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

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3 LITERATURE REVIEW

This literature review is structured in four separate yet integrated parts. Part one reviews agriculture extension projects in developing countries, part two summarises some sustainable agriculture practices that apply to Tonga; part three briefly critiques these approaches. Finally, part four discusses how the judicious use of learning theory could serve to guide more practical and culturally suitable approaches; in particular, how the processes of Cambourne’s (1988) model of learning are applied to the processes used in Participatory Rural Appraisal (PRA), a commonly used process of community education in the South Pacific.

3.1 Part 1: Agricultural extension projects in developing countries

3.1.1 Introduction
Agricultural extension is an ongoing process of getting useful information to people and to help them to acquire knowledge and skills to improve farming practices (Hazelman, 2005). Extension processes involve the transfer of technology to farmers, and communication to find solutions. It often involves communication and education, and specific techniques might include fine tuning messages by market research, integrating different knowledge systems for technological development, and techniques that contribute to the development of better relationships among researchers, farmers and others (King, 2005). Godbold (2005:2) defined extension as a service system that assists farmers through educational procedures for improving farming methods and techniques, increasing production efficiency, better income, a better level of living and lifting educational standards of rural people.

3.1.2 Brief background of agricultural extension in developing countries

This section discusses agricultural extension in the Pacific Islands and other developing countries. The purpose is to briefly describe selected examples of agricultural extension projects across a range of developing countries and to identify issues that still need to be
addressed. The section begins with South Pacific Islands before discussing other developing countries.

3.1.3 Tonga

The Ministry of Agriculture Fisheries and Forestry (MAFF) plays an important role in the development of the agricultural sector in Tonga in researching and advising farmers on technology for production and marketing development (Toafa, 1994). The Research Division of MAFF is responsible for all research programs considered relevant for the agricultural production and development and examples are fertiliser application rates, and pest and disease controls. The Extension Unit is specifically responsible for delivering recommendations from research stations to local communities and squash growers (Toafa, 1994:72 -74).

During the Extension Summit held in Tonga in 2005, Sisifa (2005), reported that to achieve the national aims and objectives of their development projects, Participatory Action Research (PAR) needs to be integrated into the Tongan agricultural farming system. This needed to bridge the gap between the expectations of the Ministry of Agriculture and the farmers. Currently the facilitators and the stakeholders are often unclear about the goals of programs offered.

Also Toafa (1994:13 - 14) previously reported that action research could allow the researcher and stakeholders to exchange ideas for the improvement of the squash industry in Tonga as well as the understanding of the stakeholders involved in the operation of this industry. Thus, the PAR approach is not a new idea.

3.1.4 Solomon Islands

Jasen (2005) reported that Participatory Agricultural Extension (PAE) is practised in the Solomon Islands, in households, nuclear and extended families, because about 85% of the population are living in rural clans, tribes and communities. The PAE enables farming households to have multiple ways of earning income to meet their basic needs such as feeding families, as well as other important socio-cultural goals such as social obligations,
cultural ceremonies, church and community obligations, and management of their environment for future generations.

3.1.5 Fiji

Agriculture is the largest sector of Fiji’s economy and more than 75% of Fijian households are engaged in crop production, livestock production, forestry or fishing (Kumar, 2007, Secretariat of the Pacific Community SPC, 2006). The SPC reported in 2006 that low agricultural income, higher food prices, urban migration, higher food demands, increased land clearing, declining production and the degradation of the environment were major threats to the well-being and economic viability of the country. It called for ‘shifting the mindset of rural people from subsidence driven lifestyle, to increase productivity and growth driven mode of production’.

The agricultural extension system developed for Fiji was essentially the means by which new knowledge and ideas were introduced into rural areas in order to bring about change and improve the lives of farmers and their families. Fung and Blank (2005), when discussing agriculture extension systems, reported that GTZ Participatory Extension in Fiji aimed at poverty reduction, enhancing self help capacities, participation and gender balance, strengthening commercialisation of extension services and a greater involvement of civil society organizations in service delivery.

In 2007, Mr Janendra Kumar told the Fiji Times that the Ministry of Agriculture and Ministry of Fisheries and Forest (MAFF) were jointly working together to provide food and income security to alleviate poverty in Fiji. Kumar (2007) also added that seaweed farming and forestry could provide many benefits for the people especially in the outer islands. He believed that local people needed to work in partnership with the Ministry because of technical knowledge and know-how both groups had to offer. What the Ministry wanted was for farmers to co-operate to increase their agricultural production. Kumar stated that extension officers were the frontliners of this program who acted as an interface between the farmers and the Ministry.
For example, Kingi and Kompas (2005) reported that the government encouraged indigenous Fijians to take up profitable sugarcane growing using traditional practices of “communal farming” and it appeared that improvements among inexperienced farmers in these co-operative farming groups occurred. Further, Taveuni (2005) reported on a monitoring system designed for farmers to understand their progress using tools for the graphical analysis of performance in crop production and financial performance. The data for this monitoring were based upon the information the farmers provided for the extension officers. It was reasoned that the farmers would be more likely to understand feedback from the extension officers because they talked in the same language (Taveuni, 2005).

In summary, there has been a rapid increase in the use of information and communication technologies in agricultural extension systems in Fiji for the purpose of the dissemination of agricultural information to rural audiences (Prakash, undated). UNDP (2008) further reported on other similar strategies to promote sustainable land use practices using participatory community techniques to identify partnership opportunities with government, local communities, NGOs and regional organisations. However, Kumar (2007) identified a number of constraints faced by agricultural extension programs and these included a lack of strategies to overcome poor delivery of services for farmers such as making false promises, poor communication and lack of technical advice. Kingi and Kompas (2005) also believe that communal land ownership could hinder farming activities as it does not meet either farmers’ socio – cultural obligations or commercial targets (Taveuni, 2005). Furthermore poor infrastructure in the rural areas and costly maintenance cannot be sustained by commercial farming (Prakash, undated:16).

3.1.6 Samoa
The economy of Samoa is a predominantly village-based agriculture where copra, banana, and taro are important for their livelihood, especially in rural areas. FAO (2005:3 - 4) reported that 70% of local people are actively engaged in agriculture and fishing.

Agencies such as FAO (2005) argued that farmers in Samoa should be involved during the planning and development of agricultural extension approaches. In particular, they need
more advice relating to their unique situation. FAO (2005:9-10) reported that the crop advisory section is specifically designed as a venue for demonstration, training and consultation among advisory crop officers and local farmers. The purposes of the consultations are to identify the constraints, problems, and objectives of programs designed to improve technology and the delivery of extension advice to local farming communities.

It was suggested in the American Samoa Country Report (1999) that the Crop Advisory Section (CAS) should carry out the following activities:
• meeting with village farmers to form farmers’ groups;
• encouraging farmers groups (four to five farmers each) to identify their needs and problems;
• working with farmers’ groups to make a matrix that ranks and scores the problem in the following dimensions: importance, effects, severity and relative ranking among other agricultural issues.

According to FAO (2005:8-12), some of the constraints faced by the crop advisory officers (extension) in Samoa are:
• lack of refurbishment of CAS to accommodate their roles and responsibilities;
• poor standard of education in CAS to develop better networks with farmers;
• lack of gender equity in CAS when women are regarded as valuable extension work and many of them now work on the land;
• lack of sufficient language skills, especially among new staff, to address and communicate with older farmers and local chiefs during meetings, etc.;
• lack of appropriate budget, such as only 30 litres of fuel per week, for a CAS officer to achieve her targets in remote areas.

3.1.7 Papua New Guinea
After World War II, agricultural extension was adopted in Papua New Guinea to raise the level of subsistence agriculture that was based on shifting agriculture. Suitable cash crops were introduced and this enabled indigenous farmers (*Didiman*) to earn a better income (Godbold, 2005:1).
The Papua New Guinea Department of Agriculture and Livestock also developed a National Agriculture Development Plan as a blueprint for future directions in agriculture and rural development. Its goal is to assist over 70% of the total population and its focus is on domestic trading of fresh produce as an important source of income (IRETA, 2006).

In 1995, Papua New Guinea operated the Question and Answer Services (QAS) as a convenient service for farmers (IRETA, 2006). In addition, the agricultural extension services and extension staff have been assigned to administrative districts to relay information on crop varieties and to provide technical advice to rural farmers, mainly through demonstrations and field visits (Godbold, 2005:4). IFAD (2007:1) argued that staff in implementing organizations and local stakeholders should also participate in the evaluation of extension programs. This process is more likely to allow the findings to reflect variations in local agro-ecology, living standards and institutional support systems in Papua New Guinea. Further the IFAD (2007) recommended the use of PAR and formal surveys during data acquisition and emerging solutions phases of the project.

The World Bank (2008), financed the Papua New Guinea Small Holder Agriculture Development Project. Its aim is to increase the involvement of local communities in oil palm development and to stimulate income generation in small holdings. An upgrading of access roads and a financial mechanism will allow the extension services; to enhance small landholder productivity through good governance, rural communities participation and strengthening of their capacities to manage projects.

