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Review on value chain analysis of medicinal plants and the associated challenges

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Abstract

At present, 80 percent of the populations in developing countries rely largely on plant-based drugs for their health care needs. The present medicinal plants value chain is characterized by the informal nature of its upstream base (producers, gatherers and collectors) and its better organized and more formally structured actors downstream (processors and wholesalers/retailers). Overall, the value chain operates with little vertical integration and almost no horizontal collaboration. The goal of this analysis is to provide a diverse group of stakeholders with the information needed to make sound decisions and plan interventions focused on developing productive and globally competitive industries dependent upon the sustainable management of scarce natural resources that will benefit local people. The collection and marketing of medicinal plants from the wild is an important source of livelihood for many of the poor in developing countries. Value chain strengthening is a potentially powerful tool for promoting NHWP (Nature, Health, Wealth and Power) - related development goals, but deliberate interventions are necessary to create opportunities for the rural poor. Medicinal plants can be collected from wild and cultivated areas. The supply chain is often very long with as many as six or seven marketing stages involving primary collectors and producers, local contractors, regional wholesale markets, large wholesale markets and specialized. Medicinal Plants supply chains have varying requirements for their cultivation, resource management in the wild, harvesting, processing, and importantly marketing. In order to become competitive in the medicinal plants global market place, value chain must become more flexible, innovative, and efficient, so it can bring to market new products in a timely fashion.

Keywords: Value Chain, Medicinal Plant, Producer, Least Developed Countries, Marketing

1. Introduction

Plants have been used since ancient times to heal and cure diseases and to improve health and wellbeing of organisms. Medicinal plants (MPs) play a significant role in meeting the demands of the traditional medicine markets, which are found both domestically in producing and in overseas markets and in economic, social, cultural, and ecological aspects of local communities. Despite ancient nature of the tradition, medicinal plants still form the basis of traditional or indigenous health systems and are reported by the World Health Organization (WHO, 2003) ^[35] to still be used by the majority of the populations in most developing countries.

Interest in traditional systems of medicine and, in particular, herbal medicines, has increased substantially in both developed and developing countries over the past two decades. The last three decades have seen substantial growth in herb and herbal product markets across the world. Rapidly rising exports of medicinal plants during the past decade attests to worldwide interest in these products as well as in traditional health systems. According to the Secretariat of the Convention on Biological Diversity, global sales of herbal products totaled an estimated US\$60 000 million in 2002 (WHO, 2003) ^[35].

At present, 80 percent of the populations in developing countries rely largely on plant-based drugs for their health care needs, and the WHO has estimated that in coming decades a similar percentage of the world population may well rely on plant-based medicines. Thirty percent of the drugs sold worldwide contain compounds derived from plant material.

The present MP value chain is characterized by the informal nature of its upstream base (producers, gatherers and collectors) and its better organized and more formally structured actors downstream (processors and wholesalers/retailers). Overall, the value chain operates with little vertical integration and almost no horizontal collaboration. Yet actors are conscious that there are local and export market opportunities for MP products without necessarily being able to identify consumer trends or react quickly to them at their level of operation (FAO, 1993) ^[14].

The Nature, Health, Wealth, and Power (NHWP) framework focuses on the nexus of natural resources, human health, economic concerns, and governance as a driving force in rural development. It highlights the interlinked challenges of (a) facilitating sustainable utilization and improved management of natural resources, (b) improving standards of health and nutrition, (c) promoting economic growth and poverty alleviation, and (d) empowering rural producers and institutionalizing popular participation in public decision-making (Criss *et al.*, 2006) [7].

Because of the expanding interest in medicinal plants, new income generating opportunities are opening up for rural populations. With many of the MPs gathered from the wild, the collection and sale of MPs is providing a complementary source of cash for many extremely poor rural households. However, despite the fact that the products collected can have very high value in the final products, the collectors typically receive only a small share of the final value, either because they are unaware of the real value, are unable to market it in the form wanted by buyers or are unable to market to these buyers (Shinwari and Qaiser, 2011) [34]. Thus, Value chain analysis will help to design ways of adding value at the producers to live and get the maximum benefits.

2. The concept of Value chain

The concept of value chains specifically as it relates to their role in the creation of products and value from local ethnopharmacological resources and its relevance for research on medicinal and health food plants. In a broad sense, a value chain describes the sequence of activities required to make a finished product from its initial starting material (Chopra and Meindl, 2004) [6]. Value chain research focuses on the nature of the relationships among the various participants involved in the chain, and on their implications for development. In practical terms, value chains are descriptions of the transactions and processing of a product until it reaches its end market.

However, while this sounds like a neutral, technical process, a key element of the value chain literature has been the recognition that the various actors in the chain are likely to have greater or lesser degrees of power, reflected in the kinds of incomes that each earns but also in the characteristics of the final product (Giuliani, Pietrobelli and Rabellotti, 2005) [17]. The impetus for value chain work arose from the increasingly varied value chains that can be seen for many products, both in terms of the addition of value (e.g. from simple, undifferentiated agricultural commodities to highly-processed, branded products) and the geographic distances that they cover (e.g. from very localized markets to international ones).

A fundamental distinction in the value-chain literature is between producer-driven chains and buyer-driven chains (Gereffi, 1994) [15]. This reflects the changing dynamics of the international trading system. For many commodities, changes in the regulation of international markets have increased competition among growers and traders, while, at the same time, it has become clear for certain value chains, final markets have been dominated by certain supermarkets or certain brands.

The focus of value chain research has been two-fold. One focus has been to understand how different kinds of value chain confer competitive advantage, by changing the way that a product is processed or sold (Recklies, 2001) [29]. Aside from this, value chain analysis has been used as a tool for understanding socioeconomic benefits, disadvantages, and

risks for the various member of such a chain. This second approach has been used successfully, for example for understanding the benefits of gathering non-timber forest-products most notably of plant and animal derived commodities with a high value (Wynberg *et al.*, 2003) [33], in the discussions about the benefits of Fair-trade products (Stiglitz and Myers 2006) [31].

