Holding Back the Tide

Social Return on Investment of the Embankment in coastal Badin District, Pakistan

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19 August 2015

Contents

The embankment, with fresh water flowing from Mirwah Canal to fill the lakes on the landward side

1 Executive Summary

The embankment that was constructed in coastal Badin District in 2012 has been instrumental in securing the livelihoods of more than 1,200 poor households. The cost of building the embankment was PKR 13 million (US$ 130,000) at today's prices, and for every rupee (PKR) spent, an estimated PKR 131 of economic, social and environmental value has been created.

The embankment, built to prevent seawater from flooding the land, has protected the nearby communities from climate change impacts, such as increasing sea level and the effects of storms driving seawater inland. It has altered the hydrology of the area, causing the entire ecosystem to change. Over 3000 acres of farmland that was recently too saline to grow crops are now cultivated again. Fish, prawn and crabs are abundant in the lakes and creeks that are now filled with freshwater rather than brackish water, increasing the income of fishing households by an estimated PKR 214,000 each year. Fodder is easily available, and with it the number of livestock owned by each household has more than doubled, and the time spent by women procuring fodder decreased. *Typha*, an important roofing material, is abundant and used to repair homes and for sale. Because the land can be cultivated, its price has increased significantly.

Beyond those material changes, men and women in the villages describe feelings of renewed hope for the future, and renewed self-confidence. Many women described that they are spending more, are more able to care for the household, and are more involved in the community.

These findings were evaluated using a social return on investment (SROI) approach to identify what project outcomes created the most value in the lives of the project's stakeholders.

The further significance of the embankment, though, is in demonstrating how a large number of other communities in the lower Indus delta (and beyond) could be supported to adapt to climate change and come out of poverty that is entrenched by deteriorating environmental conditions. To this end, we recommend the following:

1. Maintenance. As it is principally constructed from compacted earth, the embankment may only last 5 years without maintenance. A priority is for local government and/or groups from the communities themselves to establish a mechanism for maintaining the embankment every two years.

2. Extending the existing embankment. Extending the embankment to protect other communities that are beyond its current reach is likely to give a similar rate of return.

3. Exploring other places where embankments would work. The potential for similar embankments to play an important role in the climate change adaptation and poverty reduction strategies of district and provincial governments within Sindh province – and beyond – is significant. Feasibility studies and a commitment to use climate change adaptation and poverty reduction funds to build appropriate, safe embankments where people's lives and livelihoods are affected by seawater inundation would be a practical and highly effective strategy.

4. Increasing the voice of coastal populations. During this evaluation, we found evidence of good working relations between local government departments and local NGOs. This is an excellent foundation from which to support local communities to have a greater say in the decisions that affect them.

5. Climate Change Adaptation and Disaster Risk Reduction. Opportunities to further increase these communities' ability to adapt to climate change and disaster risk include:

- Using the likely replacement of many *katcha* houses with brick ones to ensure that the houses are designed to provide protection from riverine and pluvial floods.
- Introduce agricultural techniques, diversification of crops and crop varieties that are adapted to the projected climate variability in coastal Pakistan.

2 A Short History of the Badin Embankment

'Before the embankment, my land was in the sea. Now I am cultivating this land'

Farmer from Khamoon Mallah village

In 2012, Laar Humanitarian and Development Programme (LHDP), supported by Oxfam Novib, constructed an embankment in coastal Badin District. This embankment has made profound changes to the lives of the villagers who live near the coast. It has reduced some of the risks that climate change brings, revitalised agricultural and fishing livelihoods, and brought renewed hope into the lives of thousands of poor people.

2.1 The starting point: coastal livelihoods under threat

Most of the people who live in coastal Badin District are either farmers or fishers. Just a few years ago, both these livelihoods were on the verge of collapse.

The primary reason for this was that sea water was repeatedly entering the land. This had fundamentally altered the coastal ecosystem, and with it, the basis of people's livelihoods. Farmland had become saline, with the rice, cotton, sugarcane and other crops of previous years reduced to a single crop per year on the few hectares that could still be cultivated. Little fodder was available, and livestock ownership was reducing. The intrusion of seawater had also turned the shallow lakes and creeks that criss-cross the area brackish, reducing their productivity to the fishermen. Many fishermen were fishing in deeper waters – a less regular and more costly activity. Some villagers had moved to urban areas to look for work, or were migrating seasonally in search of day-labour.