Some of the challenges which hinder agricultural development in Papua New Guinea are poor infrastructure, weak market signals and services, mismanagement of land and renewable resources as a result of population increases and the outbreak of new pest and diseases that become threats to sustainable agriculture (Ahai, 1999; IRETA, 2006). Organic farming is being hindered by lack of technical information, poor extension services and lack of expertise in organic methods such as rotation, fertilisation, plant protection and international markets standards and competition with exports from Australia (Jenkins et al.,
2005). Jenkins et al., (2005) also reported on the lack of extension services, appropriate infrastructure and market for local products and raised the need for community participation through education and awareness-raising to enlighten and inspire local communities’ participation in adopting conservation and resource management measures of local natural resources. Further, Godbold (2005:3) asserted that agricultural methods practised by more advanced farmers are not familiar to rural farmers.

IFAD (2007:3) reported on the findings of evaluations in PNG and these included: the government capability to serve the rural poor communities remains limited while government departments are restructured and downsized to reduce government expenditure on staff; the sustainability of service delivery to rural communities is at risk because the cost of services, staff and overhead are too high; community participation remains low.

3.1.8 Vanuatu
Agriculture, fishing and tourism are the backbone of Vanuatu’s economy (World Bank, 2008). In Vanuatu, the farm support association with a motto “Farmers helping Farmers,” is concerned with research work, internal control of organic certification, better linkage and collaboration with NGOs and government extension services to bring about effective change (World Bank, 2008).

Some of the issues identified include:
• the politicians always say that agriculture is the backbone of the economy but when it comes to budget allocation, agriculture is demoted;
• food grown for home consumption is not valued;
• a side-by-side approach is needed in order for farmers to work cooperatively with extension services and develop linkages between NGOs and government extension.

3.2 Examples of Agriculture extension programs
3.2.1 Indonesia

Farmer Field Schools (FFSs) emerged in Indonesia in 1986. By 1998, more than one million farmers had participated in FFSs and the method spread to other countries in Asia, Africa and Latin America (Knox & Lilja, 2004). The methods typically bring 20 to 25 farmers from a community for intensive, field-based learning and focus on integrated pest management (IPM). IPM is critical because pest infestations are widespread due to the adoption of inappropriate farming practices (Knox & Lilja, 2004).

However, Leta (2002) reported that despite the abundance of horticultural crops in the Nusa Tenggara Timur (NTT) province of Indonesia, many NTT residents are still living under the poverty line. The Indonesian government identified agricultural extension workers as a catalyst for agricultural development in NTT, but according to Leta (2002), local farmers, agricultural extension workers and government officers identified the following problems: mismanagement of demonstration plots, dubious brochures, poor planning and mismanagement of field schools and government projects, lack of incentives to encourage farmers’ participation in development projects and lack of criteria for selection of extension workers. Some other constraints included the poor restructuring of the agricultural department, low award or salary, lack of training, lack of transport, lack of authority and bureaucratic complexity.

Leta (2002) further reported that the extension workers, farmers and government officials decided to use participatory action research (PAR) to help identify what roles of extension workers were expected by the farmers, government officers and agricultural extension workers to clarify the perception of these groups about the effectiveness of the extension workers in performing their roles and to identify the factors which impede agricultural extension workers’ ability to perform their roles effectively.

All the farmers, agricultural extension workers and government officers agreed that agricultural extension workers should work closely with farmers to increase their knowledge, skills and attitudes about the program, to empower them to be part of their communities and to transfer the programs that suit farmers’ needs and to implement the
programs as promised. The extension workers should be part of the training team and involved in the running of field schools.

Habibie (2003) also reported that PAR was being used with smallholder livestock production at Tombolo village, South Sulawesi, Indonesia. The goal here was to develop a better understanding of fodder security such as legumes and grasses and forage technology to improve livestock production.

3.2.2 Philippines
Callo (1997) discussed an application of the PAR for improving the situation of rural community in the Philippines. This research fulfilled its primary goal of fostering change through action and the significance of the PAR in the project. Later, Perez (2005) reported that Farmers’ Field School (FFS) in the Philippines have been established to provide farmers with intensive training on Integrated Pest Management (IPM) methods and issues during the life cycle of the crop. The FFS approach could empower participants with the analytical ability and skills needed to investigate the cause-effect relationship of problems in farming practices and to design a set of actions for problem-solving (Perez, 2005).

3.2.3 Africa
Farmers and communities have used a range of farm research extension (FRE) activities based on collective action in many African and Latin American countries.

The ultimate development goal of the United Nations Millennium Declaration is related to sustainable reduction of poverty in terms of food security and improved household income to be reached by 2015 (Heemskerk, 2005). Most of international development co-operation such as FAO, World Bank, European Union (EU) etc. consider agricultural development to be the engine for rural poverty reduction, household food security and for raising rural incomes.

In Africa, the farmer innovation approaches (FIAs) are designed to identify farmer innovators to promote indigenous knowledge, mainly on soil and water conservation (Knox
& Lilja 2004). The researchers and extension workers do not generally introduce new technology options but learn from farmers and provide technical assistance based on the technologies that farmers have already developed or help them to develop monitoring and evaluation processes.

Collective action takes place during dissemination of the technology and its principles, as networks of local innovators are formed. These researchers and extension workers should visit farmer innovators and host exhibitions and outreach activities to disseminate information to rural communities. Networking also helps to build up innovators’ self-esteem and strengthens the relationship between the researchers and the extension workers (Knox & Lilja, 2004).

3.2.4 Uganda
Knox & Lilja (2004) reported a study of 21 farmer research groups (FRGs) each consisting of 10 to 45 members in Kabale, Uganda. The results revealed that these FRGs followed a U-shaped pattern. Participation is initially high when groups are formed then declines as members drop out and motivation wanes. More farmers will join successful groups than less successful ones. The poorest farmers appear to participate equal in numbers with less poor farmers. While women tend to dominate the FRG membership, men tend to occupy leadership roles in mixed groups.

According to Knox & Lilja (2004), experiments are undertaken on a shared plot that is either rented by or donated to the group. All phases of experimentation, from land preparation to harvesting, are implemented collectively. Members develop common rules for the group’s operation and membership and a sociologist could be one of the external researchers to be instrumental in building the group’s organisational capacity.

3.2.5 Latin America
The Latin America-Caribbean (LAC) region has been undergoing an evolutionary process in agricultural research and extension systems in recent years. The conventional agricultural approach was driven by top-down action plans where research and advisory services were
dominated by government agencies and slowly adapted into stakeholders’ networks. It is criticised as a unidirectional process of research and extension that serves an agricultural agenda of the central government (Roseboom, et al., 2006).

A series of case studies from the Latin America-Carribean (LAC) region including Brazil, Chile, Colombia, Ecuador, Mexico, Peru and Venezuela were conducted to review these institutional reform experiences in agriculture and distil lessons learned to further advance agricultural innovation systems in the region (Roseboom, et al. 2006).

3.3 Innovations in agricultural research

The key trends in both agricultural research and extension are summarised as follows (Rosebom et al., 2006):

3.3.1 Improved governance
New rules and norms have taken shape with the introduction of competitive funding schemes in agricultural research and technology transfer activities.

3.3.2 Greater diversification of research suppliers
Competitive funds allow the expansion of researchers with a greater diversity of actors from public and private sectors, universities, non-government organizations (NGOs), producer organizations and village communities including women groups.

3.3.3 Improved client orientation and participation
Most of the science and technology (S&T) funds have incorporated increased participation of beneficiaries, namely farmers, women farmers, producer organizations and with increased sources of funding. Greater attention is given to the opinions and involvement of clients in research projects and to contribute more responsive and pragmatic agenda to address key needs of farmers.
3.3.4 Increased cross institutional collaboration
Many competitive agricultural funding schemes have encouraged greater collaboration among research institutions by joining proposals and innovative strategies in partnerships with other key stakeholders such as farmer associations and NGOs, as well as relevant international counterparts.

3.4 Innovations in agricultural extension

3.4.1 Decentralisation:
There has been a trend towards decentralisation of agricultural extension services by bringing advisory services closer to the clients and making the information readily and easily accessible to farmers, and more tailored to meet their specific needs.

3.4.2 Client orientation:
Extension officers have adopted a more demand-driven approach in order to better meet the needs of the farmers. As active partners, farmers identify the priorities for advisory services. As such, extension services have extended beyond technical information on agricultural production to include guidance on a wider range of issues, such as financial and economic concerns, among others.

3.4.3 Co-financing:
Co-financing of extension services is becoming more commonplace in the LAC region. There is a concern about what should be paid for and who should pay. The adoption of environmentally friendly technologies may be for the common good but also implies the need for public financing of such projects. Poor farmers may receive advisory services for free or through in-kind contributions while the wealthier producers could pay a substantial portion of the cost of the service. For example, in the Peruvian Agro – Innovation and Competitive Project (INCAGRO), the government has to create and strengthen an agricultural advisory services market by paying 75% of project costs through competitive funds, and the beneficiaries pay the remainder for the demanded services. The advisory
services for farmers are more client-oriented because their needs and demands have been identified for a better quality services.