A key element of these debates has been an assessment of the relative benefits to the primary producers, as compared to intermediaries, wholesalers, and retailers. Often it was found that farmers or gatherers only obtained a minimal share in the benefits of such products (Litvinoff and Madeley, 2007) [23].

Medicinal herbs, and the products derived from them, also seem to have very varied value chains. However, despite the size of trade in medicinal herbs and herbal products, surprisingly, very few studies have looked at the value chain. The WHO has estimated the demand for medicinal plants is approximately \$14 Billion per annum (2006) and the demand is growing at the rate of 15 to 25% annually. The WHO estimates that by 2050 the trade will be up to US\$ 5 Trillion. Specifically study conducted in Ethiopia a survey of medicinal plants showed that large and active demands for traditional medicines exist. Some 48 million consumers use about 56 000 tonnes of medicinal plants per annum, with consumers obtaining their plant material from healers, traders and by harvesting themselves. The consumption is based on largely wild plant stocks. Some 87% or 49 000 tonnes are harvested from wild stocks, with only 13% or 7 000 tonnes being cultivated. While the trade in raw medicinal plants is some ETB 423 million (or 42% of current expenditure on modern medicines (Mander *et al.*, 2006) [24].

The global value chain approach is a valuable analytical tool in understanding the impact of these changing patterns of internal trade in medicinal herbs and herbal products. This is despite the general criticisms that have been made of the global value chain (GVC) approach (Bernstein and Campling 2006, Gilbert, 2008) [3, 16]. Criticisms have focused on the inability of a GVC analysis to explain consumption patterns and for the inability to understand the general conditions of employment and production in poor countries. As such, a GVC approach allows us only to look at a particular slice of economic production. Despite this, the value chain approach can help us understand the kinds of impacts associated with the production of medicinal herbal products.

By understanding the external and internal linkages within production, processing and trade networks, it is possible to understand more clearly why the quality of herbal medicines may vary in different markets. The concept of the value chain also helps us understand the socioeconomic impact of this growing international trade, by illuminating the very different returns received by actors within different value chains. This commentary sets out some basic research needs in this area and offers a general model for assessing global value chains in herbal medicine.

3. Value chains of medicinal plants

While there is a relative abundance of reports on a range of food products (Menon, 2008, Wynberg *et al.*, 2003, Bryceson, 2008) [27, 33, 5], only a limited number of studies exist on value chains of herbal medicines. Alam and Belt (2009) [11] looked at the ecological threats to resources with respect to medicinal plant species and their depletion at a rapid pace due to over-collection from their natural habitats. The collection and marketing of medicinal plants from the wild is an important source of livelihood for many of the poor in developing

countries. For example in Nepal, more than three hundred thousand households are engaged in the collection of medicinal plants. A key outcome of their research has been the call for tightening restrictions on collection practices and secondly through advocating cultivation on a large scale.

Alam and Belt's (2009) ^[1] work focused on a project in Uttarakhand, northern India. It was proposed that the cultivation of a medicinal plant, Kutki (*Picrorhiza kurroa* Royle ex Benth.) Plantaginaceae, would benefit the farmers financially, provide social benefits and help preserve wild species. The European buyer would also benefit from having a secure supply of the plant from a fully traceable source. Although the authors claim that this was the first initiative of this kind between Indian farmers and a European company, there have been similar partnerships established in the UK for some time. Mander *et al* (2006) ^[24] conducted a survey of the trade in medicinal plants in Ethiopia and argued that both the Ethiopian government and the people of Ethiopia have benefited from having cheap and easy access to medicinal plants.

Alam and Belt (2009) ^[1] conclude that the cultivation of medicinal plants is more difficult than usually suggested in the scientific literature and government promotional material and stress the importance of agencies and NGOs taking these difficulties into account and take steps to minimize these difficulties. The authors further argue that, a thorough technical and economic feasibility study of the value chain, long-term involvement and an understanding of the prevalent farming systems are required to ensure the success of the chain.

A more optimistic outlook with respect to the economic potential of medicinal plants in Bangladesh is provided by Shahidullah and Haque (2010) ^[30] who suggest that a vertical integration is needed in order to benefit producers and processors at the beginning of the value chain. Their findings indicated that intermediaries dominated the primary and wholesale secondary markets and their study challenged the view that medicinal plant cultivation was only appropriate for relatively well-off people with better access to land, capital, and information. The authors argue that some of the mechanisms employed in developing and sustaining institutional relationships may also apply equally well to defining the medicinal plant value chain and list contracts, quasi-vertical integration (especially close and long term relationship), tapered vertical integration (when a company sources inputs externally from independent suppliers as well as internally within the same company), cost plus agreement (the contractor is paid a negotiated amount regardless of incurred expenses), joint ventures and strategic alliances as examples of these potential relationships. Moreover, they argue that the benefits of an integrated value chain are numerous. It enables primary producers to become active participants in the process, it removes market access barriers, results in better commercialization of products and is attractive to companies as they can have greater control over quality and supply.

Contrary to previous views of Alam and Belt (2009) ^[1], Shahidullah and Haque, (2010) ^[30] found that the cultivation or production of medicinal plants could play an important role in improving the livelihoods of poor or extremely poor people owning meager strips of land.

They argue that in order to sustain growth in medicinal plant production, a fair distribution of the gross margin to the primary producers is necessary. In the value chain system examined, it was found that downstream buyers, especially

manufacturers and consumers pay most of their money for intermediaries' value additive opportunistic pricing due to inherent weaknesses in the chain. It is suggested that a vertically integrated chain, with only producers and processors as commercial actors and NGO's as promoters could create an economically robust system which will benefit the many rather than the few.

