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Environmental products and bioeconomy: A case of pine resin's enterprises in Nepal

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Abbreviation

CF= Community Forest
CFUGs= Community Forest user groups
COVID= Corona virus Disease
DCCI= District Chamber of Commerce and Industries
EU= European Union
GPN= Global Production Network
MAPS= Medicinal and aromatic plants
MOTIFE= Ministry of Tourism, Industry, Forest and Environment
NPR= Nepalese Rupee
NVIVO=Non- Versioned Information, Versatile Outcome
USD= United states Dollar
VAT= Value added tax

Abstract

Research on environmental products, their processing firms, and global trade has been growing, however, existing studies largely focus on timber-based products within forest- based bioeconomy. This limits the attention to environmental products especially in low-income countries. This study uncovers and explains the production network through the lens of global production network theory, opportunities and limitations of pine resin processing firms within Nepal's forest-based bioeconomy, focusing on Sudurpaschim and Lumbini provinces. Quantitative and qualitative data were generated from semi-structured surveys of resins processing firm(n=9), key informant interviews (n=3) and focus group discussion(n=10). In 2023/24, the processing firm across both provinces produce or collects 5505.61 metric tons of crude resin from Sudurpaschim province and processed into 4074.1514 metric ton of rosin and 935.9537 metric ton of turpentine oil worth of maximum of NPR 853094.2695 and minimum of NPR 596257.563 (1USD= 131.60). GPN analysis reveals strong vertical integration- enterprises manage resources access, tapping, processing and export- yet are obstacle by single-market dependence, labor shortage and bureaucratic inefficiencies. Value creation is embedded in community forest tenure system, with NPR 12/kg royalties to CFUGs, while value enhancement is concentrated in different grades of rosin at firm level. Value is captured from collection to export. Opportunities lie in technological advancement, domestic market development, training and high wage to labors and institutional reform that could strengthen Nepal's position in global forest-based bioeconomy.

Keywords: Bioeconomy, Constraints, Opportunities, Pines resin, Processing firms

Chapter -1

Introduction

1.1 Background and context

Bioeconomy refers to a new emerging economic paradigm in the field of science, technology, and innovation, aiming to reduce environmental damage provoked by economic processes (Wilde & Hermans, 2021). It refers to a revolutionary model of sustainable development, where the utilization of renewable biological resources goes hand-in-hand with economic development, employment, and environmental sustainability (Smith-Hall & Chamberlain, 2023). Forest and forestry are integral components of this larger paradigm, as they provide renewable biological materials needed for various economic processes. This more focused area, known as forest-based bioeconomy, is defined by Piplani & Smith-Hall (2021, p.3) as "the set of economic activities to grow, harvest, process, reuse, recycle, and sell forest products and associated forest ecosystem services". It is considered more operational and specific than the broad bioeconomy due to its emphasis on the natural, renewable environmental products (Smith-Hall & Chamberlain, 2023). A forest-driven bioeconomy can potentially contribute to addressing worldwide concerns such as biodiversity conservation and poverty alleviation (Chamberlain & Smith-Hall, 2024). Forest-based bioeconomy has further become viewed as a significant path to achieving some of the goals of the Sustainable Development Agenda (SDGs), such as poverty alleviation, biodiversity conservation, and sustainable livelihoods, and fits into such plans as the EU Bioeconomy Strategy, 2022, and the United Nations Decade on Ecosystem Restoration.

A key component of forest-based bioeconomy is environmental products like game animals, fur-bearers, nuts, seeds, berries, mushrooms, oils, gums, resins etc., which contribute significantly to the economy (Salzman et al., 2018, Smith-Hall & Chamberlain, 2023) and are considered as billion dollar raw materials for global industries(Chamberlain et al., 2022). Environmental products (Smith-Hall & Chamberlain, 2023, p.498) can also be defined as any resources or products extracted from forest ecosystems that are used in the home, marketed, or have social, cultural, or religious significance (Shackleton & Shackleton, 2004). These products have enormous economic value, create large-scale employment and are used by an estimated 3.5 to 5.8 billion people (Shackleton & Vos, 2022). For example, according to FF,(2022), the global market for medicinal

plants was estimated to be worth 166 billion USD in year 2021 showing 11.2% of annual growth rate.Research indicates that the households with lower-income, mainly in developing countries are often more dependent and derive greater benefit from environmental products (Peerzada et al., 2021). Furthermore, the Food and Agriculture Organization of the United Nations (FAO) published a report on environmental products in the global bioeconomy, and CIFOR (The Center for International Forestry Research) reported that environmental products serve as critical pathway in forest-based bioeconomy (Verkerk et al., 2022). Although collecting and directly using environmental products adds significant value, value addition and processing of environmental products unlocks their full potential (Meinhold & Darr, 2019).

In principle, each process in production of environmental products-collection, cultivation, processing, marketing, value addition, and manufacturing—offers an opportunity to develop a new enterprise or firm (Caporale et al., 2020). In this context, firm can be understood as a "managerial device for optimizing the accumulation and deployment of its available resources underpinning its core capabilities, at the lowest possible cost" (Coe and Yeung, 2015, p. 84; Smith-Hall et al., 2024, p.2). These firms vary from small, one-person operations working part-time to expansive multinational corporations, covering markets from local to global. Nonetheless, most enterprises involved in environmental product's production and commerce function within informal economies, devoid of legal acknowledgment, credit access, or reliable market avenues (Meinhold & Darr, 2019; Schippmann et al., 2006). This informality restricts their ability to grow and benefit from national bioeconomy support mechanisms. Economically, they play an important role in livelihoods, food security, the provision of goods and services, and poverty reduction by creating employment opportunities, alternative sources of income, and local wealth distribution (Badini et al., 2018). These environmental product's firm or business opportunities are embedded in the larger forest-based bioeconomy- which encompasses the entire forest value chain—from resource management to the delivery of forest-based products and services (Piplani & Smith-Hall, 2021) .Moreover, although environmental products have a significant role, they are underrepresented in research and plans of bioeconomy on forests, particularly in business development in lower-income countries (Chamberlain & Smith-Hall, 2024). Underrepresentation of environmental products has further been compounded by insufficiency of proper reliable data on volume of production, firm performance, trade flow, and market structure of environmental products. These

knowledge deficiencies impede evidence-based policymaking, investment, and the incorporation of environmental product's enterprises into formal bioeconomy strategies.

