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Education for Sustainable Development

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Abstract

This chapter focuses on Education for Sustainable Development (ESD) for communities selling medicinal plants in northern KwaZulu-Natal, South Africa. The purpose is to equip the participating medicinal plant sellers with knowledge and skills related to the trade of medicinal plants. In particular, the study focuses on cultivating the participants' awareness of the importance of conducting their business based on principles of conservation, sustainable livelihoods and environmental sustainability. The study followed a case study design within a mixed methods research paradigm. Data collection involved the use of face-to-face questionnaire administration and follow-up focused group interviews. Phase 1 results revealed a number of challenges faced by the medicinal plant sellers. These included processing, storage and packaging, lack of business skills and the conservation of medicinal plants and their products. Following a capacity building intervention based on ESD and non-formal education principles, phase II results showed that the medicinal plant sellers had revised some of their business practices—such as pricing techniques and record keeping. However, processing of medicinal plant materials, storage, packaging and conservation remained a challenge that needed further attention. In particular, sustainable harvesting practices and cultivation of medicinal plants in home gardens still presented some difficulties.

Keywords: sustainability, indigenous knowledge, medicinal plants, storage, conservation, marketing and packaging

1. Introduction and background to the study

1.1. Introduction

This study is a multidisciplinary research involving various stakeholders various stakeholders. The stakeholders were, among others, medicinal plant sellers, author(s) (as the researcher) and nature reserve owners (where medicinal plant species are conserved).

In discussing IK [1], state that traditional indigenous knowledge developed through a close connectedness with the physical and social environment that people used to enjoy. Wolfensohn, (President of the World Bank) noted that, "Part of any society's past and cultural values are its Indigenous Knowledge where, as human beings, we are expected to learn from in order to enhance developmental issues." This way, knowledge transfer within and among communities creates an enabling environment for people to deal with social, political and economic issues that affect their lives.

Echoing the above, the ESD explains indigenous knowledge as, "An endless process of learning that produces creative thinking individuals who are able to scientifically tackle problems to the benefit of society, hence ensuring a fruitful and sustainable environmental future." [2] concurs with [1] in acknowledging that ESD prepares individual for ecologically sustainable future. It also empowers them on restoring the earth's natural resources, hence fosters support for the well-being of future generations by promoting sustainable lifestyles.

In this context, the concept of ESD is used to explore the sustainable development of medicinal plant sellers in light of the plants they sell. The idea is to conserve the indigenous medicinal plant species before they become extinct. Medicinal plant sellers were targeted because they are part of the medicinal plant market chain. By virtue of their trade, medicinal plant entrepreneurs harvest many plant species for their business. The following section is the background to the study.

Contained in this chapter is the section that deals with this study's background, followed by the rationale for the study, study objectives and method of investigation. The last section discusses the study's results, interpretation and discussion. Finally, the chapter concludes by highlighting significant issues that emerged from the results.

1.2. Background to the study

The findings reported here are based on an earlier case study on medicinal plant sellers concerning the types, uses, quantities, prices charged and conservation nature of medicinal plants [3]. The case study revealed, inter alia, that medicinal plants are harvested by medicinal plant sellers without any thought of conservation on their part, thereby threatening the long-term survival of the selected plant species. The following species (**Table 1**) were found to require urgent conservation if they were to survive uncontrolled harvesting. Worse still, literature identified these species as being at high risk due to over-harvesting [4-7].

The conservation status of the medicinal plants listed in **Table 1** was compared for authenticity using the scientific sources of Red Data Records [4]. It was observed that over time, there is

danger that not all the 13 species may survive the current harvesting onslaught. For instance, medicinal plant species such as *Bauhinia bowkeri*, *Ocotea bullata* and *Warbugia salutaris* whose barks are harvested, take too long to mature, hence threat to their prolonged survival. For this study, the species mentioned were not propagated due to time constraint.