3.4.4 Outsourcing:
A recent agricultural extension reform in the LAC region has been designed for the outsourcing of advisory services to NGOs, farmer organizations, private businesses etc. Generally, public resources are used to fund the competitive contracts for local service providers of extension services. This requires the transition from a highly centralised and integrated structure to a clear separation among policy, priority setting and implementation entities within the government. Venzuela has demonstrated a new model for decentralised and demand-driven extension services. The municipal civil association for extension offers contract extension services mainly from private firms and NGOs, which has increased the ability of beneficiaries to choose service providers that best meet their needs.

Knox and Lilja (2004) discuss the way that the local agriculture research committees provide farm led research on crop production to communities. These committees are formed by community farmers in order to identify their priorities before making a proposal for an appropriate technology development. Thus, these research committees work in partnership with farmers, extension workers and scientists to learn skills in research design and experimentation and gain access to information on new technologies from the scientists.

3.5 Australia
Jennings (2005) discussed action research in New South Wales agriculture from 1999 to 2003. Action research was seen as an effective agricultural extension method for enabling farmer-driven research that aimed to achieve the objectives of the Profitable Pastures Project (PPP).

In 1993, Turnbull reported that PAR was used to facilitate the development of the Australian lamb industry because the lamb industry experienced declining consumption and the farmers were slow to change to a production of new style of lamb with lower fat
(Turnbull, 1993). The extension and research officers organised group meetings with lamb producers in South Eastern Australia and selected PAR as an effective approach for facilitating learning and communication in the lamb industry. Further it was claimed that the PAR process created a favourable environment for a rich social discourse between the industry and the country as a whole. Also, the stakeholders could gain insights that helped them to understand the linkage that existed between the industry and their clients as well as developing better knowledge about group dynamics in action research.

### 3.6 Europe

van Veldhuizein (2005) reported that “Participatory Agricultural Research and Extension” (PARE) has been institutionalised as part of the regular programmes and activities of action research development institutes. According to van Veldhuizein (2005), PARE helped capacity building, research, information networks and advisory services in order to promote sustainable agriculture as well understanding participation in terms of equal partners.

Table 3.1 is a brief summary of the strengths and weaknesses of agriculture extension programs in developing countries.
Table 3.1: Summary of Strengths and Weaknesses of Agricultural Extension Programs in Developing Countries

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
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<tbody>
<tr>
<td>• Research informs practice delivered by research station to farmers and communities</td>
<td>• Limited government budget hinders dissemination and demonstration of technical information on agricultural development programs to stakeholders</td>
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<tr>
<td>• Sharing stakeholder knowledge and experiences. For example information between the researchers/extension officers and local communities</td>
<td>• Government strategies not sustained. Local governments do not have capacities and resources to support the continuity of agricultural extension programs. Results in poor delivery of service for farmers, false promises, poor communication and lack of technical advice</td>
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<tr>
<td>• Capacity building that strengthens links between field officers and farmers and enhances self-help capacity of stakeholders. For example the formation of local farm support associations and the use of cooperative farming to improve traditional and communal farming practices</td>
<td>• Reform and restructuring programs do not serve rural poor communities</td>
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<td>• Better communication networks among stakeholders</td>
<td>• Insecurity as communal ownership of land is seen as a threat to independence</td>
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<td>• Improved farming practices through the planning and development of better service delivery systems such as effective education</td>
<td>• Poor infrastructure and costly maintenance hinders programs</td>
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<td>• Monitoring and evaluation systems. For example, monitoring and evaluation of the delivery of programs designed to suit farmers needs</td>
<td>Limited level of education of extension officers. For example limited language and communication skills hinders their ability to talk to farmers on a basis of mutual equality and respect</td>
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<td>• Intensive field based learning that involves extension workers as part of the training team. They help to promote community awareness and participation through organised field visits to farmers and exhibitions</td>
<td>• Lack of gender equity in agricultural extension programs. For example men usually dominate the leadership in mixed farming groups</td>
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<td>• Empowerment of rural communities to improve their livelihoods and to bring about positive changes. For example, farmer networks that promote links with extension workers and researchers. Producers are the</td>
<td>• Lack of participatory action research (PAR). Often stakeholders not involved in the monitoring and evaluation of agricultural extension programs;</td>
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<td></td>
<td>• Lack of stakeholder farming management and planning skills required for successful implementation. For example, training programs such as cover crops, mixed cropping, and integrated pest management to provide enough knowledge and skills for farmers to effectively implement advanced farming practices</td>
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<td>• Community participation often minimal even in</td>
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<td>Strengths</td>
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<tr>
<td>clients, sponsors and stakeholders of agricultural extension rather than</td>
<td>bottom-up participatory development programs. The roles of Pacific island farmers are governed by the rules of their society and cultural norms. For example much of what happens is influenced by the decision making and communication process in the village.</td>
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<td>beneficiaries</td>
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<td><strong>Technology transfer</strong> through collaborative action that aims to link the</td>
<td>The spoken word (oratory) during <em>fono</em> (village/church meeting) is central to living in the Pacific. Therefore ignoring the opinions of traditional leaders can quickly lead to a lack of participation in agricultural extension programs</td>
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<td>targeted innovation to indigenous knowledge on conservation and resource</td>
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<td>management</td>
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<td><strong>Improved governance</strong> to ensure funding and resources assigned for</td>
<td><strong>Conflicting demands on time.</strong> Stakeholders perform many roles at local communities where kinship, political, religious and economic activities create conflicting demands on time, and agricultural extension activities may be of lower priority</td>
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<td>agricultural research links with the needs of local communities.</td>
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<td>Includes the allocation of funds for a diverse range of stakeholders such</td>
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<td>as private sectors, NGOS, universities, village communities</td>
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<td><strong>Client orientation and participation</strong> - increased participation of</td>
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<td>beneficiaries including farmers, women groups, etc.</td>
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<td>Also many competitive agricultural funding bodies have encouraged greater</td>
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<td>collaboration and partnership among research institutions such as farmer</td>
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<td>associations, NGOs and international counterparts</td>
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<td><strong>Co financing and outsourcing.</strong> Co financing of extension services is</td>
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<td>becoming more commonplace in the Latin America Caribbean (LAC) region.</td>
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<td>Recent agricultural extension reforms in LAC have been designed for the</td>
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<td>outsourcing of advisory services to NGOs, farmer groups, private</td>
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<td>businesses etc.</td>
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<td>Strengths</td>
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<td>• Consequence of abandoning established systems. European colonization introduced the plantation (estate) system to many countries. The plantations were run by expatriate managers who often employed cheap local labour. The plantation system became unacceptable as countries achieved independence but the changes have often lowered productivity.</td>
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<td>• Failure of top-down planning. Top-down plans with farmers and rural communities exclude them from the planning processes. For example during recent extension tutor courses in Sri Lanka and Samoa, participants attributed more than 80% of the causes of extension failures to controllers who imposed a top-down approach.</td>
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<td>• Lack of commitment caused in part by low salary and inappropriate working environment.</td>
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<td>• Overemphasis on technical side of training limits the impact of extension training courses. Experimental stations were often established in many Asian countries by former colonial powers and they can be seen as extensions of colonial power.</td>
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3.6.1 Summary of Strengths

Education is the key to agricultural extension development. If this is achieved within the context of the stakeholders’ community, the gains are the application of scientific research and new knowledge to agricultural practices.

The field of agriculture extension now encompasses a wider range of communication and learning activities organised for rural people by professionals from different disciplines including agriculture, health, business studies, etc. As a result there has been a better education focus than in the past.
As central planning has declined and concerns for sustainability and equity increased, there has been an increased emphasis on genuine stakeholder participation.

3.6.2 Summary of Weaknesses

Past agricultural extension approaches were inflexible top-down, supply-driven, technically weak, patronizing, favouring rich farmers, gender-biased, not targeting youth and lacking in contact with farmers (Hazelman, 2005). A common criticism is that managers of extension services are often too urban-based and insensitive, out of direct touch with the realities of field work and rigid in using the Rule Book. Further, the social and cultural imperatives such as kinship, extended families, church obligations arising from the people are barely recognized in the agricultural extension course work.

Poor salaries and a lack of training of extension officers led to the following issues: mismanagement of demonstration plots; brochures that were inaccurate or difficult to understand and poor planning of field schools. The poor administration of the extension programs led to overlap and lack of authority and poor selection processes from extension officers.

Village-based life is extensive throughout the South Pacific and this is based upon agriculture. As the majority of the rural poor live only by agriculture, they are often reluctant to change practices that place their livelihood at risk and there are many cases of farmers suffering financial hardship after borrowing money to invest in commercial ventures. This creates a suspicion of new ideas. As a result there is little incentive for farmers to participate in sustainable agricultural programs (Jansen, 2005) if they involve change.

