

South Fly District Future Development Workshop Report

Daru, 17-18 June 2015



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Cover photo

Daru children (*James Butler*)

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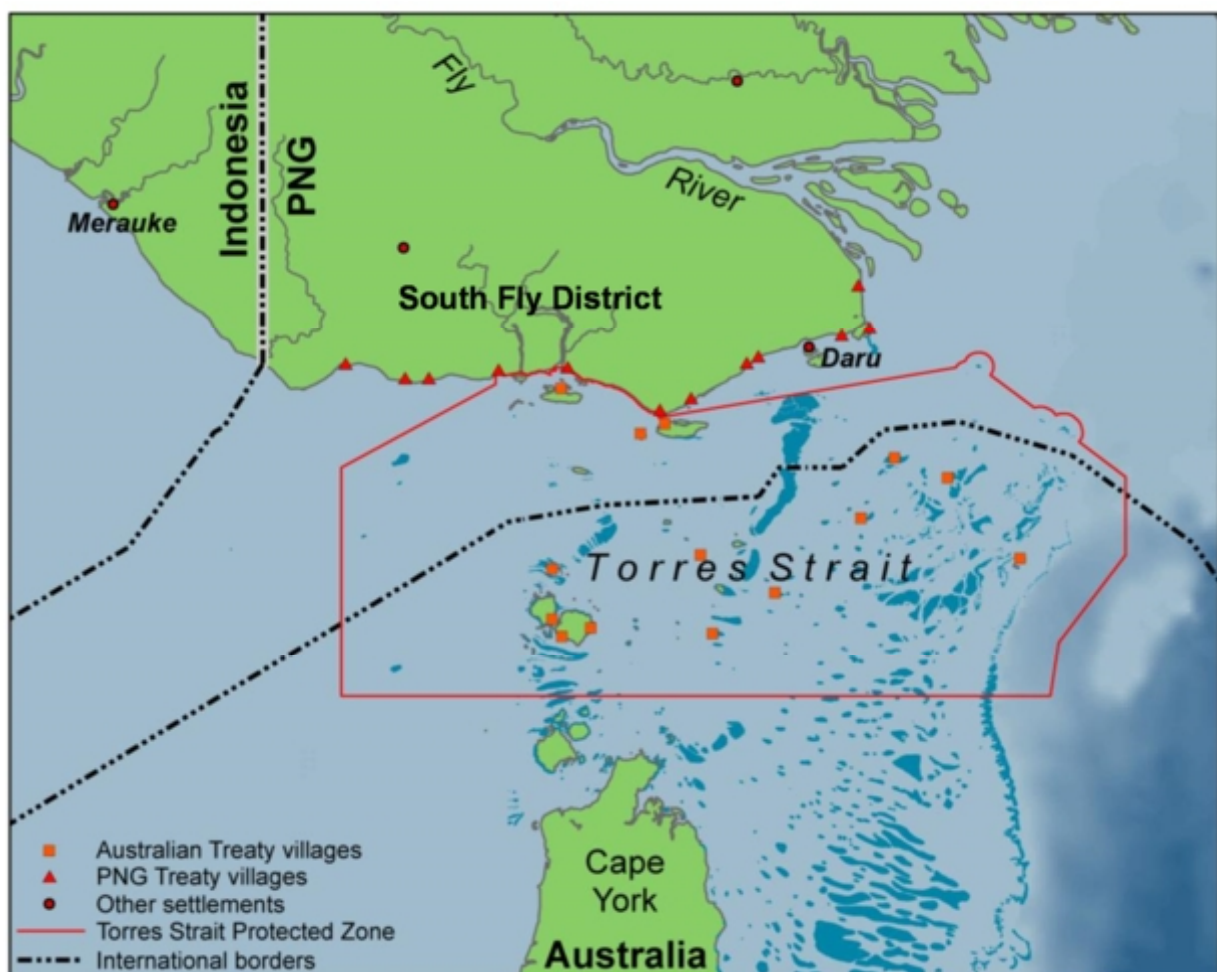
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Executive summary

The South Fly District of Western Province, Papua New Guinea (PNG), is one of the poorest regions of the country. Drivers of change affecting livelihoods in the South Fly are accelerating in pace and magnitude. Population growth, climate change, sea level rise, gas extraction, over-fishing, ongoing environmental impacts of Ok Tedi mine, and the growing Asian market for illegally-harvested marine products are all undermining sustainable human development. Current trends in natural resource use may be unsustainable, threatening future options for community development, and placing pressure on marine resources shared by PNG and Australia under the Torres Strait Treaty. Achieving sustainable development in the South Fly District requires a collaborative approach between PNG and Australian government agencies, NGOs and Australian and PNG communities in the Torres Strait.

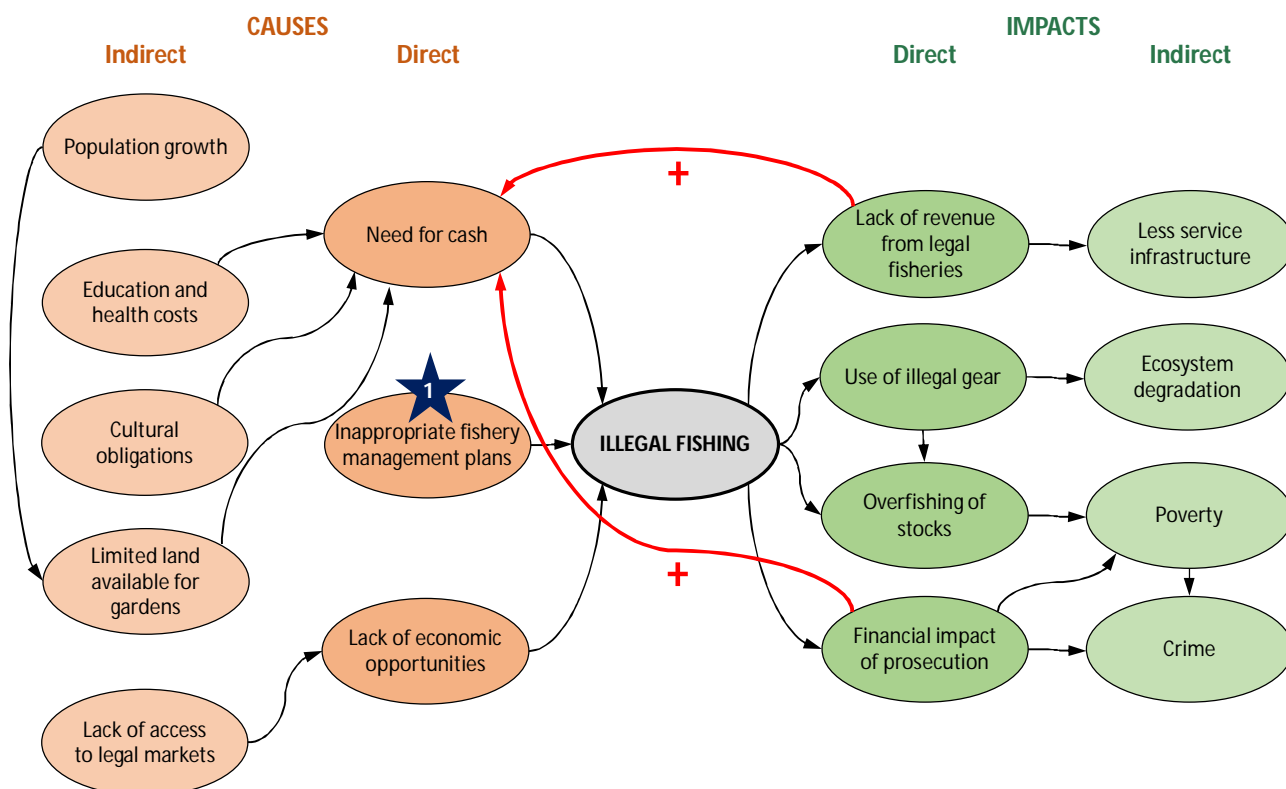
In October 2014 a symposium was held during the annual Torres Strait Treaty meetings in Cairns to discuss the situation in the South Fly District. It was recommended that a follow-up event should be held in PNG with a wider range of stakeholders. Consequently, on 17th and 18th June 2015 a workshop was held in Daru, the capital of Western Province, to further discuss the issues and identify solutions. The workshop was convened and funded by the PNG National Fisheries Authority and Australia's national science agency, CSIRO. Fifty-seven participants attended from the PNG Treaty Villages, the PNG and Australian national governments, the Western Province and South Fly District governments, businesses, Ok Tedi Mine Ltd. and NGOs. Also, representatives from Australian Torres Strait Island communities and the Torres Strait Regional Authority were present.



Participants explored the issues being experienced by coastal villages in the South Fly District, and the negative impacts on their livelihoods, environment and well-being. The following eight themes were identified, listed in descending order of priority:

1. Poor government and NGO coordination, planning and funding
2. Limited opportunities in commercial fisheries
3. Lack of infrastructure
4. Mining pollution, flooding and sea level rise
5. Illegal fishing
6. Overfishing
7. Fly River refugees
8. Food insecurity

Using causal loop analysis, participants examined the complex drivers and impacts of each theme. The example below illustrates the analysis for the 'illegal fishing' theme. Two positive feedback loops (red arrows) from the 'lack of revenue from legal fisheries' and the 'financial impact of prosecution' amplify the direct cause of a 'need for cash', creating a vicious circle. The priority action (i.e. star) was 1) *development of effective management plans and policies, including fishery cooperatives*.



From the eight themes participants identified 21 priority actions to address them (see Table A below). Relevant stakeholders and a timeframe of next steps were also agreed. Of the 21 actions, 15 (71%) were not currently being delivered by government or other development programs, four (19%) were partially being implemented, and two (10%) were planned.

To evaluate the workshop's influence on participants' perceptions and partnerships, a questionnaire survey was carried out before and after the workshop. Participants' awareness of the importance of governance increased during the workshop, and also population growth and climate change. The greatest benefit to participants was 'new ideas and solutions', and 93% had identified new partners. The most frequently mentioned new partner was Ok Tedi Mine Ltd. (OTML) and the Ok Tedi Development Foundation (OTDF), followed by the PNG National Fisheries Authority.

Table A. The eight themes of development challenges in the South Fly District, the actions identified from the causal loop analyses, and the 'heat map' of their delivery by current development programs. Red denotes not currently delivered, blue denotes planned delivery, and green denotes ongoing delivery.

Theme	Action	Delivery by current development program?
Poor government and NGO coordination, planning and funding	1. Establish Western Province stakeholder coordination body with Terms of Reference for each organisation	Red
	2. Strengthen National Agency Working Team with new Terms of Reference and the Provincial Coordinating and Monitoring Committee	Blue
Limited opportunities in commercial fisheries	1. Up-skilling and training for local villagers	Red
	2. Build new fishery infrastructure	Red
Lack of infrastructure	1. Build modern classrooms and teachers' houses	Red
	2. Train people to build adequate sanitation	Red
	3. Renovate buildings and sheds used for rainwater capture	Green Reef and Rainforest Research Centre Resilient Communities Program in four Treaty Villages
	4. Print more copies of the Community Development Plans and distribute them	Red
Mining pollution, flooding and sea level rise	1. Include non-Community Mine Continuation Agreement villages in 2009 OTML Agreement	Red
	2. Climate change adaptation planning	Red
Illegal fishing	1. Develop effective management plans and policies, including fishery cooperatives	Green Community consultation in progress
Overfishing	1. Review current management arrangements	Green Torres Strait Treaty Fishery Bi-lateral meetings
	2. Develop and fund a management plan for Treaty Villages area	Red
	3. Register all commercial vessels, stock assessments and catch monitoring, introduce catch regulations	Red
	4. Appoint dedicated fisheries officer to coordinate and drive actions	Red
Fly River refugees	1. Land acquisition for re-settlement of refugees and migrants in South Fly District	Red
Food insecurity	1. Harvest invasive fish species for processing into aquaculture fish feed	Red
	2. Develop integrated aquaculture of high value species	Green OTDF barramundi hatchery in Daru
	3. Replant sago stands	Red
	4. Improve market access into Indonesia and Australian Torres Strait	Red
	5. Protection of impacted areas and habitats through Locally Managed Marine Areas	Blue

1 Background

1.1 The Torres Strait

The Torres Strait is a narrow body of water which forms the international border between Australia, PNG and Indonesia (Fig. 1). Ecologically, the shallow seas are highly productive, with more than 150 small islands, numerous coral reefs, sandbanks, mangroves and extensive seagrass beds. Several PNG rivers including the Fly River discharge into the northern strait. As a series of relict floodplains, the relief on the PNG and Indonesian coast is flat with poor soils that are seasonally flooded or permanently waterlogged. Extensive mangrove forests dominate the coastline and Fly River delta. The climate has distinct wet (monsoon) and dry seasons (Baines et al. 1997).



