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The use of education theory to guide the implementation of participatory rural appraisal in the Kingdom of Tonga

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University of Wollongong


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2 INTRODUCTION TO TONGA

This chapter introduces the reader to the context of this study and briefly provides an overview of Tonga as a country in regard to history, geography, land tenure, social system, possible threats and actions towards sustainable development.

Tonga is the last surviving Polynesian Kingdom in the South Pacific. The word Tonga means “south” in numerous Polynesian languages (U.S. Department of State, 2007). Scholars claim that the inhabitants originally came from Samoa, but archaeological evidence indicates that the Tongan islands have been settled since at least 500 B.C. For more than 1,000 years Tongan sovereigns have strongly supported the careful preservation of local traditions and the power of the Tongan monarch reached its height in the 13th century. At the time, Tongan chieftains exercised political influence as far as Samoa.

The Tongan legend, as described by the elders, states that in the beginning, the god Tangaloa ‘Atulongolongo descended from the sky and took on the form of a plover before landing on an uninhabited island (Taumoefolau, 2006). The bird pecked a maggot growing in a creeper into three parts, and from these grew three men – the first Tongan men. Then the demigod Maui fetched women from Pulotu, the underworld, to be their wives. Their descendents multiplied and became the Tongan people.

During the 14th century, the King of Tonga delegated much of his power to his brother while retaining the spiritual authority. Later, this process was repeated by the second royal line, resulting in three distinct lines: the Tu’i Tonga with the spiritual authority, which is believed to have extended over much of Polynesia; Tu’i Ha’atakala; and the Tu’i Kanokupolu. The latter two had authority for carrying much of the day-to-day administration of the Kingdom.

The country has participated in global affairs since Captain Cook named the Kingdom of Tonga the Friendly Islands of the South Pacific on his second voyage, following a long and happy visit in 1777. The first European contact was in 1616 by two Dutch explorers,
Willem Schouten and Jacob Le Maire, who passed the islands en route to Indonesia (Taumoepepolu, 2007; Ve‘ilä, 1995). Abel Tasman was the first recorded European to land in 1643 (Latukefu, 1974).

Table 2.1 summarises many of the key facts and figures that relate to Tonga. The key features of this table will be further discussed under the major headings of: geography, the land, the people, rural development, the economic environment, social structure and governance.

**Table 2.1 Country Facts**

<table>
<thead>
<tr>
<th>Country</th>
<th>Kingdom of Tonga</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sovereign</td>
<td>George Tupou V</td>
</tr>
<tr>
<td>Prime Minister</td>
<td>Feleti Sevele</td>
</tr>
<tr>
<td>Land Area</td>
<td>277 sq mi. (717 sq km)</td>
</tr>
<tr>
<td>Total Area</td>
<td>289 sq mi. (748 sq km)</td>
</tr>
<tr>
<td>Population</td>
<td>116,921</td>
</tr>
<tr>
<td>Capital and largest city</td>
<td>Nuku’alofa</td>
</tr>
<tr>
<td>Language</td>
<td>Tongan (an Austronesian language), English</td>
</tr>
<tr>
<td>Monetary unit</td>
<td>Pa’anga</td>
</tr>
<tr>
<td>Ethnicity/race</td>
<td>Polynesian, European</td>
</tr>
<tr>
<td>Religion</td>
<td>Christian (Free Wesleyan Church claims over 30,000 adherents)</td>
</tr>
<tr>
<td>Literacy rate</td>
<td>99%</td>
</tr>
<tr>
<td>Economic Summary (2002 est.)</td>
<td>$224 million; per capita $2,300. <strong>Real growth rate:</strong> 1.4%</td>
</tr>
<tr>
<td></td>
<td><strong>Inflation:</strong> 10.3% <strong>Unemployment:</strong> 13%</td>
</tr>
<tr>
<td>Arable land</td>
<td>20%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Squash, coconuts, copra, bananas, vanilla beans, cocoa, coffee, ginger, black pepper, fish</td>
</tr>
<tr>
<td>Labour force</td>
<td>33,910 – agriculture 65%; industry and service 35%</td>
</tr>
<tr>
<td>Industries</td>
<td>Tourism, fishing</td>
</tr>
<tr>
<td>Natural resources</td>
<td>Fish, fertile soil, eco tourism</td>
</tr>
<tr>
<td>Exports</td>
<td>$34 million f.o.b.: squash, fish, vanilla beans, root crops</td>
</tr>
<tr>
<td>Imports</td>
<td>$122 million f.o.b.: food stuffs, machinery and transport equipment, fuels, chemicals</td>
</tr>
<tr>
<td>Major trading partners</td>
<td>Japan, China, U.S.A., Taiwan, New Zealand, Fiji, Australia (2004)</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Possible Threats</td>
<td>Natural disasters, depletion of resources, sea level rise, agricultural runoff, climate change and greenhouse effects</td>
</tr>
<tr>
<td>Action required</td>
<td>Natural disaster preparedness, ongoing community awareness and proactive training programs for sustainable development</td>
</tr>
<tr>
<td>International disputes</td>
<td>None</td>
</tr>
</tbody>
</table>

Source: Pearson Education, Inc. 2007; U.S. Department of State 200; Lao 200; Fa’anunu, 2007).

2.1 Geography

The Tongan archipelago is directly south of Samoa. Its 171 islands, 48 of them inhabited, are divided into three main groups – Vava’u, Ha’apai and Tongatapu and cover an 800 kilometre (500mi.)–long north–south line. Fifteen percent of the islands are inhabited (Central Planning Dept., Tonga 1991). The total land mass is approximately 747 km$^2$, of which 584 km$^2$ are considered suitable for farming and settlements (UNESCAP, 2000). Tongatapu is the largest and most populous island, comprising about three quarters of total land area and 70% of the total population. The capital Nuku’alofa, with 30% of the population, is located on Tongatapu (MAFF, 2002). The clustering of better education facilities and work opportunities in the main islands, particularly in Nuku’alofa (capital of Tonga on Tongatapu) were accountable for the continuous migration of people there. As a result the outer islands are likely to be populated by people who have lower incomes and less educational opportunities.

Figure 2.1 shows the boundaries of Tonga as being between longitudes 177º and 173ºW, and latitude 15º and 23º 30’S. The total area of the Exclusive Economic Zone for Tonga is approximately 700,000km$^2$ (UN-ESCAT, 1990). There are at least 170 islands in the archipelago,
Figure 2.1: Map of Tonga

Source: Kingdom of Tonga Sixth Development Plan, 1991 - 1995
2.1.1 Climate and Rainfall
Tonga has a maritime climate where the mean annual minimum temperature ranges from 20.7°C in Tongatapu in the south to 23.7°C at Niuafo’ou and Niuatoputapu in the far north (Figure 2.1). The climate varies from cooler and drier in the south to wetter and warmer in the north. The average rainfall in Niuas is approximately 2,500 mm and 2,000 mm in Vava’u, whereas Ha’apai and Tongatapu receive a mere 1500 mm. The average rainfall is 1775.5 mm. Trade winds blow a constant 13 -18 knots all the year round, mainly from the south east (Pelesikoti, 2003).

2.1.2 Population Distribution
Polynesians have lived on Tonga for at least 3,000 years (Pearson Education Inc., 2007; U.S. Department of State, 2008). Bagchi (2000) stated that about 35% of the population live in urban areas compared to 65% of the population living in rural areas. Urban areas were identified as those not relying on agriculture as their main source of livelihood. Rural areas can be characterised by the populace relying heavily on farming and agriculture as their main source of livelihood.