The analysis of the MP value chain is enhanced through full consideration of the role of natural resource management, health concerns, and governance issues. Value chain analysis (VCA) is an important tool for understanding the linkages between local-level NHWP (Nature, Health, Wealth and Power) dynamics and broader market systems. According to Booker *et al* (2012) ^[2] from the field observation, suggest that it is possible to increase value chain efficiency and competitiveness but that these improvements alone will not necessarily improve the lives of the rural poor. Value chain strengthening is a potentially powerful tool for promoting NHWP-related development goals, but deliberate interventions are necessary to create opportunities for the rural poor. In this regard, some key points that emerge from analysis of the MP value chain through a VCA/NHWP lens include:

Nature

- **Conservation incentives:** Economic opportunity does not necessarily translate into incentives to manage resources sustainable for all actors in the value chain. Deliberate, sustainable management of MP (e.g., cinnamon, ginger, cloves) as plantation or agroforestry crops is associated with stable demand, which creates longer time horizons for decision-making.

- **Cultivation:** There is a trend toward plantation cultivation and vertical integration of some products by downstream firms, providing them a regular supply and greater control over quality. This trend strengthens the value chain, but it also risks taking the means of production out of the hands of the rural poor and limiting their participation in the value chain. Several firms have helped local people upgrade production techniques by promoting improved harvesting and cultivation in agroforestry or forest gardens. This upgrading improves supply of raw materials for downstream actors, while having positive effects for local producers and ecosystems.

Health

- **Quality of and access to medicine:** In the rural areas where 70 percent of the population lives, continue to depend on plant-based, traditional medicines for cultural and financial reasons. The strengthening of norms and standards for medicines, as international markets demand, should lead to effective medicines being available and accessible on the local market.

- **Legitimization of traditional practitioners:** The Government of Madagascar is actively promoting the role of traditional medical practitioners and herbalists in order to increase the range of health care options. The legitimization of traditional practitioners is an important element in upgrading the quality and availability of healthcare, stimulating demand for high quality MP products and strengthening the value chain overall (Criss *et al.*, 2006) ^[7].

Wealth

• **Poverty reduction:** The majority of producers are poor (and young and/or female). MP are a source of cash income as well as means of diversifying household livelihoods. The amounts are small but not insignificant. There are opportunities to improve the position (and income) of the poor: by improving their power to negotiate prices (perhaps through a producer association), by providing stable markets for their products, or by creating opportunities for local level value-added processing (perhaps through community-level distilleries or incentives for quality control and traceability). Some producers feel that employment in plantations could increase income security, health standards and connectivity to more formal agricultural technology. A more detailed economic analysis is necessary to compare the relative advantages of production systems for smallholders.

• **Social relations between producers and collectors:** Collectors often deal in multiple products (many of which, such as rice, are more important than MP) and provide additional services such as credit. Local producers have little power to influence prices in the face of effective local-level (single potential buyer), and they accrue limited direct benefits from participation in the value chain as a result. Efforts to improve the bargaining position of producers must address the multifaceted nature of this relationship. Integrating MP producers into a broader, existing cooperative structure could improve their bargaining position. Providing services such as small credit or cereal banking through the cooperative could further strengthen the bargaining position by reducing dependence on collectors (Criss *et al.*, 2006)^[6].

Power

• **Producer organizations:** Producer associations are almost non-existent in MP sector, in part because production is “part-time” for most gatherers and producers, and in part because of the immense distance between actors. Producer organizations will be difficult to form and time consuming. However, they are necessary to improve the position of producers, to enhance the efficiency and equity of the entire value chain, to promote participation in decision-making and to promote sustainable practices. At current levels, it is unlikely that producers will have incentive to self-organize. However, it may be possible to organize them under pre-existing groups.

• **Strengthening local government.** Receipts from taxes are a potential source of revenue for cash-strapped communal governments. However, few of governments have the capacity to monitor or enforce their own policies in this regard, so there is significant leakage. Strengthening this capacity, enabling communal governments to collect taxes could provide incentive and ability for them to monitor resource use. Revenue could be reinvested in natural resource management. But it can also foster accountability from constituents if it is seen as contributing financial resources of consequence.

The MP value chain is characterized by the informal nature of its upstream base (producers, gatherers and collectors) and its better organized and more formally structured actors downstream (processors and wholesalers/retailers). Overall, the value chain operates with little vertical integration and almost no horizontal collaboration. Producers and collectors have little access to end-market information, obtain fewer benefits relative to other actors, and are the least integrated in the value chain.

4. Contribution of medicinal plants to sustainable livelihoods

For millennia, people have relied on nature – plants, insects, animals, and fungi – for their healthcare. Communities, through time, have discovered innumerable plant species with various medicinal uses, and accumulated considerable ethnobotanical knowledge to enhance the quality of their lives. The origins of traditional herbal medicine predate all existing records, and this ancient knowledge, across different parts of the world, is enormous.

An estimated 50,000 – 70,000 species of higher plants - 1 in 6 of all species - are used in traditional and modern medicine throughout the world, and many more species are important to the growing market for plant-based cosmetics and other products, representing by far the biggest use of the natural world in terms of number of species (Leaman, 2008)^[22].

Today, in many developing and transition countries these species make an essential contribution to health care, providing the only effective medicine for the significant proportions of the population, where other forms of medication are either unavailable or unaffordable.

An estimated 80 percent of the population in Africa and Asia rely largely on these plant-based drugs for their health care needs, and the WHO (2008) has estimated that in coming decades a similar percentage of the world population may well rely on plant-based medicines.

Most of these species are used only in folk medicine and the majority of the MP trade occurs within countries at local level (FAO, 1997a; Hamilton, 2004; Diederichs, 2006)^[13, 18, 6]. These local markets provide a potential lucrative trade opportunity for small-scale farmers. However approximately 3,000 of these plant species are traded internationally.

The Secretariat of the Convention on Biological Diversity values the annual global export of MPs at US\$1.2 bn (based on customs value declarations — the real situation is likely to be higher, based on actual invoiced prices). Some 30 percent of the drugs sold worldwide contain compounds derived from plant material (FAO, 2005a)^[11].

