Okavango River Basin Transboundary Diagnostic Analysis Technical Report

OKACOM

The Permanent Okavango River Basin Water Commission

Okavango River Basin Trans-Boundary Diagnostic Assessment (TDA): Botswana Component

Climate Change and Tourism Development

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Environmental protection and sustainable management of the Okavango River Basin

EPSMO

SOCIOECONOMIC SERIES

Climate Change and Tourism Development

Assessing the impact of climate change on tourism activities and their economic benefits in the Okavango Delta

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1. BACKGROUND

The EPSMO Trans-boundary Diagnostic Analysis (TDA) for the Okavango River Basin is to be completed in 2009, and it will be informed by an Environmental Flows Analysis (EFA), being carried out in parallel. The EFA involves the development of a model with response curves which estimate changes in socio-economic values for the basin in response to changes in river flows.

One of the most important economic activities in the lower parts of the basin is nature-based tourism. The hydrological modeling for the lower river basin in Botswana will involve an inundation or flooding model. A response curve will be needed for the relationship between commercial tourism and its values, and changes in inundation in the lower basin. No data exist for this relationship. The common intuitive assumption is that tourism activities and values would decline if flooding declined, but some evidence exists to suggest that the opposite might hold in certain circumstances.

Tourism in the delta involves self-driven or guided use of campsites, and guided use of lodge and tented camp accommodation. By far the bulk of the economic value is derived from expenditure on the accommodation services and the expenditures linked to these. The accommodation-based tourism product in the lower basin commonly involves a combination of water-based and land-based experiences in varying degrees of relative importance. Water-based experiences generally involve guided boat and/or mokoro travel in channels, floodplains, and ledibas, for the purposes of wildlife viewing and/or angling. Land-based experiences generally involve guided travel by safari vehicle for game viewing drives, and guided walks on trails, etc. This concept is for a survey of lodge managers and/or tour operators in Botswana to determine their perceptions on how their tourism operations and outputs would be affected by changes in flooding.

1.2 OBJECTIVES

The objective of this survey is to determine the perceptions of lodge managers/or tour operators on how their tourism operations and outputs would be affected by changes in flooding in the Okavango Delta, Botswana.

1.3 THE STUDY AREA: THE OKAVANGO DELTA

This study was carried out in the Okavango Delta located in north-western Botswana (Figure 1). The Okavango Delta has a high ecological integrity. It is formed by the inflow of the Okavango River which originates from the Angolan Highlands. The Okavango River finally drains into northwestern Botswana to form the huge wetland known as the Okavango Delta. The wetland covers an area of about 16, 000 square kilometers (Tlou, 1985). Based on flooding frequencies, the delta can be partitioned into five main regions, which are perennially flooded swamps (4887 sq. km), seasonally flooded swamps (3855 sq. km), seasonally flooded grassland (2760 sq. km), intermittently flooded areas (2502 sq. km) and dry land (1842 sq. km) (Ashton et al., 2003). Gumbricht & McCarthy (2002) describe the geological formation of the

Okavango Delta as resulting from active uplift (upwelling) associated with the African Superswell. The upwelling and faulting caused the flow of the Okavango River to split into several channels that form many islands, lakes and lagoons. The Okavango Delta is characterized by large amounts of open water and grasslands which sustain human life, plant life, wildlife, birds, insects and various living organisms. According to Okavango Delta Management Plan (2006), there are 1300 identified plant species, 71 fish, 33 amphibians, 64 reptiles, 444 birds and 122 mammals in the Delta.