2.1.3 Rural-Urban Drift and Outer Island Migration
Due to rural-urban drift and outer island migration, the environment and resources of Tongatapu and Vava’u are suffering from observable reductions in environmental quality (Pelesikoti, 2003; Tonga IWP Technical Report, 2003 & 2005; Bagchi, 1999). The effects of rural-urban drift include mounting pressures of increasing population, waste disposal, pesticides and agricultural runoff, overfishing, reclamation of wetlands, clearance of mangroves for settlements, application of destructive fishing methods such as dynamite and local poisons (derris roots) and the introduction of exotic species and climate change (UNESCAP, 2000; Kelleher, 1993; Funaki, 1993).

2.1.4 Seasons
The two main seasons are the hot wet and cool dry seasons. The hot wet season starts in December and continues until April. The cool dry season begins in May and lasts until November. August is the coolest month of the year, with an average temperature of 21.3°C
Most of the rain falls during the hot wet season due to convectional processes. Convectional rain occurs when warm air expands and rises. During its ascent, the air mass remains warmer than the surrounding environmental air. As the air is slowly, cooled water vapours in the air condense into water droplets which fall to the ground as rain.

2.1.5 Rainfall Variability
Rainfall is a climatic variable for both the people and their environment. Rainfall has the potential to cause damage to infrastructure, settlements and agriculture (Pelesikoti, 2003). The dry period (May to November) and the cyclonic months (December to March) can severely affect agricultural production (Vea’ila, 2002). Between 1986 and 1998 thirteen cyclones devastated Tonga, of which 71% had strong winds ranging from 50 to 140 knots (Tonga Meteorological Service (TMS) Annual Reports, 1998 & 1999; Pelesikoti, 2003).

2.1.6 Soil Types
About two thirds of the archipelago, such as Tongatapu and Vava’u is made up of coral-based islands, while the rest are volcanic in origin. The soils of the coral-based islands are generally fertile with thicker top soil and a layer of volcanic ash over the coral than the volcanic islands of Ha’apai group (Orbell, 1983), which are less fertile for cash cropping (UNICEF, 2001). Beecroft (1976) noted that the soils of Ha’apai group lack nitrogen (N), potassium (P) and sulfur (S). ‘Eua Island, found between 18°S-21.5°S, is made up of limestone and dormant volcanic materials (Scholl & Vallier, 1985; Vea’ila, 1995). These soils are friable, well-structured, have good drainage and contain moderate moisture (Orbell, 1992).

2.1.7 Forests
Tonga’s native vegetation is almost extinct due to the unlimited demands for farming activities, the rapid population growth, rapid urbanisation, commercial agriculture, commercial livestock production, industrial expansion, and recreation, etc. (Thaman, 1995; Clarke, 1994). The native forests were cleared for garden activities and then left to vegetatively regenerate (Wenzel, 1989; Wiser, 1999). IUCN (1991) reported that the
regenerated growth (mainly toi (*Alphitonia ziziphoides*), mo’ota (*Dysoxylum forsteri*), fekika vao (*Syzygium clusiaefolium*) etc., of the primary forest became the dominant vegetation of Tonga. UNESCAP (2000) identified coconut palms (*Cocos nucifera*) as the dominant plant species in Tongatapu and Vava’u.

2.1.8 Birds

Tonga has approximately 48 native bird species, half of which have been found in ‘Eua (SPREP, 2003b). Larson and Upcott (1982) estimated that about 3800 ha of the 4000 ha of Tonga natural forest can be found in ‘Eua, which serves to protect the diversity of bird species. Habitat destruction is the main threat to birds in Tonga. The red breasted musk parrot (*Posoepia tabuensis*), fruit doves (*Ptilinopus porphygraceus* & *P. perousii*), blue crown lory and white tailed tropical birds (*Phaeton lepturus*) are endemic species on the island of ‘Eua.

Birds are important for the goods and services they provide in their habitats for seed dispersal, pollination, controlling pests and maintaining food chains, inspiring people with their beauty, songs and behaviour, helping the economy through tourism and bird watching and are valuable indicators of environmental problems through the fluctuations in their populations (SPREP, 2003b).

2.2 The land

All land in the country is the property of the Crown. The Land Act of 1903 stated that every Tongan male above the age of 16 years old is entitled to a tax allotment of 3.3 hectares of farm land, known as ‘api tukuhau and a town allotment of 7000 square metres for housing, i.e., ‘apikolo (Bagchi, 2000; Pelesikoti, 2003; Tongilava, 1979). However, the pressure generated by population increase has led to a decrease in the proportion of eligible land being assigned for such allotments (Bagchi, 2000). In 2001, there were approximately 27,485 hectares of agricultural holdings with an average size of 3.3 hectares per holding (MAFF, Statistics Dept. and FAO, 2002).
Tongan people have very strong ties with the land as land rights and land ownership helps to establish status, wealth and linkages in Tongan society. Thus land ownership is more than a simple relationship of local people with respect to the land. Further, land tenure is one of the most critical political and economic issues in the Pacific Islands (Crocombe, 1987). Bryant (1993) reported that every country in the Pacific has a different system of land ownership or ‘belonging’ and thus has different methods of dealing with the question of land for settlement and agriculture. The distinctive Tongan land tenure system is one such system.

2.2.1 Land Act 1927

The Land Act 1927 prescribed strict rules about the hereditary estates, tax and town allotments, leaseholds and interests in lands of every description. However, these rules provided conditions for land acquisition rather than management rules (Pelesikoti, 2003). The Minister of Lands is the representative of the Crown in all matters concerning land and sea in the Kingdom (Land Act 1927, s. 19(1)). The Land Act 1927 and the Territorial Sea and Exclusive Economic Zone Act 1978 state that the rights and ownership are vested on the Crown (UNESCAP, 2000).

2.3 The people and their governance

The Tongan people are Polynesian in origin and the socio-political order is a blending of traditional Polynesian elements and western influences (Pelesikoti, 2003; Filiai & House, 1998). The Tongan society is divided into three social classes – the King and the Royal Family, Nobility, and the people or commoners (Toafa, 1992; Fa’anunu, 2007).

Tonga is the only Kingdom in Oceania that is governed by a hereditary constitutional monarchy based on the British system (Douglas & Douglas, 1989). The major government bodies are the King in Privy Council, the Cabinet, the Legislative Assembly and the Judiciary (Pulea, 1992).
2.3.1 King

The King is the head of the nation. The throne is inherited through the Royal Family (Taulahi, 1979; DP3, 1975-1980; Vea’ila, 1995; Latukefu, 1974). The King has the power to approve any legislation and to finalise petitions made by the commoners (Taulahi, 1979). The King gives his sanction and signature to all legislation prior to it becoming law (Pelesikoti, 2003).

The King also appoints the Prime Minister, Cabinet Ministers and the two governors of Ha’apai and Vava’u to his Cabinet which is presided over by the Prime Minister (Filiai & House, 1998). The Cabinet becomes the Privy Council when presided over by the King to be the highest authority in the country (Taulahi, 1979). The members of the Privy Council are appointed by the King to assist him in the discharge of his functions in Tonga (Pelesikoti, 2003; Latukefu, 1974). The criteria for the appointment of the Privy Council members are determined by the King in accordance with his views on the best interests of the nation (Vea’ila, 1995 & 2002).

2.3.2 The Legislative Assembly/Parliament

The Legislative Assembly or Parliament is unicameral. It is composed of the Cabinet Ministers, nine nobles’ representatives elected from 33 hereditary nobles, and nine people’s representatives elected from about 99.1% of the total population (Filiai & House, 1998; Taulahi, 1979). The speaker of the House is appointed from the nobles’ representatives. Afeaki (1988) notes that leadership and power are vested in the hands of only 0.1% of the Tongan population.