Figure 1. The Torres Strait and the South Fly District, PNG

The primary natural resource in the Torres Strait is fisheries. Following European colonisation, commercial fisheries emerged for *bêche-de-mer* (sea cucumber) in the 1860s, followed by mother-of-pearl shell (Schug 1996). The Torres Strait is also a key habitat for four endangered species. The dugong is listed as vulnerable to extinction by the IUCN, and is on Appendix II of CITES. The Torres Strait is the most important remaining dugong habitat in the world (Marsh et al. 2004). Green, hawksbill and flatback turtles are also common and have a similarly high conservation status under international schedules as dugong. Hunting dugong and green turtles is integral to Torres Strait islanders' culture (Butler et al. 2012).

1.2 Western Province and South Fly District

The South Fly District covers the southern region of Western Province, PNG, and forms the northern coast of the Torres Strait (Fig. 1). Most settlements are located along the coast and small alluvial islands, including the provincial capital, Daru. In 2011 the South Fly District and Daru population was approximately 19,500. Medium growth projections indicate that the Western Province population could double by 2040 (Fig. 2), and this is also likely to be the case for the South Fly District (Butler et al. 2014). The swampy nature of the landscape limits road construction, and the province is not connected to other provinces or neighbouring Indonesia. The principal modes of transport are boat or foot (NRI 2010).

Due to its isolation, Western Province is the least developed region in PNG (Allen et al. 2005). Livelihoods are almost entirely based on subsistence gardening, fishing and hunting (NRI 2010). The Human Development Index (HDI, a composite of life expectancy, education and per capita income) of Western Province in 2007 was estimated to be 0.260, lower than some of the poorest nations in the world such as Afghanistan (McGillivray 2012; Fig. 3). The low level of human development is exemplified by recent outbreaks in Daru of cholera (DFAT 2010) and drug-resistant tuberculosis (DFAT 2014).

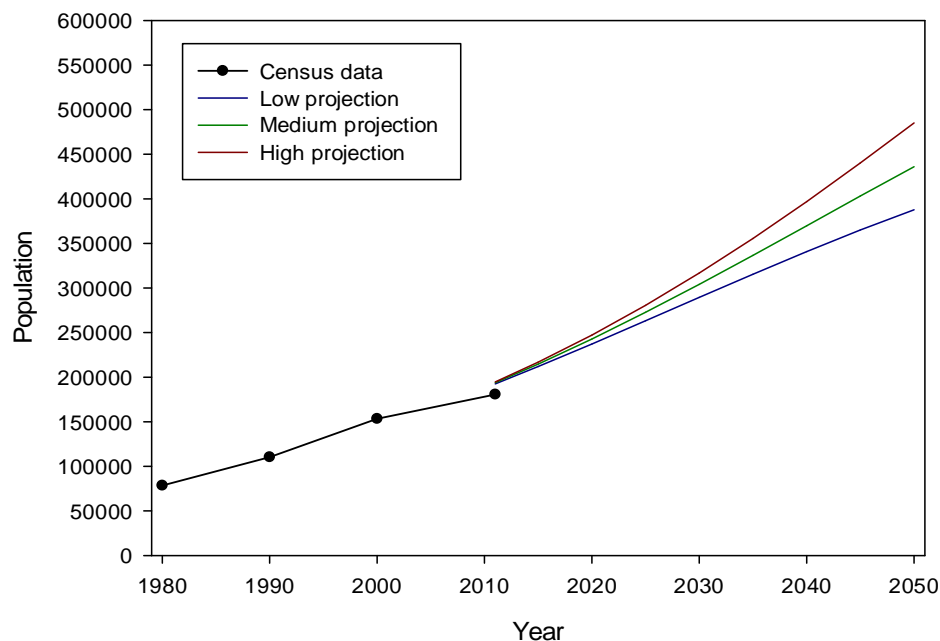


Figure 2. Population census data for Western Province, PNG in 1980-2011, and projected increases between 2012 and 2050 at low, medium and high projections. (Source: NSO 2012 and Butler et al. 2014)

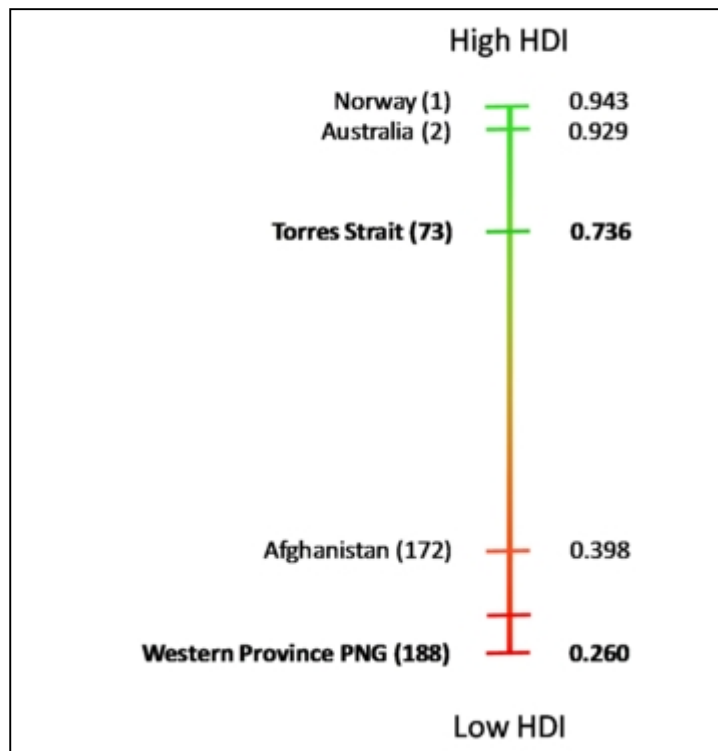


Figure 3. Comparisons between the Human Development Index (HDI) and world ranking (in brackets) in 2006-2007 for Australia, the Torres Strait and Western Province (Source: Butler et al. 2014)

1.3 Australian Torres Strait Islands

There are 15 inhabited islands in the Australian region of the Torres Strait. The total population was 8,800 in 2011. This is projected to increase by 21% to 10,667 by 2031 at the medium growth rate of 0.91% per annum (ABS 2010). As in other parts of indigenous Australia, Torres Strait islanders engage in a hybrid economy comprising state (publicly funded work-for-welfare), market (commercial fisheries) and customary (subsistence fisheries) sectors (Kwan et al. 2006, Busilacchi et al. 2013). The HDI in 2006 for the Torres Strait was 0.735 (Fig. 3), similar to the rest of indigenous Australia but lower than the national HDI of 0.965 (Butler et al. 2014).

1.4 The Torres Strait Treaty

Following PNG's independence from Australia in 1975 the bi-lateral Torres Strait Treaty was ratified in 1985 to manage the new international border. Recognizing the long-established familial, cultural and trading linkages between Torres Strait islanders and the coastal villages of Western Province, the Treaty's primary aim is to protect these Traditional Inhabitants' way of life, and to conserve the environment and promote sustainable development (PZJA 2012).

To maintain Traditional Inhabitants' livelihoods the Treaty established a Protected Zone (PZ). It includes PNG and Australian territorial waters, plus 14 Australian island communities (Fig. 1). In 2000, Australia and PNG agreed that communities from 13 South Fly District 'Treaty Villages' (Fig. 1) were also Traditional Inhabitants. Traditional Inhabitants are entitled to free movement within the PZ without passports. They are also permitted to undertake traditional fishing anywhere in the PZ, but are prohibited from fishing for monetary gain without commercial fishing licenses.

1.5 Torres Strait fisheries status

Fisheries in the PZ are defined by the Treaty as commercial or traditional. The following commercial fisheries are formally recognized, in descending order of overall economic importance: tropical rock lobster, prawns, Spanish mackerel, reef line (coral trout, barramundi and mixed reef fish), bêche-de-mer, trochus, pearl shell and crabs. Both Australian and PNG Traditional Inhabitants can access licenses to fish for commercial species. Traditional fisheries are turtle and dugong, plus the reef fishery which includes all other subsistence or artisanal gathering of fish and invertebrates, including commercial species which are caught for subsistence or cultural use (PZJA 2012).

With the exception of some sedentary invertebrates, all Australian and PNG fisheries exploit a shared stock within the PZ. Stock assessments indicate that lobster, prawn and mackerel stocks are at sustainable levels, but the status of pearl shell, dugong and turtle is uncertain. Green and hawksbill turtle populations in northern Australia are in decline (Limpus 2008, 2009). The most commercially valuable bêche-de-mer species (sandfish) is overfished and the fishery was closed in Australian waters in 1998 (Woodhams et al. 2013). The NFA closed the bêche-de-mer fishery in PNG waters in 2009 (Woodhams et al. 2013). There is also uncertainty about the status of the commercial barramundi, trochus and crab stocks, and the traditional reef fish fishery.

A survey of subsistence and artisanal fisheries in the PNG Treaty Villages and Daru in 2011-2013 suggested that since 1995, fishing effort has doubled, but catches have only increased by 20% (Fig. 4; Busilacchi et al. 2014). Catch per unit effort of reef fish has declined, suggesting a possible overexploitation of stocks, and bêche-de-mer poaching is increasing in the Australian jurisdiction of the PZ. Overall, fishing effort is increasing due to population growth and immigration from communities in the Middle Fly River affected by Ok Tedi mine (see Section 1.4). Informal cross-border trade with Indonesia is increasing due to rapid population and economic growth in neighbouring Papua Province, and the rising Asian market demand for bêche-de-mer, shark fin and fish bladders. Current catch trends are unsustainable, and if reef fish and other stocks collapse there will be a major impact on food security and livelihoods. Because many of these stocks are shared with Australian Torres Strait Island communities, there may also be some trans-boundary effects.

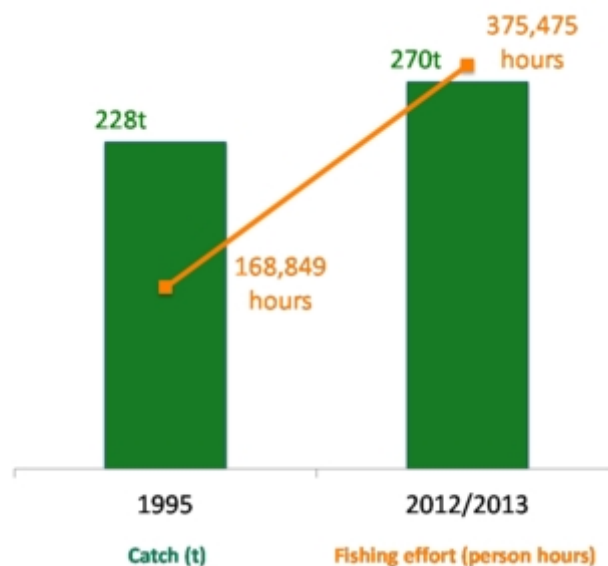


Figure 4. Estimated annual fishing effort and catch in Daru market in 1995 and 2012-2013 (Source: Busilacchi et al. 2014)

1.6 Western Province mining and gas

Non-renewable resource extraction began in Western Province in 1984 with the establishment of Ok Tedi mine in the headwaters of the Fly River (Fig. 5). However, since the 1990s accretion of sediment in the Fly River from mine tailings has caused over-bank flooding and dieback of 1,500 km² of rainforest in the middle catchment, the covering of fertile garden land by tailing and mine waste, and severe impacts on the river system from acid mine drainage, depleting fish and bird populations (Smith et al. 1990, Swales 2001). Siltation effects are expected to continue for decades (Kirsch 1993). These environmental problems have devastated the livelihoods of the 95,000 people living in the impacted region (Tingay 2006). Refugees have migrated to Daru (NRI 2010), contributing to population pressure and elevating coastal fishing effort, jeopardising the Treaty Villages' food security. This has resulted in disputes with Traditional Inhabitants over access and ownership of marine resources (Baines et al. 1997, Kinch et al. 2007). Under the 2009 Community Mine Continuation Agreement, compensation payments are distributed in Daru to impacted families. This has caused an influx of claimants and related conflict, crime and disorder (Busilacchi et al. 2014).

There are plans for two non-renewable resource extraction projects in Western Province (Fig. 5). The Liquid Natural Gas (LNG) Consortium project will link gas fields in the province's north. Underground pipelines will transport LNG from the fields to a gas processing facility and deep water port in Daru. A road corridor will follow the pipeline to a commercial centre in Oriomo, 10 km north of Daru. The Purari River hydro-electric project in Gulf Province will supply electricity to northern Australia via an undersea transmission cable, also providing electricity to Daru. However, it is not clear when these developments will start (Butler et al. 2014).

