Types and Utilization Identification of Medicinal Plants: Developing Strategy for Non-Timber Forest Products in Buffer Zone

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Abstract Indonesia is known as a storehouse of medicinal plants so that it has the nickname of a living laboratory. Communities living around forest areas whose lives are highly dependent on forests have traditional knowledge in utilizing plants or natural materials for medicinal purposes. This study aims to determine the types and uses of medicinal plants and the development strategy of medicinal plant agro-industry as one of the non-timber forest products. The research method was carried out through the identification of the types and utilization of medicinal plants, while the determination of the development strategy was carried out through SWOT analysis. The results showed that documentation activities and determining strategies for the development of medicinal forest plant diversity in addition to preserving local wisdom also provided business opportunities for non-timber forest products (NTFPs) in an effort to increase community income around the forest and minimize deforestation and forest degradation.

1. Introduction
The Lore Lindu National Park (TNLL) in the Central Sulawesi region is a tropical forest area that has fertile soil conditions, a good climate, and has abundant biodiversity, including forest plants that have medicinal properties [1,2]. The potential of medicinal plants in this forest has tremendous benefits for local communities around the forest [3]. This medicinal plant is a plant that lives wild in the forest, which can be in the form of trees, herbs, shrubs, and lianas [4]. These medicinal plants are used from generation to generation by the natives as medicine or herbal medicine, by taking parts of the plant in the form of leaves, roots, bark, stems, sap, flowers, and seeds and simply processing them into medicinal herbs to cure various diseases [5]. This method of treatment is commonly known as traditional medicine [6]. The traditional community in Palolo District, Sigi Regency, is one of the communities whose lives still rely on the potential for managing biological natural resources [7]. The people living in the TNLL forest buffer zone, they have quite good experience regarding the introduction, characterization, naming, and utilization of potential types of medicinal plants, food, and so on [8,9].

The diversity of medicinal plants in the Palolo District, which is commonly known to the public, has not been comprehensively recorded and documented to be disseminated as medicinal [10,11]. On this basis, this research was conducted to identify types of traditional medicinal plants and their use by local communities [12]. The use of medicinal plants in the last decade has tended to increase in line with the
development of the herbal or traditional medicine industry [13]. Many people have started to look at developing medicinal plants, both for their own needs and for business, even though initially medicinal plants were non-commercial non-timber forest products. With this background, studies related to internal strengths and weaknesses as well as external opportunities and challenges as well as analysis of market opportunities and competitiveness of similar products produced by other regions or countries [14].

2. Methods
Determination of initial respondents was carried out purposefully by selecting key informants with the consideration of people who are considered to have knowledge of local medicinal plants (key informants). To complete the data, the next respondent was selected from local communities around the forest which is the habitat for medicinal plants. The selection of respondents was carried out by the snowball sampling method, namely the respondent selection technique based on the recommendations of the key informants [15]. The data were collected by answering a questionnaire about the types and uses of medicinal plants. Next, the plant specimens were collected for identification. Meanwhile, the strategy for the development of medicinal plant agro-industry opportunities was carried out through a Focus Group Discussion using a SWOT analysis [16].