1.2 Statement of the problem

Despite the recognition of forest-based products and their importance in the bioeconomy, there is a lack of research on the forest- based bioeconomy (Bugge et al.,2016; Lovric et al., 2020a; Piplani & Smith-Hall, 2021: Chamberlain & Smith-Hall, 2024). Even though there is limited research on forest-based bioeconomy, the integration of environmental products in forest-based bioeconomy is largely overlooked (Dietz et al., 2018; Smith-Hall & Chamberlain, 2023a; Chamberlain & Smith-Hall, 2024).In contrast to commercially important timber species, which have comprehensive documentation along with clear management and trade protocols, the majority of environmental products do not possess established value chains or organized commercialization routes (Schippmann et al., 2006; Smith-Hall & Chamberlain, 2023).For example, although over 50,000 species are utilized for medicinal purposes, only 2,500 species are officially traded on the international market, with the majority of exchanges taking place informally and beyond regulated market frameworks. Furthermore, due to the limited potential research on forest-based bioeconomy in lower-income countries, especially one centered on environmental products, Chamberlain & Smith-Hall (2024) highlight the need for developing a forest-based bioeconomy, including environmental products, in addressing critical global challenges such as poverty alleviation and biodiversity conservation.

One significant shortcoming in forest-based bioeconomy research is the insufficient attention given to firms engaged in the production and trade of environmental products (Meinhold & Darr, 2019). In many rural areas, forest-based enterprises are the only viable source of livelihood, as many people depend directly and indirectly (Cunningham et al., 2011). These enterprises play a vital role in transforming natural resources into marketable goods and services—contributing not only to economic growth, but also to environmental sustainability and the overall development of rural communities (Meinhold & Darr, 2019). Even though there's growing recognition of the value and potential of forest-based products in national development strategies, many enterprises in this sector still operate informally. As a result, there is a lack of a full understanding of the challenges

they face and the factors that influence their success (Meinhold & Darr, 2019). For example, there have been no cases of a lead firms who directly involved in the trade of medicinal plants from Nepal to India and China (Fold et al., 2023; Smith-Hall et al., 2024). In general, the processing of environmental products has shown great potential to promote sustainable economic development in rural communities. Despite growing interest in environmental products processing enterprises as a source of employment and strategic growth in developing countries, many enterprises remain in the informal sector, with limited understanding of the underlying factors (Meinhold & Darr, 2019).

Hence, against this background, this study aims to uncover the opportunities and constraints of environmental product processing firms in forest-based bioeconomy by exploring the production network, values, volume, and institutions (which will be discussed below in the analytical framework section), particularly in developing or low-income countries in the Global South. By examining the production networks, key actors, and economic importance of firms, this research aims to identify the opportunities and limitations they encounter and suggest strategies for improving their incorporation into the formal economy.

1.3 Research Questions:

This study will attempt to answer the following basic question.

What are the constraint and opportunities for raw material processing firms in bioeconomy sector of environmental products?

1.4. Objectives of the Study:

The proposed research aims to explore the contribution of renewable environmental product processing firm in forest-based bioeconomy.

1.To map the production network particularly focusing on upstream production network of environmental product's processing firm in terms of values, volume and institution.

2. To identify the key actors involved in the environmental product's processing firm and the challenges they face.

3.To discuss the potential of firms to contribute in the forest-based bioeconomy.

1.5. Significance of the Study:

Although, a lot of study has been carried out on environmental product, this study will bridge the knowledge gap in environmental products processing firm and bioeconomy particularly of Global south. The study will shed light on the production network of environmental product, along with the opportunities and limitation that exist within production network of processing firm. By situating the findings within broader forest-based bioeconomy framework, the study will demonstrate how environmental products processing firm harnessed for value creation and contribution to national development. Moreover, the finding could aware policymakers to design regulatory simplification and maximizing the development of such firms in near future. Finally, this study will be a novelty and baseline study for further research on similar sector.

1.6. Limitation of the Study:

Although the study includes enterprises located in two provinces, some d1`ata were only accessible for one province i.e., data on volume of environmental product while qualitative assessment of enterprises activities were drawn from the enterprises located in both provinces. Moreover, various activities were carried out during different time period, so whole process could not be observed. Additionally, some respondents were hesitant to disclose detailed or precise information, particularly related to financial transaction or informal practices. As a result, some of the data are based on respondent estimates rather than their actual reports.

Chapter-2

Literature review

2.1 Understanding bioeconomy and forest-based bioeconomy

The United Nations Sustainable Development Goals of 2015 recognize and emphasize that feeding a growing global population sustainably is a major problem for the twenty-first century (Lewandowski, 2018). In recent years, this problem is further intensified by financial crises, inflation, pandemic-related loss of livelihoods, resource depletion, and climate change brought on by fossil fuels. These overlapping pressures have heightened the importance of finding solutions to problems in a variety of fields, including climate change, food security, health, industrial restructuring, and energy security (Coenen et al., 2015). As a result, concept of bioeconomy is seen as a key solution to address various challenges. However, it is also suggested that the bioeconomy aims to address food security, health, industrial restructuring, and energy security (Richardson, 2012; Bugge et al., 2016). According to Dietz et al., 2018, bioeconomy is a significant strategic paradigm change of the twenty-first century. Pathways to a bioeconomy affect all levels of society and are linked to the UN 2030 Agenda and the SDGs. They are founded on the principles of sustainable and equitable product sourcing while mitigating environmental impacts, as supported by science. It plays an important role in addressing numerous 'grand challenges' like climate change, food security, and poverty alleviation (Bugge et al., 2016). Moreover, the United Nations (2019) highlights the potential of bioeconomy that a bioeconomy can help to achieve the Sustainable Development Goals. In this context, it linked forest food and medicine to boost people's health and well-being. They target underserved communities to achieve inclusive and long-term economic growth, employment, and good work for all (Chamberlain et al., 2022).