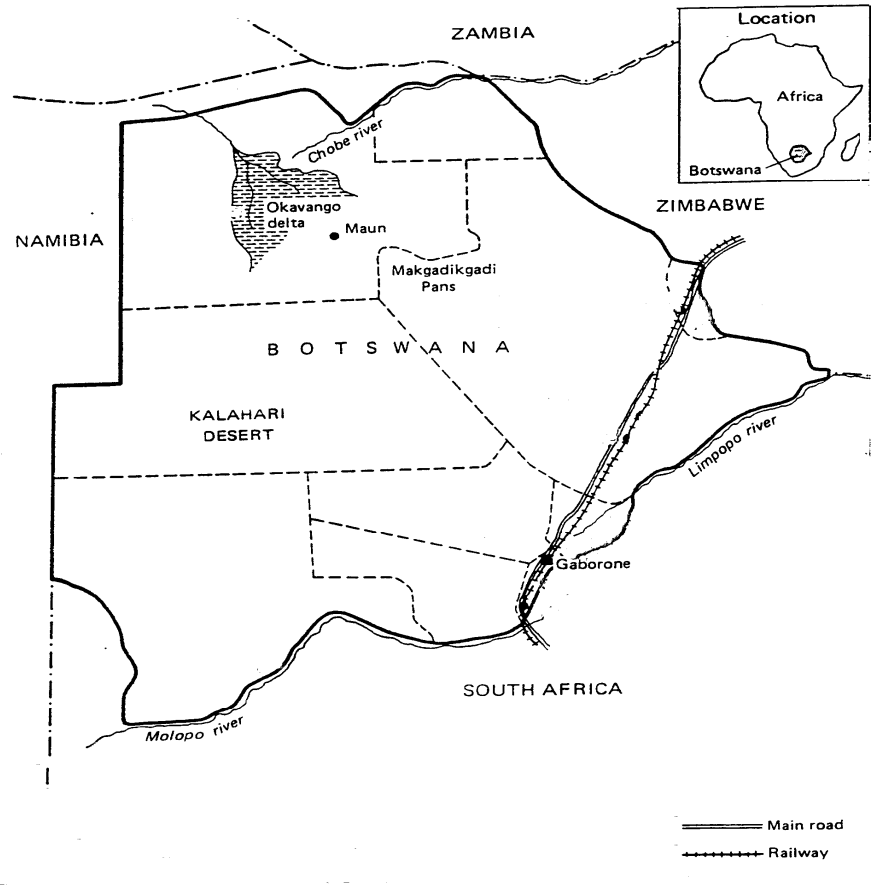

Figure 1: Map of Botswana showing the Okavango Delta

The Okavango Delta is also home to 124,712 people who live within and around it (CSO, 2002). Over 95 percent of these people directly or directly depend on the natural resources found in the wetland to sustain their livelihoods (NWDC, 2003). Livelihood activities include collection of various plant products for diffent uses, fishing and flood recession farming (Kgathi et al., 2004). Due to its rich wildlife diversity, permanent water resources, rich grasslands and forests and scenic landscapes, the Okavango Delta has become one of the key international tourism destinations in Botswana. The rich flora and fauna found in the Okavango Delta and the increase in tourism development make the wetland a suitable site for investigation in this study.

1.4 Significance of the Survey

This survey is considered significant because of the following reasons:

- The impacts likely to be caused by climate change in the Okavango Delta on turnover in tourism businesses. That is, how high floods and low flooding patterns in the Okavango Delta is likely to affect turnover in the different parts of the Okavango Delta, and hence the national contribution of tourism to GDP.

- Since the study is part of a series of studies on the Okavango River Basin cutting across Angola, Namibia and Botswana, results of the survey should inform decision makers on the best scenario in the integrated management of the Okavango River Delta.

- The study also gives an insight on how tourism business managers are likely to adapt to the changing flooding patterns as a result of climate change.

2. METHODOLOGY

A sample of 48 tour operators based in Maun or lodge managers based in parts of the delta was surveyed using a short face to face interview to determine their perceptions regarding the effects of the output (turnover) of their own business in the face of changes on flooding in the delta. An attempt was made to ensure that the sample covers lodges/camps that offer mostly water-based experiences (e.g. Swamp Stop, Jacana Camp or Little Vumbura), those that offer more or less both (e.g. Xigera, Mombo, or Camp Moremi), or those that offer mostly land based activities (e.g.Chitabe, Santawani or Khwai River Lodge).

Each respondent was asked questions relating to possible flooding patterns and expected changes in business or economic output in their resort. The resorts were characterized according to whether:

a) It caters for the upper-market, mid-market or lower market,
b) It specializes in mainly water-based activities, mainly land-based activities, or similar amounts of both,
c) It is large (more than 30 beds), medium (20 to 30 beds) or small (up to 20 beds).

The respondents were asked to assume that the current annual turnover at that site is 100%, and to suggest how turnover might change with each of the following long term scenarios reflecting changes to the flooding patterns in their area, e.g., will it increase from 100% by 25% to 125%? Or decease by 40% to 60%?

Their estimate of likely change in annual turnover output were made for each of the following five scenarios:

i) High level - high volume flooding, as in the top right of Figure 1 below, to the extent that the frequently flooded parts of their area become permanently flooded, the occasionally flooded parts in their area become frequently flooded, and the rarely flooded parts in their area become occasionally flooded. (Turnover changes ____ (up or down) by ____% to become ____% of current levels)

ii) Low level - low volume flooding, as in the bottom left of Figure 1, to the extent that the permanently flooded parts of their area become only frequently flooded, the frequently flooded parts of their area become only occasionally flooded and the occasionally flooded parts of their area become only rarely flooded. Main channels and ledibas remain permanent. (Turnover would change ____ (up or down) by ____% to become ____% of current levels)

iii) Low level - low volume flooding, as in the bottom left of Figure 1, to the extent that the permanently flooded parts of their area become only occasionally flooded, the frequently flooded parts of their area become only rarely flooded and the rarely flooded parts of their area become never flooded. Only the deeper main channels and ledibas remain permanent while the rest become seasonal only. (Turnover would change ____ (up or down) by ____% to become ____% of current levels)

iv) Low level - low volume flooding, as in the bottom left of Figure 1, to the extent that the permanently flooded parts of their area become only rarely flooded, and frequently occasionally or rarely flooded parts of their area become never flooded. The main channels and *ledibas* become seasonal and dry for much of the year. (Turnover would change ____ (up or down) by ____% to become ____% of current levels)

v) Low level - low volume flooding, as in the bottom left of Figure 1, to the extent that no flooding takes place in their area, and groundwater has to be tapped to provide water points for game and to supply the camp. (Turnover would change ____ (up or down) by ____% to become ____% of current levels)

Respondents were further asked, in an open ended question, what adaptations if any, they might be able to make to mitigate any damages they may suffer as a result of these changes. They were also asked in an open-ended question, if they have any comments, observations, or points of interest to make regarding the scenarios and their possible effects on tourism.

Data was analyzed using simple cross-tabulation according to the types of facility (upper, mid or lower market), product type (mainly water based, etc.), and size, as well as scenario, with the scores being averaged. This was assumed will provide basic data for the development of EFA response curves.