The election of the nine people’s representatives is made by universal suffrage of all Tongans over 21 years of age. The Legislative Assembly elections for all representatives of the nobles and the people are held every three years (Tongan Government, 2008). The people’s representatives in parliament are now openly challenging the ruling monarchy over issues such as government reform, corruption, environmental damage and the land tenure system (Bryant, 1993).
2.3.3  *The Constitution*

The Constitution of Tonga was first granted by His Majesty King George Tupou I on the 4th November 1875 (Tongan Government, 2008). It laid down the foundation for the present system of Government in modern Tonga. The Constitution of Tonga (COT) was written to ensure that there shall be but one law in Tonga (Latukefu, 1974; Pelesikoti, 2003). In 1862, the Emancipation Code of 1862 enabled all Tongans to become the sole heirs to the fruits of their labour and established the first Tongan constitutional government (USP, 1997).

2.3.4  *Nobles and chiefs*

Noble and chiefly titles are inherited through patrilineal lines. Both nobles and chiefs are entitled to their hereditary estates (Taulahi, 1979; Latukefu, 1974). The nobles’ hereditary estates (tofi’a) also extend the customary right to the sea surrounding the estates. The villagers are allowed to enter the nobles’ estates and the coastal areas for planting crops and fishing in order to maintain the power of nobles on their property and to reinforce the loyalty and protection of their people (Latukefu, 1976; Pelesikoti, 2003).

2.3.5  *The Legislation*

Tonga is a member of the British Commonwealth and therefore British Laws can apply if required, in addition to the legislation enacted by the Legislative Assembly.

2.3.6  *Village Life*

The village and district officers are elected by their respective villagers and hold office for three consecutive years under the responsibility of the Prime Minister’s Head Office. They discuss community issues during their monthly meetings, locally known as *fono* (Filiai & House, 1998; Tongan Government, 2008; Taulahi, 1979). *Fono* meetings normally discuss both government and village matters which could maintain the unity and solidarity of the Tongan society. Bryant (1993) notes however, that there is no doubt that the Pacific is becoming a place where it is more acceptable to question traditional authority.
The Governor’s Offices in Ha’apai and Vava’u and the government representative offices in the districts of ‘Eua, Niuafou’ou and Niuatoputapu can discharge the elected officers’ duties and responsibilities instead of the Prime Minister’s Office.

2.3.7 District Officer

The district officers have the responsibility of being local regional leaders. This position enables them to formulate regulations for the governing of village plantations. They also keep records of the birth and death rates and hold monthly meetings relating to the welfare of the people of the village (Government Act, 1903; Bagchi, 2000). The regulations formulated by the district officers will not become law until sanctioned by the Cabinet and confirmed by the Prime Minister. The noble holder of a hereditary estate is authorised to make regulations for the people who reside on their estate (Pelesikoti, 2003). These regulations have the potential to help the promotion of the welfare of local communities. Local people or commoners provide free labour on their chief’s property to maintain loyalty (Latukefu, 1974).

2.3.8 Description of social groups within the community

Tongan people enjoy a relatively high quality of life through traditional and cultural activities such as growing enough root crops for home consumption, subsistence fishing, flexible local time, weddings, funerals and other ceremonies which reinforce a strong sense of community to extended families, kinship ties and national identity (Commonwealth of Australia, 1998).

2.3.9 Status of women in Tonga

Women are the binding force of the Tongan society. They have prestigious status, known as fahu (sisters & aunts) as well as high esteem in the extended family setting. Their roles and responsibilities as fahu reveal their uniqueness during the traditional festivities such as weddings, funerals and festivities of the extended family (Filiai & House, 1998). Fahu is an unlimited cultural freedom and authority of children of sisters, to be respected by their uncles and their children. Evans (2000) argued that fahu rights are unlimited and more complex to practice. Special gifts of fine mats, tapa cloths, food and money are given to the
fahu during all traditional ceremonies. It is also expected that the men present the first fruits of their gardens to their sisters and aunties, as men do not have such a prestigious status as their women counterparts.

The roles and responsibilities of women as mothers and homemakers are pivotal to the development of families and communities (Kingdom of Tonga-National Policy on Gender and Development, 2001). Nowadays, women are more involved in social and economic activities which might affect their traditional roles as mothers and homemakers (Filiai & House, 1998; Ecowoman, 2000; & Hala’api’api, 1997).

2.3.10 Women in Development

In 1993, His Majesty’s Cabinet approved the national policy on gender and development (GAD) for Women in Development (WID). The (GAD) policy was developed as a result of consultation, support and participation of the church groups, local communities, private sector, government and non-government agencies, to give equal opportunities of access to the benefits of sustainable development (Kingdom of Tonga, 2001).

The village women development groups carry out household activities, such as, cooking, washing, growing vegetables for home consumption, tapa making, mat weaving, oil making and child rearing. They are gradually becoming more involved in economic activities such as income generation projects, business and trade, teaching, nursing, and as lawyers, doctors, politicians, etc. (Kingdom of Tonga-National Policy on Gender and Development, 2001). Hala’api’api (1997) stated that women’s groups desperately needed more training opportunities in development, trades and business skills, equality and leadership, in addition to their traditional roles as mothers, wives and educators.

2.3.11 The Church

Religion plays an important role in all development aspects of Tongan society (MoE Annual Reports, 2000; UNICEF, 2001a; UN-ESCAP, 2000; Paongo, 1997). About 99% of the population belonged to Christian churches where activities were well established and prevalent in all villages (Filiai & House, 1998; Tongan Government, 2008). Christian
teachings have had a profound effect on the Tongan society including the strict observance of the Sabbath Law, which forbids all trades, sports and most leisure activities on Sundays (Filiai & House, 1998; Ministry of Education Annual Report, 2002; Taumoefolau, 2007).

2.3.12 The Churches’ Youth Program
Most of the churches in Tonga develop their own programs for youth development. Local churches also prepare their own budgets for youth activities. The government agencies and the private sector including non-government agencies work together to develop many programs for youth development. For instance, the Ministry of Agriculture and Forestry (MAF), the US Peace Corps Tonga and the Food and Agricultural Organization (Pacific) coordinated an agricultural project, known as ‘Future Farmers of Tonga’ (FFT) to educate young farmers about cash farming. In 2006, the Tongan Government set up of a new Ministry for Youth and Employment to promote more working opportunities for youth, although most youth projects do not have sufficient financial assistance from the government.

2.3.13 Community Youth
Youth is one of the major resources in the Kingdom of Tonga. UNICEF (1998) reported over 50% of the Tongan population are under the age of 25. This age group is generally concerned with the welfare and the improvement of living conditions in Tonga (UNICEF, 2001b; Kingdom of Tonga-National Policy on Gender and Development, 2001).

Religion and sport management were mentioned as priorities for training due to the need to accommodate youth dropouts from secondary schools into local communities (Hala’api’api, 1997). It was recommended that government and non-government agencies should organise appropriate youth programs to cope with the needs of these youths, as they are the leaders of tomorrow (Commonwealth of Australia, 1998; Hala’api’api, 1997; Mahina, 1997).

2.4 Education
Education is compulsory from ages six to fourteen (Tongan Government, 2008; Social Aspects of Sustainable Development in Tonga, 2002). Free universal access is available to
primary school from class 1 to 6 and is one of the priority areas of government public investment (Tongan Government, 2008 – see Ministry for Education, Women Affairs & Culture). Most parents are willing to educate their children to the highest attainable level because education is becoming a major entry requirement for any employment opportunities.