Bioeconomy has been defined and understood in various ways. It is "the production, utilization, conservation, and regeneration of biological resources, including related knowledge, science, technology, and innovation, to provide sustainable solutions (information, products, processes, and services) within and across all economic sectors and enable a transformation to a sustainable economy" (International Advisory Council on Global Bioeconomy, 2020, p. 9). Furthermore, the bioeconomy concept has been identified that it is not a single and fixed concept, it is rather a multi vision framework which ranges from health and the chemical industry, to agriculture, forestry, and

bioenergy (Bugge et al., 2016). Across multiple vision, natural and engineering science remains central, especially in developing bio-based materials, energy solution and sustainable land use practices (Bugge et al., 2016, p.13). Scholars such as Bugge et al., (2016) and Vivien et al., (2019) divided the bioeconomy into three broad conceptual streams: biotechnology-based, biomass-based, and biosphere-based. However, Piplani & Smith-Hall (2021) have expanded the bioeconomy paradigm by identifying five distinct approaches to refine the bioeconomy framework in the context of forest systems. It provides a more nuanced perspective, explicitly including forest resources in the bioeconomy.

The bioeconomy is expected to be the guiding paradigm within the forest-based sector as they provide renewable biological resources or solution for various economic, environmental and social challenges (Bugge et al., 2016). It has been defined in various ways, and in a forest-based context can be understood to mean the use of forests to create products and services that help economies to replace fossil-based raw materials, products and services (Wolfslehner et al., 2016). Piplani & Smith-Hall, 2021, p.3 defined forest-based bioeconomy as "the set of economic activities to grow, harvest, process, reuse, recycle, and sell forest products and associated forest eco system services". Unlike the broader bioeconomy, forest-based bioeconomy is more operational and specific as it emphasizes on the natural renewable environmental products (Smith-Hall & Chamberlain, 2023). The forest-based bioeconomy connects the entire forest value chain, from natural resource management and sustainable use to product delivery. Bioeconomy development increases interest in forest resources from a variety of perspectives. First, the bi-economy increases demand for forest goods and services, resulting in increased economic opportunities for the sector. There are numerous opportunities, such as bioenergy, wood construction, packaging products, chemicals, textiles, and so on. Second, there is an increase in demand for forest land for other ecosystem services such as biodiversity, carbon sequestration, recreation, and human health benefits (Wolfslehner et al., 2016). A forest-based bioeconomy also includes biodiversity conservation, biomass production, scientific and technological capacity development, and public-private collaboration to foster innovation (Wield, 2013; Chamberlain & Smith-Hall, 2022). In addition, it serves as a paradigm to revisit the interface of the forestry sector and the other sectors, and to energize the adding of value to the products of forests. A forestry bioeconomy can then be envisioned as a changing response facilitating a shift away from fossil fuel dependence to

sustainable production of natural assets through active involvement of the participants across all levels of the production network. (Chamberlain & Smith-Hall, 2022).

2.2 Environmental products in forest-based bioeconomy

Within this context, economic activities based on forest resources have expanded their possibilities, leading the forest-based sector to shift its focus to the bioeconomy (Jankovský et al., 2021). Forest resources are considered as a vast array of products derived from plants, fungi, lichens, and animals. These include materials such as timber, firewood, fodder, medicinal substances, and edible goods. Typically, these products are tangible items made from either entire organisms or specific parts—such as bark, roots, leaves, fruits, resins, meat, or hides (Smith-Hall & Chamberlain, 2023). Among the vast array of products in a forest, non-timber forest product are goods of biological origin, including medicinal plants, mushrooms, and provisioning ecosystem services other than timber derived from forests, other wooded lands, and trees outside forests (FAO, 1995) which later were named as environmental products which are tangible biotic and abiotic goods gathered from any biome or created through synthetic production (Smith-Hall & Chamberlain, 2023, p.498). During the late 1980s and early 1990s, environmental products were recognized as having enormous potential for improving rural livelihoods, generating income, ensuring food security, providing primary health care, and conserving forests (Shackleton &Shackleton, 2004; Peerzada et al., 2021). It maintains high forest diversity aids in climate change adaptation, shelters germplasm for regeneration, and improves crop biotic and abiotic resistance (Shackleton &Shackleton, 2004; Peerzada et al., 2021). In fact, over 40,000 plant species are known to be used by more than five billion people worldwide (Shackleton & Vos 2022; Smith-Hall & Chamberlain, 2023).

Environmental products are no longer only considered as a source of food, fodder, and medicine for the poor, they are being integrated into new conservation and development strategies, such as environmental accounting, payment for ecosystem services, biodiversity valuation (TEEB, 2010), and bioeconomy (de-Arano et al., 2018). This demonstrates that commercializing environmental products through the sale of raw or processed resources in emerging global markets holds promise, as long as fundamentals such as inclusive policies, good and interactive governance, clear tenure rights, and sustainable resource extraction contribute to sustainably managed resources and

equitable markets (Peerzada et al., 2021).Moreover, commercialization of environmental products has been demonstrated in earning foreign exchange which are easily identifiable, driven by rising consumer demand for diverse bioactive compounds and products for the pharmaceutical, nutraceutical, cosmeceutical, food, and beverage industries (Laird, 2013). The abundance of existing knowledge on the use of environmental products provides the foundation for establishing a business. For instance, Kala, (2015) observed that aside from the use of existing knowledge and documentation of MAPs (falls under environmental products), the sector has several stages, including wild collection, processing, marketing, value addition, manufacturing, drug development, and capacity building. Each stage, on its own, forms the foundation for a unique enterprise. Furthermore, the promotion of environmental product through commercialization occurs via selling raw or processed materials through enterprise development deserves particular attention, since it may have more potential to contribute to employment opportunities and income generation (Meihold & Darr, 2019). The study also noted that vertically integrated enterprises—those managing harvesting, processing, and marketing—tend to retain more value and reduce income leakage to intermediaries (Meinhold & Darr, 2019). Shackleton & Pandey (2014) observed that environmental products' processing enterprises are most successful when integrated in favorable institutional environments, including access to market information, financial services, and enabling policy frameworks. These conditions create long-term sustainability and equitable participation by marginalized groups, particularly women and indigenous communities (Shackleton & Pandey, 2014).

Therefore, integrating environmental products and enterprises based on environmental products into forest-based bioeconomy not only enhances the commercial potential of resources but also serve as an important mechanism for achieving sustainable developmental goals linked with livelihood upliftment. This knowledge can also help in defining collaborative arrangements, accelerating standardization processes, creating new businesses, implementing specific public policies, and contributing to the protection of territories and traditional peoples and communities .

2.3 Conceptual framework

To investigate the production network of environmental products processing firms along with their opportunities and constraints based on Badini et al.,2019, the conceptual framework of the forest sector with four principal components proposed by Smith-Hall et al., 2024, was used as shown in figure 1. It offers an organized framework for examining the intricate nature of environmental products within the larger context of the forest sector. This framework, inspired by McGinnis & Ostrom (2014), facilitates the integration of environmental products into the forest-based bioeconomy by delineating their significance into four fundamental components as shown in fig 1.