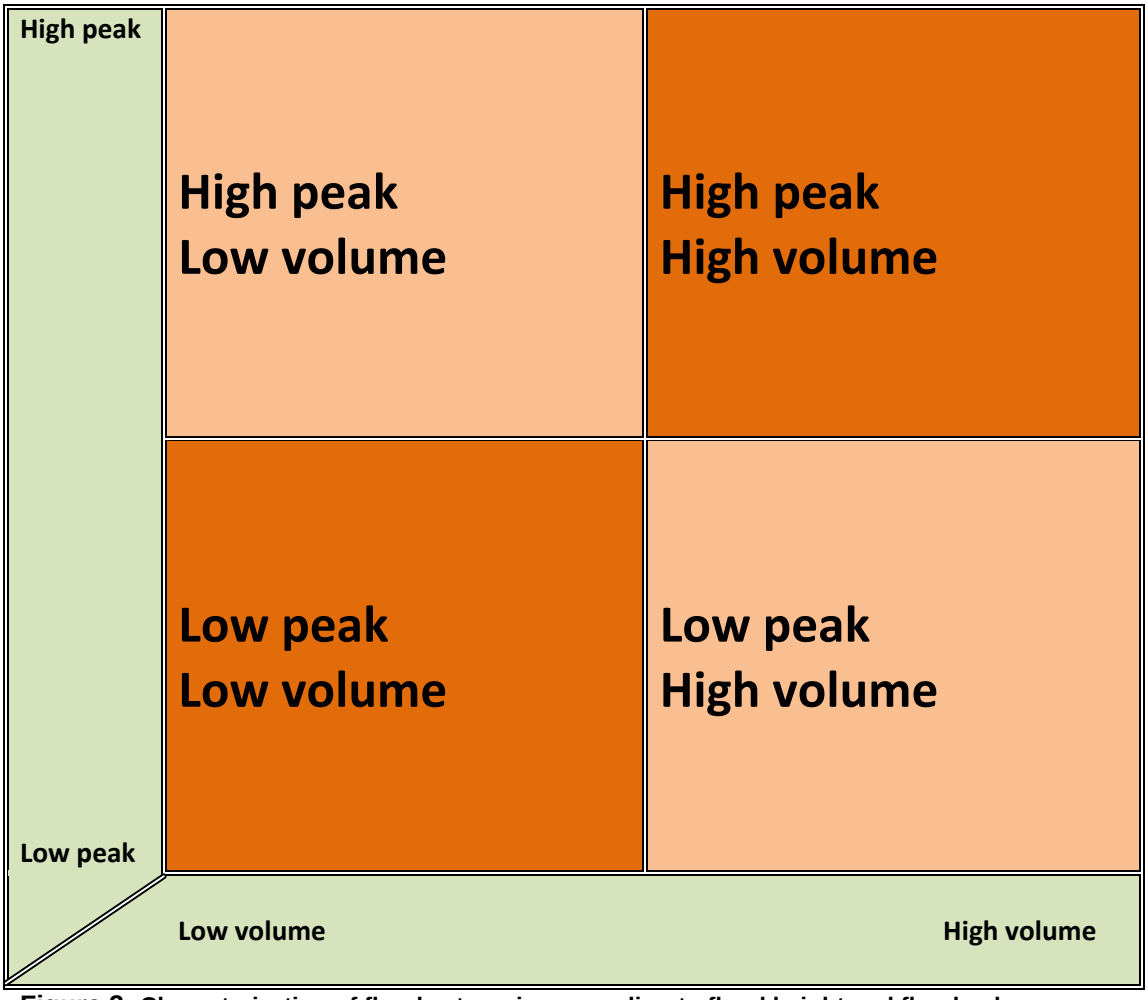

Figure 2: Characterization of flood categories according to flood height and flood volume

3. RESULTS

3.1 Types and Location of Business

Since the 1990s, there has been an increase in tourism establishments in the Okavango Delta. At present, it is estimated that the Okavango Delta has a total of 107 accommodation establishments. These establishments provide services for the different tourism segments and are located in different parts of the Okavango Delta. In determining the types of accommodation facilities, accommodation establishments were categorised into the following: hotels, lodges, guesthouses and campsites as shown in Table 1 below.

Table 1: Types of Accommodation Establishments

Type of Business	Frequency	Percentage
Hotel	2	4.2
Lodges	34	70.8
Guesthouses	1	2.1
Campsites	11	22.9
Totals	48	100.0

Results in Table 1 shows that of the 48 accommodation establishments whose managers were interviewed, 4.2% are hotels, 70.8% are lodges, 2.1% are guesthouses and 22.9% are campsites. These businesses are located in different parts of the Okavango Delta. Location was divided into upper (panhandle), middle and lower parts of the Okavango Delta. Results in Table 2 show that 10.4% of the establishments in the survey are located in the upper part (panhandle) of the Okavango Delta, 50.0% in the middle, while 39.6% are located in the lower parts of the wetland.

Table 2: Location of Accommodation Establishments

Type of Business	Frequency	Percentage
Panhandle	5	10.4
Middle area of the Delta	24	50.0
Lower area of the Delta	19	39.6
Totals	48	100.0

Table 2 also shows that the middle parts of the Okavango Delta have a higher number of accommodation establishments, followed by the lower parts of the Okavango Delta. Thus, changes in flooding caused by climate variation or change in climate is bound to have a higher impact on accommodation establishments located in the middle and lower parts of the Okavango Delta.