The church schools and private institutions administer approximately 75% of the secondary schools in Tonga. The MOE/Tonga Government Annual Report (Tongan Government, 2008 - see Ministry for Education, Women Affairs & Culture) indicated that approximately 10,500 of a total population of 15,000 students had enrolled in church secondary schools. Government schools employ approximately 30% of all secondary school teachers in Tonga compared to 70% of secondary teachers employed by the non-government education systems.

An example of the problems facing Tongan Education follows. In the decade, 1986 to 1996, total secondary schools enrolments for eligible student between the ages of 12 to 16 increased from 56 percent to 60 percent. Even though secondary education participation increased by 4 percent, 40% of students were still not attending school (Social Aspects of Sustainable Development in Tonga, 2002). The future well-being of students may depend on their education achievements. Higher qualifications can provide further studies, better jobs and higher status in local communities (Hala’api’api, 1997; Social Aspects of Sustainable Development in Tonga, 2002). If students fail their examinations or drop out of school, they can limit their future potential to earn a good income and fully contribute to their respective communities (Vea’ila, 2002).

The Commonwealth of Australia (2004) asserts that the investment in education is being drained because of the country’s narrow economic base and many young well-educated Tongans are forced to emigrate to find new working opportunities overseas. Although they send money home, the country is deprived of a young, energetic workforce. Thus a major challenge is developing and retaining a skilled workforce.
The following paragraphs describe adult education in Tonga (Tongan Government, 2008; Hala’api’api, 1997;).

2.4.1 Adult Education

Adult education is the practice of teaching and educating adults. This often happens in the workplace, through ‘extension’ or ‘continuing’ education courses at secondary school, at a college or university (ASPBAE, 2008). Other learning places may include high schools, distance community education and lifelong learning centres. The practice is also often referred to as ‘Training and Development’ and it has been referred to as andragogy to distinguish it from pedagogy.

Adult education can occur after both formal and non-formal education (Kingdom of Tonga - National Policy on Gender and Development, 2001; Tonga Environmental Education Program TCDT/FSP, 1998; USP, 1997; MOE Annual Report, 2002). Adults might participate in church and village education activities. Local governments rarely offer scholarships for adult learners. Also adult learners often have more commitments to their families than to adult education programs. As a result, many do not complete their studies. These cultural obligations often make adult education programs unsuccessful in Tonga. Therefore this researcher was challenged to consider different approaches such as non-formal education.

Non-formal education can be an extension of formal education (Social Aspects of Sustainable Development in Tonga, 2002). It is also organised to provide a second chance for learning to those who missed formal schooling. Male dropouts may help their fathers in fishing and gardening (Hala’apiapi, 1997). Girls can either serve kava (social/ceremonial drinks) or help their mothers to weave mats, cooking and making tapa cloths for families, villages and church festivities.

Fordham (1993) lists four characteristics of non-formal education:

- relevance to the needs of disadvantaged groups;
- concern with specific categories of person;
• a focus on a clearly defined purposes;
• flexibility in organisation and methods.

Table 2.1 contrasts formal and adult/non-formal education. During this study, the researcher needed to adapt a non-formal approach and the theoretical framework for this approach will be discussed in subsequent chapters.

Both non-formal and adult education programs are developed in the promotion of education for all and life-long learning (ASPBAE, 2008). The content of the non-formal education and adult education courses is based on the capacities of the learners where activities are practically oriented to fulfil the clearly defined purposes (Tight, 1996). The courses are also designed to advance the right of all to learn as well as promoting the needs and interests especially of the most marginal groups (ASPBAE, 2008). Non-formal education delivery is closely related to the community (Fordham, 1993). Its teaching and learning activities are flexible and are designed to lead the participants forward. Often it involves sharing experiences with other learning groups (ASPBAE, 2008).

Non-formal education is owned and controlled by the learning group within the community. The learners participate in making decisions about learning-teaching processes because the bottom up approach is enforced to help the learners’ understanding if necessary the social structure around them.

By way of contrast, the formal education system is controlled by a board or a ministry in a hierarchical organisation. The teacher and the students work together to achieve an externally developed syllabus that may be externally assessed.
Table 2.2: Comparison between formal, non-formal and adult education

<table>
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<tr>
<th>Purpose</th>
<th>Formal Education</th>
<th>Non-formal &amp; Adult Education</th>
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<tbody>
<tr>
<td>Long term &amp; general</td>
<td>Short term &amp; specific</td>
<td></td>
</tr>
<tr>
<td>Credential based</td>
<td>Non credential based</td>
<td></td>
</tr>
<tr>
<td>Learning places</td>
<td>Primary schools, secondary schools - universities</td>
<td>Outside the established formal system</td>
</tr>
<tr>
<td>Timing</td>
<td>Long cycle/preparatory/full time</td>
<td>Short cycle / recurrent / part time</td>
</tr>
<tr>
<td>Content</td>
<td>Standardised / input centred</td>
<td>Individualised / output centred</td>
</tr>
<tr>
<td>Academic</td>
<td>Practical</td>
<td></td>
</tr>
<tr>
<td>Delivery system</td>
<td>Institution based, isolated from environment</td>
<td>Community related</td>
</tr>
<tr>
<td>Rigidly structured, teacher and student centred and resource intensive</td>
<td>Flexible, learner centred and resource saving</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>External/hierarchical</td>
<td>Self governing/ democratic</td>
</tr>
</tbody>
</table>

Sources: Modified from Smith 2008

2.5 Economic Development

Fishing and agriculture are the backbone of the economy of Tonga. Crowley et al., (2003) reported that Tonga would appear to have an advantage in agricultural production with its favourable subtropical climatic and physical conditions in relation to its population size and relative abundance of suitable land. On the other hand, Tonga’s economy is characterised by a large non-monetary sector and heavy dependence on remittances from the more than half of the population that lives overseas (US Department of State, 2007).

Agriculture is still the principal sector and major economic activity in Tonga (Commonwealth of Australia, 1998; MAF-Statistics Dept., & FAO, 2002; Pelesikoti, 2003). It contributes significantly to the local economy as a major source of food, cash income, employment, Gross Domestic Product (GDP) and foreign exchange. The agricultural sector development needs to be sustainable by the adoption of appropriate
farming practices to maintain the productivity of the land resources of Tonga for both agricultural and non-agricultural activities (ADB, 2006a). The larger islands are very fertile and grow supporting crops for local consumption (Orbell, 1983). Squash (*Cucurbita maxima*), kava and vanilla are still the country’s principal export commodities while watermelon, coconuts, and root crops are gaining in importance (MAFF, Statistics Dept., & FAO, 2002).

### 2.5.1 Fishing

Fishing and the marine environment are important in the lifestyle and culture of the people living in the 2700 Pacific Islands spread over 30.6 million km² of ocean area (SPC, 2000; Kearney, 1980; Zann, 1981; Ministry of Fisheries Reports, 2000a, 2000b, 2001, 2002 & 2004). Fish and other marine resources provide 39% of total animal protein in the diet of the islanders compared to 16% for people worldwide (SPC, 2000). Seafood is an important source of lipids, vitamins and minerals. Despite fishing being one of the most important activities in Tonga, Thistlewaite et al., (1993a, 1993b) argued that traditional fishing methods such as hand thrown nets, spears and fish traps, were more destructive than modern fishing equipment due to intensive fishing practices on the reef.