Family names	Scientific names	Zulu names	Conservation Status	Part used
Apiaceae	<i>Alepidia amatymbica</i> Ackl.& Zeyh.	i-Khathazo	Vulnerable	Root
Orchidaceae	<i>Ansellia africana</i> Lindl.	i-Mfeyenkawu	Vulnerable	Whole tree
Fabaceae	<i>Bauhinia bowkeri</i> Harv.	u-Mdlandlovu	Rare	Bark
Hycinthaceae	<i>Boweia volubilis</i> Harv.ex Hook.f.	u-Gibisila	Endangered	Bulb/tuber
	<i>Merwillia plumbea</i> (Lindl.) Speta	i-Nguduza	Vulnerable	Bulb
	<i>Eucomis autumnalis</i> (Mill.) Chitt.	u-Mathunga	Vulnerable	Tuber
Asphodelaceae	<i>Bulbine frutescens</i> (L.) Wild.	i-Bhucu	Endangered	Leaves
Zamiaceae	<i>Encephalartos natalensis</i> R. A. Dyer & I. Verd	i-Sigqiki somkhovu	Rare	Tuber
	<i>Encephalartos villosus</i> Lem	i-Mfingo	Rare	Root
Apolynaceae	<i>Haworthia limifolia</i> N. E. Br.	u-Mathithibala	Vulnerable	Whole plant
Apocynaceae	<i>Mondia whitei</i> (Hoof.f.) Skeels.	u-Mondi	Vulnerable	Root
Hypoxidaceae	<i>Ocotea bullata</i> (Burch.) Bill.	u-Nukani	Vulnerabled	Barks
Canellaceae	<i>Warbugia salutari</i> (G.Bertol.) Chiov.	i-Sibhaha	Critical endangered	Bark, stem, roots and leaves

Adopted with permission from Ref. [6].

Table 1. Priority species for conservation.

1.3. Rationale for the study

The rationale for this study was to identify ways by which medicinal plant sellers would conserve medicinal plant species since they are major stake holders in the medicinal plant selling business. Having realised that medicinal plant sellers harvested plant species in an unsustainable manner, it became necessary to bring to their attention the need to harvest plants in a sustainable manner. This involved various methods on plant conservation that ensured continued availability and future use of the said species. Thus, the study introduced the concept of sustainability, a concept described as a wise use of resources (medicinal plant species) for future generations [8]. Principles of sustainability include the recognition that the needs of future generations are not compromised as we seek to meet current demands. It was

necessary for the author(s) to engage medicinal plant sellers to share ideas on how to sustain medicinal plant species that are dwindling. This was sought to be achieved by the following objectives:

1.4. Objectives of the study

The study's objectives were

- To establish challenges faced by medicinal plant sellers in their medicinal plant selling businesses.
- To identify the quantities of medicinal plants sold in northern KwaZulu-Natal.
- To establish the key role players in the medicinal plant selling businesses.
- To share information on scientific and indigenous methods of propagating medicinal plants during the intervention programme.
- To assess the effectiveness of the intervention.

1.5. Research methods

This study involved a survey and case study concerning medicinal plant sellers in northern KwaZulu-Natal, South Africa. The study was conducted in the Province's three biggest district municipalities namely, uThungulu, Zululand and uMkhanyakude. For the Zululand district municipality, the study locale was the Mona market in the Nongoma area. Mona market is the largest market in northern KwaZulu-Natal, and it operates once a month. At uThungulu, the survey took place in Richards Bay and Empangeni town markets. Mtubatuba town and uMhlabuyalingana were the research areas in uMkhanyakude District Municipality.