3.2 Type of Market and Services Provided

There are different tourists segments that visit the Okavango Delta each year. These tourists segments are categorised based on the level of expenditure they have during their visit to the Okavango Delta. In this survey, the different types of businesses are categorised into three based on the income level of visitors to these establishments. The categories are: up-market, middle market and lower market tourists. Table 3 shows the percentage of businesses services of particular tourist segments.

Table 3: Tourist Segments

Type of Business	Frequency	Percentage
Upper Market	24	50.0
Middle Market	14	29.2
Lower market	10	20.5
Totals	48	100.0

Table 3 shows that 24 or 50.0% of the managers of establishments interviewed noted that they provide services for up-market tourists, 29.2% for middle market, while 20.5% provide services for the lower tourists market. Services provided by tourists provided can also be caterigorised into water based tourism activities, land based tourism activities or both, while the last category is that of hotels which provide services to anyone who cares to lodge with them despite the income level they happen to fall into (Table 4).

Table 4:Specialisation of Tourism Business

Specialisation of Business	Frequency	Percentage
Water-based tourism activities	7	14.6
Land-based tourism activities	18	37.5
Both water and land activities	19	39.6
Offers accommodation to everyone	4	8.3
Totals	48	100.0

Results in Table 4 show that almost all the accommodation facilities except for the last category (4 or 8.3%), are depended on flooding patterns in the Okavango River Delta. This means that the availability of land-based or water-based tourism activities in the Okavango Delta will largely depend on flooding patterns of the Okavango River. As a result, changes in flooding caused by climatic variation will affect the tourism business either positively or negatively depending on location of the facility.

3.5 Size of Accommodation Establishments

In an attempt to control negative environmental impacts caused by tourism development, the Botswana Government allocates accommodation establishments in different sites in the Okavango Delta based on the number of beds allowed per night. The Government assumes that the number of tourists, tourism activities and facilities in different sites of the Okavango Delta can be maintained within the carrying capacity of the different sites as determined by the number of available beds per accommodation establishment. The number of beds in a particular zone is thus perceived by the Botswana Government as a tool to control the negative

environmental impacts caused by tourism in the wetland. Table 5 below shows the number of beds available in the different parts of the Okavango Delta.

Table 5: The Number of Beds Available

Size of Accommodation Facility	Frequency	Percentage
Large (more than 30 beds)	8	16.7
Medium (20-30 beds)	10	20.8
Small (up to 20 beds)	30	62.5
Totals	48	100.0

Table 5 shows that the majority (83.3%) of the accommodation establishments in the Okavango Delta have the 30 or less beds per establishment. Only 8 or 16.7% of the establishments have more than 30 beds. These are facilities that are likely to be in the lower parts of the Okavango Delta especially hotels and lodges in Maun.

3.6 High Level-High Volume Flooding

Respondents were asked to state how their business turnover would be affected by flooding in the event that the frequently flooded parts of their area where their lodge happen to be located becomes permanently flooded with the occasionally flooded parts in their area becoming frequently flooded, and the rarely flooded parts in their area becoming occasionally flooded. Results on how turnover will be affected by high floods are shown in Table 6 below.

Table 6: High Level High Volume Flooding

Description of Turn Over	Frequency	Percentage
Turnover will go UP	8	16.7
Turnover will go DOWN	27	56.2
Nothing will change	13	27.1
Totals	48	100.0

Table 6 shows that 56.2% of the respondents noted that their turnover will go down in the event of flooding levels going high. When asked about the extent at which turnover will go down, 29.2% of the respondents said it will go down by 25%, 20.8% said it will go down by 50%, while 4.2% said it will go down by 100%. Some of the comments which respondents made as reasons why they assume their businesses will go down include the following: during high flooding roads become damaged, making access to tourism facilities and areas difficult; game viewing and bird watching becomes difficult because the damaged roads and a lack of concentration of bird species in particular areas as is the case when there is no flooding; and, tourists cancel their bookings because of the fear of increased incidence of diseases such as malaria and the risk associated with being killed by floods. Most of the facilities located in the middle and upper parts of the Okavango Delta are those that will have a low turnover due high floods. On a similar note tourism facilities like hotels in Maun and those situated far away from channels seem to have lower probability of being affected by high flooding levels in the Okavango Delta Infact, 45.8% of the respondents noted that turnover in their establishments will not be affected.

3.7 Low Level-Low Volume Flooding *(main channels and ledibas remain permanent)*

Responds were also asked to make speculations of their turnover in the event that flooding levels are low (low level - low volume flooding). Responded were specifically asked to indicated the extent to which their business turnover would change in the event that the permanently flooded parts of their area become only frequently flooded, the frequently flooded parts of their area become only occasionally flooded and the occasionally flooded parts of their area become only rarely flooded and main channels and ledibas remain permanent. Results on the extent at which turnover will be affected by low flooding patterns in the Okavango Delta are shown in Table 7.

Table 7: Low Level Low Volume Flooding

Description of Turn Over	Frequency	Percentage
Turnover will go UP	20	41.7
Turnover will go DOWN	9	18.8
Nothing will change	19	39.6
Totals	48	100.0

Results in Table 7 shows that majority (41.7%) of respondents noted that the turnover will go up; 18.8% said it will go down, while 39.6% said there will be no change. Results further show that for those who noted that their turn over will go up, 31.2% said it will go up by 25%; 4.2% said it will go up by 50% while 6.2% said it will go up by 100%.