Why was seawater entering the land? Badin District is part of the Lower Indus plain, formed by the alluvial deposits of the Indus River, with a general elevation of about 50 meters above sea level. The coastal areas are lower than this, and are highly exposed to sea level rise and coastal erosion. The level of the sea is rising globally, due to anthropogenic climate change, at a rate that has increased to over 3mm per year since the 1990s[i]. At the same time, river deltas are generally subsiding as upstream dams capture the sediments that would once have been deposited by annual floods. The combination of these processes result in increased erosion of coastal areas and greater intrusion of seawater inland. In coastal Badin, the Left Bank Outfall Drain (LBOD) has exacerbated seawater intrusion.

Moreover, coastal Badin is highly disaster-prone, having been affected by floods in 2010 and 2011, by cyclones, heavy rains and heat waves. Climate change has intensified the risk of these types of extreme weather events, and the science is clear that extreme climate events over the coming decades will have an increasing impact on human health, security, livelihoods, and poverty across Asia[ii].

This combination of collapsing livelihoods and frequent disasters has resulted in the coastal populations of Badin being the poorest of the District.

The Laar Humanitarian and Development Programme (LHDP)

LHDP was established in 2006, emerging from the efforts of a group of friends working in different walks of life. They had realized that there was no adequate local institution for making vulnerable and marginalized communities more resilient and well informed in the wake of disasters.

LHDP have been working in southern Sindh since it was established under the Societies Act 1860 in July 1st, 2006. It has been working on three main sectors: humanitarian response, sustainable livelihoods, and disaster risk reduction.

The organization works directly with communities, acknowledging them as the frontline actors through building their capacities. LHDP works in six districts of Sindh province: Badin, Thatta, Tando Mohammad Khan, Kashmore, Shahdad Kot, and Hyderabad.

2.2 The intervention: building the embankment

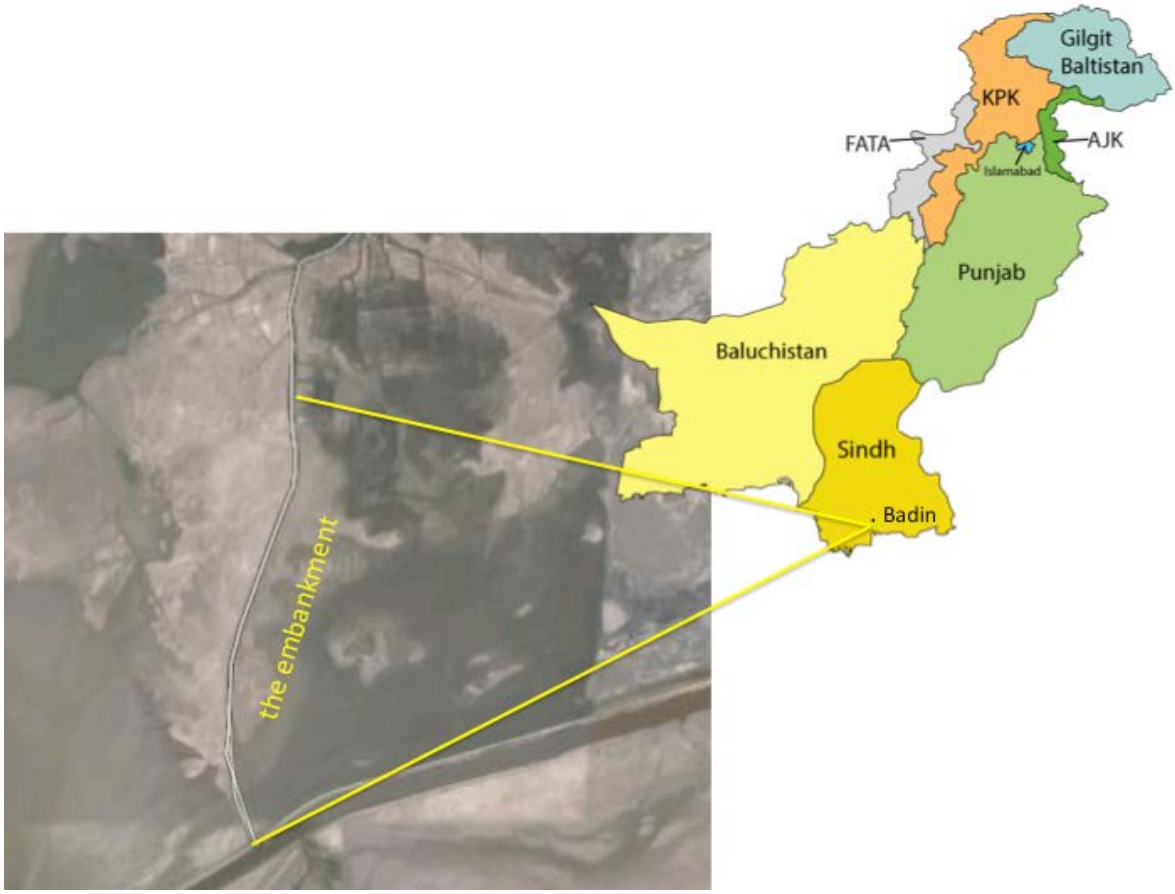
In 2012, the local organisation LHDP and Oxfam Novib – in collaboration with the Sindh Irrigation and Drainage Authority (SIDA) – constructed an embankment to stop seawater from entering the land.