Fung and Blank (2005) identified the following challenges for agriculture extension: maintaining an efficient and effective extension service despite limited human and financial resources of Pacific Islands; promoting integrated extension service delivery; and reducing dependency on external funding. Further, Taveuni (2005) argued that the agricultural
extension programs are still developing and need to improve processes in order to make a sustained, positive impact on agriculture.

3.7 The Impact Agricultural of Extension Programs in Summary

In 2005, the Extension Summit held in Nuku’alofa emphasised Participatory Action Research (PAR) in Action. Sisifa (2005) asserted, during the Extension Summit, that an essential element of the Pacific agricultural extension system is to empower people in rural communities to improve their livelihoods and to bring about positive changes in a sustainable way. Halavatau (2005) supported this view and reported that the stakeholders are starting to work in partnership in the Development of Sustainable Agriculture in the Pacific (DSAP). King (2005) also reported that when participatory learning was introduced it was successful when the extension people played a facilitative role, and that this brought about positive changes for local communities. Bammann (2007:117) reported that he anticipated that participatory action research processes will replace the expert-driven, quantitative approaches of conventional research and that the data collection and analysis will be carried out largely by stakeholders with the support team as facilitators.

In summary, the key priorities of the Pacific Extension Summit 2005 were to build the capacity of extension staff and associated institutions to undertake participatory research and extension (PARE) and participatory needs assessment at tertiary institutions, NGOs with government extension and research staff.

Hazelman (2005:12) reported that PAR already existed in Pacific Island communities in regard to the following:

- how villagers set priorities;
- how villagers make decisions on development projects;
- how they allocate resources for priority projects;
- how they organise themselves;
- how select responsible community members.
Further, good PARE leaders are highly valued if they:
• have the good of the community at heart;
• are totally committed to developing the community;
• are honest and reliable;
• are trusted by community;
• have earned the respect of the community through past deeds;
• live in the community.

Other researchers such as Godbold (2005:4) recommended that rural development packages should integrate participatory action research where the extension officers and the farmers are able to access and adapt technology for the development of crop production. But IRETA (2006:6) also emphasised the importance of documenting research activities into valid and available information and this was seen as one of the major needs to enhance agriculture in the Pacific. In 2007, IRETA recommended Question and Answer Services (QAS) to be used in the South Pacific because it has responded to queries from students, farmers, policymakers, teachers and farmers where the topics are based on various aspects of agriculture. The establishment of QAS national nodes would bring the service closer to users, decrease the time lag between the questions and responses given and make globally available information attuned to local situations by involving local experts.

3.8 The history of some specific agricultural practices that have been introduced into Tonga

Agriculture is the mainstay of the Tongan economy (Commonwealth of Australia, 1998; MAFF (Tonga), Statistics Dept (Tonga) and FAO, 2002; SPREP, 1993). The Ministry of Agriculture, Food and Fisheries (MAFF) on behalf of the Government of Tonga is the focal point for agricultural development programs in the Kingdom (MAFF, Statistics Dept. and FAO, 2002). MAFF is responsible for the planning, experimentation and implementation of the agricultural programs. In the past, local farmers have been told what to do in regard to their own agricultural practices, and consequently, these agricultural programs have failed for a number of reasons. These include lack of training (of both the MAF officers and local
farmers); poor planning and mismanagement; lack of midterm reviews and final evaluation of the agricultural programs; lack of sufficient funding; lack of appropriate training materials; and poor quality planting materials (DSAP, 2004 & 2006; Pole, 2004; PASA/TCDT, 2004; SPREP, 1993). Halavatau and Hazelman (2002b) list major problems of agriculture in Tonga including: poor market structure; poor crop and animal husbandry; plant protection problems; poor agricultural roads; lack of funds; poor access to lands; cutting trees; lack of contact with the local farmers; dispersal of inappropriate information; and low quality animal breeds.

3.8.1 Table 3.1 summarises many of the agricultural practices that have been introduced in Tonga and outlines the purposes and methods of these approaches. The potential impact of these programs has been limited by a number of factors that are discussed after the table.
### Table 3.2: Summary of the Traditional Agricultural Practices

<table>
<thead>
<tr>
<th>Farming Practices</th>
<th>Purpose</th>
<th>Methods</th>
<th>Impact on Farmers</th>
</tr>
</thead>
</table>
| **Crop Rotation** | • Grow more crops on the same plot of land within one operational cost  | • MAFF and PASA organized site visitation for bush allotments; TV and Radio programs were organized for community education | • Followed but soon gave up  
  • Lack of interest as yields of their farms were reduced  
  • Mono cropping produced greater income  
  • Did not get planting materials on time  
  • Did not understand the impact of crop rotation on soil fertility  
  • One day training was too short; More training activities needed to acquire skills’  
  • Expensive machinery costly |
| **Started**       | 1950’s                                                                 | • One day training workshop                                            |                                                                                  |
| **References**    | Halweil, 2002; Hoponoa, 2004; PASA/TCDT 2003, 2004 & 2005a&amp;b;       | • Sorting of domestic waste for recycling                              |                                                                                  |
|                   | Halavatau & Hazelman 2002; Ho, 1996; MAFF, Stats Dept. & FAO 2002:12,  |                                                                         |                                                                                  |
|                   | UN ESCAP, 1990; Pelesikoti, 2003; Altieri 2000; DSAP, 2004 & 2006;      |                                                                         |                                                                                  |
|                   | Pole, 2006; SPREP 1998                                                 |                                                                         |                                                                                  |
| **Composting**    | • Environmental management  
  • Recycling  
  • Providing safer and healthier environment  
  • Better materials for seedbeds nursery  
  • Making composting at local homes | • Sorting of domestic waste for recycling                              | • Followed but soon gave up  
  • Unavailability of resource materials for composting  
  • Inaccessibility of information  
  • Lack of funds  
  • Poor communication network  
  • Impractical, laborious and time consuming |
<p>| <strong>Started</strong>       | 1985                                                                   | • Sorting of domestic waste for recycling                              |                                                                                  |
|                   | Fakatene, 2004; Thaman, 1994; Hoponoa, 2004; Pole, 2004; Halweil, 2002;  |                                                                         |                                                                                  |
|                   | DSAP, 2004;                                                            |                                                                         |                                                                                  |</p>
<table>
<thead>
<tr>
<th>Farming Practices</th>
<th>Purpose</th>
<th>Methods</th>
<th>Impact on Farmers</th>
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</thead>
<tbody>
<tr>
<td><strong>Liquid Organic Fertilizer</strong></td>
<td>• Improve soil nutrients by recycling</td>
<td>• One day training activity</td>
<td>• Followed but soon gave up</td>
</tr>
<tr>
<td><strong>Started</strong></td>
<td></td>
<td></td>
<td>• Cannot tell the differences</td>
</tr>
<tr>
<td></td>
<td>• Maintain safer and healthier environment</td>
<td></td>
<td>• Insufficient training activities</td>
</tr>
<tr>
<td></td>
<td>• Providing better for families</td>
<td></td>
<td>• Lack of follow up activities</td>
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<td></td>
</tr>
<tr>
<td><strong>Cover Crops</strong></td>
<td>• Maintain soil fertility, biodiversity and sustainability</td>
<td>• Site visitation</td>
<td>• Followed but soon gave up</td>
</tr>
<tr>
<td>(Mucuna pruriens)</td>
<td></td>
<td>• Personal to person contacts</td>
<td>• Unavailability of resource materials</td>
</tr>
<tr>
<td><strong>Started</strong></td>
<td></td>
<td></td>
<td>• Lack of funds</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Poor communication network</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td>DSAP, 2004 &amp; 2006; Hoponooa 2004; Fakatene, 2006; Fakalata, 2004 2005;</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>PASA/TCDT, 2004a; Thaman 1994; Vea’ilia 1998; TCDT/PASA, 2004</td>
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<tr>
<td><strong>Moon Planting Guides</strong></td>
<td>• Planting crops according to different phases of the moon</td>
<td>• Use moon planting guides for farming activities such as cutting, planting, weeding, harvesting</td>
<td>• Lack of guidance handouts in local language</td>
</tr>
<tr>
<td><strong>Started</strong></td>
<td>• Better production</td>
<td>• Cooking and eating habits must follow different phases of the moon</td>
<td>• Limited facilitator understanding about moon planting guides</td>
</tr>
<tr>
<td></td>
<td>• Appropriate pest management control</td>
<td>• Planting schedules for programs such weeding, fertilization etc.</td>
<td>• Lack of funds</td>
</tr>
<tr>
<td></td>
<td>• Better use of resources</td>
<td></td>
<td>• Lack of farmer understanding of techniques</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td>Fakalata, 2004 &amp; 2005; PASA/TCDT, 2004;</td>
<td></td>
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<tr>
<td>Farming Practices</td>
<td>Purpose</td>
<td>Methods</td>
<td>Impact on Farmers</td>
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</tr>
<tr>
<td>Seed Saving</td>
<td>Preservation of local seeds which are better adapted to local conditions</td>
<td>Radio programs relays the information</td>
<td>One day workshop was not long enough&lt;br&gt;• Lack of interest on the activity&lt;br&gt;• Lack of handouts due to limited project funds&lt;br&gt;• Ineffective demonstrations done in isolation&lt;br&gt;• Lack of materials required for practical activities&lt;br&gt;• Lack of confidence in sharing knowledge, and practices with others</td>
</tr>
<tr>
<td>Agro Forestry</td>
<td>Sustainability of agricultural productivity depends on the regulating function of forest</td>
<td>MAFF responsibility such as preparing seedlings at head office nursery for sale&lt;br&gt;Limited radio &amp; TV programs to educate local farmers about agro-forestry</td>
<td>Lack of interest after started&lt;br&gt;• Local farmers do not understand the importance of trees planting for environment&lt;br&gt;• Lack of follow-activities and visits&lt;br&gt;• Tree loss at school compounds</td>
</tr>
<tr>
<td>Companion Planting</td>
<td>Growing two or more crops together during the planting</td>
<td>MAFF encouraged local farmers to grow different crops</td>
<td>Lack of consultation and dialogue with local farmers</td>
</tr>
<tr>
<td>Farming Practices</td>
<td>Purpose</td>
<td>Methods</td>
<td>Impact on Farmers</td>
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<tr>
<td><strong>Started</strong> 1970</td>
<td>periods; • Fewer problems for crops than in mono cropping • Potential to improve farm productivity and minimize outbreaks of pests and disease • Different crops could deter pests and diseases such as yams and onions • Enhancing and promotion of the integrated production systems, soil conservation methods and organic agriculture • Preserves, maintain and improve the ultimate goal of agroecology • Good diet may be complimented by domesticated pigs and fowl, fish and eels provided by poly cultural mix of trees, tubers and fruits</td>
<td>Radio programs reminded farmers of the importance of companion planting • Site visitation • Limited training workshops conducted about companion planting</td>
<td>• One way channel of information by the project officers • Television programs did not reach the outer islands • Did not participate in planning, development and implementation of farming projects • Did not use more recent research about companion planting • Lost interest; as companion crops produced lower yields compared than mono cropping</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pesticide Use</th>
<th>Purpose</th>
<th>Methods</th>
<th>Impact on Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Started</strong> 1960’s</td>
<td>• Control weeds, pests and diseases • More food for local consumers</td>
<td>• MAFF informed local farmers about pesticides • Radio Programs informed local communities about the safe use of pesticides (SUOP) and safety gears • One-day training workshops about SUOP • Preparing leaflets in the Tongan languages about SUOP</td>
<td>• Limited understanding of SUOP and impacts on environment • Lack of participation in the planning, implementation and evaluation • Lack of safety equipment and clear instructions • Instructions in information booklets hard to follow • Lack of awareness about the health risks • Ground water pollution by chemical seepage</td>
</tr>
<tr>
<td>Farming Practices</td>
<td>Purpose</td>
<td>Methods</td>
<td>Impact on Farmers</td>
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</tbody>
</table>
| Insect repellents | • To deter insects from the gardens to maintain agro-biodiversity | • Typical ingredients included soap, lemon skin, cooking oil, dish washing fluid, bulb onions, garlic  
• Methods and knowledge are highly productive, socially equitable and economically viable | • Local farmers did not like the traditional pest control  
• Loss of useful insects repellents  
• Contamination of the water system  
• Loss of agricultural biodiversity |
| Started          | 1970    |         |                  |
| References       | Altieri, 2000, Fakalata, 2005; Ho, 1996. |         |                  |
| Sand Rings       | • Sand are put around the plants and vegetable to keep snails, bugs and pests from crossing the line  
• Self-help program and make people more independent and encourage self sufficiency | • Women’s development groups living on low-lying islands like Ha'apai (Figure 1.1) usually practice the use of sand rings around the plants | • No written information about the use of sand rings on the outer islands  
• Lack of farmer awareness campaigns about the appropriateness of this farming practices |
| Started          | 1990    |         |                  |
3.9 Summary of current issues facing agriculture in the context of Tonga

