Apiculture industry development and expansion in Papua New Guinea

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Abstract

Beekeeping was introduced to Papua New Guinea in the 1940s for research purposes and by the 1960's apiaries were established for household honey consumption. In 1976, under a New Zealand-PNG Government bilateral agreement, the apiculture industry was expanded for commercial development. In the late 1980s, honey production peaked at 100 tonnes annually, mostly exported to European markets. Due to management and financial problems, the bank foreclosed Honey Producers Limited in 1993 and the apiculture industry collapsed. In 2007, the National Government identified apiculture as a sub-sector of the livestock sector in the National Agriculture Development Plan and allocated K3.15 million over ten years for the implementation of the Apiculture Development Program. To achieve the goals of the current plan, the authors argue for eight areas to be targeted and suggest strategies for each area. Critical for success are effective private-public partnership arrangements and the work of extension and advisory services. By adopting the strategies for the eight target areas, the apiculture industry can thrive and become a sustainable cottage industry contributing to the well-being of beekeepers, associated stakeholders and the nation's economy.

Key words: beekeeping, apiculture, apiaries, honey production, cottage industry, private-public partnership arrangements, marketing

Introduction

Beekeeping was introduced from Australia to Papua New Guinea (PNG) in the 1940s. Initially for research purposes, the apiculture (or beekeeping) industry went on to develop commercial production of honey. In 1976 the industry received a boost under a New Zealand-PNG government bilateral aid project. However, mismanagement and financial problems resulted in a collapse of the industry in 1993. Little happened until 2007, when apiculture was identified as a sub-sector of the livestock sector in the National Agriculture Development Plan (NADP) 2007-2016 and allocated K3.15 million over ten years for the implementation of the Apiculture Development Program. This article reports on the background of PNG's apiculture industry and hopes for the future.

Brief history

European honeybees (*Apis mellifera*) were first introduced into PNG in the late 1940's from Australia (Anderson, 2008:6). This stock was used for research purposes at the Apiary Research Centre at Moitaka, (National Capital District, NCD) between 1950-1960. Research results indicated that bees *(Apis mellifera)* at lowland altitudes and climatic conditions cannot produce enough good quality honey (Department of Primary Industries, 1982:2). Around that time, some expatriate missionaries and planters in the Highlands region were farming bees for the production of honey for household consumption.

In 1964, Mr Aub Schindler, President of the Kainantu Branch of the Highlands Farmers and Settlers Association (HFSA), requested that the Department of Agriculture Stock and Fisheries (DASF) consider conducting research into formalized introduction of bee farming into the highlands region. This request was echoed by Ian Fairley Graham Downs, National President of HFSA and a senior statesman and parliamentarian, that saw the relocation of the Apiary Research Centre from Moitaka, to Aiyura and then to Fimito (Eastern Highlands Province, EHP), where it was commercialized. Research results indicated suitability of bee farming and honey production; hence, the HFSA requested DASF and the government to reduce the tariff duties on importation of materials needed for the beekeeping industry (Orlegge et al., 2010:7).

With continued research and production, in 1976 'Italian type' colonies were imported from New Zealand under a New Zealand-PNG government bilateral aid project. Since then, the only legal introductions have been from Australia and New Zealand. Hence, all current European honeybees in PNG are descendants of bees that were originally imported from Australia and New Zealand (Anderson, 2008:6). The New Zealand Government provided the necessary financial and technical assistance to the Government of PNG to develop the apiculture industry.

By 1980, Papua New Guineans were engaged in beekeeping and honey production as income earning ventures. Officers from within the National Department of Agriculture and Livestock (NDAL) and the Eastern Highlands Department of Primary Industries (EHDPI) were trained in apiculture management and so the spread of bee farming to local farmers was achieved (Orlegge et al., 2010:8). Marketing strategies became a necessity as the commercial production of honey increased

In 1983, the NDAL organized pioneer farmers to contribute equity to Honey Producers Limited (HPL), operating on a cooperative system that would cater for the marketing of their produce. HPL acquired land and established a processing and manufacturing factory. Apart from importing items such as veils, smokers, overalls, boots and gloves to sell to farmers, HPL acquired saw milling equipment to manufacture hive boxes and other bee keeping equipment. The Project Management Unit (comprised of NDAL and EHDPI officers) took on the management of HPL. Beekeeping became a successful cottage industry in the EHP. HPL employees from other provinces such as Simbu, Western

Highlands, Southern Highlands and Enga, were trained in beekeeping and became farmers who also encouraged others (Orlegge et al., 2010:9).