The fisheries’ coastal resources have been over-exploited and threatened by unsustainable practices such as use of local poisons, dynamite, destruction of corals, and over-collection of shellfish (Wilkinson, 1975; Zann, 1981; Fisheries Annual Reports (Tonga), 1998 & 1999; Chesher, 1984 & 1985; UN ESCAP, 1990; IUCN, 1991). Overexploitation occurs when too many fish are removed from a stock is that reproduction cannot replace the numbers lost (SPC, 2000; Wilkinson, 1975; Ministry of Fisheries Annual Reports, 2000, 2002, 2003 & 2004). The fishing communities hold the key to preventing the decline of catches of accessible fish, seaweed and shellfish in inshore lagoons and reefs, as well as protecting the coastal environment through co-management (Crowley et al., 2003; Tongilava, 1979; Vea’ila, 1995 & 2002; King & Fa’asili, 1999; Statistics Department Abstracts, 1987 & 1991). SPC (2000) argued that co-management is either an informal or a legal arrangement between government representatives, community groups and other user
groups to take responsibility for, and manage, a fishery resource and/or its environment on a cooperative basis.

2.5.2 Tourism
Tourism could be a major catalyst for sustainable development in Tonga by promoting preservation of historic and archaeological sites, cultural activities, such as, dancing and production of handicrafts, continual used of traditional architectural designs and conservation of marine resources, native forests, public parks and reserves (GoT, 1991). The tourism industry contributed a major share of the economy with foreign exchange earnings reaching T$20 million per annum in 2002 (GoT, 2004).

2.5.3 Rural development projects
Rural development activities are aimed at improving the standard of living in rural areas and outer islands (Eco Woman 2000). Rural development projects have been designed to address the needs of the local communities but the perspectives were of those who introduced them (Stoke, 1991; Blaikie, 1996). The rural and outer island communities should therefore be integrated as partners into such projects (Pelesikoti, 2003; TEMPP, 2001; GEF/UNDP/SPREP/IWP/DoE-Tonga, 2002 & 2003).

The participation of local communities in projects can build on the many innovative ideas that people offer once they are convinced that their voices will be considered (Pelesikoti, 2003). Bryant (1993) argued that a number of Pacific countries attempted to reverse the levels of urbanisation by developing decentralisation schemes and placing increasing emphasis on rural development.

2.5.4 Non-Government Organizations (NGO)
Non-Government Organisations (NGOs) are non profit and charitable organisations set up to supplement the role of the government in serving the needs of groups and communities which are not fully catered for by public institutions (TCDT/FSP, 1998a & b). NGOs operate many projects such as cement tanks for families’ water catchment, kitchen and cooking charcoal stoves projects, beautification projects, lagoon watch, domestic waste management, planting of multi-purpose trees, arts and crafts, weaving and tapa making,

The Tonga Community Development Trust (TCDT) was established in 1984 as an indigenous, autonomous organization which serves the communities of Tonga by promoting sustainable local development in Tonga especially in the rural areas. TCDT promotes local development by assisting in the identification, planning and implementation of village-based development projects in the outer islands and rural areas of Tonga.

2.6 Summary

The geography and the history of Tonga provide an understanding of the basis of the livelihood of the Tongan people. They rely on fishing and subsistence farming for survival. Crocombe (1989) stated “in cultural terms, the very existence of the Pacific people is inseparable from the land”.

The tropical climate varies little throughout the year and throughout Tonga. However, long-term climatic variation associated with global warming has the potential to damage most of its economic development (agriculture and its fragile environment). Thus the environment and resources are both sensitive to sea level rise and climatic change. Even now, the tropical forest is virtually extinct due to a high demand for crop cultivation as well as meeting the needs of local population growth.

Land is a symbol of life for all Pacific Islanders, particularly the Tongan people. Rural Tongans rely on plantation and subsistence agriculture (U.S Department of State, 2007); and the Tongan households derive both cash (commercial sales) and non–cash income (produce for home consumption) from agricultural activities (Crowley et al., 2003).

Women play an important role in local community development activities to maintain their position as the binding force in the society. They are continually involved in many aspects of community development including income-generation projects, teaching, nursing, politics and policing as well as taking care of their family. They desperately need to
participate in more training workshops and further education programs so they can perform their tasks effectively.

The church also plays an important role in the development of Tonga. The Christian faith that has dominated Tongan life for almost two centuries is still influential (U.S. Department of State 2007). All commerce and entertainment activities are illegal on Saturday from 12.00 midnight till Sunday 12.00 midnight, and the constitution declares the Sabbath to be sacred, forever.

Rural development needs to address the needs of local communities rather than those of the donor agencies. The needs of the people living in rural areas and remote outer islands could be identified as the main target of the development projects. Non-government organizations (NGOs) must be working cooperatively with government agencies to cater for the needs of the most disadvantaged groups in Tongan society such as those on remote outer islands.

2.7 Challenges to sustainable development in Tonga

The purpose of this section is to outline the major challenges to sustainable development in Tonga and to describe the contribution that this study makes to meeting these challenges. The educational problem is outlined and linked to the purpose statement and research questions.

2.7.1 Introduction

Tonga has a small domestic market, and is distant from global markets. High transportation costs and limited economies of scale impact on prices (UNICEF, 2001). About 60% of the Gross Domestic Product (GDP) is contributed by the agricultural sector (GoT, 2004). Factors affecting agricultural development include geographic isolation, limited landmass, expensive transportation networks, overseas market fluctuations, sea level rise and cumbersome governance structures (Commonwealth of Australia, 1992 & 1998; Fairbain, 1992, Crocombe 1987).
Tonga is ranked the third most vulnerable out of 111 countries assessed using a Global Composite Vulnerability Index, which measures vulnerability to external economic shocks and natural disasters (Social Aspects of Sustainable Development in Tonga 2002). Limited resources and a fragile environment have also been threatened by the predicted rises in sea level (Pelesikoti, 2003; SPREP 1999; DoE, 1999; World Bank, 1990, 2008; GEF/UNDP/SPREP/IWP/DoE, 2003& 2004; UNDP & SOPAC, 2004; UN-ESCAP & GOT, 1990). Other effects of climate change, such as the increasing frequency and severity of cyclones, also endanger Tonga even though it is accustomed to a high rate of natural disasters (UNDP/SOPAC, 2004; Commonwealth of Australia, 1992 & 1998; Fairbairn, 1992; Crocombe 1987).

2.7.2 Poverty

Despite there being no standard definition for poverty in the South Pacific, rural and regional measures have been developed to mitigate poverty in Tonga (Social Aspects of Sustainable Development in Tonga, 2002). The Tongan government has formulated specific policies to direct planning towards improving the standard of living of its people (Tongan Government: Official Website, 2008). The environmental issues of conservation and resource management were integrated into the national planning framework to achieve sustainable economic growth, generate more employment opportunities, improve health standards, and conserve Tonga’s natural resources (Tongan Government: Official Website, 2008; Pelesikoti, 2003).

Matangitonga (2005) states that about 23% of members of sixteen communities interviewed in 2003 by the Government of Tonga and Asian Development Bank (ADB) in Tongatapu, Ha’apai, Vava’u, ‘Eua, Niuatoputapu and Niuafo‘ou were living below the poverty line of T$28.18 per week. Poor families had to make difficult daily choices between paying school fees or buying food under such conditions. The Government of Tonga and the Asia Development Bank (ADB) defined poverty or ‘masiva’ as being without or having limited access to land, food, housing, education, health services and money. These poverty line figures were based on an analysis of the Household Income and Expenditure Survey of 2001 (Vava’u Press, Matangitonga, 2005). Hardship or tu’utamaki is living in the very
difficult situation of being dependent on relatives for food, money, shelter and the support for too many dependents in the household. Hardship was also strongly associated with the inability to meet the family’s basic needs and traditional obligations through having limited resources, particularly land.