Approximately 100 plant species have contributed significantly to modern drugs: the anti-cancer compound taxol is extracted from the Pacific Yew Tree (*Taxus brevifolia*), and phytochemicals from *Pterocarpus osun* are used in the treatment of sickle cell disease (FAO, 2009)^[10]. Although Phyto-pharmaceuticals are heavily regulated and mainly in the hands of large processing firms for medicines, there exists good potential for small scale farmers to grow plants on a contract farming basis for such large firms. As a result the expanding interest in MPs, new income generating opportunities are opening up for rural populations and in particular for small-scale farmers.

Medicinal Plants (MPs) can assist in supporting farm households with income generating activities, can provide a ‘safety-net’ if other anticipated incomes fail, and overall can help the rural economy by contributing to subsistence medicine and health care provision.

With many MPs, cultivated and/or sustainably wild harvested, their marketing can provide a complementary source of much needed ready cash for small-scale farmers. Furthermore, activities related to the farming, collection and primary processing of MPs represent primary opportunities for rural women to engage in income generating activities.

However, despite the fact that the products cultivated and/or collected can have very high value in terms of final products, small-scale farmers and collectors typically receive a small share of the final value, either because they are unaware of the

real value, are unable to market it in the form wanted by buyers or are unable to market to these buyers (FAO, 2005) [11]. The degree of processing and adding value varies greatly between plants, and rural context, and while the trade in some products is largely confined to local, national and regional markets, others are successfully internationally traded commodities.

5. Production/Supply, Value Addition and Distribution

5.1. Production

According to the study carried out by Kuipers (1997) [20], there are two sources of supply of medicinal plants: i) material collected from the wild; and ii) cultivated material.

6.1.1. Wild harvesting

Wild harvesting is the collection of plant material from wild sources. This material can take many forms, such as the bark, leaves, fruits, herbs, flowers, wood, or roots. It may be collected from many locations, including open pasture, waste agricultural land, gardens, the roadside, or forestland. In some cases, the plants may be “weeds” found in agricultural or wasteland; in others, they may be plants or parts of plants found in horticultural areas or in forestland.

The bulk of the material traded (both domestically and internationally) is still wild harvested and only a very small number of species are cultivated (Lange, 1996) [21]. It is difficult to provide accurate global data on the volume of wild harvested medicinal plants as it is very difficult to distinguish between wild and cultivated material. Although data can be indicated for some specific cases, there is very little actual global data on the volume of wild harvested medicinal plants. Herbal raw material is often either collected by wage laborers (often from outside the state) or farmers with small landholdings. Cultivation of herbal raw material is rare: in Bangladesh, for example, more than 90 percent of the collection of medicinal plants is from the wild. Illegal and unscientific collection is common. Although the major part of wild harvested material is sourced from developing countries, a surprisingly high amount is also gathered in developed countries.

Of major concern is the fact that a significant part of wild harvested material is now traded commercially. As the prices paid to the gatherers tend to be very low, commercial plant gatherers of the natural resources rather than manage them, as their main objective is to generate an income. Although there are many common species that can be harvested sustainably and with little impact on their survival, an increasing number is not in this category. Of particular concern for the sustainability of the wild resource is the fact that many of the materials are the roots of plants, which are the most difficult plant parts to harvest sustainably.

According to the Report of the Task Force on Conservation and Sustainable Use of Medicinal Plants (2000), a critical factor in wild harvesting is the availability of cheap labour to undertake the very labour intensive work of gathering. Because in many cases income from such sources represents the only form of paid employment for inhabitants of remote rural areas, there is a ready availability of workers. Further, contractors who employ the collectors often act as middlemen and traders as well. Collectors are often dependent on contractors as they are poor and often owe money to the contractors.

Most countries have few or no regulations, which control the collection of material from the wild. India, Bulgaria, and Nepal are notable exceptions. India has banned the export of

several wild species in their raw material form, although the export of finished products containing the material is allowed. A major part of the high range Himalayan plants are wild harvested and any of these are close to extinction from over-harvesting or unskillful harvesting:

6.1.2. Cultivated material

Cultivated material is more suitable for large-scale uses, such as the production of drugs by pharmaceutical companies, which require standardized products of guaranteed or known content and quality. These quality requirements are becoming increasingly important as drug regulations become more stringent in many countries.

Argentina, China, Hungary, India, Poland, and Spain are examples of countries that cultivate some materials on a large scale. Requirements of successful commercial cultivation operations are to produce high quality drugs using low input cultivation methods while recognizing that the material has to compete on a highly competitive international market.

Given the higher cost of cultivated material, cultivation is often done under contract. In the majority of cases, companies tend to cultivate only those plant species, which they use in large quantities or in the production of derivatives and isolates, for which standardization is essential and quality is critical. Some grower cooperatives or collaborative ventures have been set up to enable growers in some countries to achieve greater negotiating power and achieve higher prices.

These have tended to be in developed countries, such as the Netherlands, and in Eastern European countries, which export significant quantities to the rest of Europe and to North America.

Globally, the areas cultivated are limited because cultivated material bears higher production costs, must have secure land ownership or access and requires more sophisticated (and costly) management expertise. Costs must be carried for long periods – in many cases over ten years. The low prices of wild harvested material make the return to cultivation low in many cases.

Wild harvested material is often sold as cultivated. An estimate for Germany suggests that some 70-90 percent of the medicinal plant material imported into that country has been wild harvested (Lange, 1996) [21]

6.1. Distribution

The supply chain is often very long with as many as six or seven marketing stages involving primary collectors and producers, local contractors, regional wholesale markets, large wholesale markets and specialized suppliers.