The embankment is 2.26 km in length, running from Pateji to Mirwah Talhar tail-end above the village Shaikh Keerio Bhandari. It is constructed of compressed earth and has a height of 7.5 feet.

In 2014, additional culverts were put in to allow drainage of any excess water. Two thousand mangroves were planted on the seaward side of the embankment, and 2500 trees planted on the embankment itself (*Konocarpus* sp. and *Euclom* sp.) to strengthen it. Although the tree planting was unsuccessful, the mangroves are growing.

LHDP have also implemented several other activities with a number of the communities, including climate change awareness raising, and support on adapting agriculture to climate change. This report, however, is only concerned with evaluating the outcomes of the embankment, and not with these other activities.

Map of the Badin embankment, Sindh Province, Pakistan[iii]



2.3 How people's lives have changed

'Now I feel that I can eat easily three meals a day, and have social activities. I am feeling that I am an important person because I have some money'

A fisherman, Ashique s/o Baloch Kahn, Shad Man Lund Village

The embankment has altered the hydrology of the area, causing the entire ecosystem to change.

First and foremost, the embankment provided a physical barrier to seawater, preventing it from flooding the land. Heavy rains – and fortunately the monsoon rains have been good in the years since the embankment was built – then leached salt from the surface of the soil. This made it possible to cultivate farmland that had previously been infertile (Figure 1). This in turn increased the value of land, and increased crop production. The increased crop production meant that farming households could sell more rice, increasing their income, which, along with also having more rice stored for household consumption, contributed to increased food security.

With seawater no longer penetrating inland, the water in lakes and creeks turned from being brackish to freshwater. This increased the productivity of these water bodies, making fish more available and increasing fish catch. This in turn increased the income and food security of fishing households (Figure 1).

The decreased salinity of the soil also meant that more fodder became available. This increased the carrying capacity of the land for livestock, and reduced the amount of time required to feed animals. Many households increased the number of livestock they kept (Figure 1), which increased their assets and also increased milk production, with greater consumption in the households and more opportunities for sales.

The reduced soil salinity also enabled bullrush (*Typha* sp.) stands to develop. *Typha* is often among the first wetland plants to colonize areas of newly exposed wet mud, with their abundant wind dispersed seeds that can survive buried in the soil for long periods of time. It grows in freshwater (or slightly brackish) conditions. With *Typha* readily available, households had a readily available source of material to make roofing mats to repair their homes, and for sale.

Beyond the material changes, members of the communities emphasise other things that have changed. A frequent response from villagers was that they felt happier now because they knew they would have three good meals a day. Several people mentioned that they were planning for the future for the first time in years, planning to rebuild their *katcha* houses in brick.

There is even evidence that the embankment has reversed migration to urban areas: a reported 22 families from the 30 villages surveyed have returned from Badin and other towns where they had previously gone to find work.

2.4 Changes in women's lives

'Our ground water was brackish before, now after the construction of the embankment it has changed and become sweet water'