As soon as NDAL and EHDPI provided training, HPL provided the necessary beekeeping equipment and materials, initially with three to five hives. The cost of materials was recovered from the sales of the honey. Further HPL provided transport and other support to ensure honey was extracted and brought to the factory. In addition, HPL provided the guarantee for farmers to obtain loans from the Agricultural Bank of PNG (Orlegge, et al., 2010:10).

Boom times

Following the impetus that the apiculture industry received from the PNG-NZ bilateral aid project in 1976, the industry experienced steady growth. Commercial production of honey and export were achieved by 1984 and by 1989, bee hives peaked at about 6000 hives, with about 500 farmers producing 120 tonnes of honey per annum. Domestic demand was at 100 tonnes whilst import demand from Germany alone was at 100 tonnes per annum. HPL expanded its operations by setting up a primary processing plant at Korn Farm (WHP) and was actively processing and packing honey and honey by-products for the local market as well as for sales in overseas markets, especially Germany and Austria (Orlegge et al., 2010:10).

The 1993 crisis

However, in 1993 the Bank applied its statutory powers of foreclosure when Honey Producers Limited experienced management and financial problems. This forced the company to wind down its operations in 1994.

Between 1994 and 2000, the beekeeping farmers were left to fend for themselves. There was an absence of advisory, training and extension services as well as access to loans, grants and marketing outlets.

In 2001, the National Department of Agriculture and Livestock provided limited advisory as well as financial assistance towards the revival of the apiculture industry. These efforts with farmer mobilization by the Highlands Farmers and Settlers Association resulted in the formation of the Isten Hailens Beekeepers Association (IHBA) and its affiliates (District Beekeeping Clubs) which resulted in a resurgence of the industry. Since then the industry had slowly grown with the establishment of New Guinea Fruit Company Limited and other smaller entities as buyers, processors or marketers of honey, ensuring competition and improved prices, as well as training and extension services. This was complimented by the strategic intervention by the NDAL and EHP Provincial Government in the area of incentives to farmers to increase honeybee colony numbers (Orlegge et al., 2010:11).

Annual honey production 2001-2010

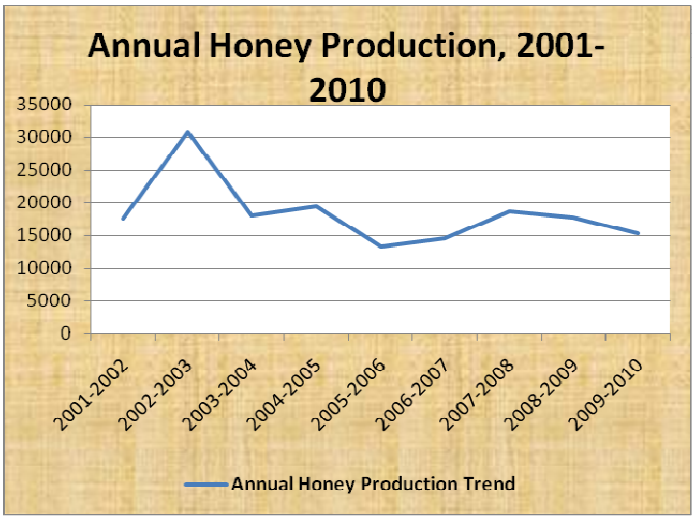
It was not possible to get statistics on honey production from official sources and the statistics in the following table and graph were compiled from information obtained by the author and a colleague from various sources of honey producers.