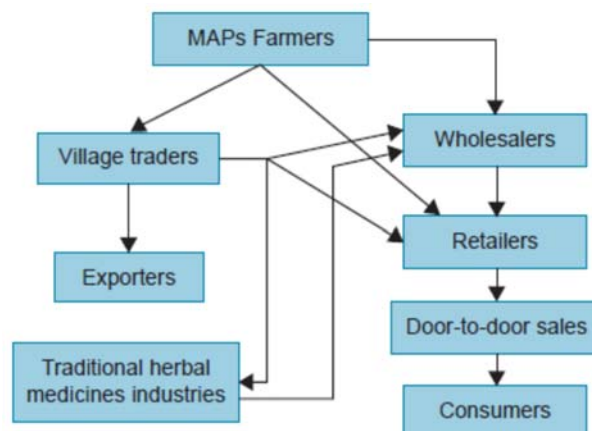


Fig.1: Supply chain of medicinal plants (Marshal, E., 2011) [9]

The long supply chain contributes to the low prices primary collectors and farmers receive for their products. As collection is still more common than cultivation, huge differences in the quality of raw materials occur. The differences concern the amount of active ingredients based on where the plants were grown, what parts of the plants are being used, how the plants were harvested and how they were stored. Raw material is often also adulterated, as collection from the wild cannot guarantee the uniformity of raw material.

Industry buys from suppliers and wholesalers rather than direct from smallholders because of the substantial quantities and broad range of raw material that is needed. This makes product traceability nearly impossible. Currently, contract farming and buy-back arrangements provide the only practical alternatives for exporters whose customers require traceability.

Both global exports and imports have been increasing, although the total value has been declining, suggesting falling average unit prices from 1991- 2002 (FAO, 2005a)^[11]

The contribution of LDCs (Least Developed Countries) as exporters have their own share; for instance Sudan and Afghanistan can be seen to be the dominant exporters, 63% and 23% respectively over the period 1998-2002 (FAO, 2005a)^[11].

Markets for herbal medicines in developed countries – especially in Europe and the United States – are highly regulated and very difficult to penetrate, particularly for developing countries and LDCs whose materials have not undergone the stringent tests required by developed country pharmaceutical manufacturers before mass production. Developed countries therefore tend to export unprocessed or slightly processed materials. In the case of India, around 80 percent is export of raw materials including dried plants, extracts and isolated ingredients. The export of finished medicinal products, mostly homoeopathic and ayurvedic medicines, accounts for the remaining 20 percent. Some developing countries with a long tradition of use of medicinal plants are major exporting countries – China, the Republic of Korea, Chile, India, Brazil and Thailand, for example. Exports are predominantly in raw material form and only to a lesser extent finished products. With their large populations and ancient heritage of traditional herbal-based medicines, China and India are two of the world's largest markets for medicinal plants, though not necessarily the largest traders (FAO, 2005a)^[11].

7. Strategies for successful and sustainable marketing

Medicinal Plants supply chains have varying requirements for their cultivation, resource management in the wild, harvesting, processing, and importantly marketing. The generic activities common to most MP supply chains while the people and organizations who may commonly be involved in MP supply chains. In local MP enterprises where the market channel is short, the same people (small-scale farmers, collectors) often harvest, process, and sell the product to the final consumer. In longer chains, it is more common for different activities to be carried out by different individuals, groups, or organizations.

For trade to be equitable, individuals or groups should be reasonably compensated for their contributions (labour, technical expertise, marketing skills, etc.), and level of risk taken. The variation in MPs, from raw fruits and food to aroma chemicals and phyto-pharmaceuticals, is reflected in a wide range of different types of markets, from bulk to niche,

informal and seasonal, to formal and regulated.

Most plants are traded regionally and in small quantities, in rural, peri-urban, and urban settings.

For example, it is estimated that informal trade in MPs in southern Africa is dominated by 500 000 traditional healers that dispense crude remedies and herbal medicines from more than 1000 plant species, to between 50 and 100 million consumers (Diederichs, 2006)^[8].

A study conducted in Ethiopia indicated that Large and active demands for traditional medicines exist. Some 48 million consumers use about 56 000 tonnes of medicinal plants per annum, with consumers obtaining their plant material from healers, traders and by harvesting themselves (Mander *et al.*, 2006)^[24].

As such, for small-scale farmers and/or collectors to move from subsistence to trade, or small informal traders to move into more regulated small-scale businesses, various barriers to entry into trade are often encountered, for example access to seedling for planting, to the resource in the wild and market information. As activities become more specialized further along the supply chain, there are greater opportunities for single traders or small groups of traders to exert their market power and establish mechanisms to prevent others entering the business (Marshall, Schreckenber & Newton, 2006)^[26]. In addition, export oriented marketing is particularly demanding, requiring detailed information about specific markets, product specifications and standards. A key challenge for people involved in MP activities is to identify these barriers and, where possible and legal, identify ways to remove them.

Supply chain analysis can improve understanding of how trade networks operate, who the main actors and organizations are and what their specific activities are, the different routes for trading the MP (which exist and could potentially be developed), and the skills, capacity and experience available for successfully engaging in trade.

In local, medicinal markets, consumers mostly require fresh (with the exception of bark), undamaged and effective medicines. As most consumers are from low income brackets, the demand for value added products may be limited, and in southern Africa in particular, it is likely that the demand for crude traditional medicines will increase given the HIV/AIDS pandemic that is giving greater use for traditional medicines as an alternative to expensive and often unavailable Western drugs (Diederichs, 2006)^[8].

7.1. Managing cultivation and the natural asset base

The majority of MPs exhibit different natural abundance and reproductive rates. Domestication, cultivation and resource management in the wild techniques need to be mastered by small-scale farmers and/or collectors. These improve quality and yield; can increase livelihoods, with some external support). Indeed, given the demand for a continuous and uniform supply of MPs and the accelerating depletion of forest resources, increasing the number of MPs species in cultivation is an important strategy for meeting a growing demand. Compared to the quantity of wild harvested MPs, few species are currently cultivated, and one explanation for this may be that cultivated plants are sometimes perceived by consumers as being of inferior quality compared to slower growing wild specimens, which can have higher rates of active ingredients. This is a challenge and requires support from both public and private institutions to change such perceptions. This can be carried out by informational and promotional campaigns in local communities to change

consumers' perceptions on cultivated MPs. Domestication of a previously wild collected species requires both substantial investment of capital, know-how and also several years of investigations (FAO, 2003)^[12].