Hawa, a women from Morio Mandhro village

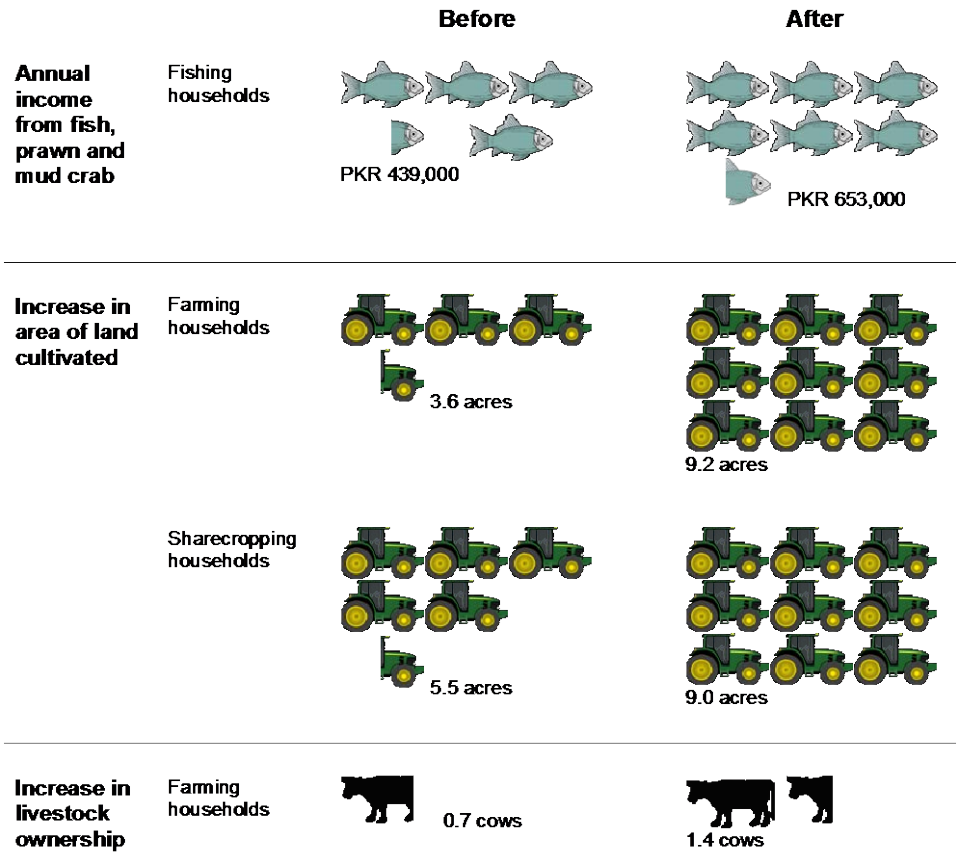
Many of these changes are reported at a household level, and there have been specific changes in women's lives, too.

Even though the number of livestock kept by most households has increased, with fodder more readily available, women reported spending less time feeding livestock (an average of one hour forty minutes less each day). Women have taken the opportunity to develop new livelihood opportunities, such as catching and drying small fish for the poultry industry, and selling *Typha* roofing mats.

The spending power of many women has improved, and many expressed pride that they can buy new *jutis* (shoes), clothes, and items for the home, and that they felt they could manage their households now.

Nearly half of the women we spoke to said that they felt more respected and were more involved in decision making as a result of the economic upturn in their lives

Figure 1. Changes in fishing income, area of land cultivated and cow ownership before and after the embankment



Women and girls talking about the embankment in Shaikh Kirio Bhandari village

3 The Evaluation: Social Return on Investment

'*Our income has increased, my children are going to school, and we have food*'

Allah Dino, a fisherman from Haji Sakhi Mandhro village

This part of the report focuses on the quantitative evaluation of the impacts of the Badin Embankment. The methodology used, Social Return on Investment (SROI)[iv], is a holistic approach to evaluation that allows the measurement of social, environmental and economic value that a project (or organization) has created.

The methodology has six steps and this section of the report goes through each step in turn:

- Establishing the scope
- Identifying stakeholders
- Mapping outcomes
- Evaluating the outcomes and giving them a value
- Establishing impact
- Calculating the SROI

3.1 Scope of the study

The scope of the evaluation is to capture the changes in the lives of key stakeholders created by the Badin Embankment.

3.2 Identifying stakeholders

Within SROI analysis, stakeholders are defined as *people or organisations that experience change, whether positive or negative, as a result of the activity being analysed*.

The lead investigator, together with LHDP project staff, identified a list of potential stakeholders. This provisional list was then finalised through meetings with stakeholders themselves – community discussions, meetings with local government staff and with other local NGOs. The full list of stakeholders, including the rationale for inclusion or exclusion of possible stakeholders, is given in the Supporting Material[v].

The first group of stakeholders are the communities that live directly inland from the embankment, who rely on **farming**, **sharecropping** and **fishing**. New livelihoods opportunities have opened up for women and existing ones have become more profitable. **Absentee landowners** have also benefitted, as more of their land become cultivatable.

To understand the impact of the embankment, on all of these stakeholders, it is important to understand where the changes took place. Although the original plan of the embankment project was focused on a small number of villages, it had not been anticipated that the effects would transform an ecosystem. Anecdotally, it seems likely that around 50 villages might have gained in some way, even if they have to travel to realise some of these benefits (e.g., increased fish or *Typha* availability). For the purpose of measuring the impact, we took a conservative stance that 30 villages nearest the embankment had benefitted (see the Supporting Material for details). This is likely to underestimate the impact of the embankment.