In 1990, Tonga’s Government established a rural and regional development unit within its Central Planning Department to directly assist the disadvantaged where it perceived vulnerability to poverty (Ministry of Education Annual Report, 2000; Statistical Department & Tonga Government, 2004). It was noted that the Commonwealth of Australia provided assistance that aimed to reduce Tonga’s vulnerability to poverty by strengthening public systems, stimulating economic productivity and raising living standards of at-risk groups. The Australian Government Grant Scheme for Tonga provided $203,229 dollars for its Vulnerability and Adaptation Initiative (VAI) for the implementation of water supply systems and coastal planting communities’ projects (Vava’u Press Ltd, 2007). Vulnerability and Adaptation Initiatives (VAI) were designed to help with a program which targeted community-level activities.

Commercial agriculture with new crop varieties may bring new pests and diseases triggering frequent pesticide applications which in turn may cause pest outbreaks in different phases and possible failure of current control systems (Fakalata, 1993). In the early 1990s, high-value cash crops, such as squash (Cucurbitea maxima) and vanilla became the main export crops, with squash accounting for 80% of total export earnings (Social Aspects of Sustainable Development in Tonga, 2002; Pearsons Education, 2007). However, squash production has left Tonga vulnerable to market and climate fluctuations, and exposed to the impacts of plant diseases and pests. As a result, small growers are unlikely to sacrifice the security of subsistence production and commit themselves entirely to export production and a recent study (Velde et al., 2003) indicates that, due to the high external inputs of fertilisers and other agrochemicals for squash production, concerns have arisen on the adverse effects of these farming practices on local ecosystems particularly in relation to ground and lagoon water quality.
FAO (1996) shows that economic performances of South Pacific Small Island Developing States (SPSIDS) were weak and unstable. Gross Domestic Products (GDP) have often been outpaced by population growth and several of these countries showed almost no rise in average real per capita incomes over the period 1980 - 1989, which was possibly linked to the high levels of aid received and remittances from family members working overseas. Between 1980 and 1989, average rises in real income per capita ranged from -2.0% to 0% per year in Fiji, Papua New Guinea and Vanuatu, and zero to +2% per year in Samoa, Kiribati and Tonga. At the same time, population growth in SPSIDS was among the highest in the world.

2.7.3 Exploitation of natural resources

In Tonga, local families realise that basic sources of their livelihoods and generous culture rely mainly on the environment. Unfortunately, activities such as pesticide use, rubbish disposal, land clearing, sand mining, and inshore fishing are often detrimental to the sustainable use of their fragile environment and limited resource base. Some of the impacts, threats and possible solutions are discussed below.

2.7.4 Forests

Forests can be used for several purposes such as cultural activities, timber extraction, agriculture, water catchment protection and foreign exchange earning (TCDT/FSP Report, 1998). Tonga’s native forest is virtually extinct as a result of clearance for cultivation and settlement (Pelesikoti, 2003; Prescott; 1989; IUCN, 1991; UNESCAP GoT, 1990; Central Planning Department, 1991; Wenzel, 1989; Fairbairn, 1992). There are approximately 3.3 hectares of indigenous tropical rainforest remaining on Tongatapu. The IUCN (1991:259) stated that the natural forest exists primarily on steep slopes, inaccessible coastal areas and the summits of volcanic islands such as Kao, Late, Tofua and Tafahi. Secondary vegetation is the dominant type in Tonga and as native trees are not replanted, so ferns and grassland with bare soil becomes the replacement (Vea’ila, 1995 & 2002).
2.7.5 Fisheries

In the South Pacific, and Tonga in particular, the ocean is of profound significance. A majority of the Pacific Islanders rely on fishing for their survival (Crocombe 1987). Kearney (1980) and Hooper (2000) state that fishing is important with respect to culture, sustenance and recreation of the island states in Oceania and their domestic economies. The marine environment and resources of Tonga have been degraded primarily as a result of rapidly increasing population pressure, sand mining, overfishing, traditional gleaning of accessible reefs, dredging, disposal of untreated wastes into the ocean, destruction of coastal wetlands, and clearance of mangroves (Chesher, 1984 & 1985; UN-ESCAP GoT, 1990; IUCN, 1991). The Fisheries Department reported that much of the fisheries’ coastal resources such as finfish, beche de mer, lobsters and shellfish are under pressure particularly in Tongatapu as a result of unsustainable harvesting (Pelesikoti, 2003; Fisheries Annual Reports, 1997 &1998; Chesher, 1984 & 1985; UN-ESCAP GoT, 1990; Carpenter et.al., 1989; Zann, 1981; Wilkinson, 1975; Tukia, 1984; Tongilava, 1979; IUCN, 1991).

Sewage discharge can be a problem as it causes habitat destruction, and it may introduce disease, heavy metals and pesticides. In Tonga, household sewage is initially held in septic tanks and the problem is mainly related to overflows. The quantities of heavy metals in sewerage would be expected to be low (Professor John Morrison pers. communication, 2007). However, organic pollutants, pesticides and polychlorinated biphenyls and dioxins, mainly produced in the northern hemisphere, are potentially a significant threat to crustaceans. These compounds affect hormonal systems and can cause low fertility and birth defects. These, particularly agricultural chemicals (pesticides) are transmitted through atmospheric deposition into the ocean and by runoff from land (SPREP, 2003; Bagchi, 2000; Velde et.al., 2003; PASA/TCDT, 2003 & 2004).

2.7.6 Farming

Tonga has an agriculture-based economy (Refer to Table 2.1) that is characterised by large trade deficits, and a heavy reliance on external development assistance and private remittances from Tongan communities’ overseas (Commonwealth of Australia, 1998). Geographic isolation and a narrow resource base restrict the scope for export diversification.
and import substitution. Although the soils of Tonga are generally fertile, cash crops such as squash, pumpkins and watermelons rely on pesticides and fertiliser application for continued intensive production (Manu, 2000).

Table 2.3: Proportion of Households with Respect to the Level of Agricultural Activity to the Total Households, by Location of Households: 2001

<table>
<thead>
<tr>
<th>Location of Household</th>
<th>Total Households</th>
<th>Proportion of Household(%), by Level of Agricultural Activity</th>
<th>Proportion of Household(%), by Level of Agricultural Activity</th>
<th>Proportion of Household(%), by Level of Agricultural Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Non Agricultural</td>
<td>Minor Agricultural</td>
<td>Agriculturally Active</td>
</tr>
<tr>
<td>TONGA</td>
<td>15,738</td>
<td>30.4</td>
<td>5.3</td>
<td>64.2</td>
</tr>
<tr>
<td>Tongatapu</td>
<td>10,583</td>
<td>38.6</td>
<td>7.3</td>
<td>54.2</td>
</tr>
<tr>
<td>Vava’u</td>
<td>2,625</td>
<td>15.4</td>
<td>1.4</td>
<td>83.2</td>
</tr>
<tr>
<td>Ha’apai</td>
<td>1,298</td>
<td>15.6</td>
<td>1.5</td>
<td>82.9</td>
</tr>
<tr>
<td>‘Eua</td>
<td>863</td>
<td>9.0</td>
<td>1.3</td>
<td>89.7</td>
</tr>
<tr>
<td>Niuas</td>
<td>369</td>
<td>8.9</td>
<td>0.5</td>
<td>90.5</td>
</tr>
</tbody>
</table>

Adapted from MAFF, Statistics Department and FAO Agricultural Census (2002)

The United Nations Food and Agriculture Organisation (FAO, 1996) argued that while Pacific Island countries were undoubtedly small and remote, it was becoming clear that smallness need not be a handicap to development where strategies and policies promote development and sustainability.