Resource management plans for harvesting of wild MP resources to be sustainable, market demand must be balanced with the availability of the species in the wild, and its recovery rates after harvesting.

Where commercial harvesting is proposed or already taking place, a species management plan is needed in order to accurately assess impact and establish sustainable harvesting rates. To effectively undertake many of the components of a harvesting management plan will require technical extension support.

The most useful and practical guide available for the preparation of a management plan, detailing how to measure plant populations, distribution, harvesting yields, etc., written specifically for supporting communities to sustainably utilize non-timber forest product species, is found in (Peter M.C. (1996)^[28].

7.2. Harvesting Techniques

The quality of MPs and the sustainability of extraction are closely linked to how plants are harvested. Many MPs can be harvested without harming or killing the individual tree or plant, but it largely depends on what parts are harvested as to the potential impact on the individual plant. For example, harvesting an entire individual plant to extract medicinal properties can have a detrimental impact upon a species. Likewise, bark is frequently collected for medicinal property extraction, and intense and frequent harvesting often results in ring barking of trees, which can subsequently die (Diederichs, 2006)^[8].

Furthermore, the time of harvesting, and other processing aspects such as the rate and temperature of drying, and storage conditions can influence the quantity and quality of yield. The season, time of the day harvested and technique adopted all vary depending on whether mature or tender parts are harvested, and some medicinal herbs are collected only at night. Roots are often harvested by digging 15 to 20 cm away from the plant and by levering the root. Exudates, such as resin, are tapped into small containers and transferred to plastic containers, or recycled tin cans. In many cases, the harvested products need to be field-dried for short periods to remove excess moisture, whereas more perishable products such as flowers may need to be processed or transported without delay.

7.3. Processing

Processing MPs to add value, stabilize properties for a longer shelf life, and improve hygiene, occurs at different scales using a range of technology and equipment, from basic to very specialist. Production facilities may range from simple units, which extract incense or essential oils, to highly sophisticated factories producing perfumes and medicinal preparations.

Processing for local use may simply involve preparation methods such as hot and cold water extraction, expressing the juice after crushing the plant, powdering dried plant material using water, oil or honey to transform a dried powder into pastes or even fermenting the plant matter, using a source of sugar.

As such, preparing doses from extracts can be a suitable activity for a small-scale enterprise, thereby helping meet the healthcare demands of local populations. As medicinal

compounds often naturally occur in small quantities in a plant, processing can require large volumes of raw material, and therefore scaling up or expanding an activity can have natural resource and infrastructural implications.

7.4. Drying and packaging

Drying is the most commonly important processing technique for MPs, since many more specialized processing technologies require dried MP material. Options include shade, oven or freeze drying. Shade drying is the lowest cost option: plant material should be chopped into small pieces and placed onto permeable material that allows airflow from all directions, and dried away from air pollution and dust. Oven drying is faster and more effective than shade-drying and as such involves less risk of fungal contamination and "aflatoxin infection (toxic compounds produced by certain moulds).

However, large drying ovens are an expensive investment for a small-scale producer/processor. Freeze drying is the most expensive and comprehensive drying technology, reducing plant material to very low moisture contents, and providing stable material with limited risk of infection and concentrated medicinal properties, for long periods of time (Diederichs, 2006)^[8].

Traditional knowledge and processing In the informal markets of southern Africa, for example, MPs are mostly sold in raw unprocessed forms, or in a basic processed form (chopped, ground, or boiled extracts). Collectors often sell plants to traditional healers who have the knowledge to undertake the necessary steps to prepare medicines suitable for administering.

Packaging is usually simple, using locally available and free products such as newspaper wrappings, plastic packets, and recycled glass bottles. Commercial pharmaceutical operations, by contrast, produce medicines under strict regulations concerning processing and packaging. Traditional knowledge is closely tied to processing as healers can both identify plants with medicinal properties, and understand what mixtures and doses of plants can be used to treat particular ailments. Often specific mixtures are the specialty of individual healers. The traditional manner of application of a MP should inform the type of processed product to be manufactured from it (Diederichs, 2006)^[8]. Processing can be adjusted in many cases to suit different consumer groups, and it can be advantageous to process a range of types of the same product, such as the echinacea herb used as an immune booster which is available as a tea, tincture, capsule, pills, and specifically dosed syrups for children.

7.5. Safety

Based on the long history of MP usage, users of traditional medicines accept that they are safe for human consumption. However, the absence of regulation of the MP trade in aspects such as collection, processing, and storage provides no such guarantee, and environmental pollution, misidentification and adulteration can provide further grounds for concern.

7.6. Storage

The shelf life may vary for different MPs, and different MPs should be stored separately. Recommended storage areas should be well ventilated and designed to prevent contamination by insects, rodents, etc., and good attention should be paid to the cleanliness and good maintenance of such areas. Humid shady conditions are required for roots and tubers for evaporative cooling, and sawdust and straw can be

used for fruits and other more perishable products to avoid skin damage. Spreading over ventilated trays can be a useful way to store dried MPs. Storing plants, extracts, tinctures and other preparations may require controlled temperature and humidity conditions or protection from light.

7.7. Packaging

Packaging to avoid damage during transport is different from packaging to produce a final product, grade it, or improve its presentation and shelf-appearance.

Some products are sensitive to compression or impact damage and bruising, and others to contamination, and as such require individual wrapping with appropriate mediums, such as straw, bubble paper, corrugating medium, wooden, or plastic trays.