The 30 villages contain a total of 1238 households, of which 24% farm their own land, 31% are sharecroppers and 39% fishers[vi].

With the land, lakes and creeks increasingly productive, there are more opportunities for **local government** agencies to generate revenue. For example, water charges (*Abiana*) are payable according to the acreage of each crop. The Sindh Irrigation and Drainage Authority (SIDA) have undertaken improvement work to the irrigation system, dredging and extending irrigation channels up to the embankment. There would have been little point in doing so when much of the land was uncultivated.

Finally, the experience of **LHDP** in developing and implementing the project has increased their understanding of climate change adaptation, and has given them additional opportunities to collaborate with local government. Other NGOS and government authorities confirmed the high regard in which this expertise is held.

The people of coastal Badin District

A survey of coastal Badin and Thatta Districts was conducted in 2011 by the Sindh Coastal Development Project[vii]. The survey included villages in Bhugra Memon and Ahmed Rajo Union Councils, where the current evaluation took place.

The 2011 survey found very high poverty rates, with 55% or 73% of households classified as poor depending on the methodology used. Human Development Index (a combined measure of life expectancy, education, and per capita income) scores within Badin were 0.36, which is comparable with those of Least Developed Countries. Most houses (77%) were *katcha* (wattle and daub), and average monthly income was PKR 18,607 (approximately US$180).

Almost all of the agricultural land is smallholdings, with the average farm size being 10-11 acres Rice yields are low, averaging 45 monds per acre. Twenty-eight percent of households reported owning buffaloes, 15% owned cattle, and although 22% of households produced milk, just 3% sold any. The diet was generally poor, with just small amounts of protein, fruits and millk consumed. Purchasing food accounted for 51% of the average household expenditure. Out migration was reported from 31% of villages.

Women were generally free in their right to vote and own livestock, and were usually consulted on household matters. However, they owned almost no property and almost none of them had outside employment. Female literacy rates were just 5%, compared to 22% for males.

3.3 Mapping and valuing outcomes

3.3.1 The outcomes

The changes (outcomes) that the communities and the other stakeholders experienced were identified in a two-stage process.

An initial list of changes was identified through discussions with LHDP project staff. These were then tested through focus group discussions and individual interviews and revised according to stakeholders' own perceptions of what changes had happened and which were important.

Most of these changes have already been described in Section 2 (above), and the full list of outcomes given in Table 1.

3.3.2 Evaluating the outcomes establishing value

One or more indicators were developed for each outcome to understand what changes had happened (see Supplementary Material for details). Financial proxies were also developed for most of the outcomes (Table 1) to enable a valuation of the changes. Data on the indicators and proxies were collected in individual structured interviews with farming, fishing and sharecropping households (3 households of each type from a sample of 12 of the 30 villages) and with women (also 3 from each of twelve villages).

This was cross-referenced with evidence from focus group discussions in each of the 30 villages. Further triangulation of data was conducted through semi-structured interviews with land agents (for land price changes) and with two market traders (for *Typha* roofing mats).

Information on the outcomes for other stakeholders was obtained through interviews with key staff (and in the case of the outcome for LHDP, a questionnaire for staff who had worked on the project).

Table 1. Outcomes of the Badin Embankment

Stakeholder	Stakeholder sub-group	Outcome
Communities	All households	Increased availability of housing materials
		Increased food security
		Increased income
	Fishing households	Increased fish, prawn and mud crab catch
	Farming households	Increased land available for cultivation
		Increased land value
		Increased incidence of ownership disputes
		Increased fodder availability
		Increased ownership of productive assets (eg livestock)
	Sharecropping households	Increased land available for cultivation
		New livelihood options (*Typha* for making mats)
		Increased fodder availability
		Increased fish, prawn and mud crab catch
		Increased ownership of productive assets (eg livestock)
	Women	Decreased workload (reduced time collecting fodder)*
		Increased confidence*
Absentee landowners		Increased land value
LHDP		Increased technical knowledge and expertise
Local Government	Sindh Irrigation Drainage Authority	Increased revenue from increased irrigation use (*Abiana*)

Notes:

1. Outcomes in italics were not used for the overall calculation of impact. This was to avoid double counting: the outcome of 'increased income' for all households is the sum of the increases in income from the specific livelihoods activities of fishing, rice cultivation, milk and dairy production and sales of *Typha* roofing mats.
2. Women participate in almost all of the outcomes, and were separately interviewed on them. However, as the unit of analysis is the household, only those outcomes unique to women are listed in this table.
3. Outcomes marked * were evaluated qualitatively but not ascribed a financial proxy due to time constraints.