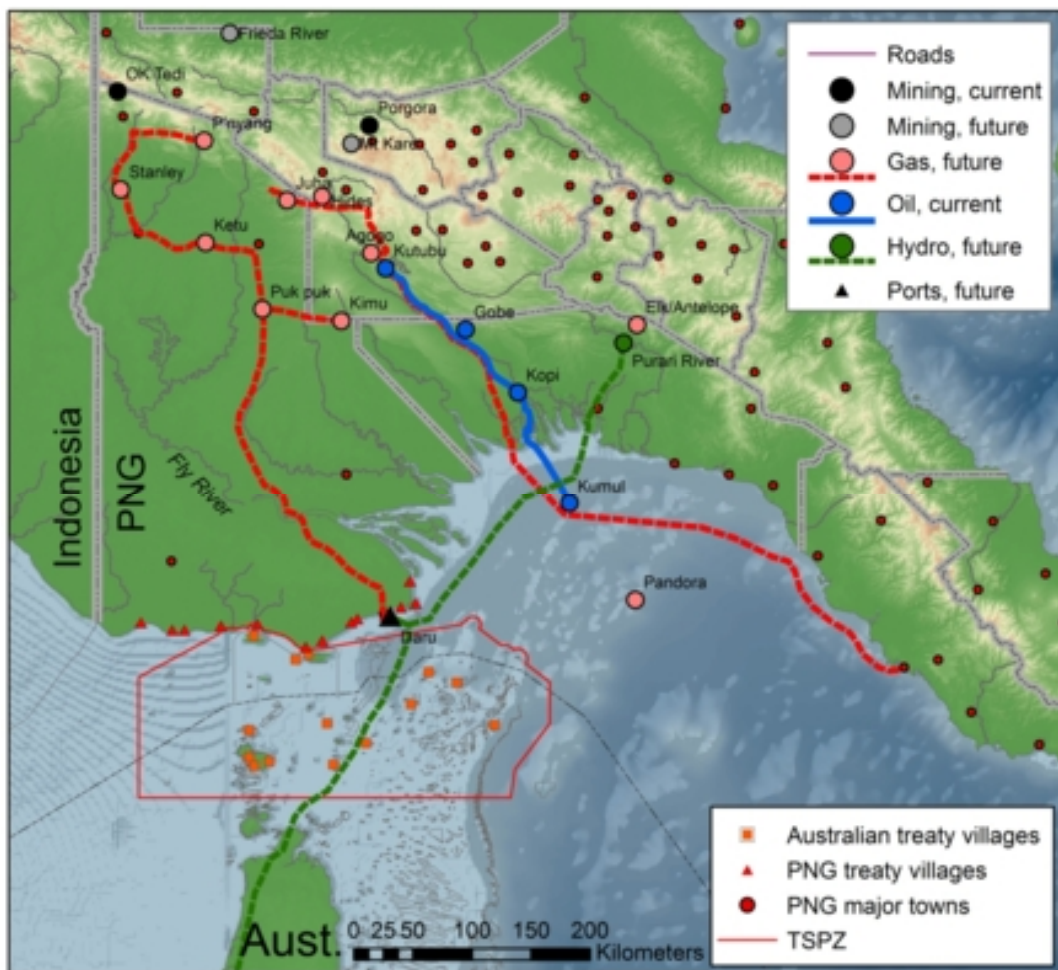


Figure 5. Locations of proposed oil, Liquid Natural Gas, mining and hydro-electricity developments in south-western PNG (Source: Butler et al. 2014).

2 Workshop process and results

2.1 Workshop objectives

In October 2014 a symposium was convened by the PNG National Fisheries Authority (NFA) and CSIRO as part of the annual Torres Strait Treaty meetings in Cairns. The symposium discussed the current situation in the South Fly District and potential solutions that could achieve sustainable development for local communities. It was recommended that a follow-up event should be held in PNG with a wider range of stakeholders. Consequently, on 17th and 18th June 2015 a workshop was held at the New Century Hotel, Daru. Again, it was convened by the NFA and CSIRO. The workshop objectives were:

1. Ensure that PNG stakeholders in government, NGOs and communities are aware of current development issues and challenges in the South Fly District
2. Identify priorities for development, particularly for fisheries and coastal issues
3. Identify potential strategies and partnerships necessary to improve coordination and implement effective development

To ensure participation by all relevant stakeholders, invitations were sent to 70 PNG community leaders, government agencies, businesses and NGOs. In addition, the Australian High Commission, the Australian Fisheries Management Authority, the Torres Strait Regional Authority (TSRA) and the Department of Foreign Affairs and Trade (DFAT) were represented. In total 57 stakeholders attended, including 12 Treaty Village or other community leaders, Ok Tedi Mine Ltd. and Ok Tedi Development Foundation, three local businesses and four NGOs (Table 1). Notably, 11 representatives of five PNG Government departments travelled from Port Moresby. Eleven (19%) participants were women. The workshop was facilitated by Dr. James Butler of CSIRO, and funded by NFA and CSIRO. DFAT assisted the attendance of Australian Government agencies and the TSRA. All participants gave verbal consent for the workshop results to be published and for photographs to be taken.



Workshop participants at the New Century Hotel, Daru (*Torres News*)

Table 1. Workshop participants and their affiliations (including acronyms referred to in the text)

No.	Name	Organisation
1	Kebei Salee	Member for Sigabaduru, Treaty Village Chairman
2	Amos Nakau Sepa	Member for Old Mawatta Treaty Village
3	Abua Roy	Member for Ture Ture Treaty Village
4	Biza Gera	Councillor, Kadawa Treaty Village
5	Frank Warapa	Councillor, Buzi/Ber Treaty Village
6	Goise Korosa	Member for Parama Treaty Village
7	Eli Bize	Member for Jarai Treaty Village
8	Peter Papua	Member for Mabudauan Treaty Village
9	Saima Dimia	Representative for Sui Treaty Village
10	Tibau Kaware	Councillor, Kiwai Local Level Government (LLG)
11	Buna Narua	Councillor, Kiwai Local Level Government (LLG)
12	Bill Menai	Councillor, Morehead Local Level Government (LLG)
13	Meremi Maina	Maru Marine Ltd.
14	Gideon Memafu	Sunset Fisheries Co-operative
15	Jeffery Tom	Ok Tedi Mine Ltd. (OTML)
16	Lalatute Avosa	Ok Tedi Development Foundation (OTDF)
17	Robin Wainetti	Daru Pioneer Representative
18	Charles Samilo	Gogodala Landowners Resource Development Authority
19	Daina Budia Exon	Bata Community Development Foundation
20	Sonia Yeung	World Vision
21	Alma V. Acub	World Vision
22	Stephen Milford	World Vision
23	Deborah Moses	World Vision
24	Elinyn Lifu	Deputy Mayor, Daru Urban Town Council
25	Kimsion Yammelong	Western Province Administration Fisheries
26	Dainah Gigiba	Western Province Administration Fisheries
27	Odori Koloni	Western Province Administration Fisheries
28	Dick Jogo	Western Province Administration Fisheries
29	Joseph Posu	PNG National Fisheries Authority (NFA)
30	Oliver Teno	PNG National Fisheries Authority (NFA)
31	Augustine Galuwa	PNG National Fisheries Authority (NFA)
32	Eslon Wafihwaieh	PNG National Fisheries Authority (NFA)
33	Ian Liviko	PNG National Fisheries Authority (NFA)
34	Presley Kokwaiye	PNG National Fisheries Authority (NFA)
35	Noah Taia	PNG National Fisheries Authority (NFA)

No.	Name	Position
36	Rita Goye	PNG Coastal Fisheries Development Agency (CFDA)
37	Serah Amos	PNG Coastal Fisheries Development Agency (CFDA)
38	Kally Pamuan	PNG Police – Transnational Crime Unit
39	Bira Ausi	PNG Police
40	Ravini Igo	PNG Border Liaison Officer, Daru
41	Les Ture	PNG Customs Service
42	Dr. John Clinton Balavu	PNG Department of Foreign Affairs
43	Gregory Hombuahin	PNG Department of Foreign Affairs
44	Gelam Mark	PNG Border Development Authority
45	Thomas Malaisa	National Agriculture Quarantine and Inspection Authority, Daru
46	Clayton Harrington	Treaty Liaison Officer, Australian Department of Foreign Affairs and Trade (DFAT)
47	Wayne See Kee	Torres Strait Regional Authority (TSRA)
48	Kenny Bedford	Torres Strait Regional Authority and Member for Erub (TSRA)
49	John Jones	Australian Fisheries Management Authority (AFMA)
50	Ireire Olewale	Australian High Commission, Port Moresby
51	Riin Teoh	Australian High Commission, Port Moresby
52	Dave Rutherford	INLOC Ltd.
53	Sheriden Morris	Reef and Rainforest Research Centre (RRRC)
54	Dr. Andy Steven	CSIRO
55	Dr. James Butler	CSIRO
56	Dr. Sara Busilacchi	CSIRO
57	Dr. Simon Apte	CSIRO

2.2 Workshop agenda

The workshop ran for 1 ½ days, and consisted of four sessions lasting approximately 3 hours each:

- Session 1: What are the key challenges for South Fly District communities?
- Session 2: What are the impacts and causes of these issues?
- Session 3: What are the necessary interventions?
- Session 4: Are these interventions being delivered by current development?

2.3 Workshop results

2.3.1 Session 1: What are the key challenges for South Fly District communities?

This session consisted of presentations on key issues and projects discussed at the Cairns symposium, and subsequent discussion amongst participants. Presentations were given by the NFA, CSIRO, the PNG CFDA, OTML, OTDF, and the RRRC's Community Resilience Program.



Participant discussing fisheries issues in the Torres Strait Protected Zone (*Kenny Bedford*)

Each participant was then asked to write one priority development issue on a sticky note, and these were then placed on a wall and grouped into themes. Eight themes were identified in the following order of priority:

1. Poor government and NGO coordination, planning and funding (23 issues)
2. Limited opportunities in commercial fisheries (seven issues)
3. Lack of infrastructure (five issues)
4. Mining pollution, flooding and sea level rise (four issues)
5. Illegal fishing (two issues)
6. Overfishing (two issues)
7. Fly River refugees (one issue)
8. Food insecurity (one issue)

2.3.2 Session 2: What are the impacts and causes of these issues?

In this session participants were divided into eight focus groups, consisting of mixed community, government and NGO stakeholders to promote discussion and learning. Each focus group was assigned one of the themes identified in Session 1. The groups were asked to analyse their theme using simplified 'causal loop analysis', modified from CIFOR and SEI (2009). Causal loop analysis follows four steps (Fig. 6): Step 1 identifies the sequence of linked direct and indirect impacts emanating 'downstream' from the problem; Step 2 identifies the direct and linked indirect causes 'upstream' of the problem; Step 3 identifies the primary feedback loops from the impacts which either amplify (positive feedback) or dampen a cause (negative feedback); Step 4 identifies priority actions to address the causes. Designing actions which target feedback loops is important, because otherwise the feedbacks can maintain a 'vicious circle', perpetuating the problem.

Each group was given flip chart paper and pens to draw the causal loop analysis for their theme, and were facilitated by CSIRO and NFA participants.