1.5.1. Population and sampling

The research targeted informal medicinal plant sellers. Medicinal plant sellers were targeted because they harvest and stock large quantities of traditional medicine for trade purposes. This is over and above what is harvested by traditional healers for healing purposes, although the latter sometimes buy such products from the former. A sample of 56 medicinal plant sellers participated in the study, selected through purposive/judgmental sampling. Kumar [9] stated the major aspect for purposive sampling as enabling one to come up with suitable data so as to meet the research's purpose. Accordingly, one has to deal with prospective interviewees with regard to data for his/her study. Thus, the study's participants were purposively selected through informal household interviews with individuals who identified those with knowledge of medicinal plants, their willingness to share information and their experiences in selling medicinal plants. Participants also included those who volunteered to participate in the study within the confines of their medicinal plant shops. Other participants were the local authority employees from whom permission to conduct household interviews and field surveys were requested and subsequently granted.

1.5.2. The data collection process

ESD emphasises that people should enjoy their natural resources while not compromising future generational needs. In this study, the ESD programme served as a capacity-building intervention strategy, and it involved establishing trust between the researcher and community members who were medicinal plant sellers. The purpose was to address the issue of environmental awareness, conservation, marketing and storage of medicinal plant stocks. These aspects emerged as medicinal plant selling business's challenges that required attention. In addition the researcher roped in an expert resource person from the university to facilitate on economic and business management issues. Apart from the university-based resource persons and the community members, other stakeholders were the owners of the nature reserve (husband and wife) where the workshop was held. These two became resource persons during the workshop.

The first stage in data collection was preliminary research in public markets to identify resource persons for the study. Here, the researcher explained the purpose of the research. Subsequently, appointments were made with prospective participants for data collection. Market areas were chosen as initial sites for contacts. These provided important initial information about the medicinal plant sellers. Interviewing people at their business sites presented minor challenges such as possible interference from other respondents wanting to have an input where it was not required, in addition to direct interference with the flow of their business. In light of this, it became imperative to arrange for interviews at the participants' homes.

Interviews were followed by focus group discussions involving selected medicinal plant sellers from each market. This was to elicit, among other issues, challenges faced by the participants for which they needed capacitation. It is asserted by Borgatti [10] that focus group interviewing is particularly suited for obtaining several perspectives about the topic including gaining insights into people's shared experiences of daily life on the topic under discussion. The main purpose of focus group discussions in this study was to evaluate respondents' attitudes, feelings, beliefs, experiences and reactions concerning challenges they faced on daily basis in their business.

Furthermore, grey interview areas that needed further elucidation were followed up during the focus group discussions. There was one focus group per sampling site consisting of five individuals, except for the uMhlathuze Municipality which was represented by two members. These were the only medicinal plant sellers at that site. Altogether 12 people participated in the focus group discussions. The focus group discussions were audiotaped, transcribed, coded and analysed.

1.5.3. Nursery experiments

The experiments were conducted on vegetative propagation of the species highlighted in **Table 1**. The aim of doing these experiments was to replicate seedlings to supply to medicinal plant sellers. Vegetative propagation was chosen over sexual propagation in this regard

since it yielded more seedlings at a faster rate than propagation of medicinal plants through seeds. The method of vegetative propagation and the plants appearances after propagation was demonstrated to medicinal plant sellers. As stated earlier, not all medicinal plant species were propagated due to time limit. These included species such as *Ansellia africana*, *Haworthia limifolia* and *Boweia volubilis*.

Another purpose for conducting experiments was to determine whether medicinal plants germinate in different environmental conditions, for example, temperature, growth substrate, water requirements and light intensity. The experiments were done without adding plant species seedlings with growth stimulants. That was so the medicinal plant sellers could conduct similar experiments without having to add fertilizers and hormones to plant seedlings at home. The plants were watered in the morning, once a day till their growth stabilised. All the experiments were conducted in a nursery. The detailed experimental procedure for the three plant species are given below.