3.4 Establishing impact

Most often, multiple factors come together to bring about change. Understanding this is necessary to prevent falsely claiming greater impact from an activity than is actually the case. This section outlines the approach taken to understanding the contribution to change of the Badin embankment. Conservative assumptions were used for all outcomes, which means that the final valuation is likely to be an underestimate. The deadweight, attribution, displacement and drop-off were estimated for each outcome separately.

3.4.1 Deadweight and attribution

'Deadweight' is a measure of the amount of outcome that would have happened even if the activity had not taken place. 'Attribution' is when that contribution can be assigned to a specific organisation.

The details of the deadweight and attribution assigned to each outcome are given in the Supplementary Material, but the general approach was as follows.

Those outcomes directly relating to the physical changes (such as increase in land prices) were given a deadweight of 10% to reflect the slim possibility that another agency would have built the embankment.

For other outcomes, the deadweight was estimated through an analytical process with LHDP staff, where a range of possible contributing factors were assessed, and the most conservative estimate (highest deadweight) taken. This lead to deadweights of between 10-50% for all outcomes.

The only direct attribution is the livestock distributed by the Pakistan Red Crescent Society and Badin Rural Development Society. The attribution was set at the number of livestock distributed as a proportion of the estimated total number of livestock in the 30 villages (see Supplementary Material). This is a conservative figure (i.e., high attribution) as it assumes no livestock deaths or sales have happened since distribution.

3.4.2 Displacement

'Displacement' is when an outcome from the project cancels out an existing activity elsewhere, such as when an enterprise set up by a project causes a similar enterprise nearby to fail.

In this study, there was little potential for displacement, as rice, fish and dairy are sold beyond the local area (e.g., traders transport some fish for sale in Karachi). The potential of increased production of *Typha* roofing mats was one possible case. It was assessed through with semi-structured interviews with two traders in Badin, who did not think the extra production would affect the market to a significant degree. Displacement was thus set between zero and 20% for all outcomes.

3.4.3 Drop-off

'Drop-off' is the estimate of how much an outcome reduces over time: for example, livestock will become less valuable after a certain age, or rising input prices might reduce the income from rice farming over time.

The basic rationale for estimating drop-off used here is that the minimum lifespan of the embankment in the absence of any maintenance is 5 years, equivalent to a drop-off of 20% per year. This is highly conservative, as it assumes no maintenance, and because many outcomes would not stop immediately if the embankment was breached (e.g., it would take repeated inundations of seawater over time to make soils infertile).

Making typha roof mats in a sharecropping household, Shaikh Kirio Bhandari village

3.5 Calculating the SROI

3.5.1 Investment

The total investment in the Badin embankment was calculated as PKR 10,846,000 (Table 2, and see the Supplementary Material for further details). At today's prices, this is equivalent to approximately PKR 13 million (US$ 130,000)

3.5.2 Calculating the impact

The main outcomes and their estimated value are given in Table 3, below.

Not all of the impacts would have accrued immediately, and so the first year of impact was set as 2013. As mentioned previously, without any further maintenance, the lifetime of the embankment may be as little as 5 years. This is the duration over which value is projected.

The Government of Pakistan's discount rate of 3.5% is used to reduce the value of each outcome after the first year. This recognises the fact that people generally prefer to receive money today rather than tomorrow because there is a risk or because there is an opportunity cost to delay.

As mentioned above, due to time constraints, it was not possible to establish a value for all of the outcomes (see Table 1). By not including these outcomes, the valuation is likely to underestimate the total value created by the embankment.

The main value created is in the increase in the value of land, and the increase in catch of fish, prawn and mud-crab. These two outcomes account for 89% of the total value created (Figure 2). Other important areas of value are increased rice production, and the value of *Typha* mats (as both home-made construction materials and for sale). Approximately 91% of the value accumulated in the communities themselves.

The average increase in value estimated for fishing households was PKR 218,000 (US$ 2,140) per year (Figure 3). Farming households gained by PKR 1,413,000 ($13,900) per year, with the increase in land price responsible for 92% of this increase. Sharecropping households gained an estimated PKR 293,000 (US$ 2,350) per year.

3.5.3 Sensitivity analysis

Despite rigorous data collection, analysis and calculation, the SROI ratio is still an estimate of true value created by the embankment. Sensitivity analysis is a way of exploring how robust the SROI ratio is.

It works by varying some of the assumptions in the SROI calculation. If small changes to the assumptions reduce the ratio to 1:1 then the estimate is unlikely to be robust, whereas if the assumptions have to be altered beyond the point where they could realistically lie in order to bring the ratio down to 1:1, then the SROI ration is more likely to be robust. The assumptions that were tested (Table 4, below) were: exclusion of the outcomes that contribute most of the value, a slower onset to the benefits than was reported, increasing deadweight, attribution and displacement of the impacts.