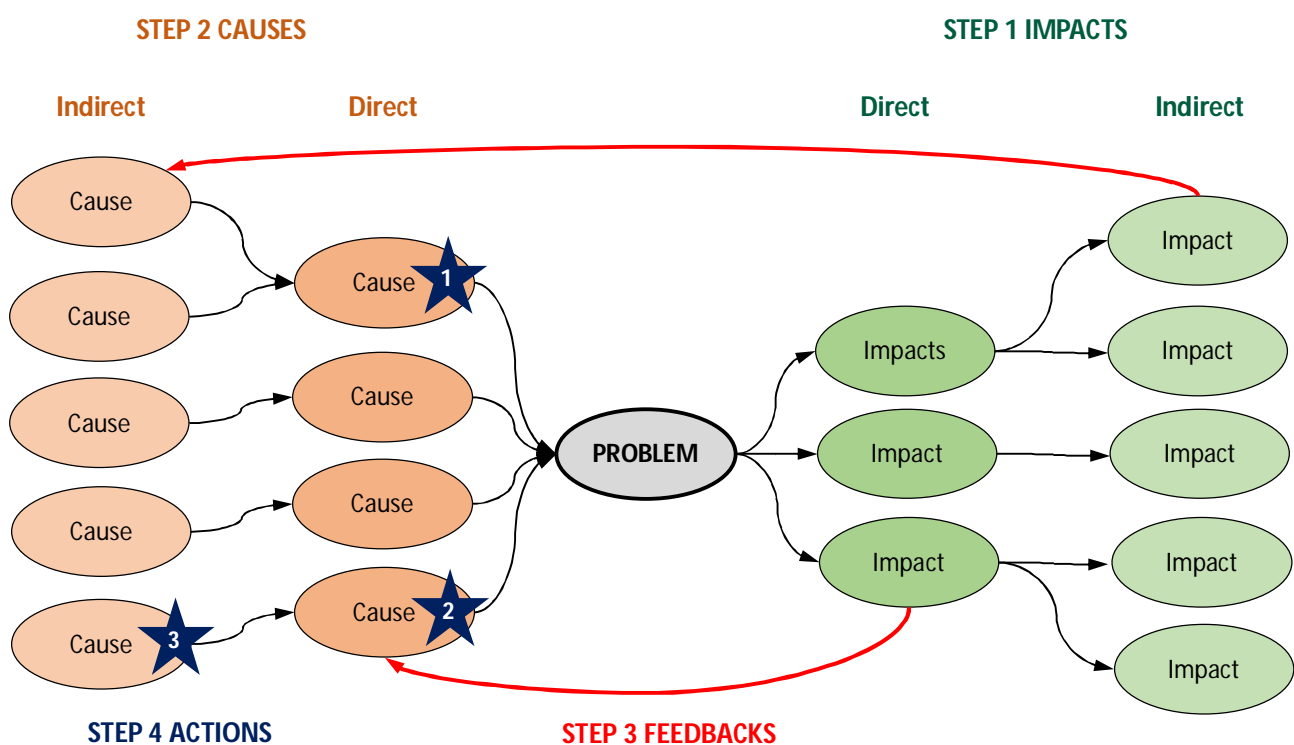


Figure 6. The four steps of causal loop analysis including prioritised actions (stars)

2.3.2.1 Poor government and NGO coordination, planning and funding

This was the highest-ranked theme. It caused six direct impacts: lack of resources, duplication of effort or gaps, confusion about stakeholders' roles, unequal distribution of resources, litigation and lack of partnerships (Fig. 7). This led to problems not being resolved, and ultimately poverty. Direct causes were lack of leadership, corruption, poor coordination and communication skills, a failure to understand the problem, and the geographical isolation of the South Fly District which creates a 'silo effect' amongst stakeholders. Also, cultural influences were a direct cause, underpinned by a breakdown of traditional values. One major feedback loop was identified, whereby the lack of partnerships (direct impact) exacerbated the silo effect (direct cause).

The priority action, which aimed to tackle the feedback loop, was 1) *establish a Western Province stakeholder coordination body with Terms of Reference for each organisation*. The second action targeted poor coordination and communication skills: 2) *strengthen the National Agency Working Team with new Terms of Reference and the Provincial Coordinating and Monitoring Committee*.

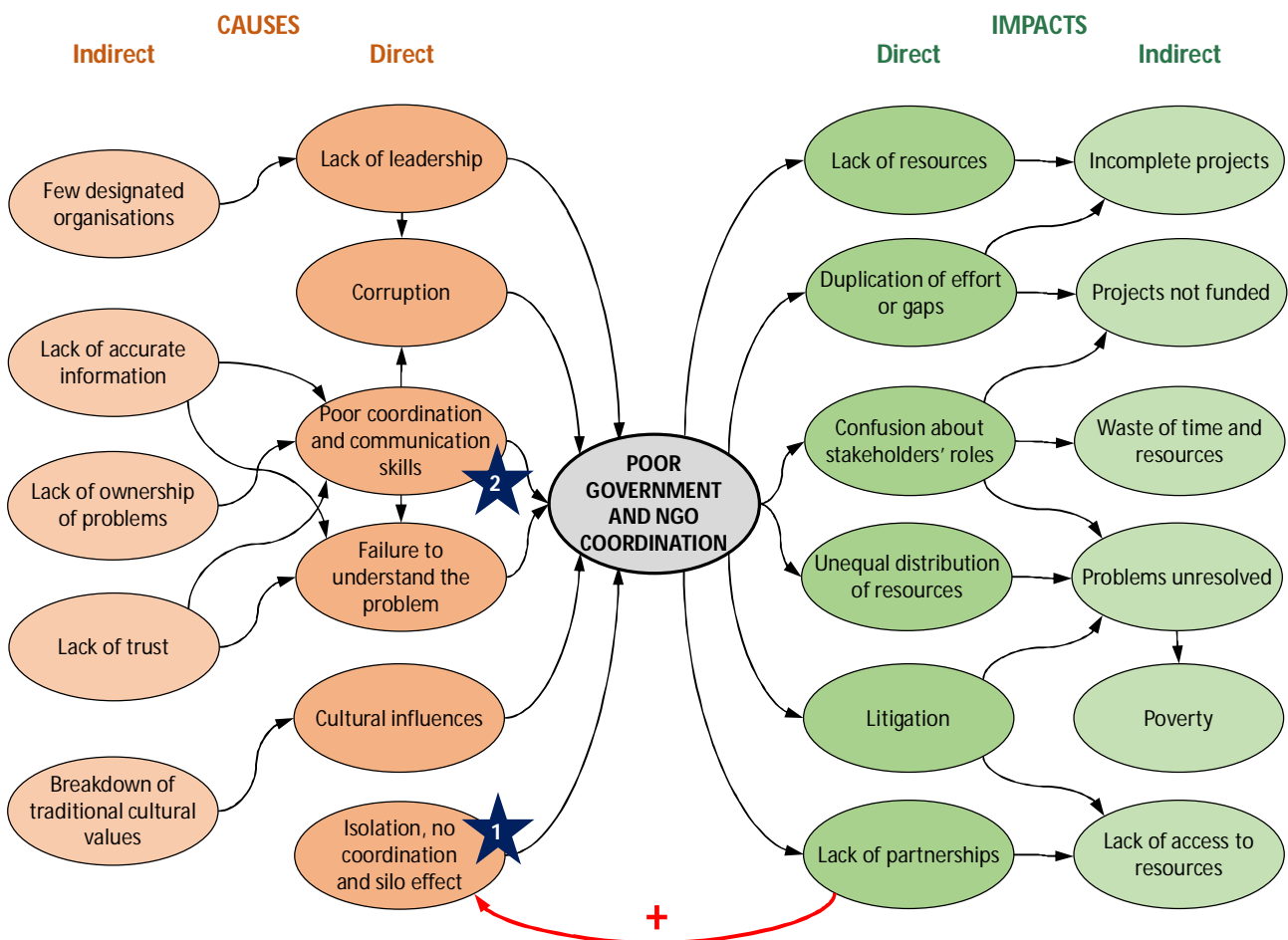


Figure 7. Causal loop analysis for the highest-ranked theme, poor government and NGO coordination, planning and funding. The actions are 1) *establish a Western Province stakeholder coordination body with Terms of Reference for each organisation*, and 2) *strengthen the National Agency Working Team with new Terms of Reference and the Provincial Coordinating and Monitoring Committee*.



A focus group using causal loop analysis to analyse a theme (*Sara Busilacchi*)

2.3.2.2 Limited opportunities in commercial fisheries

This was the second-highest ranked theme. There were three direct impacts: no income, no industry growth and a lack of skills transfer (Fig. 8). Indirect impacts included no cash for paying for food or school fees, social issues and law and order problems, and a lack of skilled human resources. Direct causes were a lack of market access, unavailability of fishing licenses and funds, lack of storage facilities, a lack of buyers, fluctuations in international fishery process and depletion of fish stocks. Indirect causes were a lack of market access, unavailability of fishing licenses and funds, lack of storage facilities, a lack of buyers, fluctuations in international fishery process and depletion of fish stocks. Isolation and the lack of transport underpinned poor market access, plus tribal conflict. Inappropriate government policies were underlying the unavailability of licences, and the lack of available land underpinned the lack of storage facilities. Two positive feedback loops were identified. First, social issues and law and order problems caused by a lack of income exacerbated tribal conflict and hence the lack of market access. Second, low industry growth and resulting poor infrastructure exacerbated the lack of storage facilities.

The priority action tackled the lack of skills: 1) *up-skilling and training for local villagers*. The second priority addressed the lack of storage facilities and the feedback loop which exacerbated this: 2) *build new fishery infrastructure*.

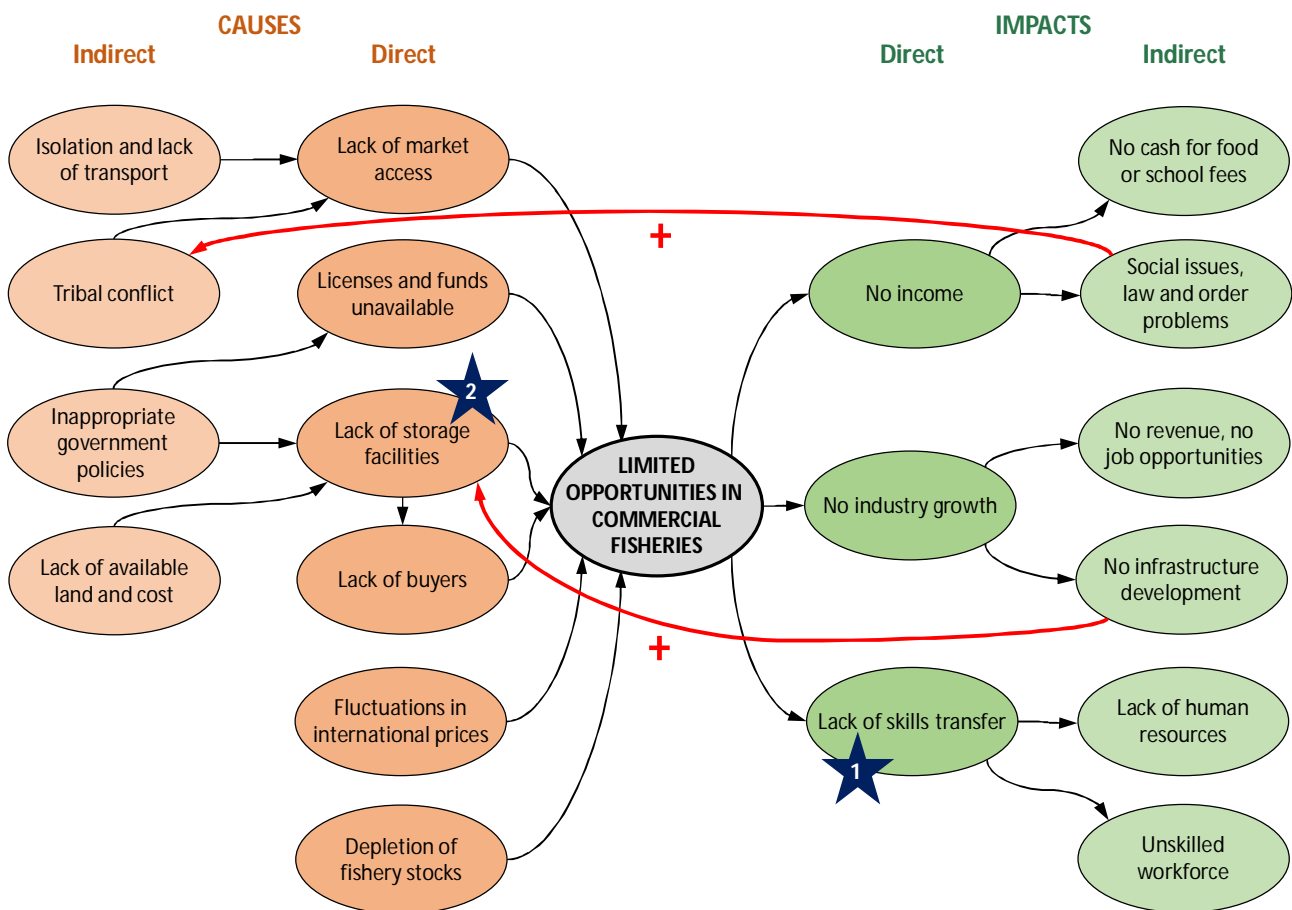


Figure 8. Causal loop analysis for the limited opportunities in commercial fisheries theme. The priority actions are: 1) *up-skilling and training for local villagers*, and 2) *build new fishery infrastructure*.

2.3.2.3 Lack of infrastructure

The third-highest ranked theme was 'lack of infrastructure'. There were several impacts, causes and inter-relationship between them, plus three positive feedbacks (Fig. 9). The direct impacts included high transport costs, poor communications and lack of sanitation which together resulted in poor health and education services, limited market access, and inconsistent planning. No funding for maintenance of existing infrastructure and reduced resilience to disasters together resulted in poor maintenance and community dissatisfaction. The direct causes were a lack of policies and plans for infrastructure, plus political patronage and corruption which result in litigation. These were underpinned by poor government coordination, perceptions of exclusion, self-interest and poor business leadership. There were three positive feedbacks: inconsistent planning exacerbates a lack of policies and plans; mis-perceptions caused by poor communication infrastructure exacerbates perceptions of exclusion, and community dissatisfaction from disasters and poor maintenance drives political patronage and corruption.

Four actions were identified. The priority was 1) *build modern classrooms and teachers' houses* which sought to address the lack of policies and plans and the feedback loop from inconsistent planning. The second priority was 2) *train people to build adequate sanitation*. The third was 3) *renovate buildings and sheds used for rainwater capture*, which tackled the lack of maintenance and community dissatisfaction feedback. The fourth was 4) *print more copies of the Community Development Plans and distribute them*.