Table 1: Annual honey production in kilograms 2001-2010

Year	Honey production in kg
2001	17,666 kg
2002	30,763 kg
2003	18.104 kg
2004	19,495 kg
2005	13,399 kg
2006	14,570 kg
2007	18,758 kg
2008	17,783 kg
2009	15,309 kg

Source: compiled by Wilson Thompson and Leon Saleu in May 2010 from information obtained from NGFCo, Highlands Industry, Kami (Lufa) Honey, Enga DPI, Hon. Sam Basil, MP for Bulolo

Figure 1: Annual honey production in kg 2001-2010



Compared with the statistic of 120 tonnes of honey being produced in 1989, the figures above provide an indication of the collapse of the industry since then with annual averages around 16 tonnes. It is noted that farmers continued to produce honey after HPL stopped operating but amounts were not recorded if the honey was sold in their own community, to niche markets such as expatriates, teachers, missionaries, hotels or schools, or even packaged and sold

in retail outlets. Buyers do not record those figures, as this does not enter the formal system. Anderson (2008:7) records that there were 4,000 hived *Apis mellifera* colonies in the Eastern Highlands in 2009 compared with 6000 hives fifteen years earlier in 1994. This is another indicator of the decline in apiculture.

Government remedial strategy

The inclusion of apiculture in the livestock sector of the National Agriculture Development Plan 2007-2016 has been the most significant indicator of recent government interest in addressing the current slump in the industry. The development and expansion of the Apiculture industry is consistent with the United Nations Millennium Development Goals, the Papua New Guinea Vision 2050, the PNG Development Strategy Plan 2010-2030, the Medium Term Development Plan 2010-2015 and the NADP 2007-2016.

Review on the prospects of the apiculture industry

In assisting the promotion of the apiculture industry, the following studies have been undertaken:

- Small holder bee keeping in the highlands; GTZ Study, n.d
- Technical assessment report on the status of apiculture (beekeeping) industry in the highlands region, Department of Trade and Industry, September 2005
- National Agriculture Development Plan, 2007-2016, GoPNG, 2007
- Surveillance of parasites and diseases of honeybees in Papua New Guinea; Dr Denis L. Anderson, CSIRO, September 2008
- National *Varroa* surveillance, awareness, training, Nime Kapo, NAQIA, March 2009
- Potential economic impacts of the *Varroa* bee mite on pollination of major crops in Papua New Guinea, Cunningham et al., ACIAR, July 2009
- Infestation of *Varroa* mite in *Apis mellifera* colonies and its effect on beekeeping industry in EHP, Leon Saleu, DAL, July 2009.

Reports of these studies were presented at the 2010 National Apiculture Industry Workshop in Goroka. Participants included farmers, extension and technical officers, researchers, administrators, program managers, processors, small equipment manufacturers, farmers and industry associations, national program directors and staff from the farm level, private and public and non-state sectors. The workshop aimed to share views that would contribute towards the development of the apiculture industry and create the foundation for a PNG Apiculture Strategic Development Plan (Dekuku et al., 2010:2).

The following observations were made by workshop participants

1. The apiculture industry has the potential to expand to cater for nutrition, food security and income earning opportunities for farmers

2. Potential exists for downstream processing for exports and substitution of imports
3. Bees assist in pollination of various cash and food crops and more targeted research and interventions are required for optimal benefit
4. There is a need to understand pests and likely diseases affecting hives, but importantly, to engage in good husbandry management to maintain and increase honey production
5. Apiculture is described as an infant industry and needs strategies to promote its unique identify and raise its status as an industry that contributes to the nation's economy and well-being of farmers
6. The apiculture industry needs government policy, funding and technical support in terms of training, good husbandry management, research and dissemination of information, continued extension work, awareness and surveillance of disease and pests, and subsidy and direct assistance in capacity building

Participants discussed issues and collectively suggested ways forward for the PNG apiculture industry, with due concern for the new *Varroa* mite infestation in honeybee colonies. The proceedings of the workshop were published as a strategy to move the industry forward (Dekuku et al., 2010). An Apiculture Strategic Development Plan (ASDP) was formulated to guide industry led initiatives as well as government financing which were deemed necessary for the development of the apiculture industry (L. Saleu & W. Thompson, 2010).