1.5.4. Propagation of *Ansellia africana* Lindl.: Orchidaceae

The stems of the plant were marked at the base and strapped to the fork of a tree. Similarly, a semi-shaded deadwood trellis could be made to hold a number of plants in accessible positions. Vegetative propagation of *A. africana* was done by Zobolo et al. [11] using the stem cuttings. The aim of the experiments was to determine the effect of growth medium, that is, cow dung manure and river sand at the average temperature of 28°C. Sexual production of the plant species was conducted by Diederichs et al. [12]. The results of the experiments shown in this chapter were conducted by Ndawonde and Imenda [13] using river sand. It was found that river sand is a suitable medium for the plant species since it drains easily and this removes water logging, thereby allowing the plant to absorb water easily.

1.5.5. Propagation of *Haworthia limifolia* Harv.ex Hook.f.: Hyacinthaceae

To plant *H. limifolia*, one has to cut offshoots from the stem and plant them separately. Roots would then develop from the part of the piece dug into the ground. A week later, roots also form from the upper part of the pieces, a sign that the cuts are stabilising. The adjustment would then lead to the expected growth of shoots after a month or so, but strictly under conditions from 23 to 30°C [12]. During experimentation, the top and bottom cuts were placed in river sand at the temperature range stated above.

1.5.6. Propagation of *Boweia volubilis* N. E. Br.: Apocynaceae

Bulb scales were broken off from large bulbs at the end of the growing season (that is, autumn or winter) and inserted upright into sand. Bulbs formed along the base were transplanted when large enough to handle.

Propagation through tubers was done by making two equal halves of the tubers, and then digging them into river sand. After a period of 2–3 weeks, the halves developed roots and become established.

2. The intervention

The Eurostat Adult Education Survey distinguishes four categories of non-formal education, namely classroom learning, distance learning, seminars and workshops and guided on-the-job training [14]. Practically, one finds a continuous interplay among formal, non-formal and informal education. As such, it is common to see non-formal and informal education dovetail in educational settings that are established to provide formal education. Certainly, within the notion of life-long learning, one has to be prepared to see continued interplays among these forms of learning. In this study, the dominant mode of non-formal education followed was a combination of seminar and workshop. Thus, the intervention was designed to address the challenges that emerged from the interviews and focus group discussions. Specifically, the workshop addressed conservation and marketing of medicinal plants, among other related issues.

Although the medicinal plant selling business is dominated by older women with minimal formal schooling [13], medicinal plant sellers were introduced to the concepts of balance sheet, record keeping and issues pertaining to banking. An accounting and business studies expert was invited to share with medicinal plant sellers viable business skills in terms of book keeping, marketing and pricing of their wares. As a scientist, the researcher handled issues of storage and conservation. Together with the nature reserve management team, they demonstrated how selected medicinal plant species could be properly cultivated and nurtured in order to capacitate the participants so that they could grow their own stock in their home gardens. The main purpose of conducting the demonstrations was to share with the participants' information on different environmental conditions under which different medicinal plants germinated and, therefore, how they could be cultivated. The demonstrations were carried out without any use of any growth stimulants. This way, it was envisaged that there would be an added desired outcome of creating space for social transformation among the plant selling communities, with the aim of taking them to a higher level of social responsibility.

This was done at a natural plant nursery chosen for its production of several plants regarded as now extinct due to over-harvesting in KwaZulu-Natal. The nature reserve was centrally located amongst the research sites. Its owners were part of resource persons who served as workshop facilitators. They understood and spoke iSiZulu, hence were able to communicate easily in participants' home language. The nature reserve owners facilitated on how to cultivate medicinal plant species. Discussions were carried out during the workshop, following various presentations in order to clarify issues raised during presentations and allow for the sharing of experiences and ideas.

3. Data analysis

Qualitative data involving the workshop results were analysed following qualitative methods of data analysis. Braun and Clarke [15] said qualitative analytic methods can be roughly divided into two camps: (a) those that are based on a particular theoretical or epistemological position and (b) those that "are essentially independent of theory and epistemology, and

can be applied across a range of theoretical and epistemological approaches.” Under the first category, for example, see Ref. [15] where conversation analysis and interpretative phenomenological analysis (which allow relatively limited variability in how the approach is applied within that framework) are placed.