The agricultural sector is seen as a potential engine of economic growth. The Asia Development Bank (ADB) funded the Tongan outer islands agriculture development as an economic growth project to alleviate poverty (Crowley et al., 2003:2). Even though the soils in Tonga are of a more superior quality for farming activities than the other tropical areas (Orbell, 1992), the agricultural sector is economically underdeveloped because there are approximately 6,000 Tongan households engaged in agricultural activities but only 250 farmers are considered to be commercial farmers, and even most of these operations are small scale, sole operators employing on a casual basis (Crowley et al., 2003).

The Tongan agriculture sector faces several constraints including lack of scale; distance from markets; high costs and limited availability of transport links, high costs and shortages of labour due to outward migration; and significant climate risks especially droughts and cyclones. The sector’s main issues are reducing the economic vulnerability resulting from the exporting of only one crop; squash to a limited market; achieving equitable development in different island groups; overcoming Tonga’s geographic and economic isolation; and achieving an efficient reorganisation of the structure and functions of the organisation (ABD, 2006: 2).

However, the ADB (2008) reported that the evaluation of the Tonga Outer Islands Agriculture Development Project showed little evidence of improvement. Household incomes and agriculture exports have changed little since the formulation of the project. Moreover, the ADB evaluation team rated the Tonga Outer Islands Agricultural Development Project as unsuccessful, less relevant, less effective, inefficient and less likely to be sustainable as well putting a considerable financial burden on the Government without producing any sustainable economic returns (ADB, 2008).
3.10 Summary of the education-related issues

3.10.1 Limitations of past agricultural educational approaches used in Tonga

In the late 1960s, local farmers in Tonga started to use agrochemicals for crops and pest control. The Ministry of Agriculture, Food and Forestry (MAFF) became concerned about the safety of farmers and implemented an education program that used handouts which translated English information about the safe use of agrochemicals into the Tongan language. In addition, several radio programs broadcast this information to raise public awareness. However, the translation of materials from English into the Tongan language was not effective as it failed to take into account the cultural settings and orientation of Tonga as the English versions were developed overseas and did not apply well to the local situations (Vea’ila, 1998 & 1999). Consequently, local farmers did not always see the relevance of the information and did not take the time to read and comprehend the information presented (SPREP, 1993 & 1998). Thus the one-way transmission of information to local farmers was a failure (Halavatau & Hazelman, 2002b). Tongan farmers were expected to memorise complex and technical instructions and then put them into practice. For the most part, farmers did not understand many of the complicated terminologies used in pamphlets or on the radio.

Radio programs had been used in Tonga to promote public awareness and to advertise public meetings about the safe use of pesticides (SUOP) and alternatives for ecological sustainable agricultural practices (ESAP). It was assumed that the public would understand and comply with the suggestions made in such programs, which included invitations to attend face-to-face information sessions at head office (TCDT/FSP, 1998). However, in most cases, local people did not attend because of the lack of transportation and time delays in the notification of meetings.

The language and examples found in the English-based pamphlets covered situations that were not appropriate within the Tongan environment. For instance, the manufacturer used “scoop” for mixing agrochemicals where local people are familiar with spoons, small cups, sea shells or tapuni’i hina (Tapuni’i hina is the lid of a pesticide container) (Vea’ila 1999; PASA/TCDT, 2004a & b). Also, Tongan local farmers still mixed pesticides without
wearing any protective equipment and were confused by the equipment (when it was available) used for measuring chemicals and the proper mixing of chemicals (e.g., how the measures of volume in millilitres (mL) converted to table spoons and scoops which were not commonly used. The farmers did not understand the mathematical calculations presented or the scientific terminologies used. In addition, the use of *Tapuni’i hina* became a problem because they varied in size (Ve’a’ila, 1999 & 2002).

Most of the training materials were not printed due to budget constraints (Halavatau & Hazelman, 2002b; Pole, 2004). The education programs were funded by donor agencies and, upon the completion of the project, there was not enough funding for further printing of training materials.

### 3.10.2 Lack of consultation and dialogue

Local people did not participate in the planning and development of any teaching/learning materials before becoming involved with the program. They were not given a chance to discuss the educational program's aims and objectives, the proposed activities, the agenda, the topics covered, or the methodology of the training program (SPREP, 1993 & 1998). They were told what to do rather than given the opportunity to discuss and plan what they wanted to learn. This lack of consultation and discussion contributed to the participants’ loss of interest in the program.