Here, this study uses this conceptual framework working with the analytical devices (Smith-Hall et al., 2024, p.5), which consist of four principal components as, resource base and unit- forest ecosystem and specific products extracted, activities and interaction- process of harvesting to marketing, Actors and stakeholder- firms, CFUGs, governmental agencies, and Outcomes- economic, social and environmental. To capture the broader economic linkage, study integrates the global production network theory which is described below (Coe & Young 2015) that facilitates empirical exploration of the environmental product processing firm in forest-based bioeconomy. Three main component of global production theory named, value, power and embeddedness- are mapped across four components. This integration allows the analysis to focus on; analytical devices such as value creation, tenure, value enhancement, value capture, Societal embeddedness, territorial embeddedness and outcomes with indicators. Moreover, along with these analytical devices, this study investigates the opportunities and limitation (based on Baidini et al., 219; Caporale et al., 2020). existing within each principal component.

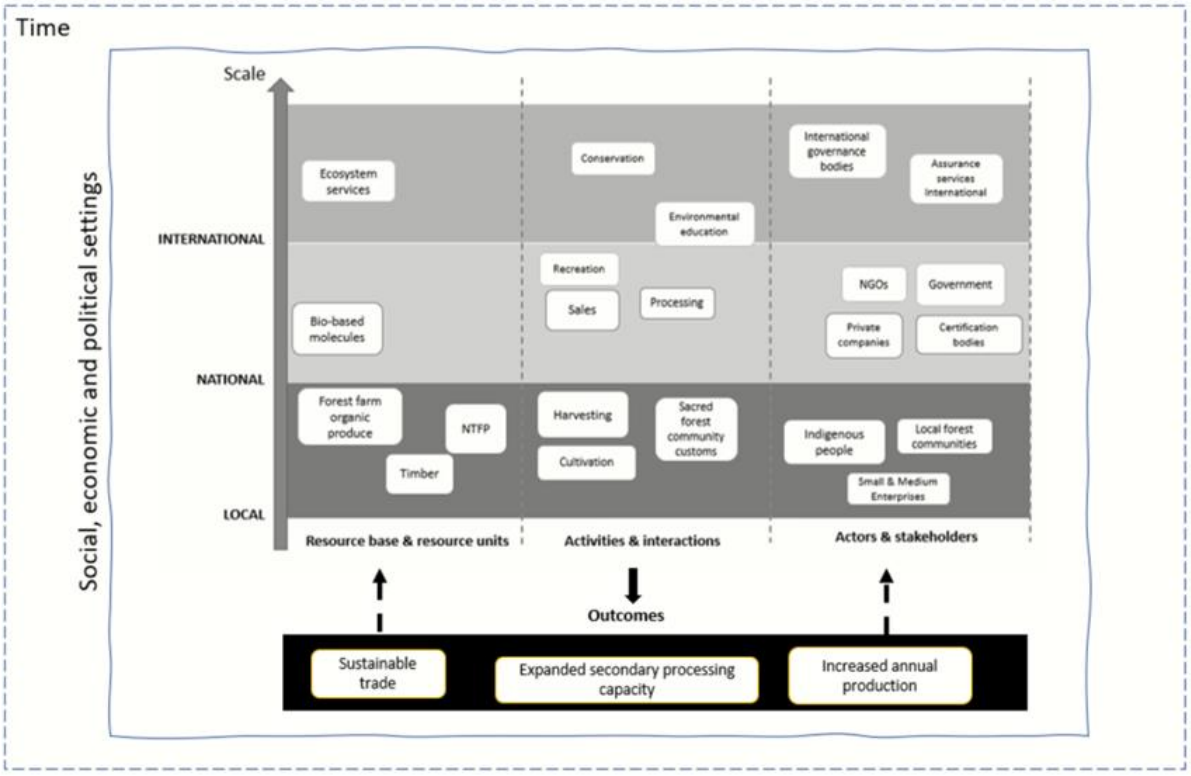

Figure 1: A conceptual framework for the forest sector includes four components: resources, activities, actors, and outcomes. The white boxes show examples of the diversity within each component (Smith-Hall et al., 2024).

2.3.1 Understanding global production network theory:

A global production network theory is a framework allow to understands industrial organization and economic development, allowing for a structured analysis of particular sectors within specific regions (Coe, 2021). According to Coe & Yeung, 2015, pp.1-2, a production network is defined as "an organizational arrangement, comprising interconnected economic and non-economic actors, coordinated by a global lead firm, and producing goods or services across multiple geographical locations for worldwide markets". According to Smith-Hall et al. 2024, GPN theory encompasses trade network for renewable environmental products, yet there is limited research on forest-based products, such as timber for guitar making (Gibson & Warren, 2016), wood-products in Bolivia (Murphy, 2012), medicinal plant in South Asia (Pauls & Franz, 2013; Pouliot et al., Pyakurel et al., 2018; Wallrapp et al., 2019; Fold et al., 2023), wildflowers in South Africa (Hughes et al.,

2015), the spice trade within the EU (Lakner et al., 2018), savanna restoration efforts in Brazil (Montenegro et al., 2024) and spice and medicinal plant in Asia(Nepal) (Pyakurel & Smith-Hall, 2025). The mobilization of the GPN framework relies on the operationalization of three interconnected variables, Value, power and embeddedness (Coe &young 2015, Coe, 2021, Smith-Hall et al. 2024). The value derived from environmental products is generated by rural households' harvesting activities, bolstered by elements such as the assets of harvesters, access conditions, and available infrastructure (Ellis, 2000; Smith-Hall et al. 2024)). This value is further amplified through processes such as grading, processing, and certification of environmental products, while unique location-specific factors, alongside rent-seeking behaviors, royalties, and taxes, impact the net margins for individual actors (Coe& young 2015; Smith-Hall et al. 2024). Power, it is influenced by relationships among harvesters, traders, and wholesalers. Successful practices are imitated by both firms and non-firm actors. Regulatory actions from government bodies, NGOs, and certification agencies also play a role. Additionally, social movements like green consumers push firms towards sustainability. Lastly, embeddedness is influenced by factors that connect actors to specific roles and locations, including traders' behaviors, geographic limitations, and established supply chain roles, which affect their economic activities and interactions (Coe& young 2015; Smith-Hall et al. 2024).