3.8 Low Level-Low Volume Flooding *(only deeper channels and ledibas remain)*

Under this scenario respondents were asked to assume that flooding patterns in the Delta become low such that only deeper main channels and ledibas remain permanent while the rest of the areas become seasonal. Specifically, respondents were asked to indicate the extent of the change in business turnover under the low level of flooding where the permanently flooded parts of their area become only occasionally flooded, the frequently flooded parts of their area become only rarely flooded and the rarely flooded parts of their area become never flooded. In this scenario, only the deeper main channels and *ledibas* remain permanent while the rest become seasonal only. Table 8 shows the results.

Table 8: Low Level Low Volume Flooding

Description of Turn Over	Frequency	Percentage
Turnover will go UP	14	29.2
Turnover will go DOWN	14	29.2
Nothing will change	20	41.7
Totals	48	100.0

As shown in Table 8, an equal number of respondents (29.2%) said that the turnover will go down and up, respectively. For respondents who noted that their turnover will go up, 25% noted that their turnover will go up by 25%, while only 4.2% said it will go up by 100%. Respondents who noted that their turnover will go down, 25% noted that their turnover will go down by 25% while only 4.2% said it will go down by 100%. These respondents made the following comments regarding the changes of their turnover: the reduction of floods will lead to a reduction in water based activities; without water, some channels cannot be accessible; it will be hard to find game or wildlife for viewing since it will migrate to far away areas from our lodge; and some of our camps might become seasonal. A total of 41.7% of the respondents noted that there will be no change in their turnover.

3.9 Low Level-Low Flooding *(main channels and ledibas are seasonal and dry)*

Respondents were asked to state how their turnover would change if flooding levels become low such that the main channels and *ledibas* become seasonal and dry. Respondents were specifically asked to assume that flooding levels are low to the extent that the permanently flooded parts of their area become only rarely flooded, and frequently occasionally or rarely flooded parts of their area become never flooded. The main channels and *ledibas* become seasonal and dry for much of the year. Responses based on this scenario are shown in Table 9.

Table 9: Low Level Low Volume Flooding

Description of Turn Over	Frequency	Percentage
Turnover will go UP	16	33.3
Turnover will go DOWN	18	37.5
Nothing will change	14	29.2
Totals	48	100.0

Results in Table 9 show that 33.3% of the respondents noted that turnover will go up, the majority (37.5%) said it will go down and 29.2% said nothing will change. For those who said turnover will go down, 10.4% said it will go down by 25%, 25.0% said it will go down by 50%, while 4.2% will go down by 100%. Respondents noted that turnover will go down because of following: game will migrate to water fed points; water and land activities will become inaccessible; the environment will become dusty and clients may resort to other options; and, substitute *mokoro* for boats then run the camp seasonally or close down.

3.10 Low Level-Low Volume Flooding *(no flooding at all, boreholes drilled)*

Finally, respondents were asked to state how their turnover would change in the event that there is no flooding such that boreholes would have to be drilled for the supply of water. That is, the low volume flooding to the extent that no flooding takes place in their area, and groundwater has to be tapped to provide water points for game and to supply the camp. Results on how turnover is perceived to change under low volume flooding are shown in Table 10.

Table 10: Low Level Low Volume Flooding

Description of Turn Over	Frequency	Percentage
Turnover will go UP	16	33.3
Turnover will go DOWN	28	58.3
Nothing will change	4	8.3
Totals	48	100.0

Results in Table 10 shows that the majority (58.3%) of respondents noted that turnover will go down, 33.30% said it will go up while 8.3% said there will be no change. For those who said it will go down, 2.1% said it will go down by 25%, about 25% of the respondents said it will go down by 50% and 10.4% said it will go down by 100.0%. Respondents noted that turnover will go down because of the following factors: lack of water will affect water based activities; game will migrate to other areas; most water and land based activities cannot be carried out if there is no water.

3.11 Adaptations Strategies

Changes in flooding patterns will result in a fall in turnover in many accommodation establishments. Some of the managers made suggestions on how they can adapt to such changes, these include the following:

- When flooding decreases, operators should shift from water based tourism activities to land based activities.
- Increasing marketing and advertisement of tourism in the Okavango Delta to include land activities with less focus on water activities to avoid failure when floods fall.
- In dry periods, drill and increase water points in the form of boreholes. Where possible, pump water from permanent sites to drier areas and have water points for watering of wildlife.
- During years of high floods, operators should move away from flooding areas to relocate in non-flooded areas and different product available in the new site should be marketed.
- In dry periods, water should be supplied to the camp/lodge through the means of large water containers.

3.12 General Comments

Having been made aware of climate change effects on the flooding patterns of the Okavango River Delta and the resultant changes in turnover of tourism businesses, respondents in this survey made a few general comments about these changes as follows:

- Location of a tourism business is important since most tourists who come to the Okavango Delta like to view game and water. As a result, reduction in floods in the Okavango Delta will make some of the tourists loose interest in coming and this will affect turnover in many businesses.

- An increase in floods in the Okavango Delta may result in channels such as Savuti which dried many years ago to flow once more. In the event that this happens, new tourism businesses in that area can be opened up.

- High floods can also result in water flowing to areas such as Tsodilo Hills which are some of the important cultural sites in the Okavango Delta. These areas are currently having many visitors, and with increase of water in these areas, their tourism potential will be increased as more tourists will begin to visit these areas.

- Since bookings could get cancelled due to high floods, high floods could be viewed as not good for tourism related business.