Target areas for development

Development strategies for apiculture are associated with bee farming, honey production, improved management capacity, breeding, processing, packaging and marketing. The development plans of the honeybee industry must embrace all important aspects of the apiculture industry, which include important policy directives, health, disease and quarantine control measures, product quality standards, marketing infrastructure, training and extension, and research and development. Development strategies for apiculture must add to the sustainability and livelihood of honey producers and other stakeholders in the industry.

To achieve the intentions of the apiculture industry, it is argued that there are eight target areas to be addressed:

1. Stakeholder collaboration and capacity building
2. Establishment of nucleus colony development centres and queen bee breeding centres
3. Provision of recommended standardized bee keeping equipment and materials and supplies
4. Research, outreach, field days, workshop and seminars
5. Industry standards, guidelines, training, awareness and information dissemination

6. Extension and advisory services and interaction of industry participants
7. Honey extraction, purchasing, processing, manufacturing and marketing
8. Industry associations, consultation, private-public partnership arrangements and evaluation.

Target 1: Stakeholder collaboration and capacity building

The first target prioritizes collaboration and capacity building of stakeholders in the apiculture industry. For the industry to prosper there is the need for a coordinated approach involving government agencies, farmer and industry associations and the private sector (suppliers, processors and manufacturers). Strategies for capacity building should be identified from the beginning to ensure that various inputs are available to achieve the required outputs. The appropriate technical agencies such as NDAL, in particular the National Bee Office, the Highlands Regional Office and the Department of Commerce and Industry need to have capacity in terms of personnel, logistics and other resources to undertake effective training, extension and advisory services (Gonapa, 2010). Standardized materials, up-to-date training manuals, processing equipment and safety gear are needed.

Though there are some beekeepers who were trained in the past, those farmers need refresher and advanced beekeeping management training. All new bee farmers have to be trained on basic beekeeping techniques prior to engaging in beekeeping. Visits to beekeepers by provincial and district bee extension officers are needed on a regular basis. With the recent spread of parasitic mite and other pests and diseases of bees, the colonies have to be monitored and infected colonies have to be checked regularly to ensure wise management decisions (Orlegge, 2010:39).

Suggest tasks for stakeholder collaboration and capacity building are to:

- conduct a needs assessment of the apiculture industry in terms of technical manpower capacity and resources to expand the industry
- assess farmers' skills, farming systems, queen bee and colony stock, number and capacity of suppliers of equipment and materials, buyers, processors, exporters, manufacturers, trainers, intervals in coordination and liaison
- do a training needs analysis of relevant stakeholders such as farmers, queen bee breeders, suppliers of goods and services, trainers, departmental advisors and industry associations
- develop and publish standardized and up-to-date training manuals, information kits, teaching materials and aids for earning
- acquire recommended bee keeping and honey processing equipment, materials and supplies for use in training, extension and related activities
- acquire infrastructure such as office space, resource centres, computers, stationery, vehicles
- provide certification, training, extension and advisory support services
- ensure coordination and timely and regular consultation under Private-Public Partnership Arrangements with government agencies, farmer

groups, farmers, queen bee breeders, colony suppliers, equipment suppliers, honey processors, investors, consumer groups and industry lobby groups

Target 2: Establishment of centres for nucleus colony development and queen bee breeding

The second target is to establish centres for nucleus colony development and queen bee breeding**.** New queen stock and varieties have to be determined in a bid to establish nucleus colony development and queen bee breeding centres to supply nucleus hives, bee frames, pollen and honey frames and quality queen bees to farmers. PNG needs its own bee and queen bee breeding program to expand the stock levels. At present, hives are split into nucleus hives and existing colonies are split further and further thus reducing bees in any one colony, making it weak and causing a reduction in the productivity level of each bee in a colony (Orlegge, 2010:38).

Queen bee breeding is a delicate and risky task and with limited resources and experienced breeders, current hives have old queens where the queen bees are living beyond the one year required to maintain production. Without queen bees and an annual re-queening program and colony splitting, hives will not produce well and bee productivity and honey production will be low. Currently 2234 hives are in production in the Eastern Highlands Province (Saleu & Negiha, 2010:26). To improve productivity of these existing hives and to bring the other 1,000 unused hives into production, thousands of queen bees need to be produced each year. To bring 3500 hives into production in a year is a huge task.