In summary, the SROI ratio remains positive even if these assumptions are changed to wholly unrealistic levels. The SROI ration of this project should be considered robust.

3.5.4 The Social Return on Investment

The base-case social return on investment for the Badin Embankment is that over the five years since its construction it is forecast to have **created value equivalent to PKR 131 for each rupee spent**. This represents an exceptional return on investment[viii] and makes a strong case for the maintenance of the embankment and the construction of similar embankments elsewhere.

Table 2. Estimated cost of the Badin Embankment (2012 prices)

Embankment construction:	PKR 9.8M
Estimated cost of additional unbudgeted LHDP time staff:	PKR 720,000
Estimated value of support from SIDA in tendering and supervising the construction:	PKR 15,000
Cost of tree & mangrove planting and culverts	PKR 311,000
Total (2012)	**10,595,000PKR**
Total (inflation adjusted to 2015 prices)	**13,198,753PKR**

Table 3. Summary of the values created by the Badin Embankment

Stakeholders		Outcomes	Financial proxy indicators	Value in first year	Value over 5 years
Communities	(All households n = 1238)	Increased availability of housing materials	Value of home-produced typha mats used to repair houses	3,455,263PKR	9,447,985PKR
		Increased food security	Value of reported changes in diet	2,292,140PKR	6,766,397PKR
		Increased income	Change in income	*147,872,458PKR*	*439,086,713PKR*
	Fishing households (n=484)	Increased fish, prawn and mud crab catch	Change in income from fishing	103,466,044PKR	305,431,762PKR
	Farming households (n = 295)	Increased land available for cultivation	Change in income from rice farming	5,950,656PKR	18,962,510PKR
		Increased land value	Change in value of land	381,895,364PKR	1,127,355,113PKR
		Increased fodder availability	Change in income from milk sales	2,858,187PKR	8,437,368PKR
			Value of reported change in consumption of milk/dairy	2,355,856PKR	6,954,486PKR
		Increased ownership of livestock	Value of change in number of livestock	22,271,596PKR	65,745,751PKR
	Share-cropping households (n = 388)	Increased land available for cultivation	Change in income from rice farming	5,103,894PKR	15,066,695PKR
		New livelihood options (typha mats)	Value of change in sales of typha roofing mats	2,698,011PKR	7,377,373PKR
		Increased fodder availability	Change in income from milk sales	595,596PKR	1,758,198PKR
			Value of reported change in consumption of milk/dairy	3,098,549PKR	9,146,918PKR
		Increased fish, prawn and mud crab catch	Change in income from fishing	27,795,666PKR	82,052,806PKR
		Increased ownership of livestock	Value of change in number of livestock	12,817,314PKR	37,836,710PKR
	Absentee landowners	Increased land value	Change in value of land	51,831,409PKR	153,006,320PKR
NGOs	LHDP	Significant change in expertise on climate change adaptation	Equivalent cost of achieving reported change in technical expertise	1,417,500PKR	4,517,041PKR
	SIDA	Increased revenue from irrigation water use (Abiana)	Increased revenue from irrigation water use (Abiana)	229,978PKR	732,853PKR
		Grand Total		**630,133,022PKR**	**1,860,596,287PKR**
		Net Present Value			**1,724,700,388PKR**
		Investment			**13,198,753PKR**
		SROI Ratio			**131**

Notes:

1. The numbers given in this table are the actual ones used for calculation and if quoted independently should be rounded up to the nearest ten thousand rupees.
2. The first year values and input costs are adjusted for inflation to current year equivalents.

Figure 2: The proportion of total value contributed by each outcome.

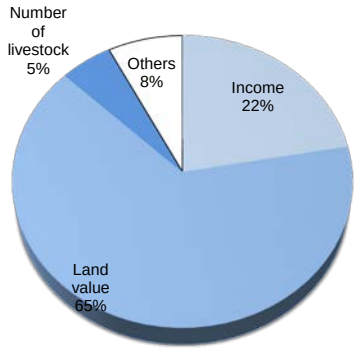


Figure 3. Average value accruing to fishing, farming and sharecropping households per year (in thousand PKR)