4. Assessment of the intervention

The usefulness and effectiveness of the intervention was assessed through home visits by means of open-ended interviews, two months after the workshop (phase 1). The assessment focused on the areas directly addressed in the workshop, namely medicinal plant storage, marketing, sales and conservation. Assessment was done in phases so as to obtain near perfect results through constant monitoring.

5. Results

The results presented here are in line with the objectives of the chapter.

5.1. Challenges of the medicinal plant selling businesses

The study revealed that medicinal plant sellers were involved in the informal trade in traditional medicines. These results confirm findings by Botha et al. [16]. His/her findings were to the effect that traditional medicine vendors in South Africa traded under a shoe-string budget. Theirs was a case of surviving from hand to mouth, hence their failure to save enough to expand their vending ventures. In short, their income was spent on household needs.

This ESD study showed that the system of determining price units charged for the medicinal plants was determined by market leaders where medicinal plant sellers had shops. Neither banking nor record keeping of income versus expenditure was found to be commonly practised among medicinal plant sellers in this study. To further compound traditional medicine vendors’ woes, they do not keep records of their business dealings, hence cannot keep track of the business trend as should be the norm.

In addition, their business is affected by their lack of knowledge in terms of proper tree harvesting. That is, traditional medicine plant sellers’ methods of harvesting do not serve plants. Instead, their harvesting methods destroy the same plants they would need tomorrow to sustain their business. Positively, the medicinal plant sellers applauded the move to provide them with licences that would enable them to harvest their products in an environmentally acceptable manner.

The following subsection shows the quantities of medicinal plants sold at Mona Market, a wholesale of medicinal plants in northern KwaZulu-Natal.

The medicinal plant species in **Table 2** were also used in the Mona area. The wholesale has a variety of medicinal plant species, of which *Hypoxis hemerocallidae* was in highest demand (86–100%)

in all stalls. Although the plant cannot cure HIV/AIDS-related illnesses, it is believed to alleviate their symptoms [17]. Medicinal plant sellers were requested to reflect on this.

If transportation fee, time, work effort (in chopping up the plant material) and the risk of collecting plants in the fields is considered, a maximum price of R140.00 (14 dollars) per 50 kg reused maize bag would not be profitable enough to sustain the business.

Scientific name	Part used	Sub-sample (g)	Price (R)	25-kg and 50-kg size maize bags	Price (R)	Dollars
<i>Acorus calamus</i>	Rhizomes	207.09	5.00	25	60.00	6
<i>Acridocarpus natalitus</i>	Leaves	694.62	5.00	50	120.00	12
<i>Aptenia cordifolia</i>	Bark	65.72	5.00	25	30.00	3
<i>Callilepis laureola</i>	Bark	295.27	5.00	50	100.00	10
<i>Calodendrum capense</i>	Bark	235.52	5.00	25	60.00	6
<i>Capparis tementosa</i>	Bark	127.79	5.00	25	40.00	4
<i>Chlorophytum modestum</i>	Roots	562.40	5.00	25	50.00	5
<i>Clivia minnata</i>	Whole plant	194.49	5.00	50	70.00	7
<i>Conia capensis</i>	Whole plant	146.21	5.00	50	100.00	10
<i>Drimia robusta</i>	Bulb	207.09	5.00	25	60.00	6
<i>Erythrophyleum lasianthum</i>	Roots	350.94	5.00	50	100.00	10
<i>Hypoxis hermellocallidae</i>	Bulb	694.62	5.00	50	120.00	12
<i>Mondia whitei</i>	Bark/roots	14.10	5.00	50	140.00	14
<i>Ocotea bullata</i>	Bark	296.27	5.00	50	70.00	07
<i>Olinia radifolia</i>	Roots	146.11	5.00	50	80.00	8
<i>Sarcophyte sanguinea</i>	Roots	282.07	5.00	50	140.00	14
<i>Urginea sanguinea</i>	Roots	138.08	5.00	50	70.00	7

Table 2. Quantities of certain herbal medicines sold in Nongoma (Mona bulk sale), Northern KwaZulu-Natal region and, income generated by traders in standard 25-kg and 50-kg reused maize meal bags.