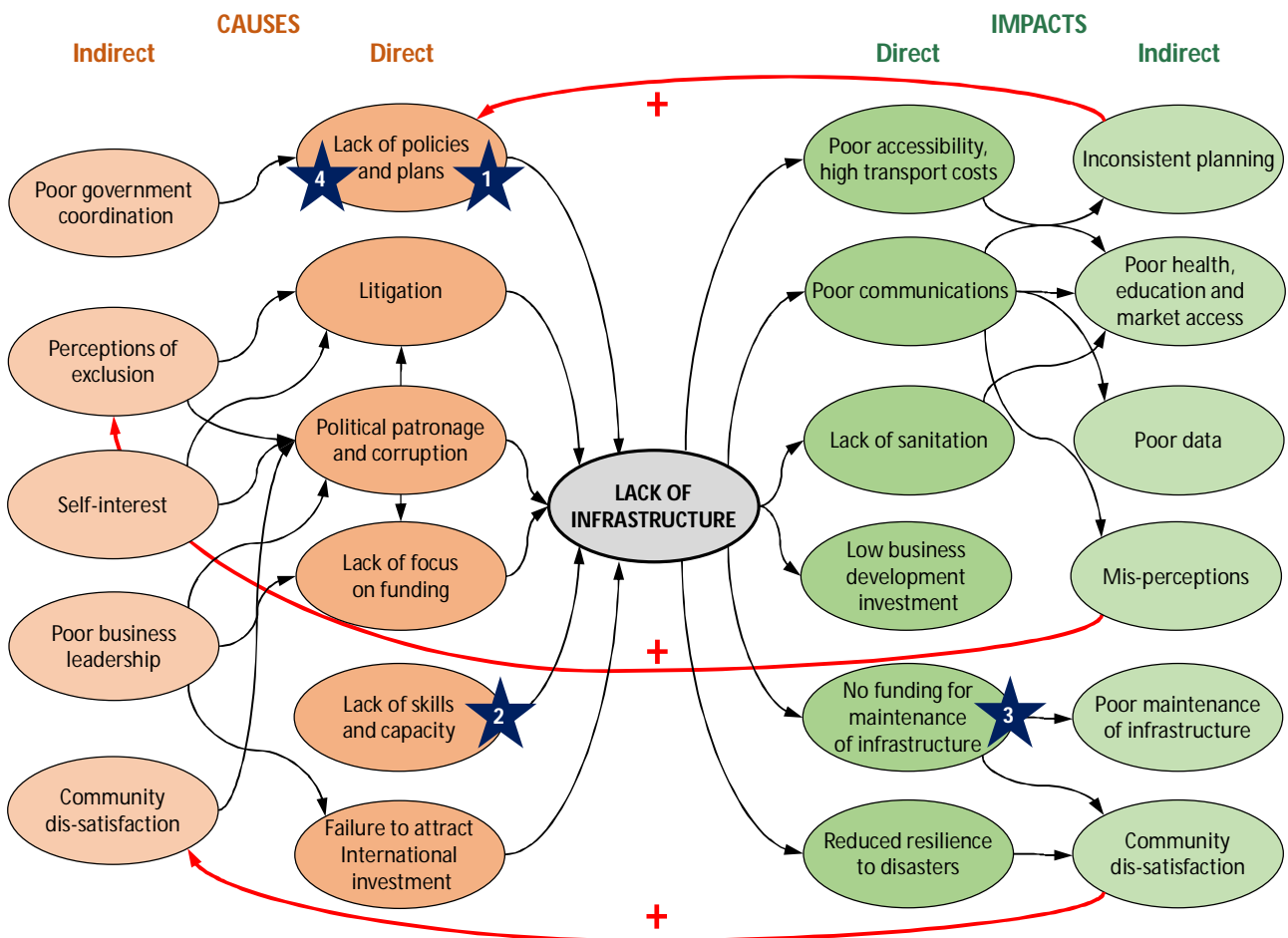


Figure 9. Causal loop analysis for the lack of infrastructure theme. The priority actions are: 1) *build modern classrooms and teachers' houses*; 2) *train people to build adequate sanitation*; 3) *renovate buildings and sheds used for rainwater capture*; 4) *print more copies of the Community Development Plans and distribute them*



Participant presenting a group's causal loop diagram (*Sara Busilacchi*)



A Treaty Village leader discussing an action identified by another focus group (*Kenny Bedford*)

2.3.2.4 Mining pollution, flooding and sea level rise

The fourth-highest ranked theme was 'mining pollution, flooding and sea level rise'. This covered the combination of issues related to the environmental impacts on the Fly River from Ok Tedi mine, and sea level rise linked to climate change (Fig. 10). These may cause health problems, fish contamination, reduction of fish stocks, river habitat change due to sedimentation, loss of land from flooding, and potential impacts on Warrior Reef in the Torres Strait. The indirect impacts included a loss of public confidence in Ok Tedi and the PNG government, loss of fishing income, Fly River refugees in the South Fly District and linked social conflict and food insecurity. The direct causes are discharges of metal-contaminated sediments and waters from Ok Tedi, spillages during loading operations in the Fly River, and separate to these, climate change and sea level rise. For Ok Tedi's impacts, the indirect causes are the government's need to maximise mining profits, which result in poor environmental controls.

There was one feedback loop, which was negative. This linked the loss of public confidence in Ok Tedi and government to the mine's environmental controls. In this case, the loss of confidence has resulted in apathy and disengagement, which reduces the pressure on Ok Tedi to upgrade its environmental management.

Two actions were identified. The first was 1) *include non-Community Mine Continuation Agreement villages in 2009 OTML Agreement*. This would extend the compensation payments to South Fly District villages which are impacted directly or indirectly by Ok Tedi, but have not been included in prior OTML or OTDF development activities, and also tackle the feedback loop caused by loss of public confidence. The second was 2) *climate change adaptation planning* for the South Fly District.

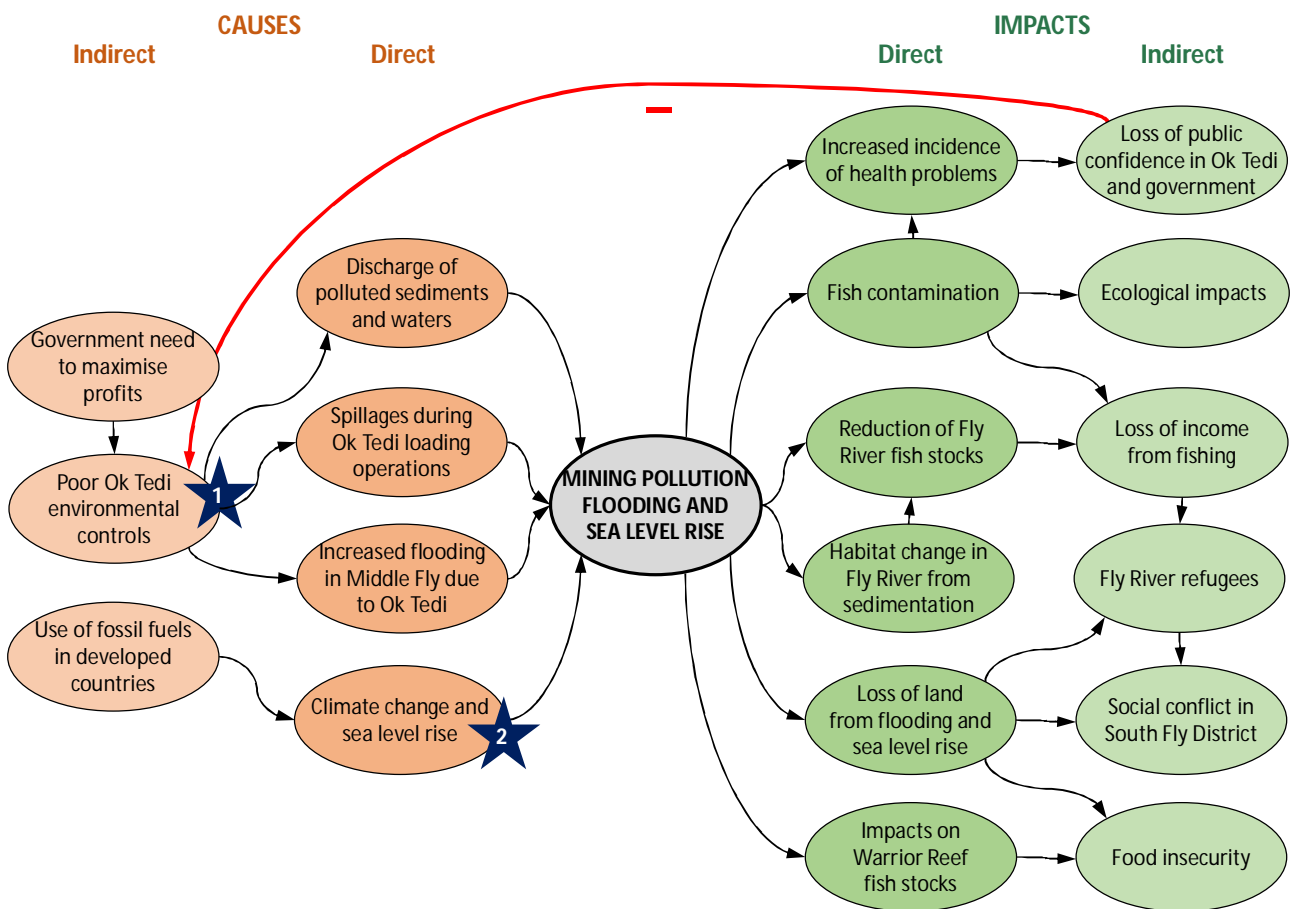


Figure 10. Causal loop analysis for the mining pollution, flooding and sea level rise theme. The priority actions are: 1) *include non-Community Mine Continuation Agreement villages in 2009 OTML Agreement* and 2) *climate change adaptation planning*

2.3.2.5 Illegal fishing

The fifth-highest ranked theme was 'illegal fishing'. The direct impacts were lack of revenue from legal fisheries, use of illegal fishing gear, which was linked to over-fishing of fish stocks, and the financial impact of prosecution for apprehended individuals (Fig. 11). Secondary impacts were ecosystem degradation, poverty and further crime due to the need for cash. There were three direct causes. First was the need for cash, which was driven by education and health costs, plus cultural obligations, and limited land available for gardens to grow and sell produce, which in turn was driven by population growth. Second was inappropriate fishery management plans, and third was lack of economic opportunities, which was driven by the lack of access to legal markets. There were two positive feedback loops, both of which exacerbated the need for cash: lack of revenue from legal fisheries, and the need to pay fines if individuals were prosecuted.

One action was identified: *the development of effective management plans and policies, including fishery cooperatives*. This did not address the feedback loops which amplified the need for cash.