2.7.7 An example of market fragility

Squash is Tonga’s main export product and even though squash production is risky, the Tonga Development Bank provided loans for 1239 holdings (90% of the total) that farmed squash, while the other banks only loaned money to 122 holdings (10%). By 2003, Tonga exported a total of 20,000 tonnes but in 2004, only 13,000 tonnes of squash were exported to Japan. This happened because the Japanese market was flooded with squash from Russia and China (Vava’u Press - Matangitonga, 2004) and not only did Tongan growers sell less
produce, they also experienced the lowest return ever for their squash of between 20 and 25 cents per kilogram. This was disastrous.

Further, the World Bank (1990) stated that commercial farmers in Tonga used more fertilisers and pesticides than in the past and this has contributed to the declining soil fertility and water holding capacity. The effects of the overuse of fertilizers and pesticides can directly or indirectly alter food chains in the natural surroundings and some chemicals may be stored in tissues of organisms and accumulate in both terrestrial and aquatic environments.

MAFF and Statistics Department and FAO (2002:37) state that of the total holdings, 13% were applying fertilisers and inorganic fertilisers were preferred over organic ones. Around 11% (1,125) of holdings applied inorganic fertilisers and 6% (610 holdings) organic fertilizer. In terms of agricultural chemicals, one out of five holdings applied agricultural chemicals. Of these holdings, two thirds were sprayed with herbicides and insecticides.

The highest proportion of holdings applied with inorganic fertilisers was reported on Tongatapu (16.5%) followed by Vava’u (8.9%). In the case of agricultural chemicals, 20% of the total holdings in Tongatapu had insecticides and herbicides applied. Holdings in ‘Eua (7.9%) and Tongatapu (7.2%) had the highest tabulated proportions of the use of organic fertilisers. (Further details are reported in Appendix Two which includes details of the pests and diseases of crops in Tonga and the types of chemical used for pest and disease control).

2.8 The problem of pesticides

Pesticides kill potential disease-causing organisms and control insects, weeds and other pests, and are contained in many household products (SPREP, 2003; PASA/TCDT/FSP, 2003 & 2004; EPA, 2004a, 2004b, 2004c; UNDP/GEF/SPREP/IWP/DoE Technical Reports, 2003 & 2004). All such common products are considered pesticides, including cockroach sprays and baits, insect repellents for personal use, rat and other rodent poisons, flea and tick sprays, powders and pet collars, kitchen, laundry, and bath disinfectants and
sanitizers, products that kill mould and mildew, lawn and garden products such as weed killers, and swimming pool chemicals.

About fifty-seven pesticides banned or not registered in developed countries were nevertheless widely available in South Pacific nations. Such banned pesticides can cause adverse effects on people’s health and environment in different ways. All banned pesticides have been targeted by the Pesticides Action Network’s (PAN’s) “Dirty Dozen” campaign (PASA/TCDT/FSP Annual Reports, 2000-2004; PCRC, 2003; SPREP, 2003; UNDP/GEF/SPREP/IWP/DoE Technical Reports, 2003 & 2004; Velde et.al., 2003; ATSDR, 2002; IISD, 1998; Vea’ila, 2002; Bagchi, 2000).

SPREP (2003) points out persistent organic pollutants, known as POPs, are toxic substances released into the environment by human activities and are among the most dangerous chemicals in widespread use. According to the International Institute for Sustainable Development (International Institute for Sustainable Development -IISD, 1998), POPs are grouped into three categories including pesticide POPs, industrial chemical POPs and POPs that are unintended by-products. The pesticide POPs include aldrin, chlordane, dieldrin, endrin, heptachlor, mirex and toxaphene. The industrial chemical POPs include hexachlorobenzene and polychlorinated biphenyls (PCBs), consumed by industry or generated as by-products of various industrial and combustion processes; and the POPs that are unintended byproducts, dioxins and furans (IISD, 1998; Agency for Toxic Substances and Disease Registry (ASTDR, 2002).

Sources of POPs in the South Pacific include burning of rubbish, plastics and rubber, slashing and burning, fumes and gases from motor vehicles, poor storage of agrochemicals and pesticides, and PCBs from old electric transformers (PASA TCDT/FSP, 2003 & 2004; Fakalata, 1993; Fakatene, 2004; Bagchi, 2000; Meril,1993)).

The Pesticides Act of 2002 regulated the registration, manufacture, importation, sale, storage, distribution, use and disposal of pesticides in Tonga. This Act states that the active ingredient of any pesticide formula used in Tonga should be biological in nature. The
pesticides that do not meet the regulations of this Act are prohibited or denied registration. However, the legal and regulatory infrastructure does little to address priority concerns related to chemical mismanagement in Tonga (Pelesikoti, 2003; DoE, 2003; Bagchi, 2000; PASA, 2002 & 2003). Major shortcomings in chemical management legislation occur with pesticides, fertilisers, industrial chemicals, petroleum products and consumer chemicals (Bagchi, 2000; Mowbray, 1984).

Van der Velde et al., (2006) analysed the intensification of agriculture and the attendant pressure on the island fresh water resources such as on Tongatapu where they exist as lenses that float on top of denser salt water underneath the island. According to van der Velde et al., (2006), over the last 10 years, squash pumpkins have accounted for 40% of the total earnings and represent 60% -70% of the GDP derived from agricultural exports. This increase in exports is matched by an abrupt increase in the import and usage of the agricultural chemicals. Simultaneously, the islands’ freshwater lenses are increasingly under pressure from agricultural chemicals where approximately 70% of Tonga’s population reside on Tongatapu. Thus the shift from subsistence to commercial agriculture has increased the numbers of growers who are using pesticides for their farming activities, particularly in areas of population growth (See Appendices One and Two for details).

Van der Velde et al., (2006:460) reported that fertilisers make up 60 -70% of the value of the imported chemicals while the total import value of pesticides including fungicides and herbicides used for agricultural purposes has increased by a factor of about 2.5 since 1987. Pesticides imports were about 0.7 million TOP in the period of 1999-2001, while fertiliser imports were about 1 million TOP in the same period (data from Tonga’s Statistics Dept (quoted in van der Velde et al. 2006).

2.8.1 Impact of Pesticide Use
SPREP (2003) states that POPs are highly toxic, causing death, disease, and birth defects among humans and animals. Specific effects can include cancer, allergies and hypersensitivity and damage to the central and peripheral nervous system. POPs can damage the reproductive and immune systems of exposed individuals as well as their
offspring; they can also have developmental and carcinogenic effects. These highly stable compounds can exist in the environment for years before breaking down. They circulate globally through a process known as the grasshopper effect (SPREP, 2003); i.e., POPs released in one part of the world can be transported through the atmosphere to regions far away from the original source, through a repeated process of evaporation and deposition (Bagchi, 2000; SPREP, 2003; van der Velde et al., 2003; Pelesikoti, 2003)

POPs concentrate in living organisms through a process called bioaccumulation (SPREP, 2003; EPA, 2003 & 2004). Though not soluble in water, POPs are readily absorbed in fatty issues, where concentrations can become magnified by up to 70,000 times those in the background. Fish, predatory birds, mammals and humans are high up the food chain and so absorb the greatest concentrations. When they travel, POPs travel with them. As a result of these processes, POPs can be found in people and animals living in regions such as the Arctic, thousands of kilometres from the sources (SPREP, 2003a). Pesticides that enter the air or water do not stop at country borders (TEMPP Annual Reports, 2001; TCDT/FSP Annual Report, 1998; EPA, 2003 & 2004c; DoE, 1999; SPREP, 1999; Bagchi, 2000).