### 3.10.3 Inadequate education program

Adult learners need a flexible learning situation in which they have some control over the planning and implementation of the learning activities (SPC, 1999; PASA/TCDT, 1998 & 2004). A trainer's lack of experience in the role of an educator of Tongan adults did not encourage local participants to participate in the learning process. He did not understand the cultural setting such as the role of the head of the household and the status of women, especially in Polynesian societies. The church leaders and the paramount chief are most powerful in the South Pacific, followed by the law enforcers (such as the police). The council of elders and the senior citizens are able to formulate by-laws for the unity and solidarity of the Pacific Islands (WWF, 1990). By-laws are not written in the South Pacific
but local people are well informed on compliances during the fono or village meeting (SPC, 1999; SPREP, 1993 &1998). These cultural elements of local societies must be respected when integrating the safe use of pesticides (SUOP) and sustainable ecological agricultural development (ESAP) into the Tongan community. For instance, the national dresses such as ta’ovala or the fine mats for wearing around the waist, kie Tonga (in Tonga) or kie Samoa (in Samoa), are the fine mats to be worn on special occasions. Lavalava (in Cook Islands), sulu (in Fiji), tupenu (in Tonga), sari (in India), or suits (in English) must be worn by the educators.

Adult learners have different needs to those of a child in a classroom learning situation. The needs of the learner should be identified before proceeding in the teaching-learning process. The vast experience and creative skills of the Pacific Islander in oratory and local expertise in singing, poem and storytelling, kava circles, dancing and debating were missing from the education programs. These cultural elements of the environment and resources of their island states must be integrated into education programs in order to reinforce active participation in a project.

The target audience of any project is the learners, not the facilitator. The target audience must learn independently of the safe use of pesticide (SUOP) and ecological sustainable agricultural practices (ESAP) to build their confidence to participate (DSAP, 2006; Halavatau & Hazelman, 2002b).

The agricultural education programs in Tonga did not use simple terminology and local languages which are understandable by local people (PASA/TCDT, 1998 & 1999; Vea’ila, 1999 & 2002). The language used should reflect that used by the local people, to whom the program is directed and who are the intended learners (Bryant, 1986).

Jargon is widely used, particularly in countries where English is a native language, which is found more difficult to understand by the majority of Pacific Islanders where English is not their mother tongue. The use of simple English could help the users (i.e., the local people) to understand the PAR process and how to participate actively in the learning tasks.
The education systems that exist in Asia, Europe and western nations are inappropriate for use in developing countries, such as Tonga. Educationalists often feel frustrated when their models do not work in such developing countries. The lack of understanding of the cultural context and social values held by Pacific Islanders is a major factor in the failure of the PAR program (SPREP, 1993 & 1998). Taufu’i (1996) states that culture includes "not only the arts and letters but also different modes of life, the fundamental rights of human beings, value systems and traditional beliefs", and therefore culture must be considered when planning and implementing an education program.

The traditions and cultures of local communities should be well understood before any education project can be started. If we ignore cultural identities, local communities feel that there is something missing from the project (Hala’api’api, 1997; PASA/TCDT, 2004). Thaman (1988, 1995, 2002) stated that Pacific policy-makers and leaders need to address and acknowledge traditions and cultural contexts at all levels – personal, household, village, island, national, and regional. Its cultural setting is one of the basic elements and cornerstones for the development and assessment of a project in any community (SPREP, 1998; SPC, 1999).

3.11 The need for education theory to guide these programs

The Tongan experience in agricultural education shows that many of the education programs, implemented at the time, did not achieve acceptable outcomes. Agricultural education programs in crop rotation, composting, synthetic pesticide use, agro forestry, cover crops, seed savings, moon planting, insect repellents, sand rings of home gardens, and companion planting, designed to enhance ecologically sustainable development in Tonga, achieved limited success and were not sustained (PASA/TCDT, 2004; Vea’ila, 1998 & 1999) because they failed to engage, motivate and empower local families, women’s groups, youth groups, or students to change their strongly held attitudes and actions.

Limited understanding of the Tongan cultural context and the inconsistent use of PRA are
reported as reasons for the failure of these programs and it is not surprising that stakeholders gradually developed mixed feelings and negative attitudes about participating in these projects (PASA/TCDT, 2004a & b; Vea’ila, 1998 & 1999). For example, as stakeholders such as local farmers, the women’s groups, and the youth groups were not fully informed about the purpose and content of education programs, they did not know in detail the benefits to be achieved. As a result, they were not sure about which program was appropriate for them to join.

The stakeholders often lacked appropriate knowledge (K), skills (S), attitudes (A), and practices (P) (KSAP) to cope with the education program. For instance, the Tongan farmers did not understand that toxic agrochemicals could kill both insects and human beings; they did not know that the littering and dumping of rubbish and domestic waste on reefs and lagoons caused pollution that could result in the outbreak of epidemic diseases. It is also apparent that the farmers either could not read technical information in the education programs and/or comprehend them. Their lack of knowledge, skills, and experience resulted in Tongan farmers not appreciating the potential of the project. Further, local farmers were not invited to participate during the planning and development of the projects (Halavatau & Hazelman, 2002a & b; SPREP, 1993 & 1998). As a result, they were not able to provide constructive comments and local input into the projects. The use of more dialogue and communication would have given the participants more opportunities to understand and participate in the program, as well as feeling that they “owned” the project (UN/ESCAP, 1990). The participants also claimed that the projects were time-consuming and impractical and the project planners did not clearly explain the impact of the programs on the participant's environment and their families, nor explain the time the participants must put into the project in order to get the desired results.

In summary, the previous education programs did not provide the participants with opportunities such as workshops to gain more experience before becoming actively involved with the project.
3.11.1 Suggested improvements

It could be argued that the limitations of the education programs should have been identified before they commenced (DSAP, 2004 & 2006; SPREP, 1998). Also the stakeholders should have been able to discuss the project in detail to gain an understanding of its purpose, its methodology, its practical activities, the commitment required and its desired results. They should have known the roles and responsibilities they were to undertake in order to maximise the social and economic benefits from the project. Also their environmental and educational backgrounds could have been used to enrich and promote the effectiveness of the project (Vea’ila, 1995 & 2002; SPREP 1998; SPC, 1999).

The government and non-government organisations (NGOs) should have done more research into the impact of the Tongan education programs. Participants should have been interviewed by the education program coordinator to obtain their views on the impact of the education programs on their families (PASA/TCDT 2004a & b; Halavatau & Hazelman, 2002a & b). Their comments and responses should have been analysed systematically in order to plan, implement, review, monitor, and evaluate the project (SPREP, 1993 & 1998). This lack of continuous research and clarity were major factors in the discontinuation of the program.

There was insufficient support structure to promote participants’ interest and engagement in the project (SPREP, 1993). The lack of support services (such as short field days, planting materials required, transportation, work plans, regular meetings, group discussions, field visits, and funding) discouraged participants, who gave up and finally quit the education program (PASA TCDT, 2004; DSAP, 2006). Further, the education programs did not disseminate information widely enough, especially to rural areas and the outer islands.

Support services should have been flexible enough to cope with local situations and enable participants to learn at their own pace. More flexibility in the education program might have allowed the participants who were more engaged to help those who were less engaged, thereby increasing the effectiveness and usefulness of the program.
As the participants in this study were adult learners and past learning experiences had failed due poor implementation and a lack of cultural understanding, an adult learning education framework that is culturally appropriate is more likely to be successful. Adult learners are more likely to be self-motivated and usually they enter an educational setting with more extensive life experiences than children (Knowles, 1980). Therefore, adults require different methods of teaching/facilitating when in a learning situation. Knowles, Holton, and Swanson (1998) suggested that andragogy is a way in which educators can professionally guide adult learners with the ultimate aim being to facilitate change in an adult person (Knowles, Holton, & Swanson, 1998:60). Andragogy is based on five assumptions of the adult learner.

- Self-Concept: As a person matures, he or she moves from dependency to self-directness.
- Experience: Adults draw upon their experiences to aid their learning.
- Readiness: The learning readiness of adults is closely related to the development tasks of his or her social roles.
- Orientation: As a person learns new knowledge, he or she wants to apply it immediately in problem solving. Thus an adult is more problem centered than centered in learning (Knowles, 1980:44-45).
- Motivation (Later added): As a person matures, he or she receives their motivation to learn from internal factors (Knowles, 1984:9-12).

These guiding assumptions need a relevant learning theory to support the practical implementation of this framework and section 3.12 discusses these theories and leads to a model that is considered appropriate for the context of this study

### 3.12 Relevant Learning Theory

Several learning theories may be considered in relation to the analysis and development of the PRA Program in Tonga. The two most prominent groups of theory throughout the twentieth century have been those of behaviourism and cognitivism, the latter including,
most recently, constructivism (Bigge & Shermis, 1992).