7.8. Organization

Good organization can increase resiliency to external shocks, and access to new markets, and is about making the most of social assets and personal skills for successful marketing. This can have a positive impact on:

- Improving product quality and making supply consistent, and being able to diversify through different processing methods;
- Overcoming large distances to the point of sale and achieving more cost-effective means of transport and marketing;
- Being able to access and acting upon market information and in doing so increase the ability to negotiate with other 'actors' in the supply chain;
- Promoting the product to potential traditional healers, consumers, pharmaceuticals, etc.
- Improving levels of transparency between collectors, processors and traders to avoid the concentration of market power in a few hands.

The ability of a group of people or a community to organize itself to have a positive and sustained impact is influenced by a number of factors including social cohesion, the existence of other forms of organizations, and the presence of charismatic individuals able to motivate people to action. There is a tendency, when MPs are collected from private land, for the organization to take the form of a cooperative, and where the resource is collectively-owned, to lead to the development of communal organizations (Marshall, Schreckenberg & Newton, 2003)^[25].

Sources of external support can be helpful in establishing and strengthening community organization.

7.9. Marketing and market information

Successful marketing can result in improved income, status, and confidence for those involved in

MP activities, and some general approaches include:

- ✓ Awareness of market demand by talking to different traders and healers about volume and price, what consumers are purchasing, etc.;
- ✓ Exploring different marketing options depending on resource access and transport infrastructure, selling unprocessed or processed, directly or indirectly to customers, traders, traditional healers, regional wholesalers, etc.;
- ✓ Adding value where possible, and prolonging shelf-life of the more perishable medicinal products through grading or processing into simple products, including dried leaves, oil extracts, etc.;
- ✓ Good organization to collaborate with other collectors,

processors, traders, etc., and pooling stocks to attract traders who prefer to buy bulk quantities;

- ✓ Sharing knowledge and experiences with other collectors or traders and, where necessary, the cost of seeking external advice;
- ✓ Where possible, share resources with other collectors, processors, or traders, and re-use and recycle equipment, to reduce capital investment;
- ✓ Gain familiarity of existing markets and trading routes, to help identify new types of products, or niches for existing products, which could be filled.

Successful marketing strategies are subject to local and transport differences, and consumer preferences. They may differ for MPs, which are traded fresh, or processed, or in bulk or as high value low volume products. Establishing a good relationship with traditional healers and other buyers comes from delivering reliable qualities and quantities of MPs, and it can be advisable to start modestly, securing a small network of buyers to whom a reliable supply can be delivered.

7.10. Niche marketing

In recent years green consumerism, coupled with a concern for environmental conservation and a preference for organic products, has provided a new impetus for MAPs.

However, green marketing is a competitive and heavily regulated industry, and requires both specialist knowledge and considerable financial investment to become certified. Requirements for any credible certification, with which a price premium can be placed on the marketed product, include meeting sustainable management criteria. Aspects of this are inaccessible, both financially and technically to small-scale producer communities or organizations, and would require external support to undertake.

Niche marketing is therefore relatively inaccessible to small-scale producers, unless they are able to bulk up the supply of their product through some type of formal organization, directly to a wholesaler who will pay them a premium for their product.

In most cases it is almost certain that producers would require both investment and external expertise in order to achieve recognized certification, including Fair Trade status, guaranteeing them access to a premium paying niche market. Accessing market information Market information is varied but generally related to quantity, quality and price characteristics of particular products in different markets, and is essential to enter new markets and hold onto existing ones. Good organization can help develop social assets and contacts with a variety of traders and healers, and help access more market opportunities.

Market information is only part of the picture, and those involved in MAP trade also need to have the capacity to be able to act upon it (Marshall, Schreckenberg, & Newton, 2006)^[26].

Market information and contacts can be less crucial when marketing a product with high demand, or marketing very locally.

It does however often become more important for trade when investments are made in processing and grading to sell different products at different prices. Medicinal plant collectors can be vulnerable to market concentration in the hands of only one or a few traders, traditional

healers, or organizations, because of often low formal education levels, and remoteness from information sources. Community organizations and other forms of external support can enable collectors to negotiate improved working relationships with existing traders, or even seek new opportunities.

Education, business skills and a willingness to take risks Level of education can be an important factor in determining people's capacity to engage in income generating activities. At collector level it appears the informal education and learning on the job may be more important in ensuring a household's success, but for trading beyond a local level, basic bookkeeping and numeracy skills are often required (Marshall, Schreckenberg & Newton, 2006)^[26]. Personal characteristics, such as self-confidence, a willingness and ability to experiment, innovate, and take risks, and in particular, attention to detail, are all often as equally useful qualities to have for MAP collectors and traders. Furthermore, culture and tradition and a community's indigenous knowledge can be very important in determining success, both in terms of MP resource management, and the customary procedures for working with, and supplying, traditional healers.

Diversification options to reduce vulnerability Diversified MP activities, through access to a range of products available for collection or trade is generally associated with reducing vulnerability and risk and enhancing sustainability.

Alternatively, processing the same product can provide a range of goods to cater for different consumer preferences, and in turn diversifies the market. Other ways to diversify small-scale enterprises can include incorporating useful by-products, perhaps from processing raw material, into other activities. An example might be to use branches of suitable species, once the leaves containing medicinal properties have been extracted, in agricultural mulches.

8. Challenges & Opportunities

Challenges for Least Developed Countries

- ✓ The indigenous medical knowledge is enigmatic and hence the secrecy prevents free knowledge sharing
- ✓ Poor harvesting (indiscriminate) and post-harvest treatment practices;
- ✓ Inefficient processing techniques leading to low yields and poor quality products; Poor quality control procedures;
- ✓ Difficulties in marketing; Lack of local markets for primary processed products; and Lack of access to latest technological and market information and No market infrastructure
- ✓ Efforts to conserve biological diversity are not bringing the desired results
- ✓ Lack of research on development of (high-yielding varieties, domestication, product and process).
- ✓ Low scientific capacity deters isolation of active principles from medicinal plants
- ✓ The mode of presentation of medicinal plants to patients is not attractive and poor hygiene limited the confidence
- ✓ Producers operate in isolation and have little bargaining power for sales and prices
- ✓ Distances, scarcity of information and uncertainty of supply source reduce incentives to collaborate
- ✓ Adding value to MP products is constrained by the lack of high quality packaging material (vials, cream and lotion jars, bags, bottles and boxes).
- ✓ Wildcrafters and small cultivators are reactive rather than

proactive value chain actors.