Suggested strategies to establish centres for nucleus colony development and queen bee breeding are:

- to assess the apiculture industry's needs for a sustainable supply of nucleus starter hives and colony hives as well as queens for new hives and annual re-queening of all hives
- to identify appropriately trained personnel on various agricultural stations with resources to establish four queen breeding and colony development centres
- to establish links with Private-Public Partnership Arrangements by identifying, training, equipping and resourcing eight farmers to establish model nucleus development and queen bee breeding centres to maintain a supply chain and motivate farmers
- for centres to have a supply of starter hives (nucleus colony), bee frames, and queen bees and be able to provide the environment, equipment and materials for use in training, extension and related purposes
- for queen bee breeding centres to supply the amount of queen bees required for new hives and for annual re-queening of hives.

Target 3: Provision of recommended standardized beekeeping equipment and materials and supplies

The third target for apiculture development is for bee farmers to have access to affordable recommended standardized beekeeping equipment and materials and supplies. In the past, Honey Producers Limited imported and supplied the necessary tools of the industry which they provided to farmers after training, with costs to be recovered from honey sales. Since the collapse of the industry in 1994, most equipment and materials are old or are hand-made or are modified by farmers or suppliers and may not be standardized. Hives must have standardized frames and materials, so that it does not adversely affect production or movement of bee. Improvised design and construction of hive boxes and other materials, may affect production. For the industry to prosper, farmers need access to proper equipment, materials and funding. To expand the apiculture industry requires investment in apiary equipment and materials.

Suggested strategies to sustain the provision of recommended standardized beekeeping equipment and materials and supplies are:

- for agricultural authorities associated with the apiculture industry to survey and make known recommended beekeeping equipment and materials
- to identify established and potential suppliers of recommended equipment and materials that comply with industry standards
- to undertake awareness and training for farmers and industry participants to use only recommended equipment and materials
- to seek government tax and duty exemption for importation of beekeeping, honey processing and manufacturing equipment and materials
- to provide farmers and industry participants with the necessary standard beekeeping equipment and materials to be subsidized or recoverable from honey sales.

Target 4: Research, outreach, field days, workshop and seminars

The fourth target is research, outreach, field days, workshops and seminars. Research is necessary to create knowledge about bee farming, honey production and processing, management, pests, diseases, marketing, issues and best practices. What numbers of bees are in a colony? What is the yield of honey? What are the issues and how widespread is the impact of problems? Will climate change and global warming affect production and productivity and the effects of pollination on crops? Research is essential to provide data on the extent of apiculture problems and to develop containment and mitigation measures. Field days are needed to get first-hand accurate information. Funding is needed for research and development of husbandry methods that facilitate optimum conditions and outputs.

We need development of good bee husbandry, harvesting and post-harvest strategies. There is a need for research into bee husbandry in terms of

geography, altitude and production cycles, and also export standards and markets. PNG is faced with bio-security issues due to its geographical connection to Indonesia and South East Asia. Agricultural problems PNG now faces include the coffee pod borer, cocoa pod borer, sugar cane leaf blight, potato blight and, for beekeeping, the invasion by *Apis cerana* and the presence of the *Varroa* mite. Research is essential to ascertain the impact (performance, production, productivity) on horticultural and agricultural crops in PNG. Research is of little value unless the findings are disseminated and this needs to happen through publications, workshops, seminars and outreach activities.

Suggested strategies to promote research, outreach, field days, workshops and seminars are:

- to compile a bibliography of all studies, research and publications related Apiculture in PNG
- for the Department of Agriculture and Livestock to provide directions for research
- to conduct observational research on hives in relation to altitude, geography, location, locality, production cycle, productivity, weight of hive and use of accaricides (pesticides for killing mites) on productivity in each location
- to identify diseases threatening the honey industry and develop containment and mitigation measures that will contain both the build-up of diseased population and spread of disease
- based on research and findings, to develop good honey bee husbandry management, good harvesting and post-harvest strategies and develop guidelines and manuals and standards for farming, management, handling and local processing and exports and market strategies
- to develop gender equity strategies for participation in apiculture
- to explore uses of honey such as in recipes, baby foods, cereals and confectionery as well as medicines and cosmetics. In addition to honey, beehives have other by products, including royal jelly, pollen, propolis and bee wax.
- to disseminate research findings and outcomes through user friendly approaches such as field days, seminars and workshops and reader-friendly bulletins that can be understood by farmers with education below Grade 10 level.