- During low floods, birds return to their areas of concentration, and fishing becomes more prolific. Hippos and crocodiles become visible all year round, this is good business for tourism.

- If there is no water, there is no reason for tourists to come to the Okavango Delta.

- High floods may increase our expenditure (e.g. transport and utilities).

- During high floods some of the areas cannot be accessible and low floods can make the vegetation to become not attractive.

- The socio-economic status of the people living around the flooded areas is affected. Low turnover in tourism businesses due to flooding may result in no jobs and income for local people and this will affect their wellbeing.

4. Analysis of Results

Results in this survey focused on five main scenarios in assessing the impact of climate change on tourism activities and their economic benefits in the Okavango Delta, Botswana. This was carried out through an assessment of the perceptions of lodge managers/or tour operators on how their tourism operations and outputs would be affected by changes in flooding in the Okavango Delta, Botswana. As a result, this analysis is largely based on the perceptions of tourism operators on the level of flooding in the Okavango Delta. This descriptive approach on its own is not sufficient to make appropriate decisions in the management of the Okavango Delta. However, modelling these perceptions may yield better results and analysis.

Results in this survey indicate that the majority of the accommodation facilities that will be affected by change in flooding patterns are located in the middle parts of the Okavango Delta. These are facilities with which have up to 20 beds per night. Most of these facilities offer both land and water-based tourism activities. As a result, if there is need for mitigation measures to be taken, tourism operations in the middle parts of the Okavango Delta will need to brought on board.

Results indicate that High Level - High Volume flooding where the frequently flooded parts of their area become permanently flooded, the occasionally flooded parts in their area become frequently flooded and the rarely flooded parts in their area become occasionally flooded will affect the tourism turnover in the Okavango Delta. That is, turnover will go down. Factors which operators noted to this problem include the fact that when floods are high, roads become damaged and access to tourism facilities become difficult; game viewing and bird watching becomes difficult becomes of the roads, game also becomes scarce due to the lack of concentration of these species in particular areas as is the case when flooding is not a problem. Operators noted that when all these happen, tourists cancel their bookings because of the fear of problems of diseases such as malaria and partly because they do not want to be killed by floods. Results indicate that most of the facilities located in the middle and upper parts of the Okavango Delta are mostly those that will have a low turnover due high floods.

Based on the perceptions of tourism operators, high-level-high flooding is not a desirable phenomenon for the tourism industry. The issue of turnover going down can be illustrated by flooding patterns which took place in the Okavango Delta in 2000. Flooding in the Okavango Delta in 2000 resulted in the closure of Moremi Game Reserve (located within the inner parts of the Delta) for eight months because roads were impassable (Mbaiwa, 2005). During this period, there was a decline in self-drive tourists in the Okavango Delta and tourism revenue went down. The results of flooding in the Okavango Delta at this time resulted in retrenchments of workers in the Okavango Delta since turnover was low in most accommodation establishments. A similar scenario is likely to happen in the event of high flooding patterns in the Okavango Delta. Retrenchments suggest that income and livelihoods for most people working in tourism businesses in the Okavango Delta will suffer.

Results in this survey also indicate that turnover would also go down drastically in Low level-Low Volume flooding scenario. In this scenario, its so dry such that there is no flooding and boreholes have to be drilled to get water. This scenario indicates a very dry period where groundwater has to be tapped to provide water points for game and to supply the camp. In scenario, operators noted that turnover will be greatly be reduced more than in the High Level-High Flood scenario. Operators that

turnover will go down because the lack of water will affect water based activities; game will migrate to other factors; and, most water and land based activities cannot be done if there is no water. In this regard both land-based and water-based activities will be affected. This again was is an undesirable scenario for tourism operators. As is the case with the High Level – High Flooding scenario, retrenchments will be carried out and livelihoods of workers will be affected. Studies in desiccation of the western parts of the Okavango Delta (i.e. by Kgathi et al, 2004) have shown that dryness definitely affects many economic activities of which tourism is one of the factors. Tourists who visit the Okavango Delta come mainly to enjoy the wilderness nature and scenic beauty of the wetland. As a result, a very dry environment is likely to be unattractive to tourists hence the tourism industry under these conditions can collapse.

The favoured scenario appears to be the Low Level-Low Volume Flooding. This is a scenario where the permanently flooded parts of the Delta become only frequently flooded, the frequently flooded parts of their area become only occasionally flooded and the occasionally flooded parts of their area become only rarely flooded and main channels and *ledibas* remain permanent. This scenario appears to be the “ok” and desired scenario in that it is in this scenario that most operators noted that their turnover will go up. This therefore shows that tourism in the Okavango Delta will do well where there is permanent water in channels and lagoons to allow for both water-based and land-based activities. It is in this scenario where income generation and employment opportunities are likely to be high. In this regard, government and local communities working in the tourism industry are likely to benefit more in terms of revenue generation and employment opportunities.

Adaptation strategies are necessary in the changing patterns of floods in the Okavango Delta. As a result, different operators suggested different adaptations since their turnover will be affected differently based on the location of their business. Operators therefore suggested a number of adaptation strategies. These include the following: When flood patterns go down, operators should shift from water based tourism activities to land based activities; during flooding years, operators should move away from flooding areas to those which are not flooded and market a different product available in the new site; in dry periods, drill and increase water points in the form of boreholes. Where possible, pump water from permanent sites to drier areas and have water points for watering of wildlife; and in dry periods, supply water to the camp/lodge through the means of large water containers. Adaptation strategies for different shocks to livelihoods have been studied in the Okavango Delta (e.g. by Kgathi et al, 2004). However, nothing has so far been studied in tourism. This, therefore suggest that adaptation strategies in the event of high level-high volume floods or low level – low volume flooding patterns which seem to affect turnover and the tourism industry drastically should be the subject of future tourism research.