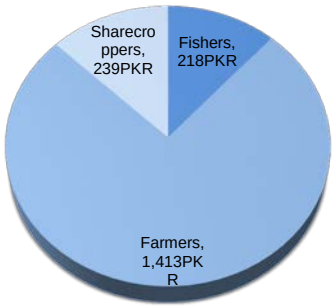


Table 4: Effect on the SROI ratio of varying key outcomes and discounting rates

Adjusted Variable	SROI ratio
Calculated SROI ratio	131:1
Outcomes	
Removing the land price outcome	41:1
Removing the value of both land price and of fish, prawn and mud crab	14:1
Removing the value of land price; fish, prawn and mud crab; and livestock asset	6:1
Deadweight, attribution, displacement and discount rates	
Increasing the combined deadweight and attribution to 90% for all outcomes	16:1
Increasing the combined deadweight and attribution to 90% and the displacement to 20% for all outcomes	13:1
Increase discounting rate to 8% (i.e., slightly higher than the highest rate of annual inflation in Pakistan since 2012)	119:1
Time of impact	
Reduce the impact in first year of impact (2013) by 50%	108:1

4 Recommendations

The Badin Embankment is an outstanding example of climate change adaptation. Communities that were loosing their livelihoods, and becoming increasingly impoverished suggested the embankment as a solution. After the correct process of conducting a feasibility assessment and commissioning an engineer to design and build it, LHDP, working in collaboration with the Sindh Drainage and Irrigation Authority brought about its construction.

The communities are now protected from the threat of sea floods every time there is a high tide. Their livelihoods have returned, and their income, sense of confidence, and ability to plan for the future have grown.

The impact of the embankment on the lives of poor people gives rise to some important recommendations:

1. Maintenance. As it is principally constructed from compacted earth, the embankment may only last 5 years without maintenance. A priority is for local government and/or groups from the communities themselves to establish a mechanism for maintaining the embankment every two years.

2. Extending the existing embankment. Extending the embankment to protect other communities that are beyond its current reach is likely to give a similar rate of return.

3. Exploring other places where embankments would work. The potential for similar embankments to play an important role in the climate change adaptation and poverty reduction strategies of district and provincial governments within Sindh province – and beyond – is significant. Feasibility studies and a commitment to use climate change adaptation and poverty reduction funds to build appropriate, safe embankments where people's lives and livelihoods are affected by seawater inundation would be a practical and highly effective strategy.

4. Increasing the voice of coastal populations. During this evaluation, we found evidence of good working relations between local government departments and local NGOs. This is an excellent foundation from which to support local communities to have a greater say in the decisions that affect them.

5. Climate Change Adaptation and Disaster Risk Reduction. Opportunities to further increase these communities' ability to adapt to climate change and disaster risk include:

- Using the likely replacement of many *katcha* houses with brick ones to ensure that the houses are designed to provide protection from riverine and pluvial floods.
- Introduce agricultural techniques, diversification of crops and crop varieties that are adapted to the projected climate variability in coastal Pakistan.

Livestock grazing on the vegetation close to a freshwater lagoon

5 Notes and references

[i] IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)].Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

[ii] IPCC, 2013 (ibid)

[iii] Note: This map is a generalized illustration only, and the representation of political boundaries do not necessarily reflect international issues of recognition, sovereignty, and jurisdiction.

[iv] For more information on Social Return on Investment, see Social Value International at http://socialvalueint.org/tag/social-value-international/

[v] Further details of the SROI methodology and clculations are given in the supplementary document '*SROI of the Badin Embankment: Supporting Material*', Steve Jennings, August 2015.

[vi] The livelihoods of the remaining 6% of the villages was not recorded, but following the study by the Sindh Coastal Development Project, the villages are likely to include small numbers of government workers, businessmen, wage labour, etc.

[vii] Sindh Coastal Community Development Project (2012). Baseline Survey of Coastal Areas of Badin & Thatta Districts. Main Final Report. Published by: Sindh Coastal Development Authority, Sindh Coastal Community Development Project, Planning and Development Department, Government of Sindh. Karachi.

[viii] Comparison of the SROI ratio of the Badin Embankment with that of similar projects is limited by the small number of climate change adaptation projects that have so far been evaluated using SROI methodology. The Talensi FMNR Project in Ghana (a World Vision project) gave a SROI ration of 43:1 within 10 years of the end of the project (Peter Weston & Reaksmey Hong (2013). Talensi Farmer-Managed Natural Regeneration Project in Ghana. Social Return on Investment Report. World Vision Australia). In Kenya, an evaluation of an adaptation project with farmers yielded an estimated SROI ratio of 47:1 (Chaudhury, A.S., Helfgott, A., Thornton, T.F. & Sova, C. (2014). Participatory adaptation planning and costing. Applications in agricultural adaptation in western Kenya. Mitigation and Adaptation Strategies for Global Change, Published online July 2014. Springer International Publishing AG).

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