Target 5: Industry standards, guidelines, training, awareness and information dissemination

The fifth target for apiculture development and sustainability relates to industry standards, guidelines, training, awareness and information dissemination. For the apiculture industry to prosper, trained and specialized officers are required to coordinate effective and efficient extension and advisory services. This involves formal and informal training and continuous dialogue and involvement of the technical officers and industry participants through training, visitation, demonstrations, undertaking projects together and also through accessible model farmers and farms

The industry relies on the knowledge and skills of the technical officers, farmers and industry participants. All bee farmers have to be trained on basic beekeeping training prior to engaging in beekeeping. This includes familiarization with beekeeping materials and actual field trip. There needs to be establishment of apiculture training and resource centers to facilitate training of beekeepers and extension officers on all aspects of beekeeping including pest and disease control.

Farmers need training in post-harvest handling and storage to ensure contaminants are not introduced into extracted honey. Ideally, standards and quality control must start from the farm to the processing and onto the export market or on the shelves. Apart from being trained as farmers, it is now necessary to enable farmers to manage their money and resources including the need to save. Farmers can undertake various book keeping and management training and training that can provide access to various financing, loan and credit facilities.

Suggested strategies to promote industry standards, guidelines, training, awareness and information dissemination are:

- to develop apiculture industry standards, guidelines and training manuals and equipment, materials and aids
- to train technical officers and specialists in aspects of bee husbandry and honey marketing and for them to pass on their knowledge and skills to others
- to provide various levels of training in particular aspects of apiculture such as pest control, harvesting, processing, handling, bookkeeping, materials and safety, queen breeding and colony breeding
- to identify and encourage model farmers and model centres to undertake outreach on research and new industry practices through open-days, displays, information dissemination, field days, practical sessions and demonstration projects

Target 6: Extension and advisory services and interaction of industry participants

The sixth target for the apiculture industry is extension and advisory services and interaction of industry participants**.** Dekuku (2002:41) argues that interaction between participants in the apiculture industry and extension and advisory officers is critical if benefits of research and best practices are to be reflected in efficient and improved husbandry. Interaction amongst farmers themselves as well as from industry advisors enables ideas and techniques to be explained and demonstrated to increase beehives and honey production. Advice on appropriate management skills can be provided by extension and advisory services to queen bee breeders and colony suppliers.

Regular extension visits to beekeepers by provincial and district bee extension officers are needed to identify problems and opportunities and to develop

appropriate strategies to address them. Problems differ from time to time, and from farmer to farmer. Through regular visitation by government officers farmers can be advised of matters that concern them at a particular point in time. For example, the *Varroa mite* was present in 2005 and bees were weak or dying out but this was not detected until 2008. The result was a lack of development of containment strategies, lowering of farmers' morale, a decline in honey production and spread of the disease.

Suggested strategies for improved extension and advisory services and interaction of industry participants are:

- for model farmers and resource centres to undertake outreach on research outcomes, new industry practices, policy and technical information; to conduct field days with interactive practical sessions and demonstration projects; in addition to follow up visits and discussion with farmers, industry participants, communities or associations
- to contact many people to attend interactive sessions planned by extension and advisory officers or model farmers to be conducted at regular intervals at suitable locations
- to communicate industry development and research outcomes at resource centres and on farm visits
- to facilitate stakeholder consultation forums at events such as seminars, field days and workshops on a regular basis to coordinate effective and efficient outputs
- to identify progressive farmers and industry participants and assist them to access advanced training, government funded programs or support from financial institutions to further their development

Target 7: Honey extraction, purchasing, processing, manufacturing and marketing

The seventh target for the apiculture industry concerns honey extraction, purchasing, processing, manufacturing and marketing. Farmers need confidence in the system, that there will be guaranteed market for the honey that they will produce. Farmers were greatly affected when Honey Producers Limited collapsed in 1994 and there is anxiety that this could happen again. There is a need to establish high levels of confidence in the industry by having reliable and reputable honey processors and manufacturers.