5. Conclusion

In this survey change in flood patterns in the Okavango Delta was perceived to have positive and negative impacts on turnover in the various tourism businesses. Positive impacts of high flooding were reported mainly by those managers whose businesses are located relatively far away from flowing channels. These are establishments whose nearby channels are rather seasonal or have dried in the past year. The assumption by managers in these facilities is that an increase in floods would result in their channels having more water hence attract wildlife and tourists to their areas.

High floods were also reported to have a negative impact on turnover, because they make tourism areas to be inaccessible with a possibility of close-down of the affected tourist facilities. Mangers noted that tourist cancel their bookings during flooding. The impacts of high flood are, thus, similar to those of low level low volume flooding such that the area becomes dry to a point where boreholes are dug. Some of the managers noted that if there is no water, there is no tourism as tourists come to view the water and game. During a spell of dry period, game migrates from areas without water to areas where there is water.

In the event that there is no tourism (i.e. during high level- high volume or low level-low volume scenarios), it is not only turnover that is going to be affected, livelihoods in the Okavango Delta will also be affected. This is because the backbone of the economy in the Okavango region is tourism, as such, if tourism goes down, many people will loose their jobs and this will affect households.

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The Okavango River Basin Transboundary Diagnostic Analysis Technical Reports

In 1994, the three riparian countries of the Okavango River Basin – Angola, Botswana and Namibia – agreed to plan for collaborative management of the natural resources of the Okavango, forming the Permanent Okavango River Basin Water Commission (OKACOM). In 2003, with funding from the Global Environment Facility, OKACOM launched the Environmental Protection and Sustainable Management of the Okavango River Basin (EPSMO) Project to coordinate development and to anticipate and address threats to the river and the associated communities and environment. Implemented by the United Nations Development Program and executed by the United Nations Food and Agriculture Organization, the project produced the Transboundary.

Diagnostic Analysis to establish a base of available scientific evidence to guide future decision making. The study, created from inputs from multi-disciplinary teams in each country, with specialists in hydrology, hydraulics, channel form, water quality, vegetation, aquatic invertebrates, fish, birds, river-dependent terrestrial wildlife, resource economics and socio-cultural issues, was coordinated and managed by a group of specialists from the southern African region in 2008 and 2009.

The following specialist technical reports were produced as part of this process and form substantive background content for the Okavango River Basin Trans-boundary Diagnostic Analysis

Final Study Reports	***Reports integrating findings from all country and background reports, and covering the entire basin.***		
		Aylward, B.	*Economic Valuation of Basin Resources: Final Report to EPSMO Project of the UN Food & Agriculture Organization as an Input to the Okavango River Basin Transboundary Diagnostic Analysis*
		Barnes, J. et al.	*Okavango River Basin Transboundary Diagnostic Analysis: Socio-Economic Assessment Final Report*
		King, J.M. and Brown, C.A.	*Okavango River Basin Environmental Flow Assessment Project Initiation Report (Report No: 01/2009)*
		King, J.M. and Brown, C.A.	*Okavango River Basin Environmental Flow Assessment EFA Process Report (Report No: 02/2009)*
		King, J.M. and Brown, C.A.	*Okavango River Basin Environmental Flow Assessment Guidelines for Data Collection, Analysis and Scenario Creation (Report No: 03/2009)*
		Bethune, S. Mazvimavi, D. and Quintino, M.	*Okavango River Basin Environmental Flow Assessment Delineation Report (Report No: 04/2009)*
		Beuster, H.	*Okavango River Basin Environmental Flow Assessment Hydrology Report: Data And Models(Report No: 05/2009)*
		Beuster, H.	*Okavango River Basin Environmental Flow Assessment Scenario Report : Hydrology (Report No: 06/2009)*
		Jones, M.J.	*The Groundwater Hydrology of The Okavango Basin (FAO Internal Report, April 2010)*
		King, J.M. and Brown, C.A.	*Okavango River Basin Environmental Flow Assessment Scenario Report: Ecological and Social Predictions (Volume 1 of 4)(Report No. 07/2009)*
		King, J.M. and Brown, C.A.	*Okavango River Basin Environmental Flow Assessment Scenario Report: Ecological and Social Predictions (Volume 2 of 4: Indicator results) (Report No. 07/2009)*
		King, J.M. and Brown, C.A.	*Okavango River Basin Environmental Flow Assessment Scenario Report: Ecological and Social Predictions: Climate Change Scenarios (Volume 3 of 4) (Report No. 07/2009)*
		King, J., Brown, C.A., Joubert, A.R. and Barnes, J.	*Okavango River Basin Environmental Flow Assessment Scenario Report: Biophysical Predictions (Volume 4 of 4: Climate Change Indicator Results) (Report No: 07/2009)*
		King, J., Brown, C.A. and Barnes, J.	*Okavango River Basin Environmental Flow Assessment Project Final Report (Report No: 08/2009)*
		Malzbender, D.	*Environmental Protection And Sustainable Management Of The Okavango River Basin (EPSMO): Governance Review*
		Vanderpost, C. and Dhliwayo, M.	*Database and GIS design for an expanded Okavango Basin Information System (OBIS)*
		Veríssimo, Luis	*GIS Database for the Environment Protection and Sustainable Management of the Okavango River Basin Project*
		Wolski, P.	*Assessment of hydrological effects of climate change in the Okavango Basin*
Country Reports	***Angola***	*Andrade e Sousa,*	*Análise Diagnóstica Transfronteiriça da Bacia do Rio*