Examples of pesticide use in Tonga include furadan that is used for animal poisoning, e.g., roaming animals, such as pigs and dogs. Sisifa et al. (1993) stated that pigs are virtually all raised under the free-range system and can inflict widespread damage to crops. Similarly, chickens are left to scavenge for food, facilitating losses to dogs, and hindering harvesting and egg collection.

Watts (1993) stated that groundwater analyses revealed residues of traces of the dichlorodiphenyltrichloroethane (DDT) metabolite, dichlorodiphenyldichloroethylene (DDE), in Tongan groundwater. DDT, and especially DDE, accumulate in plants and in fatty tissues of fish, birds, and other animals.

Harrison et al., (1996) reported on a study to determine the occurrence of organochlorine compounds in the marine environment around main population centres in Tongatapu. Sediment samples showed evidence of contamination from organochlorines; including
DDT and its metabolites; chlordane and PCBs were also found. Possible sources may be intensive agriculture in the areas to the east of the Fanga’uta lagoon or the disposal of chemical wastes.

Chen et al. (1999) carried out a preliminary study to see if significant pollution of the Fanga’uta Lagoon on Tongatapu by pesticides was occurring. The survey results indicate that concentrations of selected priority pesticide residues analysed in a CSIRO laboratory ranged from low parts per billion (ppb = ug/kg) to much greater parts per million (ppm = mg/kg) range. Chlofluazuron concentrations in both sediment and soil samples were relatively high. A significant transport of pesticides from the site of application into the aquatic environment had occurred. Chlofluazuron is quite persistent in nature and may have concentrated in sediments with time. Although flunidazole was detected in low concentrations, its presence in the sediment and soil samples also indicates its persistence in the environment.

Chen et al. (1999) showed that pesticide residues could be found on farms and that there was also some migration of more persistent pesticide residues such as chlorfluazuron into Fanga’uta Lagoon. Although there is no definite conclusion on persistence in the soils and off-site migration and accumulation in sediments studied, this confirms both potential migration of some pesticides, especially chlorfluazuron, to water bodies in Tonga and exotoxic effects on soil microbial populations and aquatic biota. Harrison et al., (1996) found organochlorines in shellfish in Tongatapu at concentrations above the detection limits. In addition, Morrison (2000) found elevated levels of nitrogen and phosphorus at Fanga’uta Lagoon in Tongatapu.

In 1998, the Tonga Community Development Trust (TCDT) / Foundation for the People of the South Pacific (FSP) carried out a survey of pesticide use in Tonga. About 65 % of the respondents did not understand the English instructions given by manufacturers on labels (PAP/TCDT/FSP, 1998). Some of the difficulties related to the fact that English instructions were too hard to follow (PASA/TCDT/FSP, 2002). Most farmers do not read/write/understand English very well (PASA/TCDT/FSP, 2002 & 2003). In actual
practice, the mixing and application of pesticides on their farms are based on guess work and estimations, or advice from their friends. Some of the growers assumed that the stronger the mixture of agrochemicals the better, so that they wasted money, time and resources when they did not follow the instructions.

A previous survey (Ve’a’ila, 1999) reported that about 25% of the people interviewed recommended preparing instructions and use information in Tongan language. The results of the survey were published in Tongan language and a free copy was given to each participant in the communities’ pesticides awareness workshops, coordinated by the Pesticides Awareness and Sustainable Agriculture (PASA) Program of the Tonga Community Development Trust (TCDT) throughout the Kingdom of Tonga. However, this approach appears to have had little impact.

Other approaches to agricultural and environmental problems have made use of experts in development organizations who produced a series of actions that were intended to be initiated at the community level. Community consultation, if any, was limited to community leaders who were often older men, but women and young community members were excluded from the decision-making processes in relation to such issues as land use, conservation and natural resources management (Ecowoman, 2000). As a result, success was often very limited.

Local communities, government and non-government agencies often incorporate Participatory Rural Appraisal (PRA) approaches in data collection, analysing of information, development and evaluation of projects (Ecowoman, 2000; Halavatau and Hazelman, 2003; Pretty, 1995 & MAFF Tonga, 1996). The strength of the PRA approach is that it educates local communities to identify their needs, rank priorities, and develop possible solutions in moving towards sustainable development. Because of these experiences, a community can collect information about localised issues such as marine conservation, watershed resources, agriculture, traditional cultural activities and the final decision-making is shared among them. Whilst the approach is useful in identifying problems and proposing solutions, it seems to be limited in the implementation and
evaluation phases (Cambourne, 1988 & 1995). As such, there is the potential to generate disappointment when an agreed solution to a problem is not fully implemented and evaluated.

The majority of Tongan farmers have limited education and training in the proper mixing and safe application of pesticides (PASA/TCDT/FSP Annual Reports, 2002 & 2003; Fakatene, 2004). However, pesticides can enter our bodies through ingestion, inhalation and absorption (PASA/TCDT/FSP Annual Reports, 2000-2004; PCRC, 2003; SPREP, 2003; UNDP/GEF/SPREP/IWP/DoE Technical Reports, 2003 & 2004; Velde et.al., 2003; ATSDR, 2002; IISD, 1998; Fakalata, 2004). Therefore, it is important to know that pesticides, of themselves, can adversely affect not only the person who mixes and sprays them but can also adversely affect or even kill anyone or anything in the food chain.

This study focuses on pesticide use in Tonga and on finding alternative and more effective ways of educating people about pesticide use. These are serious concerns because of the detrimental impacts of pesticides use on the environment and resources of Tonga (TEMMP Annual Reports, 2001; PAP/TCDT/FSP, 1998a & b; Pelesikoti 2003; Hardin 1968; Bagchi 2000; Fakalata 1993 & 2003; Fakatene 2004; Pole, 2004; Hoponoa, 2004; UN ESCAP GoT, 1990). Pesticide contamination threatens human health, alters food chains and is extremely toxic to vulnerable island ecosystems of the South Pacific particularly Tonga (PCRC, 2003; Commonwealth of Australia, 1998; UNDP & SOPAC, 2004; Velde et.al., 2003; PASA/TCDT/FSP, 2003 & 2004; DoE, 1999; WHO, 1996; SPREP, 1999; Manu, 2000). Further, pesticide runoff may destroy the fragile coral reefs, mangrove swamps and sea grass beds that provide habitats for fish and help control coastal erosion (Bagchi, 2000; Pelesikoti, 2003; PASA/TCDT/FSP, 2003 & 2004; Fakalata, 1993).

2.9 Conclusions
Poor farming practices including over-ploughing, improper applications of agro-chemicals and clearance of trees on steeper slopes, may cause agricultural runoff such as pesticides and soils washing into the aquatic systems and affecting coastal fisheries’ resources and marine life. Therefore it is important to raise public awareness and change to ecologically
sustainable development practices by using approaches such as participatory rural appraisal (PRA) to promote self-sufficiency and minimise the detrimental impacts of negative farming practices on the environment and resources of Tonga.

Positive practices, such as proper use of agrochemicals, use of alternatives for sustainable ecological agriculture, including home gardens, mixed cropping and legumes, will maintain soil fertility and appropriate sustainable ecologically development practices for Tonga through using the PRA approach. This study has the potential to support such practices through the judicious application of supporting educational theory. As such, the study not only has the potential to benefit Tonga but may also benefit other nations in the South Pacific.

The next chapter explores a number of educational theories that have the potential to support PRA. Eventually one approach was chosen. However, it is recognised that several approaches are possible but the one chosen was considered the most suitable for this context.