3.12.1 Behaviourism

Elements of behaviourist theories (Lefrancois, 1972) are apparent in the PRA program. Stimulus materials are provided through radio and television broadcasts, the dissemination of printed materials and workshops, to which communities - farmers and gardeners - are expected to respond. What is missing, however, to a significant extent, is the important behaviourist element of reinforcement (Skinner, 1958) either extrinsic, i.e., attached to the response, or intrinsic (Lefrancois, 1972) (i.e., the relatively immediate experience of success as a result of changing behaviour (The results of changing agricultural practice of the kind sought in the PRA in Tonga are, clearly, more long-term than immediate)

3.12.2 Cognitivism


Essentially, meaningful reception learning occurs when information is presented to the learner in a more or less complete form which can be subsumed into the learner’s existing cognitive structures, i.e., made meaningful (Lefrancois, 1988). Clearly the PRA Program has relied heavily on the first part of this process: the presentation, in various forms, of information to prospective learners. What is not evident, however, is the adequate consideration and effective utilisation of the learner’s existing cognitive structures - their language, experiences, cultural traditions, etc. Such learning cannot be really meaningful and is highly unlikely therefore, to impact greatly on practice.

In contrast to Ausubel, Bruner (1966) originally favoured discovery learning, where learners were provided with experiences through which they organise their own cognitive structures - “categories”, coding systems (Lefrancois, 1988:88) - for themselves.

According to Bruner (1966), instruction based on this theory involves five main aspects:
i. **Optimal experiences** that predispose the learners to learn. Learning and problem solving require the exploration of alternatives. Instruction is designed to promote this function by minimising the risk involved in exploration, maximising the informativeness of errors and weakening the effects of previously established constraints on explorations and curiosity (1966:198).

ii. **Structuring knowledge for optimal comprehension.** The grasping of the structure of a subject to form understanding in a way that permits many other things to be related to it meaningfully (1966:7).

iii. **Organisation of the materials to be learned into optimal sequences of presentation.** The task of the instructor is to convert knowledge into structures that are within the grasp of learners at various ages and to arrange the structures in an optimum sequence of materials to be learnt.

iv. **Stimulating thought** in an education setting. “If information is to be used effectively, it must be translated into the learner’s way of problem solving. Therefore instruction should make the learners or problem solver self-sufficient” (Bruner 1966:53).

Again, it is difficult to see evidence of this approach in the current PRA program, or the possibility of its implementation in any major way.

### 3.12.3 Constructivism

Bruner’s view of cognitive learning, above, is constructivist in that it is based on the belief that knowledge is not passively received but actively constructed by the learner to generate understanding when prior knowledge is related to present experience (Wheatley, 1991).

Driver (1988) argues that instruction based on constructivist perspectives has to take into account findings relating to the learner’s ideas and beliefs and there are various features that may be seen to be characteristics of such a perspective. She states that:

a. “Learners are not viewed as passive but are seen as purposive and ultimately responsible for their own learning. They bring their prior conceptions to learning situations.

b. Learning is considered to involve an active process on the part of the learner. It
involves the construction of meaning and often takes place through interpersonal negotiation.

c. Knowledge is not “out there” but is personally and socially constructed, its status is problematic. It may be evaluated by the individual in terms of the extent to which it “fits” with their experience and is coherent with other aspects of their knowledge.

d. Teachers also bring their prior conceptions to learning situations not only in terms of their subject knowledge but also their views of teaching and learning. These can influence their way of interacting in classrooms.

e. Teaching is not a transmission of knowledge but involves the organisation of the situations in the classroom and the design of tasks in a way which promotes scientific learning.

f. The curriculum is not that which is to be learned, but a program of learning tasks, materials and resources from which students construct their knowledge” (Driver, 1988, in Fensham, 1988:138).

Bruner himself, in his later work, following Vygotsky and with Wood and others has placed increasing emphasis on 'social constructivism' and 'interpersonal negotiation'. The emphasis here is on interaction between a novice (learner) and an “expert” (parent, peer, teacher) where the latter 'scaffolds' the learning experience through suggesting, hinting, questioning, demonstrating and so on, withdrawing the scaffolds as the learner “internalises” the knowledge, skills, etc. (Vialle, et.al., 2000).

Constructivist approaches, also, are not in evidence in the current PRA program. Elements of social constructivism, however, do offer possibilities for implementation in the program to considerable effect. Further, the above approaches are compatible with the guidelines of andragogy and are evident in the more comprehensive theoretical framework provided by Cambourne (1988). It is this framework, detailed below, which is explored in practice in the PRA program in Tonga, in this thesis.

The central concept in Cambourne’s model of learning is that of engagement. He argued that engagement is a necessary pre-condition for meaningful learning to occur, but before engagement will begin, learners need to be convinced that the learning activity is do-able and own-able by them. In the context of this study it was essential for the facilitator/researcher to establish conditions that would lead to learner engagement.

Cambourne’s original model specifically related to literacy learning (in classrooms) and is adapted from what he sees as the conditions of “natural learning” of spoken language. Recently Cambourne has revisited the concept of natural learning and his 2009 publication (Cambourne, 2009, in press). He described the term 'learning' and its cognates as 'knowledge', 'understanding', 'comprehension', 'knowledge-building', etc) with 'meaning', ‘meaning making'. He argues that natural learning involves a process of construction of 'meaning' that he describes as:

an unpredictable mix of personally constructed, internal, pictures, sounds, feelings, which seem to be unleashed by, and closely related to, the range of symbol systems humans are constantly using and manipulating to create new topical, and contextually relevant meanings which allow them make sense of the world. (Cambourne 2008, p. 25).

As pedagogical framework, natural learning provides a scaffold that can be used to guide the ways in which the researcher/facilitator effectively engage learners in learning about ESAP as the lack of sustained learner engagement, a major reason for the failure of past programs. Such a framework is underpinned by the following assumptions about human learning (Cambourne, 2009, 26):

- 'meaning' is an internal cognitive construction of the human mind which serves to make sense of the world.
- 'making sense of the world' is essential for survival of the individual and the species.
- the human mind is capable of constructing meaning using a range of symbol systems.
- biological and cultural evolution has 'selected' the construction of meaning using a range of symbol systems as a species-survival trait for homo sapiens.
learning to create and communicate meaning using a range symbol systems needs to be a 'fail-safe' procedure in human society.
learning to control the oral form of language of the culture into which one is born is the primary and predominant symbol system which members of a culture need to learn

The challenge in this study is to effectively apply this model learning to agricultural learning/education in Tonga, thus supporting and strengthening the development and implementation of a PRA program. Cambourne’s model identifies seven conditions for successful learning, with a major focus on the “engagement” of the learner in the learning process and activities. Engagement is necessary for the first two conditions to be successfully met and is facilitated to the extent that the other five conditions are met. What follows is based upon Cambourne’s work (1988, Chapter 4 & 5).

3.13.1 Immersion
Immersion relates to the context in which the learning takes place, the extent to which the learner’s environment - social, cultural, physical - is “saturated” by the knowledge, skills, practices to be mastered. In another way, it involves the extent to which the learning is part of the real world, the real-life experience of the learner.

3.13.2 Demonstration
This condition embodies important elements of social constructivism, above, in that it involves the learners in observing (seeing, hearing etc) the “action or artefacts” to be learned, in practice by an expert. Demonstrations of the same actions or other artefacts need to be repeated so that the learner is engaged, and begins to select and internalise the demonstrations. Therefore demonstrations need to be repeated continually to allow the learners to engage with the task. For engagement to occur, the learner must be given a sufficient amount of information from the demonstration to make it part of his skills and knowledge (Cambourne, 1988:47-49). In addition, the learner needs to believe that the demonstrations are relevant and of some value in their daily lives.
3.13.3 Engagement

As Cambourne says (1988:50), “While immersion and demonstration are necessary conditions for learning to occur, they are not in themselves sufficient.” Unless the learner engages with the demonstration effective learning will not occur. Among other things, before engagement will begin, learners need to be convinced of the following:

That any of the demonstration which is witnessed must be perceived as do-able or own-able by them. In other words, potential learners must see themselves as potential talkers, readers, bike riders, writers, and so on. Emulating the demonstrations they’ve witnessed will somehow further the purposes of their lives.

That attempting to emulate the demonstration will not lead to any unpleasant consequences if they fail (Cambourne 1988:34-35).

The remaining five “conditions” relate to their contributions to learner engagement and the contributions that these “conditions” make to learner engagement will be explored during this study.

3.13.4 Expectation

This involves the expectations of the learner that the demonstrated learning is “do-able” and “own-able”, that it will “further the purposes of their lives” and that the consequences of failure will not be “unpleasant.” It also involves the positive expectations of the significant other (demonstrator, teacher) for the learner in these same three areas, and her/his ability to communicate them to the learner.

3.13.5 Responsibility

Cambourne (1988:61-66) states that learners should take responsibility for their own learning, although the instructor may know what is best for the learners. These are the sorts of things a facilitator can do to promote responsible learning:

- learners learn best if they “have a go” first and then seek help;
- explaining something to someone else is probably one of the most effective ways to make decisions about learning;
- the teacher should be the last resort in solving a learning problem;
- demonstrations should be organised so that options for choices are made an integral part of the learning environment.
3.13.6 Approximation
This condition relates to the learner trying out what they have learned and being able to experiment and make mistakes - approximations of correct responses - and learn from them. This may be more applicable in language/literacy learning than in agricultural practices, but even here should be taken into account in relation to all the other conditions.

