transport projects in defined hilly areas produced an ERR of 11 percent compared to 36 percent in the plains. After excluding two failed sub-projects, 10 returned an ERR below 12 percent, 10 were between 13 percent and 49 percent and 11 over 49 percent (with 7 over 100 percent).

Table 4.6.3 summarises the ERR estimates by region and shows that all regions achieved an ERR above 12 percent. The higher rate of return found in the West region is due to the regional sample consisting of four culvert projects.

The sensitivity of the results is also shown, by testing a fall in benefits by 25 percent and a rise in costs by 10 percent, and this indicates that Central and East schemes fall below 12 percent.

Table 4.6.3: Economic Rates of Return by region

Regions	Average sub-project cost (USD)	ERR (Percent)	Sensitivity Analysis (Benefits fall by 25%/costs increase by 10%)
Central	26,583	17%	9%
East	23,497	24%	10%
West	12,389	85%	58%
South	20,250	26%	16%
North East	41,526	45%	18%
North West	43,904	49%	20%
Total	**27,032**	**31%**	**16%**

Source: Atos Consulting analysis 2014

The NSP PIM report shows that of 223 sub-projects monitored in the transport sector 13.5 percent were functional with defects. The types of problems reported included low quality and cracks in some parts of bridges, retaining walls and culverts, as well as improper graveling of roads. A small proportion, 0.4 percent, was reported as not being functional[37].

This survey found a slightly higher sub-project non functionality rate. Out of the 33 projects, five (or 15 percent) were found to be either functional with defects or not functional. All of the projects that were assessed as non-functional were tertiary road schemes, with two found to be not functioning (one had been destroyed and the other affected by military activity).

4.6.4 Wider impacts

Investment in transport provides a wide range of social and indirect economic benefits not all of which are captured in the above ERR estimate (which only accounts for the value of cost and time savings).

Beneficiaries also mentioned intangibles, like better access to neighbouring villages, as a strong positive outcome of NSP investment, and other tangibles, like the money saved in the repair and maintenance of vehicles.

The case study in Box 4.4 illustrates one community's view on the impact of improved transport on village life. The case study is of a gravelling and

[37] PIM report 3rd Quarter 2013.

culvert construction scheme in Herat and illustrates other wider benefits. These include better access to clinics and school, a reduction in wastage of perishable agricultural goods and improved communication with neighbouring villages.

The Polwari transport project at the time of the survey was nearly three years old. This demonstrates that this particular gravelling project was able to sustain positive benefits and this may be due to the way maintenance is being organised by the community. The case study also shows the spill-over impacts on other communities utilising the improved road infrastructure.

4.6.5 Impacts summary

The review of NSP IIIA projects indicates that 31 percent of CDCs elected for more roads and better connectivity as their priority. There is also a high demand for road gravelling projects. The review has found that the transport sub-projects surveyed after 17 months of operation continue to provide benefits to the community.

A key issue is the ability of communities to maintain the infrastructure. The sustainability of rural roads is a particular problem that so far has no long-term solution. The Ministries of Public Works and Rural Rehabilitation and Development have recently made agreements with CDCs to maintain some stretches of rural roads and assessing the effectiveness of these arrangements will be important in the next phase of NSP.

Sustainable arrangements for maintaining the rural roads infrastructure remains a major challenge. However, the experience of Polwari village is that for now they are able to sustain positive benefits from their road investment.

Box 4.4 Case Study of transport project

Project: Tertiary Road Gravelling			
Region	East	District	Kuz Kunar
Province	Nangarhar	Sector	Transport

Background: Polwari Village, 15 Km from the district capital, had no access road to connect the village to neighbouring villages and district capital. Villagers relied on animals to transport produce to market or visit clinics. Because of the time taken, the community was reluctant to produce perishable items like fruits and vegetables, which need to be transported to the local markets in minimum time.

Project Details: The community with the technical support of the FP (NPO/RRAA) designed the project. With NSP funding of USD 59,000 and CDC contribution of USD 6300, a 1.7km graveled road was constructed (along with culvert construction and diversion walls), connecting the village to the nearest market and clinic.

Operations & Maintenance: An Operation and Maintenance Committee has been established for maintenance of the project, whereby in case of damage to the facilities, money is collected from each family on a need basis. According to community members, when the road was damaged due to floods in March 2013, each family contributed around 10 Afs and around USD 400 spent to repair the road. The project was completed in July 2011 and was found to be in a functioning order as of April 2014.

Benefits: The direct beneficiaries of the project are 224 families. However the survey team noted that all nearby villages now have a shorter route to district capital/markets and have also indirectly been benefited. Community members estimate that around 500 families have benefited from this project.

- Travel time to markets reduced by 10 min per trip, to school by 30 min, and to the nearest clinic by as much as 60 min.
- With the road, it is now easier to shift patients to the clinic as vehicles have access right inside the village.
- Villagers now cultivate vegetables and fruits as they have easier access to the nearby markets, and earn additional income.
- Having no road access was a major constraint for other development activities. With better access to the village other organizations, like DACAAR (Water Project), NRC (Shelter for refugees) and Save the Children (Education Project), are now implementing their projects.

"We now have easy access not just to the markets but also to the clinics and schools. We can now safely take our children to schools and pregnant women to clinics".

Source: BRD research 2014