Biophysical Series		Helder André de	Okavango: Módulo do Caudal Ambiental: Relatório do Especialista: País: Angola: Disciplina: Sedimentologia & Geomorfologia
		Gomes, Amândio	Análise Diagnóstica Transfronteiriça da Bacia do Rio Okavango: Módulo do Caudal Ambiental: Relatório do Especialista: País: Angola: Disciplina: Vegetação
		Gomes, Amândio	Análise Técnica, Biofísica e Socio-Económica do Lado Angolano da Bacia Hidrográfica do Rio Cubango: Relatório Final:Vegetação da Parte Angolana da Bacia Hidrográfica Do Rio Cubango
		Livramento, Filomena	Análise Diagnóstica Transfronteiriça da Bacia do Rio Okavango: Módulo do Caudal Ambiental: Relatório do Especialista: País: Angola: Disciplina:Macroinvertebrados
		Miguel, Gabriel Luís	Análise Técnica, Biofísica E Sócio-Económica do Lado Angolano da Bacia Hidrográfica do Rio Cubango: Subsídio Para o Conhecimento Hidrogeológico Relatório de Hidrogeologia
		Morais, Miguel	Análise Diagnóstica Transfronteiriça da Bacia do Análise Rio Cubango (Okavango): Módulo da Avaliação do Caudal Ambiental: Relatório do Especialista País: Angola Disciplina: Ictiofauna
		Morais, Miguel	Análise Técnica, Biófisica e Sócio-Económica do Lado Angolano da Bacia Hidrográfica do Rio Cubango: Relatório Final: Peixes e Pesca Fluvial da Bacia do Okavango em Angola
		Pereira, Maria João	Qualidade da Água, no Lado Angolano da Bacia Hidrográfica do Rio Cubango
		Santos, Carmen Ivelize Van-Dúnem S. N.	Análise Diagnóstica Transfronteiriça da Bacia do Rio Okavango: Módulo do Caudal Ambiental: Relatório de Especialidade: Angola: Vida Selvagem
		Santos, Carmen Ivelize Van-Dúnem S.N.	Análise Diagnóstica Transfronteiriça da Bacia do Rio Okavango:Módulo Avaliação do Caudal Ambiental: Relatório de Especialidade: Angola: Aves
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		Hancock, P.	Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module : Specialist Report: Country: Botswana: Discipline: Birds
		Mosepele, K.	Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module: Specialist Report: Country: Botswana: Discipline: Fish
		Mosepele, B. and Dallas, Helen	Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module: Specialist Report: Country: Botswana: Discipline: Aquatic Macro Invertebrates
	Namibia	Collin Christian & Associates CC	Okavango River Basin: Transboundary Diagnostic Analysis Project: Environmental Flow Assessment Module: Geomorphology
		Curtis, B.A.	Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module: Specialist Report Country: Namibia Discipline: Vegetation
		Bethune, S.	Environmental Protection and Sustainable Management of the Okavango River Basin (EPSMO): Transboundary Diagnostic Analysis: Basin Ecosystems Report
		Nakanwe, S.N.	Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module: Specialist Report: Country: Namibia: Discipline: Aquatic Macro Invertebrates
		Paxton, M.	Okavango River Basin Transboundary Diagnostic Analysis: Environmental Flow Module: Specialist Report:Country:Namibia: Discipline: Birds (Avifauna)
		Roberts, K.	Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module: Specialist Report: Country: Namibia: Discipline: Wildlife
		Waal, B.V.	Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module: Specialist Report: Country: Namibia:Discipline: Fish Life
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		Pereira, Maria João	Análise Diagnóstica Transfronteiriça da Bacia do Rio Okavango: Módulo do Caudal Ambiental: Relatório do Especialista: País: Angola: Disciplina: Qualidade da Água

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		Mbaiwa.J.E.	*Transboundary Diagnostic Analysis of the Okavango River Basin: the Status of Tourism Development in the Okavango Delta: Botswana*
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		Ngwenya, B.N.	*Final Report: A Socio-Economic Profile of River Resources and HIV and AIDS in the Okavango Basin: Botswana*
		Vanderpost, C.	*Assessment of Existing Social Services and Projected Growth in the Context of the Transboundary Diagnostic Analysis of the Botswana Portion of the Okavango River Basin*
	Namibia	*Barnes, J and Wamunyima, D*	*Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module: Specialist Report: Country: Namibia: Discipline: Socio-economics*
		Collin Christian & Associates CC	*Technical Report on Hydro-electric Power Development in the Namibian Section of the Okavango River Basin*
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		Ortmann, Cynthia L.	*Okavango River Basin Technical Diagnostic Analysis: Environmental Flow Module : Specialist Report Country: Namibia: discipline: Water Quality*
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		Paxton, C.	*Transboundary Diagnostic Analysis: Specialist Report: Discipline: Water Quality Requirements For Human Health in the Okavango River Basin: Country: Namibia*

Environmental protection and sustainable management of the Okavango River Basin

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