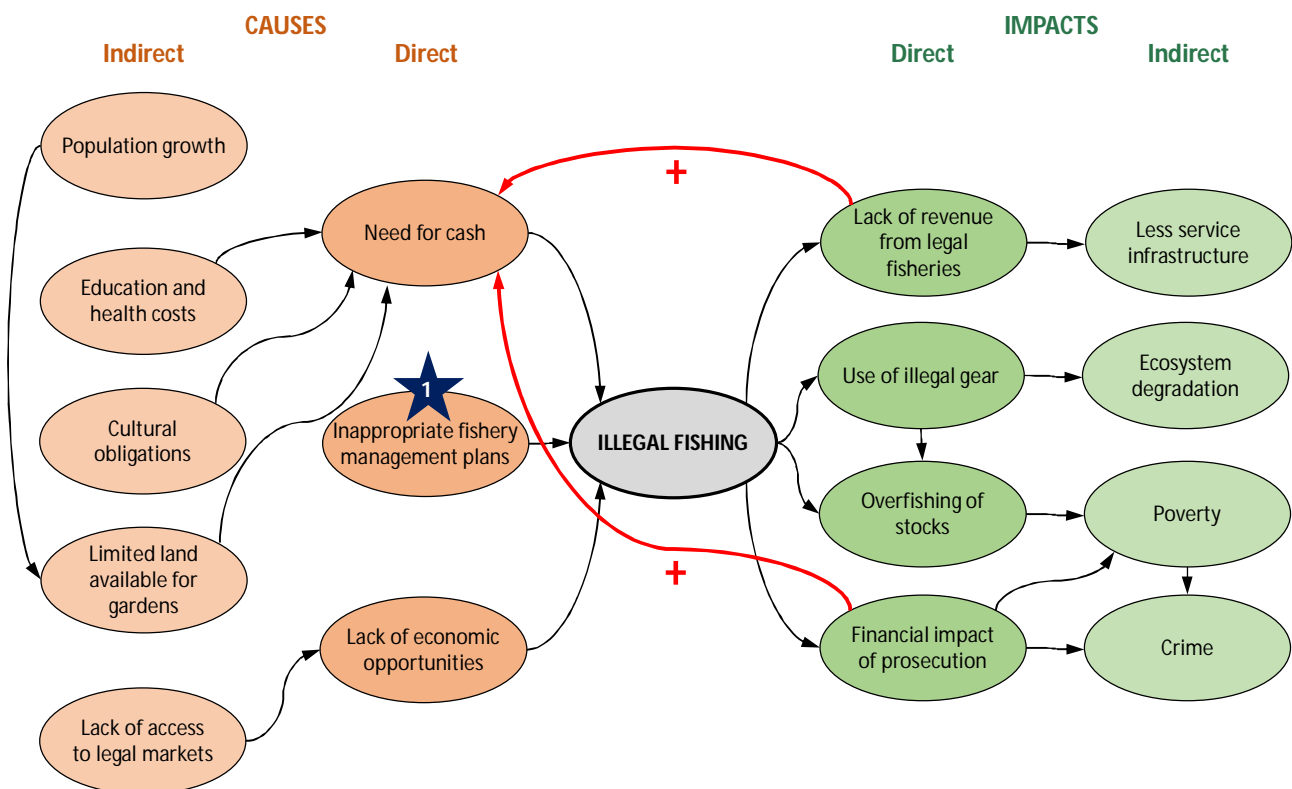


Figure 11. Causal loop analysis for the illegal fishing theme. The priority action was: 1) *development of effective management plans and policies, including fishery cooperatives*

2.3.2.6 Overfishing

The six-highest ranked theme was 'overfishing'. This was one of the most complex problems, with numerous direct and indirect impacts and causes, plus three positive feedback loops (Fig. 12). Direct impacts were less income from fisheries and conflict between traditional owners. Fly River refugees and other immigrants, which both resulted in poverty, tribal tensions and crime. Derris root fishing, declines in native fish species and the use of nets had broader ecological impacts, including the degradation of coral, increased invasive fish species replacing native species, and by-catch of turtles and dugongs. Finally, overfishing leads to food insecurity and poor health and nutrition for communities. Direct causes were population growth, destructive fishing methods, and lack of management and compliance capacity. The need for cash to cover rising fuel prices for outboard engines drives the targeting of high value species and illegal fishing. Finally, the loss of traditional cultural values undermines community-based management systems. Poverty and conflict between traditional owners and immigrants exacerbates the need for cash, lack of fishers' awareness and management compliance.

Four actions were identified: 1) *review current management arrangements*, which tackled the feedback loop between poverty and fishers' lack of awareness; 2) *develop and fund a management plan for Treaty Villages*; 3) *register all commercial vessels, stock assessments and catch monitoring, introduce catch regulations*; and 4) *appoint dedicated fisheries officer to coordinate and drive actions*. This also addressed the feedback loop between conflict and lack of management compliance.

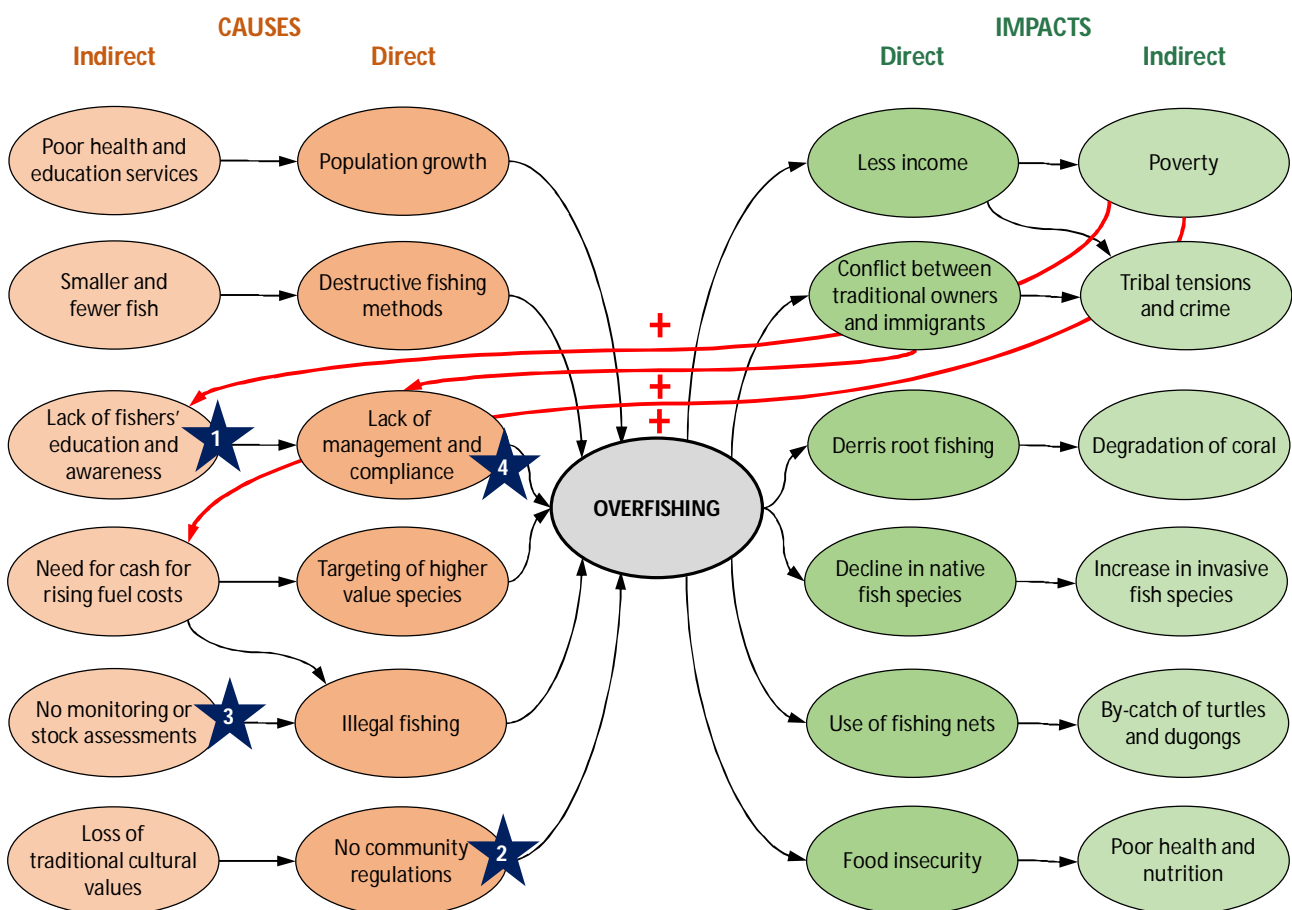


Figure 12. Causal loop analysis for the overfishing theme. The priority actions were: 1) *review current management arrangements*; 2) *develop and fund a management plan for Treaty Villages*; 3) *register all commercial vessels, stock assessments and catch monitoring, introduce catch regulations*; and 4) *appoint dedicated fisheries officer to coordinate and drive actions*.

2.3.2.7 Fly River refugees

The seventh-highest ranked theme was the problem of refugees that had migrated to the South Fly District as a result of the environmental impacts of Ok Tedi mine in the Middle Fly (Fig. 13). Direct impacts were over-population and unemployment in the South Fly District, which together lead to over-crowding, over-fishing, pressure on services, social conflict, and increased illegal fishing. Break down of law and order also places stress on limited police resources. Overall, declining levels of health place greater pressure on limited health services and the rise in drug-resistant tuberculosis. Direct causes are food insecurity in the Middle Fly due to Ok Tedi's impacts and climate change; lack of essential services in the Middle Fly due to mismanagement of funds; the need for impacted families to receive compensation payments in Daru due a lack of banking services in the Middle Fly; lack of employment due to illiteracy; and customary obligations.

There was one positive feedback, whereby the high unemployment in the South Fly District drives illiteracy and a lack of training, exacerbating the lack of employment.

One major action was suggested: 1) *land acquisition for re-settlement of refugees and migrants in the South Fly District*. This would require a complex legal and governance process, but would tackle two causes of the problem: lack of essential services for refugees and their lack of employment. The latter was related to the feedback loop between unemployment and illiteracy and lack of training.

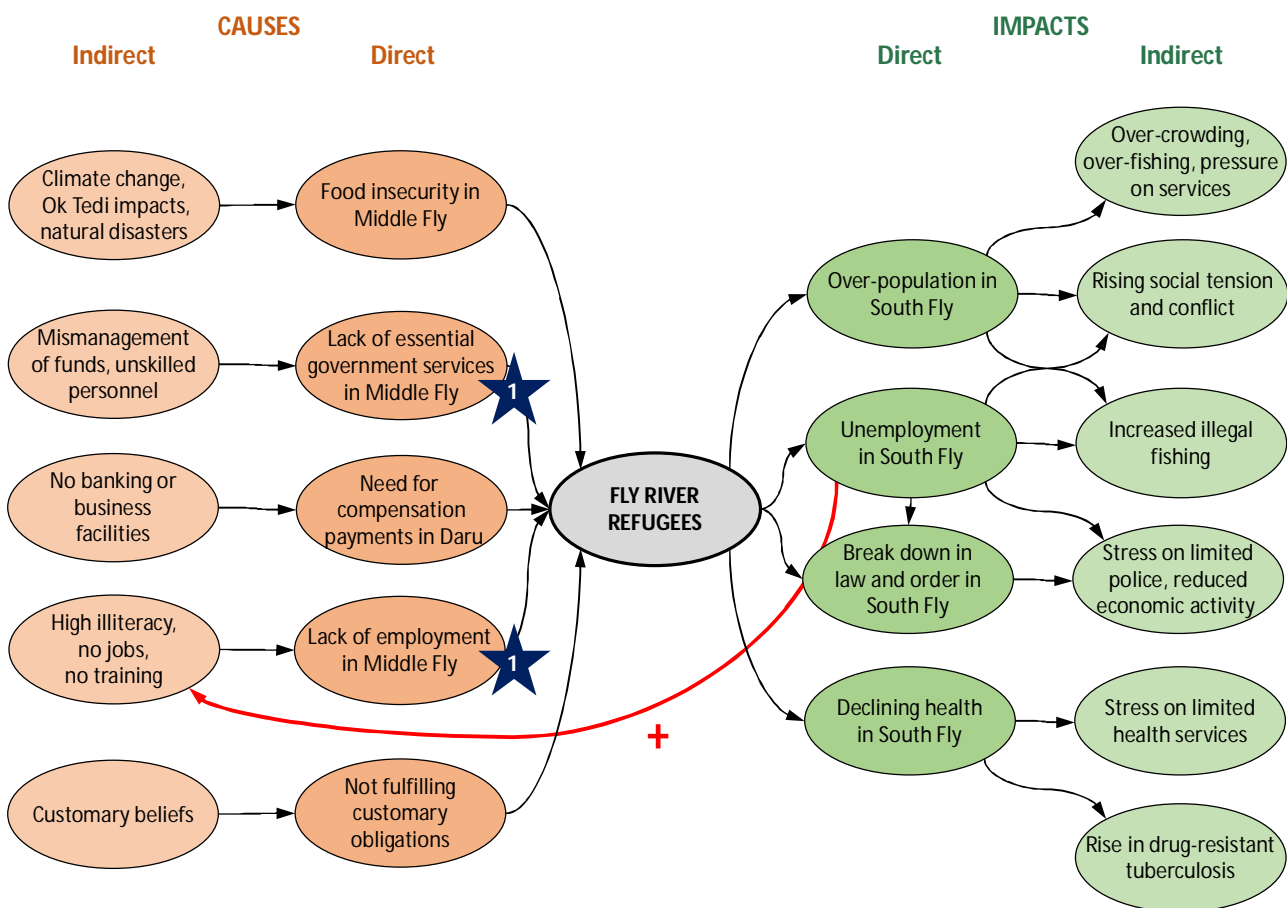


Figure 13. Causal loop analysis for the Fly River refugees theme. The priority action was 1) *land acquisition for re-settlement of refugees and migrants in the South Fly District*.

2.3.2.8 Food insecurity

The lowest-ranked theme was food insecurity (Fig. 14). This was highly complex, particularly in terms of its causes and feedbacks. Direct impacts are food shortages and over-fishing of native fish stocks, which together result in less income and unhealthy communities. Poor nutrition also impacts health and increases death rates. The lack of local alternative food drives demand for imported processed foods. Law and order problems are another impact, which drive illegal fishing and community conflict. Over-population is a direct cause of food security, which is driven by Fly River refugees, urban drift to Daru and the lack of family planning. Pollution is driven by the lack of sanitation and the environmental impacts of Ok Tedi mine and logging. Invasive species impact native fish stocks, and are driven by climate change and introductions for scientific purposes. Sea level rise and the acquisition of land by foreign investors is reducing the amount of land available for garden cultivation of food crops. Finally, poor enforcement of government policies is driven by misuse of funds and lack of infrastructure.