Advertising and marketing of PNG honey, and apiculture by-products such as candles and soap, need a high profile both for domestic and international markets. As successful development and expansion could result in oversupply of raw honey, coordination is required to have organizations that can take advantage of various markets (organic, niche, industrial supply) (Kulit, 2010:32-33). At present the National Department of Agriculture and Livestock is supporting farmers in terms of production, identifying buyers and being involved in processing and marketing of apiculture products. It is argued that the Department of Commerce and Industry could be more influential in the marketing of apiculture products.

Suggested strategies for improved honey extraction, purchasing, processing, manufacturing and marketing are:

- to ensure honey harvested by farmers is extracted immediately through extraction facilities and sold with ease at resource centres
- to implement harvesting controls to ensure the quality of honey that is extracted and sold to buyers and processors
- to identify and support processors and manufacturers under private-public partnership arrangements for honey to be marketed domestically and exported for the industry to be sustainable
- to monitor the establishment and regulation of controls to meet international standards for the honey industry and compliance with standards for the handling, packaging and labeling of finished products.

Target 8: Industry associations, consultation, private-public partnership arrangements and evaluation

The eighth target for the apiculture industry relates to industry associations, consultation, private-public partnership arrangements and evaluation. Industry associations are a means of sharing the latest news of industry developments and being a lobby group to maintain momentum for the industry's needs. Effective private-public partnership arrangements are vital for apiculture products to be successfully marketed with adequate financial return for farmers.

The private sector tends to drive an industry. Research undertaken by private sector can yield results as market forces drive them. Farmers can have land, hives and be producing honey but without markets, the industry will not thrive. Ongoing consultation is necessary for buyers to understand beekeeper operations and vice versa. There must be interaction and support and encouragement established among all stakeholders. All must comply with the requirements each other. There is a need to establish a high level of confidence in the industry by having reliable investors (local and overseas) that must work in consultation with government agencies, organized farmer associations, independent agencies and donor agencies.

Suggested strategies for industry associations, consultation, private-public partnership arrangements and evaluation are:

- to encourage farmers and industry associations to build capacity, mobilize farmers and engage in public-private partnership arrangements
- for private sector industry participants such as buyers, suppliers, processors and industry associations to facilitate extension, training, research and marketing activities at resource centres or own facilities
- for regular stakeholder consultation and review of activities
- for government to provide incentives to private sector organization in terms of tax credit, infrastructure support for private sector investment, and for use of facilities and resources under private-public partnership arrangements

Conclusion

This article has provided a brief history of the apiculture industry in Papua New Guinea from its beginnings in the 1940s until the present time. Notable events along the way were the New Zealand-PNG government bilateral aid project in 1976 that led to boom times for the honey industry in the eighties; the collapse of Honey Producers Limited in 1994 that led to the decline of the industry; the recognition of apiculture as a livestock sub-sector in the 2007-2016 National Agriculture Development Plan that saw funding being allocated; and the 2010 National Apiculture Industry Workshop in Goroka which led to the development of a strategic plan for the industry.

To achieve the objectives of the apiculture industry as covered by the Apiculture Strategic Development Plan 2010-2030, the National Agriculture Development Plan 2007-2016 and the government's Vision 2050, the authors have argued for eight target areas to be addressed. For each target area a number of strategies have been suggested. Critical for success are effective private-public partnership arrangements and the work of extension and advisory services. Ideally the partnership arrangements will mobilize resources and technical expertise to promote this industry, through a sustainable approach (Gonapa, 2010:54-55). By adopting the strategies for the eight target areas, the apiculture industry can thrive and become a sustainable cottage type industry contributing to the well-being of beekeepers and associated stakeholders and to the nation's economy.

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