5.2. Role players in marketing and trade of medicinal plants in northern KwaZulu-Natal

There are no proper marketing strategies in place for medicinal plant sellers, be it national or worldwide. As a result any assessment of their customer base is hampered, inter alia, by demographic variances, different demands for different plants and the issue of those

who do wholesale trade of medicinal plants (those responsible for the harvest when given orders). **Figure 1** provides an overview of the marketing chain of the plants harvested in KwaZulu-Natal.

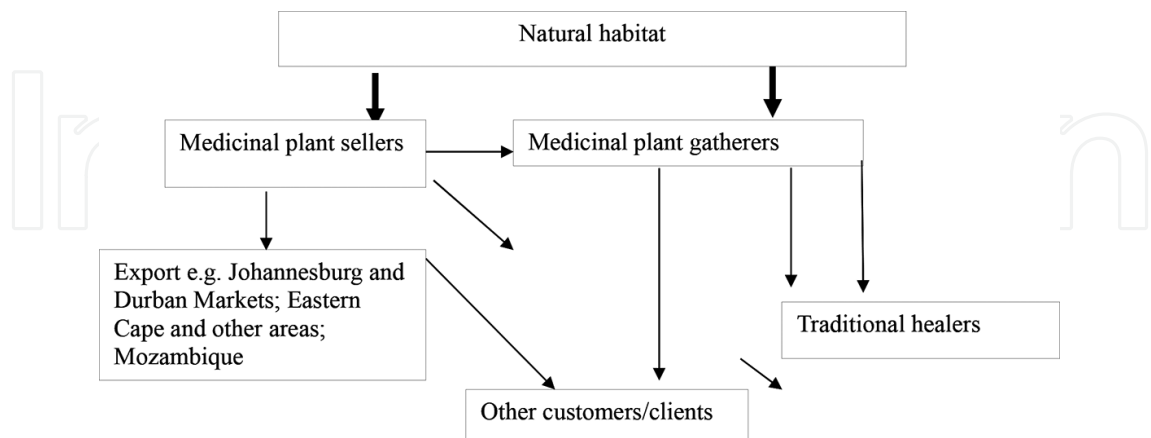


Figure 1. Marketing chain for medicinal plants harvested in Northern KwaZulu-Natal.

Figure 1 indicates a situation where prominent people in the medicinal plant business are wholesalers and retailers. But the majority are retailers as they also do plant harvesting as well.

The complicated market structure and inconsistencies in prices charged for medicinal plants was seen as not viable for medicinal plant selling business. For this reason, an ESD in communities that harvest plant species was proposed. The idea was to empower medicinal plant sellers with skills for conservational cultivation of medicinal plants on their own. The following section shows plant propagation by authors and the results thereof. There was information sharing among authors, medicinal plant sellers and nature reserve owners about growth experiments of certain medicinal plants.

5.3. Information sharing during the intervention programme

The workshop started by demonstrating on how medicinal plants are propagated following scientific and indigenous methods.

The results from nursery experiments were demonstrated to the medicinal plant sellers during the workshop. The demonstrations began with the propagation of *A. africana*.

5.4. *Ansellia africana* Lindl.: Orchidaceae

The results showed that *A. africana* was able to thrive in temperatures of 27–28°C in river sand. The following diagrams show the shoot formation of *A. africana* during experimentation.

5.5. Propagation of *Ansellia africana* using indigenous methods

Medicinal plant sellers reported that they propagated the plant species by attaching it to trees using cow dung. The same applied to the nature reserve.

For these indigenous ways of propagation, the time the plant takes to regenerate was not recorded by the propagators. The duration the plants take to grow, therefore, is not going to be reported on here.