Therefore, by combining this perspective of GPN theory, the conceptual framework helps to focus on the production network of environmental product processing firm while situation within wider objectives of forest-based bioeconomy.

Chapter - 3

Methodology

3.1 Study area

This study focuses on two provinces of Nepal: Sudurpaschim and Lumbini which are connected geographically and functionally. Resin is primarily sourced from in Sudurpaschim Province's mid-hills, which are densely forested with Chir pine (Pinus roxburghii) trees. The province currently has two active processing firm that handle all the collected resin. However, a significant portion of the resin collected in Sudurpashchim is transported to and processed in firm located in Lumbini Province, particularly in the Terai region. Studying only two active processing firm in Sudurpaschim province limits the comprehensive analysis and generalization. As a result, understanding the entire production network and value chain of the pine resin industry requires knowledge of both provinces.

Sudurpaschim province covers an area of 19,539 square kilometers, consists of 9 districts from lowland, Siwalik to the Himalayan range. It has a tropical to upper Nival climate, with 56.9% of its total area covered by forests. In the Terai and Siwalik regions, Sal forests predominate, whereas coniferous forests, including alpine scrub, are found at higher elevations (DFRS, 2015). As the major source of livelihood is harvesting and trading of environmental products, Sudurpaschim province has a lot of potential for trade, especially in environmental products (ICIMOD, 2021). Two districts within this province (Kailali and Kanchanpur) are situated in the Terai region which consists of resin enterprise, while four districts (Doti, Dadeldhura, Achham, and Baitadi) are located in the lower mid-hill region, and three districts (Darchula, Bajhang, and Bajura) are positioned in the upper mid-hill region(*oph.sudurpaschim.gov.np*) where Chir pine grows and from where enterprises were sourcing raw resin. Dadeldhura and Kailali district are considered as trade and processing hub as it is boarded with India and many raw materials of environmental products include rittha (Sapindus mukorossi Gaertn), amala (Phyllanthus emblica L.), kaulo (Machilus odoratissimus Nees), kurilo (Asparagus racemosus Willd.), resin (Pinus roxburghii) tejpat/dalchini (Cinnamomum tamala (Buch-Ham.) T. Nees & Eberm.), and Ganoderma products

have been exported from the area (DoF, 2007; Shrestha et al., 2020). The province of Sudurpaschim has produced a lot of environmental products, including rittha (Sapindus mukorossi Gaertna), resin (Pinus roxburghii), and tejpat/dalchini (Cinnamomum tamala). The majority of Chirpine resin is produced in Dadeldhura, Doti, and sold in the Kailali district (Raven, 2020).

Lumbini province covers an area of 22,288 square kilometers, making it the fourth largest province by area. It consists of 12 districts, from low land Terai to Himalayan range. Agriculture is the main economic source of the province. In Lumbini, total forest covers around 43.71% of total area of the province (DFRS, 2015). In terms of forest-based industries, 231 are registered with the company register office in Lumbini province. However, 3,385 industries are registered in small and cottage development offices (Development vision, 2022). Due to the richness in ecological conditions, it harbors a diverse range of flora species including medicinal and aromatic plants (1600 species of MAPs) (Shrestha et. al., 2020). Nepalgunj is considered as trade and processing hubs for environmental products in Lumbini province as it is bordered with India and it is estimated that around 80% of environmental products trade has been through Nepalgunj (MoFE, Lumbini, 2024).