3.13.7 Use
This relates to putting learning into practice, trying it out in the real world which offers a multitude of opportunities for learners to try themselves out in contextually relevant and meaningful ways (Cambourne, 1988:71).

3.13.8 Response
This has to do with the teacher/facilitator/demonstrator’s response to the learner’s progress/performance. It has a strong emphasis on the positive: “acceptance”, “celebration” (which carry overtones of the behaviourists’ reinforcement) “evaluation” and “demonstration” (with overtones of “scaffolding,” social constructivism).

3.14 Using Cambourne’s conditions of learning as a pedagogical framework for the PRA process
The PRA process recommends that local communities should participate in the planning and development of any project and they should have the opportunity to speak out, ask questions, and discuss their needs and priorities before any project commences. It is suggested that community leaders and local communities should participate and disseminate information to the public during the planning and development phase, as this ensures local ownership of the project. It is claimed that the PRA Process empowers and encourages local people to identify local problems and develop possible solutions by encouraging participation in decision-making and sustainable-development activities (Ecowoman, 2000; Halavatau & Hazelman, 2002a & b; Pretty, et.al., 1994; SPC, 1999; SPREP, 1993). This can lead to collective action by local communities. The process includes site identification, preliminary visits, data acquisition, and analysis to identify problems and solutions. Local people should be able to
prioritise and rank feasible opportunities before preparing a work plan for implementation and evaluation. It is, therefore, essential that these aspects are incorporated into any educational program. The Cambourne/PRA process that was developed as a pedagogical framework by adapting Cambourne (1988) model of learning as described below.

3.14.1 Immersion and Responsibility
Immersion activities included community talks, preparatory village meetings, initial interviews and workshops held on site to discuss ideas and develop activities about the safe use of pesticides and alternatives for sustainable agriculture such as compost making, recycling of domestic waste, gardening, replanting, and seed savers towards ecologically sustainable development in Tonga.

Learners can take responsibility for their learning by sharing what they had learned during community talks, initial interviews, during group meetings and presentations. Also they can practise skills during field visits (all activities - teaching, practice, communication - all printed materials utilised local native languages) at the training workshop.

3.14.2 Demonstration
Demonstration activities included but were not limited to the following activities: planning and conducting of workshops, drama presentations and youth floats, home visits and field trips, group formation/discussions/presentation, site identification and preparation, press releases (television / radio / local newspapers), compost-making and gardening. The participants and others (community members, families, schools, etc) shared and explained what they learned during the demonstration activities.

3.14.3 Expectation, Response, Use, Approximation
Expectations of the learner by the facilitator were constantly positive, communicating that tasks were do-able, structuring demonstrations to allow approximations in practice - use by the learners, accepting error, repeating demonstrations, celebrating success. Ownership of practice was turned over to learners wherever possible (scaffolding) as was responsibility for planning, etc. in early stages of the program and follow-up activities. Figure 3.1 shows how Cambourne’s (1988) model of learning was adapted for community learning in the PRA program.
3.14.4 Discussion of Figure 3.1.

The broad pedagogical framework is presented in figure 3.1 down the left hand side and this is then linked to Cambourne’s conditions of learning, including the central concept of engagement. The focus of this study was the activation of Cambourne’s “conditions” to
support teaching/learning of safe pesticide use and alternatives in Tongan communities. As evident in the model, there are considerable inter-relationships among conditions in their contribution to the engagement of learners in the learning process. Learning activities - demonstrations - were structured, varied, and located within learner communities’ experiences and cultures as far as possible (immersion). Activities were structured and restructured to allow for approximations, to provide and encourage experiences and learners expectations of success in practice (use). The facilitator’s response also embodied such expectations of the learners and the program. Table 3.1 shows how the Cambourne model breaks the PRA approach into phases to match the ‘Pacific Way’ and the context of the people of Tonga.

Table 3.3: The modified PRA process and the conditions of learning that the researcher expected to activate (Cambourne, 1988 model of learning).

<table>
<thead>
<tr>
<th>Phase</th>
<th>Events – the time frame allowed for each phase - 4 to 6 weeks</th>
<th>Conditions expected to be needed to achieve effective learner engagement</th>
</tr>
</thead>
</table>
| 1     | Individual interviews  
Group meetings  
Community talks | Immersion  
Expectations  
Responsibility  
Response [of facilitator] |
| 2     | Group meetings and training workshops  
Visits to demonstration sites and home gardens  
Drama presentations  
Newspaper articles and radio and television interviews | Demonstration  
Immersion  
Expectation  
Responsibility  
Response [of facilitator and community leaders, participants] |
| 3     | Home garden visits  
Individual interviews about the structure of the remaining phases  
Updating plans for future phases | Immersion  
Practice and Use  
Responsibility  
Expectation  
Approximation  
Response [of facilitator] |
| 4     | Networking, collaboration with government, village and church committees to form village | Demonstration  
Practice and Use |
<table>
<thead>
<tr>
<th>Phase</th>
<th>Events – <em>the time frame allowed for each phase - 4 to 6 weeks</em></th>
<th>Conditions expected to be needed to achieve effective learner engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>planning committees.</td>
<td>Response [of facilitator, chairwoman chairman, village leaders, participants etc] Expectation Responsibility</td>
</tr>
<tr>
<td></td>
<td>Planning of village cleanup program and the involvement of local high schools (22)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Development of training information for the whole community in local languages Presentation of gardens to local community members and participants, including secondary school students Publicity via newspapers, radio and television Drama presentation to school students and local community members to reinforce the key skills Ongoing follow-up up and inspections</td>
<td>Response [of facilitator, participants, public – media etc.] Expectation Responsibility Demonstration Practice and Use Immersion</td>
</tr>
<tr>
<td>6</td>
<td>Exchanging and sharing of experience among the participants during discussion (<em>talanoa</em>), field trips, home visits and kava circle (<em>faikava</em>) ceremonies, group meetings Follow-up radio talks and television interviews with two women of the group of women and two young farmers. Follow up group meetings. Follow-up garden visits, sharing and exchanging of information with interested citizens; Public awareness program to promote tourism, (SUOP), (ESAP) in Tonga</td>
<td>Responses [of participants, facilitators, public, media]Responsibility Expectation Demonstration Immersion Practice/Use</td>
</tr>
</tbody>
</table>

### 3.15 Conclusion

Agriculture is the main source of livelihood in Tonga. The Tongan government introduced agricultural development programs in production of copra, banana, vanilla, water melons,
vegetables such as tomatoes and capsicum, squash pumpkins, and use of synthetic pesticides to improve the standard of living of local families. Most of these agricultural developments failed because of the following challenges:

- lack of better planting materials;
- lack of knowledge (K), skills (S), attitudes (A), and practices (P) (KSAP) of the participants;
- lack of appropriate training programs;
- lack of dialogue, participation and communication;
- lack of funding;
- time constraints.

This literature review attempted to find an appropriate education theory to educate the young farmers and the group of women about the safe use of pesticides (SUOP) and adopting ecologically sustainable agricultural practices (ESAP) in Tonga. After considering other theories, Cambourne's (1988) “conditions of learning” was identified as an appropriate education theory and was adapted to guide the PRA training program.

Cambourne’s (1988) conditions of learning were adapted to produce a pedagogical framework designed to engage learners in natural learning situations. Therefore it was essential that local language be used to facilitate communication.

Local languages assist learners to learn more effectively about SUOP and ESAP in their local communities. In local communities, participants talked in their own language whilst the development organisation could translate local language for native English speakers. In this study, local languages were used as it was expected that this would help communities to be more confident in the processes of consultation and communication and promote their participation in the project.

Use of local resources and artefacts facilitated learners in demonstrations and provided the raw materials for the participants to take part in the program. Programs and training
booklets were written in the Tongan language to better meet the needs of the learners and help them to better understand and experience the importance of the safe use of pesticides and alternatives for ecological sustainable agriculture practices in Tonga.

The application of Cambourne’s conditions of learning (1988) is an example of a natural learning approach (Cambourne, 2009) that takes into account the traditions and cultural values of the South Pacific. Culture and tradition must not be dismissed; rather they should be recognised if engagement in any education program is to succeed. The council of chiefs, church leaders, women’s groups, elders of community groups in Tonga must be informed about any development programs and their collective wisdom respected. Culture and traditions act as the stepping stones for ecologically sustainable development in the South Pacific. Communication and transformation through parables, making stories, and orators bring a rich experience and diversity in the South Pacific. They communicate in local language rather than fie palangi. Fie palangi is seen as the language of the Pacific Islanders who migrated overseas and started to “look down upon” (sio lalo) the local communities and begin to forget (mo’ui ngalo) their unique cultural upbringings.

The next chapter will describe the implementation of the Cambourne/PRA model and how it was applied in this research in Tonga.