When sharing information on vegetative production of *A. africana*, both the nature reserve manager and medicinal plant sellers wanted to try out propagation of the plant species in sand. The workshop participants confirmed that they did not know that *A. africana* could be propagated through cuttings and using sand as a growth medium. It was agreed that the issue of time the species take to form the shoots is important to consider. When using a traditional method, the success growth rate is 80%. It was reported, however, that the regeneration period is about 6–8 months. The second demonstration was on vegetative propagation of *H. limifolia*.

5.6. *Haworthia limifolia* Harv.ex Hook.f.: Hyacinthaceae

It was interesting to note that the top cuttings developed roots seven days after the start of the propagation period. The cuttings at the bottom stimulated the growth of shoots. After a month, the plants appeared as shown below.

The medicinal plant sellers reported that they grew the medicinal plant species in old three-legged pots where the plants continued replicating themselves. They reported that they had not thought of propagating *H. limifolia* through cuttings. They said they grew the whole branch of the species and put it on top of their huts or on kraal poles. It was explained to them that it is possible to grow the plant species through cuttings. Participants were advised that the decision to propagate the species without the growth stimulants while exposing the other set of the experiments to the sun was done to get a cost-free propagation method. This could be easily done by medicinal plant sellers in their homes.

5.7. *Boweia volubilis* N. E. Br.: Apolynaceae

Results of vegetative propagation of *B. volubilis* were demonstrated to the medicinal plant sellers as well. Further, medicinal plant sellers were assisted on how to grow medicinal plants. This included the types of soil suitable for specific plant species and how to care for shoots. In addition, bookkeeping and banking strategies for small businesses such as medicinal plant selling were shared with them. At the end, participants were encouraged to adopt and adapt these to suit their specific business needs and requirements.

The sellers were made aware of how to calculate the unit prices of their medicinal plants. The facilitators presented the issue of considering labour, transportation, time spent and marketing of the products, as contributing towards pricing their commodities.

5.8. Assessment of the intervention programme

Phase I assessment results revealed a number of challenges faced by medicinal plant sellers. These included conservation and business skills (such as marketing, pricing, banking of profits—as well as record keeping of trading stock, income and expenditure) and conservation of medicinal plants and products. Following a capacity building intervention based on ESD and non-formal education principles, phase II results showed that the medicinal plant sellers

had started revisiting some of their business practices—such as pricing techniques and record keeping. However, processing of medicinal plant materials, storage, packaging and conservation still persisted as challenges that needed further attention. In particular, sustainable harvesting practices and cultivation of medicinal plants in home gardens still presented some difficulties—including the non-availability of land and the lack of irrigation capacities to cultivate the various medicinal plant species. This was disturbing, especially given that most of the threatened and rare medicinal plant species exhibited very slow growth rates. The land issue appeared to be related to the matter of land ownership, particularly given that the majority of the medicinal plant sellers were women.

The second assessment revealed that medicinal plant sellers had diversified their businesses. That is, on top of their traditional merchandise they were observed selling a variety of small items such as edibles and non-edibles. It goes without saying that this boosted their income. Given the new business trend, chances of medicinal plant sellers' businesses failing were thus reduced. Small business failures are attributed to small capital usually injected to that particular business [18]. At the same time, one should not lose sight of the need for proper management skills if one's business is to grow as well. Riddix [19] reiterated that diversification helps to protect business capital from wild swings of the market, while achieving long-term growth at the same time.

6. Conclusion

The study's educational intervention, which was aimed at equipping the participating medicinal plant sellers with knowledge and skills related to their trade, was recognised as an innovative way of sharing university knowledge and skills with indigenous communities. In particular, the focus of the study on cultivating the participants' awareness of the importance of conducting the medicinal plant selling business was based on principles of conservation, sustainable livelihoods and environmental friendliness. In addition, participants were equipped with life-long business skill to help them manage and develop their informal ventures into sustainable business entities.

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