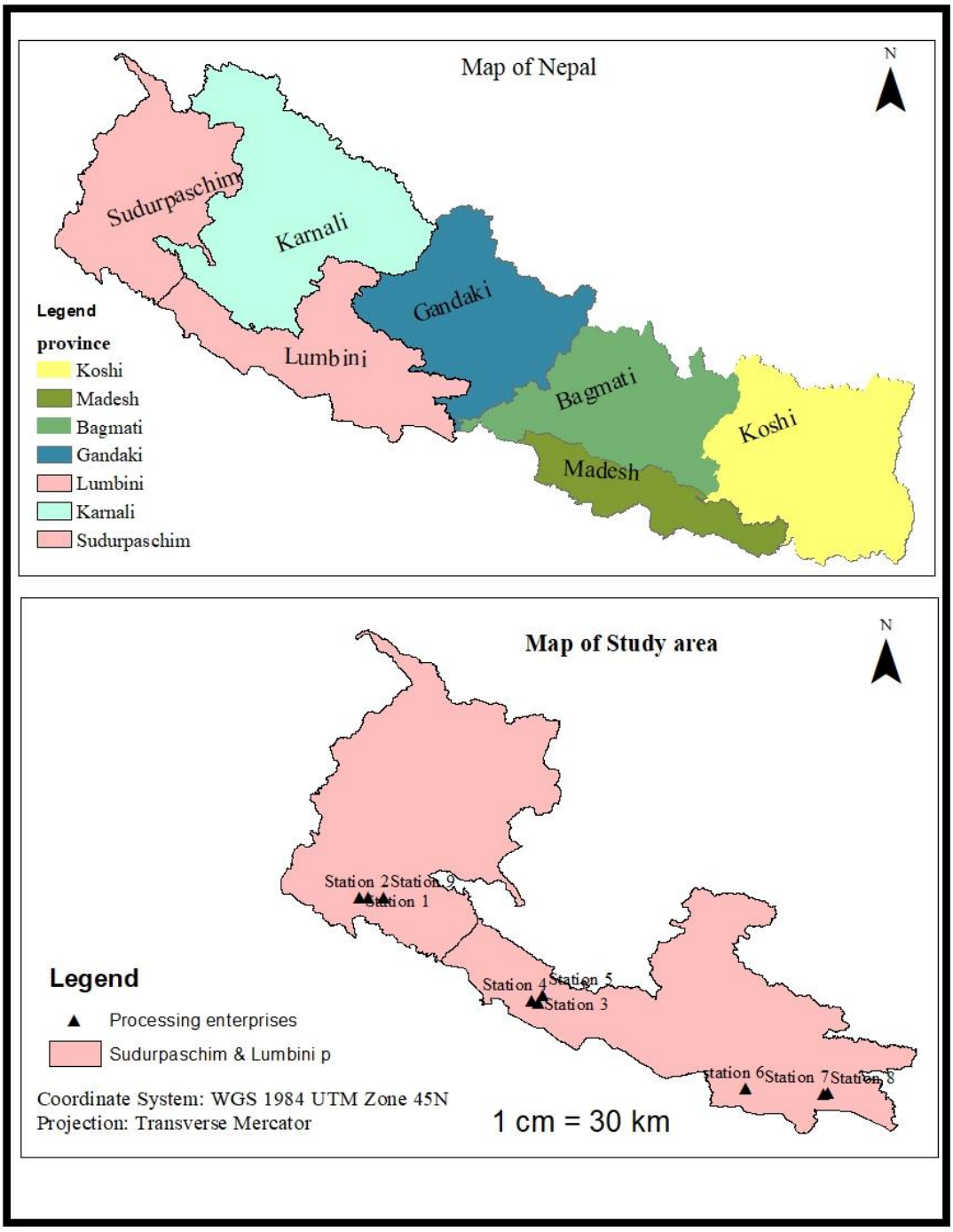

Figure 2: Map of the study area

3.2 Overview of an environmental product: Pine's Resin

Tree resins, an environmental product, that have been used for centuries several applications, ranging from waterproofing ropes and tarps to prepare tar or pitch for sealing wooden ships (Coppen & Hone, 1995). Chemicals derived after processing of resins which is called as Rosin and turpentine oil, have many applications in the chemical as well as food industry, ranging from disinfectants, detergents, paints, adhesives, to flavoring. Though several tree species yield resin, most commercial natural resins originate from pine trees (Verkerk et al., 2022).

Pine resin is one of the valuable plant extracts which is popularly tapped from 12 different pine tree species (Coppen & Hone, 1995) around the world. Recently, FAO report on forest products in the global bioeconomy (Verkerk et al., 2022) emphasized resin production, trade, and consumption, further adding that resin collection is an important livelihood practice. Similarly, FAO report states that forest-based resin production is important all over the world, with China, Brazil, and Indonesia dominating world resin production, sharing more than 90% of world production. However, the industry faces numerous challenges. In China, resin production declined due to rising labor wages, inefficient extraction techniques or lack or technology, and the need to conserve forest resources (Clopeau & Orazio, 2019). Conversely, resin consumption has increased all over the world, transforming China, a once-dominant world resin supply country, into a net importer, and Brazil, which now serves as a key supplier. Brazil, however, has remained highly productive due to optimal selection of tree species, favorable climate, and streamlined production processes, claiming its presence in world markets. Additionally, Brazil has high potential growth in resin production due to high forest coverage and human resource supply (ARESB, 2018).

In Nepal, Pinus roxburghii and Pinus wallichiana, has long been tapped for resin. Resin tapping became an attractive after the establishment of Laxmi Rosin and Turpentine Industry in 1986 (first resin industry). As introduced in 1976 by the Forest Research Institute in Dehradun, India, Rill method of resin tapping is most common in Nepal replacing cup and lip method used in past (Paudyal, 2008). Ministry of forest and Soil conservation (name changed now as MOFE) has introduce and implement Resin Collection Procedures (2064**)** for sustainable extraction of resin

(Paudyal, 2008). By evidence for high yielding, Pinus roxburghii (Chir pine) has become more prominent for resin industries, which grows in elevation of 900-1500m and sometimes up to 2700 m from mean sea level (Jackson & Marsh, 1996) and yields about 3 to 6 kilograms annually. However, Pinus Wallichiana (blue pine) occurs at higher altitudes and yield only around 1 kg annually per tree making less profitable. Resin is tapped for eight months (Resin collection procedure, 2064) from March/April- October/November and is derived from both national forests and forests managed by local communities. After the implementation of Master Plan of forestry sector in 1988, most of the resin tapping activities had been handed over to the community forest (Awasthi et al. 2020). Resin collection process is facilitated through a contractual agreement with the government-affiliated Resin company or with the private owned company. The stipulation within the contractual agreement dictates that the company shall contribute royalty per kilogram of Resin harvested from their designated forest area to the CFUG's fund according to the management plan of community forest. Typically, these agreements are effective for a duration of four to five years, as it is advantageous for the company to secure prolonged rights to a CFUG, thereby preventing other entities from acquiring those rights (Chapagain et al., 2014). Once the agreement is set up, necessary procedures for environmental impact assessment is carried out by the company under the supervision of division forest office and resin tapping begins following resin collection procedures, 2064 (Chapagain et al., 2014). Rosin and turpentine oil, derivatives of resin are highly valued in both national and international market (Paudyal, 2008). Rosin and its derivatives play a crucial role in various industries, including paper production, adhesives, paints, printing inks, surface coatings, varnishes, textiles, rubber manufacturing, soap making, sporting goods, and more (Rai & Chapagain, 2014).

3.2.1 Production, trade and export of Resin

Rescoll (2013) highlights the notable contribution of Nepal's resin, accounting for 3.18% of the global resin production. In the fiscal year 2016/17, rosin and resin acid comprised 2.3% of the total export value, surpassing the export value of medicinal herbs in that same year (TEPC, 2017). According to data, approximately 40,438 metric tons of resin can be harvested from 13,500,000 trees in Nepal annually (DoF, 2007). Nepal has the potential to extract 60,000 metric tons of resin (Subedi, 2010; Chhetri & Timilsina, 2021). In the fiscal year 2074/75 (2017/18), Nepal exported

approximately Rs. 1.59 billion nets of rosin and turpentine oil, totaling 140 tons in volume. There are around 15 different industries involved in the production of rosin in Nepal, with resin collection taking place across 35 districts but these industries have come down due to the lack of the government's clear policy to protect and promote export-oriented industries (Chhetri& Timilsina, 2021). Among these, Kailali, Doti, Dadeldhura, Salyan, and Rolpa stand out as the leading districts for resin production in Nepal (DoF, 2015moi). Companies specializing in resin purification operate in the districts of Banke, Kailali, Kapilvastu, and Jhapa in Nepal (MoICS, 2019). According to the annual report, MOTIFE (2079/80), Sudurpaschim province produce 2488.73 metric tons which is then exported (rosin and turpentine) to India after processing in the enterprises located across Sudurpaschim and Lumbini province. In contrast, Provincial Forest Directorate of Lumbini 2078/79(2021/22) present that Lumbini province produce approximately 3 million kilograms of resin from Chir pine forests annually generating significant income and employment. Data from the Department of Forest indicates that the annual resin trade has fluctuated between approximately 1,888 and 8,009 tons of resin production, with an export value ranging from NRs 57 million to 360 million over the past twelve years (Subedi et al., 2014). Over the span of five years (Fiscal Year 2069/070 to Fiscal Year 2073/074), the revenue generated from resin extraction amounts to approximately NRs. 980,981 (Dof, 2007). In Fiscal Year 2021/22, Nepal exported nine thousand seven hundred and fifty-five tons of rosin and turpentine oil valued at NPR 1.85 billion (myRepublica, 2023). The primary export markets for Nepal's rosin and resin acids include India, the USA, Turkey, Germany, the UK, and China (MoICS, 2019). However, the clear data and information on the production, trade and export of rosin and turpentine in Nepal are still not properly documented (Chhetri & Timilsina, 2021).