There were three positive feedback loops. First, less income exacerbates immigration to the South Fly district and Daru. Second, unhealthy communities exacerbate the lack of awareness of sanitation needs. Third, the demand for imported processed foods exacerbates the influx of foreign investors who can provide and sell this food, further driving the loss of land for cultivation.

Five actions were identified: 1) *harvest invasive fish species for processing into aquaculture fish feed*; 2) *develop integrated aquaculture of high value species*; 3) *replant sago stands*; 4) *improve market access into Indonesia and Australian Torres Strait*, and 5) *protection of impacted areas and habitats through Locally Managed Marine Areas*.

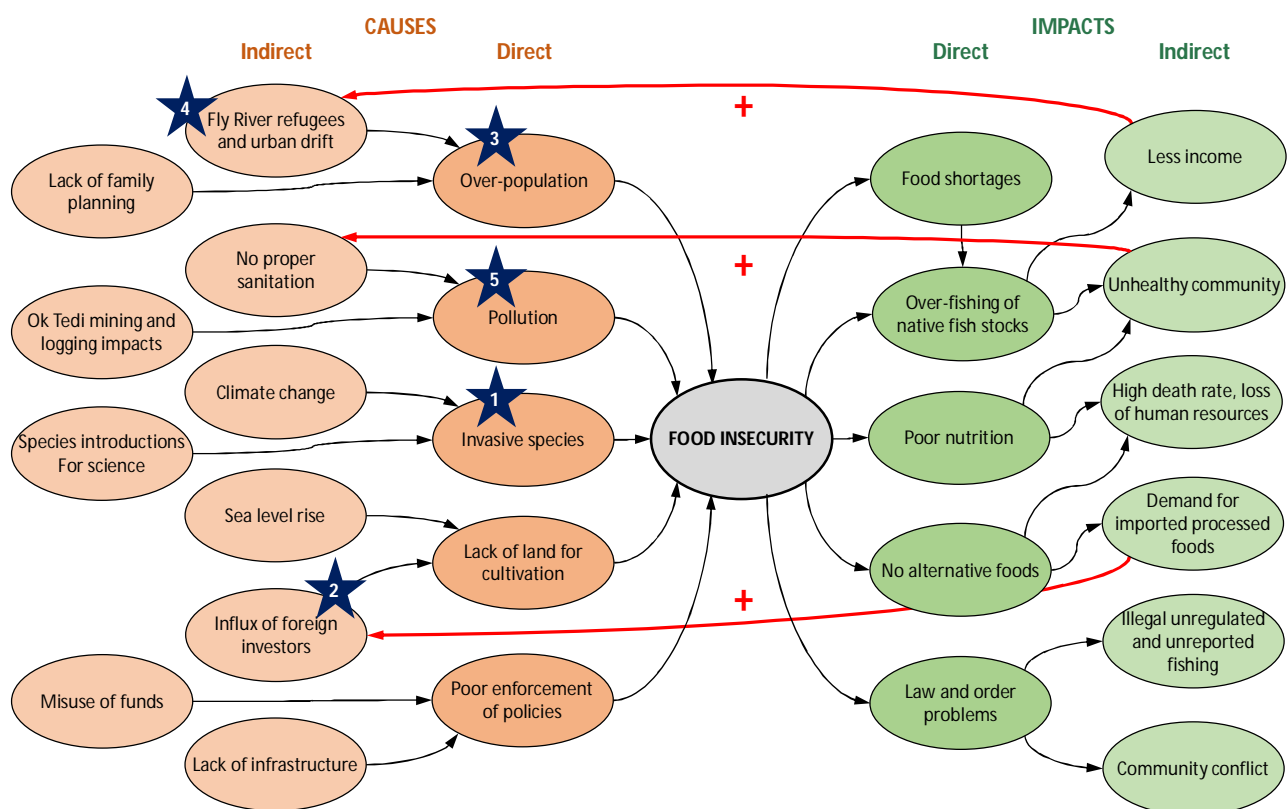


Figure 14. Causal loop analysis for the food insecurity theme. The priority actions were: 1) *harvest invasive fish species*; 2) *develop integrated aquaculture of high value species*; 3) *replant sago stands*; 4) *improve market access into Indonesia and Australian Torres Strait*, and 5) *protection of impacted areas and habitats through Locally Managed Marine Areas*.

2.3.3 Session 3: What are the necessary interventions?

Following the initial identification of interventions in Session 2, this session revisited and refined the actions. In particular, each focus group determined which stakeholders were necessary to implement the action, and designed a clear timetable for next steps. These are listed for each theme in Tables 2 – 9. The focus groups presented their action plans to the other participants for discussion and clarification.

Table 2. Actions, stakeholders and timetable to tackle the poor government and NGO coordination, planning and funding theme

Action	Who?	When?
1. Establish Western Province stakeholder coordination body with Terms of Reference for each organisation	<ul style="list-style-type: none"> • Western Province Provincial Administrator • South Fly District Administrator • OTDF • OTML • DFAT • NFA • World Vision 	31 st August 2015
2. Strengthen National Agency Working Team with new Terms of Reference and the Provincial Coordinating and Monitoring Committee	<ul style="list-style-type: none"> • NFA • Western Province Administration • World Vision • OTDF • PNG Customs Services • PNG Police • PNG Defence Force • DFAT 	30 th June 2015 National Agency Working Team meeting in Daru

Table 3. Actions, stakeholders and timetable to tackle the limited opportunities in commercial fisheries theme

Action	Who?	When?
1. Up-skilling and training for local villagers	<ul style="list-style-type: none"> • Western Province Fisheries Department • South Fly District Fisheries • Ward Members • PNG Department of Trade and Industry 	To be arranged
2. Build new fishery infrastructure	<ul style="list-style-type: none"> • Western Province Tenders Board • Contractors • Western Province Fisheries Department • South Fly District Fisheries • PNG Lands Department – Lands Officer • CFDA 	To be arranged

Table 4. Actions, stakeholders and timetable to tackle the lack of infrastructure theme

Action	Who?	When?
1. Build modern classrooms and teachers' houses	<ul style="list-style-type: none"> • Morehead LLG • South Fly District Administration • United Church • Donors • Parents and School Board can decide to collect project funds 	To be determined
2. Train people to build adequate sanitation	<ul style="list-style-type: none"> • Target communities • RRRRC to do training 	When the formal request is made to the Chairman of the Treaty Villages or Ward Member
3. Renovate buildings and sheds used for rainwater capture	<ul style="list-style-type: none"> • Chevron Construction with funding from DFAT • Donors • LLG Managers to take the lead 	When the LLG Manager is ready
4. Print more copies of the Community Development Plans and distribute them	<ul style="list-style-type: none"> • Ward Development Committee • Donors • LLG Managers • Ward Members 	Immediately

Table 5. Actions, stakeholders and timetable to tackle the mining pollution, flooding and sea level rise theme

Action	Who?	When?
1. Influence Provincial Administrator, Provincial Planner and South Fly District Administrator to include non-Community Mine Continuation Agreement villages in 2009 OTML Agreement: <ul style="list-style-type: none"> - Develop proposal - Bi-lateral meeting to endorse proposal - Wait for outcome of Provincial Administrator court case in Sept. 2015 - Engage at the provincial level - Maintain contact with OTDF 	<ul style="list-style-type: none"> • Kiwai LLG President • Treaty Traditional Inhabitants 	By June 2016
2. Climate change adaptation planning: <ul style="list-style-type: none"> - Gather information on communities on villages that will be affected by sea level rise flooding - Do projections of sea level rise in the South Fly District for next 50 years and identify vulnerable communities 	<ul style="list-style-type: none"> • Advisor of the Provincial Affairs Division who has established relationship with Treaty Villages • CSIRO and NFA contact Conservation and Environmental Protection Authority (CEPA) 	By June 2016

Table 6. Actions, stakeholders and timetable to tackle the illegal fishing theme

Action	Who?	When?
1. Develop effective management plans and policies, including fishery cooperatives	<ul style="list-style-type: none"> • Establish community fishery cooperatives • Western Province Provincial Fisheries • Provincial Executive Council – Chairman, and Daru Member • National Agency Working Team • NFA Managing Director and Board 	<ul style="list-style-type: none"> • By December 2015 Stage 1 community consultation done • Provincial Development Plan • NFA and line agencies implementation

Table 7. Actions, stakeholders and timetable to tackle the overfishing theme

Action	Who?	When?
1. Review current management arrangements	<ul style="list-style-type: none"> • NFA • CFDA • Treaty Village Members • South Fly District Fisheries • CEPA • Border Liaison Officer • Maru Marine Ltd. • Kailis Fisheries • CSIRO 	Leaders should talk now – need to take a strong message to governments and fishery authorities
2. Develop and fund a management plan for Treaty Villages, following Locally Managed Marine Areas model	<ul style="list-style-type: none"> • TSRA • Protected Zone Joint Authority • Traditional Owners • Customs Authorities • RRRC Resilient Communities Program • OTDF 	October 2015 Torres Strait Treaty Fisheries Bi-lateral Meeting
3. Register all commercial vessels, stock assessments and catch monitoring, introduce catch regulations	<ul style="list-style-type: none"> • CFDA • CSIRO • World Vision 	October 2015 Torres Strait Treaty Fisheries Bi-lateral Meeting
4. Appoint dedicated fisheries officer to coordinate and drive actions	<ul style="list-style-type: none"> • NFA • CFDA • CSIRO 	Immediately

Table 8. Actions, stakeholders and timetable to tackle the Fly River refugees theme

Action	Who?	When?
1. Land acquisition for re-settlement of refugees and migrants in South Fly District by: <ul style="list-style-type: none"> • Drafting an information paper for the Provincial Management Team 	Led by National Agency Working Team <ul style="list-style-type: none"> • South Fly District Administrator 	Next Provincial Management Team, 3 rd Quarter 2015
<ul style="list-style-type: none"> • Put a policy paper to the Provincial Executive Council 	<ul style="list-style-type: none"> • Deputy Administrator LLG Affairs 	Next Provincial Management Team, 3 rd Quarter 2015
<ul style="list-style-type: none"> • Secure budget appropriation 	<ul style="list-style-type: none"> • Deputy Administrator LLG Affairs • South Fly District Administrator • Provincial Planner 	October-November 2015
<ul style="list-style-type: none"> • Land acquisition process and zoning 	<ul style="list-style-type: none"> • National Agency Working Team • Provincial Affairs • South Fly District Administrator • OTDF • Lands Manager • LLG and Village Courts 	2 nd Quarter 2016



A focus group presenting their detailed action plan for the overfishing theme (*Torres News*)

Table 9. Actions, stakeholders and timetable to tackle the food insecurity theme

Action	Who?	When?
1. Harvest invasive fish species for processing into aquaculture fish feed	<ul style="list-style-type: none"> • Partnership between NFA and aquaculture • OTDF • Provincial Fisheries Division • CFDA 	2015-2018
2. Develop integrated aquaculture of high value species	<ul style="list-style-type: none"> • Partnership between NFA and aquaculture • OTDF • Provincial Fisheries Division • CFDA 	2015-2018
3. Replant sago stands	<ul style="list-style-type: none"> • Department of Primary Industry • Communities • OTDF • Experts from sago-producing provinces 	2015-2018
4. Improve market access into Indonesia and Australian Torres Strait	<ul style="list-style-type: none"> • Provincial Government • PNG and Australian quarantine services • Border Development Administration • DFAT 	2016-2017
5. Protection of impacted areas and habitats through Locally Managed Marine Areas	<ul style="list-style-type: none"> • CEPA • Treaty Villages • Provincial Fisheries Division • Border Development Administration • RRRC • Police and NFA Enforcement 	2016-2020

2.3.4 Session 4: Are these interventions being delivered by current development?

Following Session 3, focus groups discussed whether the actions and interventions were being delivered by current development programs (including government, NGO or other donors) in the South Fly District. A 'traffic light' system was developed, whereby green denoted the action was being delivered, red denoted no delivery to date, and blue denoted planned delivery. Each group then presented their analysis to all participants for discussion and clarification. When the actions for all eight themes were collated, it was possible to create a 'heat map' which illustrated the overall delivery of actions, and those themes where particular focus was necessary.

The heat map (Table 10) showed that of the total of 21 actions, 15 (71%) were not currently being delivered, four (19%) were partially being implemented, and two (10%) were planned. Of the top four priority themes, actions for 'poor government and NGO coordination, planning and funding' and 'limited opportunities in commercial fisheries' were not currently being delivered. For 'lack of infrastructure', the RRRC's Resilient Communities Program is providing renovation of buildings, but this is only occurring in four Treaty Villages. None of the other three actions are being delivered. For 'mining pollution, flooding and sea level rise', neither of the two actions are being delivered.