- ✓ Lack of Intellectual property rights

Overall, in order to become competitive in the MP global market place, value chain must become more flexible, innovative and efficient, so it can bring to market new products in a timely fashion. Specifically, it must improve its efficiency through better vertical and horizontal integration; accelerate development and adoption of a clear regulatory framework, including product norms and standards; build capacity for certification; and promote sustainable production practices. In addition, the industry must establish effective channels of communication among value chain actors to allow them to respond quickly to shifting market demands.

An important concern is how MSEs can benefit, based on what has been learned through the value chain analysis and what is known of end-market data and trends. The spice, herb and medicinal plants sectors in general are dominated by agricultural MSEs. However, opportunities for MSE growth in the AMP value chain are limited. The two largest segments of value chain actors—producers (wild crafters and cultivators) and collectors—are family and individual enterprises. The primary cost of entry at these two levels is time, and risks are spread by diversifying household livelihood portfolios. Processors and wholesaler/exporter/retailer segments of the value chain are much smaller in number. Their enterprises are larger, and their entry costs and risks higher. Increasingly, their livelihoods are based on their ability to source raw material from producers and collectors at competitive quality standards and prices. To maintain this access, they are frequently expected to meet economic, social and health demands from suppliers.

Opportunities in Least Developed countries

- ✓ Small-scale farmers enhancing their knowledge, skills and capacity in terms of a new enterprise as well as enhancing their environmental awareness
- ✓ Small-scale farmers having more varied farm products to trade;
- ✓ Having more farm products to sell enables a more balanced flow of cash income to the farm household throughout the year,
- ✓ Farm products that can possibly have a high market value
- ✓ Adding value to farm products with primary and secondary processing operations on farm enabling small-scale farmers to move down the supply chain
- ✓ Linkages with processing enterprises and possibilities of providing pharmaceutical companies with 'raw materials
- ✓ Fostering organization among small-scale farmers and other people in local communities, especially in the case of wild harvests and provides for community social benefits;
- ✓ Activities that are highly combinable both with household duties, and other livelihood activities, and as such particularly suitable to women;
- ✓ The employment opportunities can be further developed
- ✓ Can help to preserve indigenous botanical and medical knowledge through active use
- ✓ Developing the sector makes access to poor households high
- ✓ The current development of floriculture in Ethiopia can open-up opportunities for local and international investors to develop the medicinal plant industry

9. Ethical and legal considerations

The cultivation, collection and harvesting of medicinal plants, as well as the post-harvest processing of medicinal plant materials, must be carried out in accordance with legal and environmental requirements and with the ethical codes or norms of the community and country in which the activities take place. The provisions of the Convention on Biological Diversity must be respected (WHO, 2003)^[32].

9.1. Intellectual property rights and benefit-sharing

Agreements on the return of immediate and/or long-term benefits and compensation for the use of source medicinal plant materials must be discussed and concluded, in writing, prior to collection or cultivation. Contract cultivation of medicinal plants from propagation materials obtained from indigenous medicinal plants of a given country may carry varying degrees of property rights. The issue of rights of access to genetic resources is more complex, especially if the propagation materials have a long history as an item of international commerce, and are not indigenous to a given country (WHO, 2003)^[35].

9.2. Threatened and endangered species

Medicinal plants that are protected by national and international laws, such as those listed in national "red" lists, may be collected only by relevant permission according to national and/or international laws. The provisions of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) must be complied with.

Endangered medicinal plant species must be sourced only in accordance with national and/or regional legislation.

When medicinal plant materials from threatened, endangered, or protected medicinal plant species are obtained through cultivation, they should be accompanied by appropriate documentation in accordance with national and/or regional regulations, to certify that no such medicinal plant materials collected from the wild are included (WHO, 2003)^[35].

10. Conclusion

The literature in this area is often published in NGO and other reports and, therefore, this review cannot be comprehensive. However, it is obvious that in the area of medicinal plant research there is a gap in terms of analyzing the value chains which exist for herbal medical products very often harvested from the wild or produced in small scale agricultural practices.

From a pharmacognostic perspective this has crucial implications for the way regulations of such products ought to be developed and on the strategies for quality assurance (esp. as it relates to controlling the overall supply chain). There also is a gap in understanding on the impact that the gathering or growing of such products has for local household economies and how the benefits are shared (or not shared) throughout the value chain. The value chains for herbal medical products have some unique characteristics, which seem to have had little impact on the discussion about value chains in the socioeconomic. This is a market often dominated by small and medium sized enterprises, and one which is governed by diverse regulations relating to the products quality and health claims, which vary widely throughout the world.

The analytical framework allows an understanding of how the changing pattern of commercialization changes the value chain, and what impact this has on the various elements of the

chain from local producing householders to end user. At the same time, the approach helps to understand the way that changes to value chains may fundamentally change the product and its quality. Conversely, product requirements and quality standards as well as other regulatory requirements have an important impact on the value chain. Indeed, the impact of this complex regulatory framework differentiates the value chains of these agricultural and wild-crafted products from other forms of production and distribution.

11. Recommendations

The market requires suppliers to adhere to broker terms (quantity, quality, and timing of shipments), proper packaging, and consistency on product, price, and delivery.

To create competitive advantage, the value chain must become more flexible, innovative, and efficient. Improving efficiency requires the following aspects should be addressed:

- Better vertical and horizontal integration among actors in the value chain adoption of a clear regulatory framework and sets of product norms and standards
- Building capacity for certification standards
- Promoting sustainable natural resource and production practices

In addition, the MP industry must establish effective channels of communication among value chain actors to allow them to respond quickly to shifting market demands.

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