3.3 Data collection:

The data collection process followed a structured, multistage approach combining both qualitative and quantitative methods to comprehensively capture the dynamics of pine resin processing enterprises. The case year investigated was 2023-2024 (the Nepalese calendar year 2080/81). Quantitative and qualitative data was collected from February to March 2025 throughout the Pine resin production network: i) with the Key Informant and stakeholders, ii) processing enterprises

iii) Focus group (one with executive committee and one with user members of each CF from where processing firm collects Resin and it was discussed only in Sudurpaschim province). Before interview, consent was obtained from all the respondents. All quantitative data was recorded on mobile phone and notebook and later downloaded in Excel. Similarly, all the qualitative data were recorded on mobile phone, and later translated from Nepalese to English and later entered in Google-documents. To obtain data for general enterprises characteristics, interviews with central wholesalers(enterprises) were conducted using quantitative and qualitative data collection instruments available in the supplementary material of Smith-Hall et al., 2018. Similarly, to obtain data on production network along with opportunities and constraint of enterprises, supplementary material available on Caporale et al., 2020 (derived from Badini et al.,2018) were used. All the interviews were open-ended and dialogue-based with semi-structured questionnaires. During interview with enterprises or central wholesaler, each question asked the overall impact on resin enterprises of every specific factor as factors were divided in external and internal based on Badini et al., 2018 (graded in a scale from 1 to 5, where 1=Insignificant, 2=Slightly significant, 3=Significant, 4=Very Significant, 5=Extremely Significant and the reasons why (recorded as qualitative comments about the meaning of the numerical grade given).

The initial list of rosin and turpentine enterprises was identified based on the national survey data by Chapagain et al., 2024. Then the verification of enterprises operation was conducted by visiting to the representative of Ministry of tourism, Industry, forest and Environment (MOTIFE) and the provincial Forest Directorate (PFD)as key informants located in Sudurpaschim province. This helped shortlist enterprises and understand contextual issues that impede operations. As enterprises located in Lumbini province sources significant volumes of resin from Sudurpaschim, both provinces were included in the study for a complete analysis of production network. From the visit to MOTIFE and PFD, it was found that the total population of active enterprises in Sudurpaschim province were n=3 (n=2 was closed which was owned by same owners who were operating one enterprise out of two active enterprises). Similarly, the total population of active enterprises sourcing resin from Sudurpaschim province were n= 6 (2 were closed but registered under same owner who were actively operating other enterprises under another partner name). Therefore, the questionnaire population consisted of n=9 (total population of enterprises across two provinces at the time of interview) processing enterprises, which were operating actively. After shortlisting the

final list of enterprises, enterprises were contacted to confirm their current operational status and willingness to be involved in this research study. Furthermore, with the approval and coordination's of Provincial Forest Directorate, interviews with manager or senior level representative were scheduled. The interviews addressed the operational, economic, institutional, and logistical aspects of the resin production network.

Furthermore, interview with focus group discussion for data triangulation and to focused on the general process of resin collection, opportunities and limitation from resin sector linked with the enterprises which collects, process and export resin from their community forest was carried out. Discussion was one with executive committee and one with user members of each CF per processing firm that collects Resin and it was discussed only in Sudurpaschim province. So, in total n=10, focus group discussion were carried out under the topic of general process of resin collection by enterprises, their negotiation, opportunities they saw in resin sector and the limitation. To ensure a diverse range of perspectives, participants were chosen randomly from each community.

3.4 Data analysis

The method of data analysis for this particular study was particularly thematic analysis with some numerical analysis. The qualitative component of this study was primarily based on semi-structure interviews with various stakeholders involved in pine resin enterprises. After data was collected from the field, the data was thoroughly verified to check its comprehensiveness and consistency. According to Lacey and Luff (2007), almost all qualitative research studies involve some degree of transcription – the data may be tape recorded interviews, focus groups, video recordings or handwritten field notes. For that reason, the recorded data of the study was carefully transcribed. In this process, the original collected data and the translated/transcribed one was cross-checked to avoid differences that occur in meaning. Each transcript was then uploaded into NVIVO 14.23 for thematic coding. To guide the coding process, a structure codebook was developed based on the analytical framework for empirical investigation of the forest-based bioeconomy (Smith-hall et al., 2024) and the provided supplementary material of Caporale et al., 2018 with main parental codes

like Value, Institutional Dynamics, Opportunities, Constraints, Enterprise Capabilities and Strategies inside which the theme related answers were coded and analyzed. For example, within "Value, sub-codes such as *employment generation*, *resource access*, and *processing efficiency* were used. Similarly, under "Constraints", sub-codes included *labor shortages*, *bureaucratic delays*, and *market dependency*. After the coding and code process was finished, the condensed codes were categorized into the main research questions. Finally, the concept of the summarized themes in relation to the study questions were presented thematically and discussed in relation to the primary data and the conceptual framework of the study. Patterns, similarities, and contradictions in stakeholders' responses were identified and synthesized to draw conclusions.

For quantitative data, enterprises operational data such as volume of collection, amount processed, employment figures and wage rates. To avoid double counting, only data from Sudurpaschim provinces were collected calculating total resin collection volumes, regardless of where the enterprise was physically located. This ensures an accurate estimation of production within the province's resource base. Furthermore, quantitative data were compiled and analyzed using Microsoft Excel Version 2108. Descriptive statistics were employed to summarize the performance indicator of enterprises. To validate patterns and better understanding the dynamics of enterprise, The quantitative data were then triangulated with qualitative findings from NVIVO.