3. Results and discussion

3.1. Identification of medicinal plants

| No. | Scientific Name               | Indonesian Name | Benefits                        | Picture |
|-----|-------------------------------|-----------------|---------------------------------|---------|
| 1.  | *Andrographis paniculata*     | Sambiloto       | Medicine for colds and sore throat |         |
| 2.  | *Ortosiphon aristatus*        | Kumis kucing    | Medicine for kidney stone       |         |
| 3.  | *Anredera cordifolia*         | Binahong        | Medicine for internal wound     |         |
| 4.  | *Equisetum debile Roxb*       | Greges otot     | Medicine for broken bone        |         |
| 5.  | *Ipomoea pes-caprae*          | Tapak kuda      | Medicine for digestive          |         |
|   | Plant Name          | Common Name   | Medicinal Use                                      |
|---|-------------------|---------------|---------------------------------------------------|
| 6. | *Bryophyllum pinnatum* | Cocor bebek  | Medicine for boils and bruises                     |
| 7. | *Boesenbergia rotunda* | Temu kunci    | Medicine for colds and flatulence                  |
| 8. | *Zingiber montanum* | Bangle        | Medicine for a cough with phlegm                   |
| 9. | *Curcuma zedoaria* | Temu putih    | Medicine for stomach ulcers                        |
| 10. | *Psidium guajava* | Jambu Biji    | Medicine for diarrhea                              |
| 11. | *Mimosa pudica* | Putri malu    | Medicines for rheumatism and spinal pain           |
| 12. | *Equisetum* | Pakis         | Medicine for swelling                              |
| 13. | *Carica papaya* | Pepaya        | Medicine for dengue fever and constipation         |
| 14. | *Musa paradisiaca* | Kulit batang pisang | Medicine for wounds                               |
|   | Scientific Name         | Common Name   | Medicinal Properties                                      |
|---|-------------------------|---------------|------------------------------------------------------------|
| 15. | Morinda citrifolia      | Mengkudu      | Medicines for anti-cancer                                  |
| 16. | Annona muricata         | Sirsak        | Medicines for diabetes and cancer                          |
| 17. | Curcuma longa           | Kunyit        | Medicine for swelling                                      |
| 18. | Curcuma xanthorrhiza     | Temulawak     | Medicine for stomach ulcers and appetite enhancer          |
| 19. | Piper betle             | Sirih         | Medicine for red eyes                                      |
| 20. | Zingiber zerumbet       | Lempuyang     | Medicines for colds and seizures                           |
| 21. | Imperata cylindrica     | Alang-alang   | Medicine for malaria and nosebleeds                        |
| 22. | Pandanus amaryllifolius | Pandan wangi  | Medication for sleep disorders                             |
| 23. | Averrhoa bilimbi        | Belimbing wuluh | Medicine for coughs                                      |
| 24. | Senna alata             | Ketapeng cina | Medicine for ringworm and tinea versicolor                 |
Based on Table 1, there are 26 types of medicinal plants that are most often used by respondents in their daily life and the type of medicinal plant that is mostly used by respondents (95%) as traditional medicine is papaya. Apart from its delicious taste, papaya fruit can also be easily obtained because it has been cultivated in community yards and gardens and has become a profitable horticultural commodity. The percentages of plants that are most commonly known as medicinal plants are Beluntas (*Pluchea indica*) and Sirih (*Piper betel L*) of 90 and 95%, while the lowest percentage is Greges otot (*Equisetum debile roxb*) which is only 20%. The percentage of parts of medicinal plants that are most widely used is the leaves about 69.23%, because the leaf part is most often used because the leaves are easy to get if compared to other parts of the plant. Taking leaves for use as medicine will not damage the parent plant because it is easy to grow back [17]. The most used way was by boiling (76.92%). Processing of medicinal plants by boiling it can reduce the taste tasteless and bitter than edible direct, more sterile because it can kill germs or pathogenic bacteria and can lift substances that are contained in plants and have more reactions because they are drunk [18].

3.2. Development strategy of medicinal plant agro-industry

The development strategy of medicinal plant for communities around forest areas is formulated using a SWOT matrix, can be seen in Table 2.

**Table 2. SWOT matrix for development strategy of medicinal plants.**

| External | Internal | Strengths (S) | Weaknesses |
|----------|----------|---------------|------------|
| Opportunity | • Promotion opportunities (0.48) | Availability of raw materials (0.56) | Limited capital (0.20) |
| | • Government support (0.45) | Quality of raw materials (0.32) | Limited of technology (0.18) |
| | • Skills and management training opportunities (0.42) | Availability of labor (0.43) | Lack of motivation of the younger generation motivation (0.16) |
| | • Market opportunities (0.50) | Access location (0.48) | Lack of coordination with the government (0.13) |
| | • Infrastructure development (0.49) | Local wisdom (0.52) | Lack of partnerships (0.11) |
| | | | |
| | | 2.31 | 0.78 |
| Threat | • Competition with similar products (0.20) | Optimizing the quantity and quality of resources based on local wisdom by utilizing the infrastructure and government support to meet market demand | Increase motivation, expertise, and work ethic by forging partnerships with various parties by utilizing the infrastructure and government support to meet market demand |
| | | Improving of product quality and human resource capabilities based | |
| | | 2.34 | 4.65 | 3.12 |
| | | ST | WT | |

The efficiency of production costs and increasing the capacity of human resources based on...
Limited access to information (0.13)  
Consumer demands (0.18)  
Lack of preservation of local wisdom of medicinal plants (0.15)  
The existence of substitute products (0.18)  

| Strategy                                      | Score |
|-----------------------------------------------|-------|
| 0.84 on local wisdom in facing competition and market demands | 3.15  |
| local wisdom by forging partnerships in facing competition and market demands | 1.62  |

Table 2 shows that the best strategy for medicinal plant development is the SO strategy with the highest score of 4.65, namely optimizing the quantity and quality of resources based on local wisdom by utilizing infrastructure and government support to meet market demand. The implementation of this strategy can be done with: a.) Increasing the motivation of the community, especially the younger generation, to cultivate herbal plants to ensure the continuity of the availability of raw materials; b.) Increasing counseling and training in the cultivation and processing of medicinal plant products in a sustainable manner through the transfer of appropriate technology; c.) Network expansion marketing of medicinal plant processed products by means of promotion / exhibitions both at the national and international levels [19]. Research shows that forest communities who depend on forest resources without market access cannot support sustainable agro-industrial development.

4. Conclusion
The development of medicinal plants as raw materials for the herbal medicine agroindustry requires an increase in public understanding of efforts cultivation in a sustainable. The main strength of the development of the herbal medicine agro-industry is the availability of raw materials with the main opportunity namely the opening of market opportunities for herbal medicines, especially during the Covid-19 pandemic, and will continue to develop in a new normal.

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