Table 10. The heat map of 21 actions for the eight themes and their delivery by current development programs in the South Fly District. Green denotes current delivery; red is no delivery to date; and blue denotes planned delivery.

Theme	Action	Delivery by current development program?
Poor government and NGO coordination, planning and funding	3. Establish Western Province stakeholder coordination body with Terms of Reference for each organisation	
	4. Strengthen National Agency Working Team with new Terms of Reference and the Provincial Coordinating and Monitoring Committee	
Limited opportunities in commercial fisheries	3. Up-skilling and training for local villagers	
	4. Build new fishery infrastructure	
Lack of infrastructure	5. Build modern classrooms and teachers' houses	
	6. Train people to build adequate sanitation	
	7. Renovate buildings and sheds used for rainwater capture	RRRC Resilient Communities Program in four Treaty Villages
	8. Print more copies of the Community Development Plans and distribute them	
Mining pollution, flooding and sea level rise	3. Include non-Community Mine Continuation Agreement villages in 2009 OTML Agreement	
	4. Climate change adaptation planning	
Illegal fishing	2. Develop effective management plans and policies, including fishery cooperatives	Community consultation in progress
Overfishing	5. Review current management arrangements	Torres Strait Treaty Fishery Bi-lateral meetings
	6. Develop and fund a management plan for Treaty Villages area	
	7. Register all commercial vessels, stock assessments and catch monitoring, introduce catch regulations	
	8. Appoint dedicated fisheries officer to coordinate and drive actions	
Fly River refugees	2. Land acquisition for re-settlement of refugees and migrants in South Fly District	
Food insecurity	6. Harvest invasive fish species for processing into aquaculture fish feed	
	7. Develop integrated aquaculture of high value species	OTDF barramundi hatchery in Daru
	8. Replant sago stands	
	9. Improve market access into Indonesia and Australian Torres Strait	
	10. Protection of impacted areas and habitats through Locally Managed Marine Areas	CEPA community plans

3 Workshop evaluation

3.1 Changes in perceptions

The first objective of the workshop was to ensure that stakeholders in government, NGOs and communities are aware of the current development issues and challenges in the South Fly District. To assess whether this had been achieved, a questionnaire survey was carried out before and after the workshop. To maintain consistency, only those who responded to the questions both before and after were included in the analysis.

The first question was 'what is the priority for livelihood development in the South Fly District?' From a multiple-choice of set answers, before the workshop 'governance' was selected most frequently (30%), followed by 'infrastructure', 'income' and 'health' (Fig. 15). After the workshop, a far higher proportion of respondents (53%) selected 'governance' at the expense of 'infrastructure', 'income' and 'health'. 'Food security' also increased in importance, rising from 5% to 10%. This result corresponded with the prioritisation of 'poor government and NGO coordination, planning and funding' as a theme during Session 1, which included 23 issues.

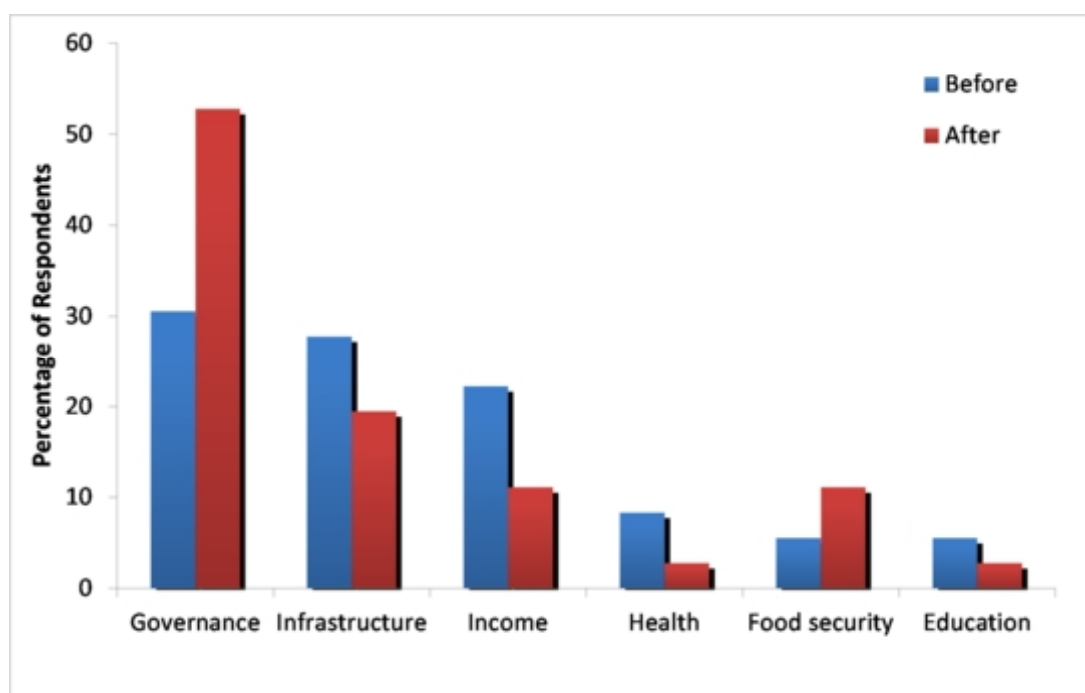


Figure 15. Participants' responses to the multiple-choice question 'What is the priority for livelihood development in the South Fly District?' before and after the workshop (n = 36)

The second question was 'what is the primary problem for livelihoods in the South Fly District?' Respondents gave open-ended answers which fell into 11 categories (Fig. 16). Before the workshop, 'infrastructure' was mentioned most frequently, followed by 'economic development', 'health' and 'governance'. After the workshop, 'governance' was identified as the most important problem, jumping from 13% to 37% of responses. 'Infrastructure' was the second most frequently mentioned, followed by 'economic development', and the importance of both declined. The importance of 'health' fell from third to seventh. 'Population growth' and 'climate change' were mentioned after the workshop, having not been identified before.

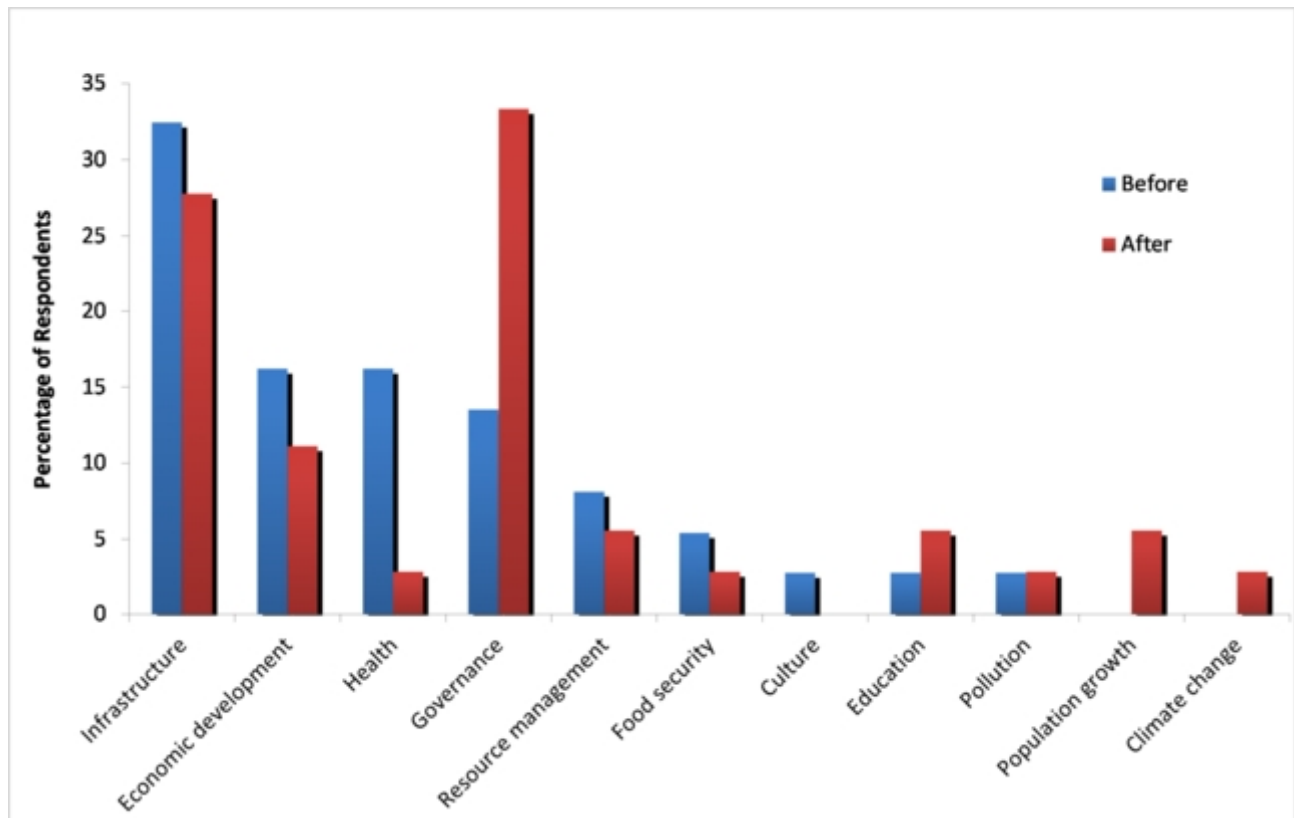


Figure 16. Participants' responses to the open-ended question 'What is the primary problem for livelihoods in the South Fly District?' before and after the workshop (n = 36)

3.2 Outcomes

The workshop was designed to encourage discussion and learning amongst the participants, and to generate new social networks. This was achieved by forming focus groups of mixed government, community, NGO and science stakeholders, both from PNG and Australia. In addition, the process of causal loop analysis aimed to challenge group members' preconceptions of the problem themes, and plenary discussion of actions and development programs was intended to raise all participants' awareness of the issues.

To evaluate the outcomes of this process, the post-workshop questionnaire asked three questions. First, participants were given a multiple-choice question: 'what is the most important thing you have gained from this workshop?' The majority (53%) selected 'new ideas and solutions', followed by 'new information' and 'new contacts' (Fig. 17). Second, participants were asked: 'have you identified any new partners who can help you improve livelihoods in the South Fly District?' The vast majority (93%) replied 'yes'. Third, participants were asked to list the organisation or person that they had identified. The most frequently mentioned (28%) was OTML and OTDF, followed by NFA (17%), CSIRO (13%) and RRRC (13%; Table 11).

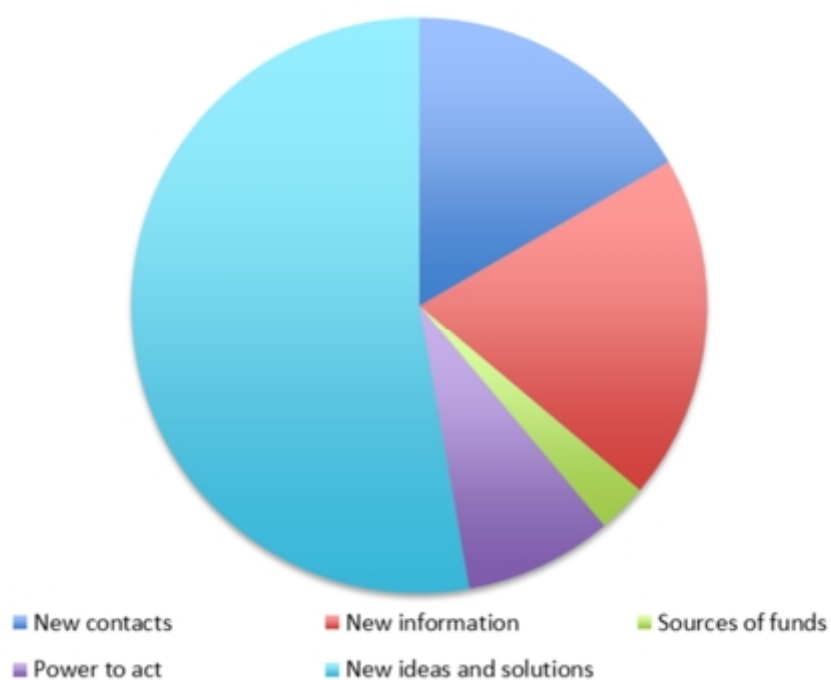


Figure 17. Responses to the post-workshop question 'What is the most important thing you have gained from this workshop?' (n = 36)

Table 11. The frequency of organisations identified by participants as new partners

Partners	Number of times mentioned	Percent
OTML/OTDF	15	28
NFA	9	17
CSIRO	7	13
RRRC	7	13
CFDA	5	9
World Vision	4	8
DFAT	2	4
Landowners	1	2
Western Province Administration	1	2
TSRA	1	2
LLGs	1	2

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