Chapter - 4

Result

4.1 Overview of pine's resin enterprises

An overview of general characteristics of pine resin enterprises(n=9) is presented in table 1 below:

Table 1:General characteristic of pine resin processing enterprises

Characteristics of enterprises	Estimate
Establishment	
After federalism	33.33%
Before federalism	66.67%
Ownership	
Private	11.11%
Cooperative	None
Private partnership	88.88%
Governmental	None
Employee	
temporary	Mean ± SD: 703.78 ± 525.96 min=98, max= 1800
Permanent	Mean ± SD: 432.78 ± 625.97, min=23, max =1800
Mode of operation	
Seasonal	100% (seasonal only harvesting)
Continuous	100% (Transporting, processing- continuous)
profitability	
profit	44.44%
loss	0
Break even	55.55%
No answer	0

Source: Field data, 2025

From the table, the majority (66.66%) of the enterprises were established before the federal structure of Nepal (2015 A.D), while 33.33% were established after federalism, which indicates a

relatively growing sector with most of the enterprises having prior experience of operating under the former governance structure. Regarding the ownership, the vast majority (88.88%) of the enterprises operate under private partnership of 2-5 people, while 11.11% of enterprises were owned privately by a single individual. No enterprises were reported under cooperative and governmental form, which shows the dominance of private sector involvement in pine's resin industry. Additionally, most of the enterprises reported that the private partners register another enterprise so that the owner and employee are same and it is for more resin collection and processing. Typically, each enterprise had 432.78 ± 625.97 permanent employees (with minimum of 23 and maximum of 1800) and 703.78 ± 525.96 temporary employees (with minimum of 98 and maximum of 1800). The large standard deviations in both categories indicate significant variation in enterprise size and labor intensity. Temporary employment appears to be more prominent, in line with the seasonal nature of resin harvesting activities. Furthermore, all surveyed enterprises operated in a seasonal mode for harvesting activities, aligning with natural resin production cycles. However, transportation and processing operations operates throughout the year continuously, showing a hybrid operational model that balances natural seasonality and processing firm continuity. For the category of profitability status, 44.44% of the enterprises indicated remaining in a state of profit, and 55.55% indicated remaining in the break-even position. Loss by one enterprise, however, did not arise, reflecting the relatively sound economic performance of the sector, but the many are still in search of profitability.

4.2. Production network of resin enterprises:

This section presents the production network of pine's resin enterprises by combining a global production network using the conceptual framework of forest sector in GPN by Smith-Hall et al., 2024. It allows a comprehensive analysis of pine resin addressing the flow of value, volume, activities and outcomes of the pine resin processing firms.

4.2.1 Principal component: Resource base and unit

Value creation

Results showed that the process of value creation in the pines resin industry starts with the legal and regulatory steps which enable resource access for tapping as shown in figure 4. Production

network of resin is straightforward as enterprises themselves are involved from agreement with community forest users' groups and tapping following the completion of necessary legal approval. Non-firm actors, namely the Ministry of tourism, Industry, forest and environment (MOTIFE), provincial forest directorate, and Division Forest office, provide approval for collection from community forest. Enterprise (central wholesaler based on Olsen and Bhattrai, 2005), deposited 12% of the royalty to collect the collection permit. They also deposited provincial tax (around 1%, depending on provincial customs) for transportation permits to transport collected resin from one district to another district in between provinces.

In year 2023-2024, the production of resin from Sudurpaschim province by nine enterprises totaling of 5505.61 metric tons as shown in table 2 below. Three enterprises located in Sudurpaschim province collectively producing 3788.5 metric tons (69% of total resin production) which is further processed in Sudurpaschim province. Enterprise 1(Sudurpaschim) was responsible for 40% of total output, which shows that it played a major role in resource mobilization and tapping operation. Enterprise 2 produced almost 28% of total resin production, while Enterprise 9 only contribute 0.61% of total which implies some limitations in value creation of production network. In contrast, six enterprises located in Lumbini provinces sourced smaller volume from Sudurpaschim province totaling of 1716.25 metric tons (31% of total resin production).

Table 2: Production of resin per enterprises

Enterprises or firm (location)	Production of resin sourced from Sudurpaschim province (metric ton) in year 2023/2024
Enterprise 1 (Sudurpaschim)	2250
Enterprise 2 (Sudurpaschim)	1504.5
Enterprise 3 (Lumbini)	500
Enterprise 4 (Lumbini)	214
Enterprise 5 (Lumbini)	200
Enterprise 6 (Lumbini)	50
Enterprise 7 (Lumbini)	451

Enterprise 8 (Lumbini)	301.25
Enterprise 9 (Sudurpaschim)	34

Enterprises thus created value through employing permanent and temporary employees for the whole operation from tapping to processing of resin. They hired permanent employer (which were titled as administration staff, district in charge, supervisors and factory worker) on the salary basis and hired collectors(who tapped resin in filed) from outside the province due to the unavailability of working people within district and province and they were employed for tapping with the labor cost ranging from NPR 20-35/kg of resin with some advance payment at the beginning of tapping season to cover essential living costs such as housing, food which were later deducted from their final earnings at the end of the tapping season. As such, "*We hired both permanent and temporary employ and temporary employ from Rolpa, Rukum, Palpa (other districts of another province) to avoid high training cost for local people. Also, locals do not give interest in resin work as they avoid resin tapping work as low-wage work"-Enterprises 1.* During loading, unloading,3-4 local people were hired under charges of an average of NPR5-15/kg of resin.

Tenure: Tenure rights plays an important role in facilitating sustained value creation in pine resin sector. Enterprises relied on long-term access to the community forest for tapping through contractual agreement with CFUGs, which are made possible by management plan or operation plan of community forest model. Study found that by securing ownership provided by CFUGs ensure stable access to resources however, the initial phase of securing contracts is often characterized by competition among enterprises for the same forest areas.

4.2.2 Principal component 2: Activities

Value enhancement:

After harvesting, pine resin is collected by harvesters in standardized containers locally known as "tinas" with an appropriate capacity of 17-kilogram crude resin. The containers are then transported from the storage depot to the processing firm or enterprises. In many instances, the resin remains in storage for a period of 3-4 months, depending upon the planning factor of an

enterprise. Once transported to the processing facilities, the resin undergoes advanced primary processing by placing resin tinas in hot chambers provided with closed steam of temperature more than 100 degree Celsius which allows resin to soften and the removal of dirty matters like chips of bark, pine needles and other impurities floating on the top layer which may almost 5kg/tinas. Turpentine is obtained as a byproduct of primary processing which amounts for 20% with 6-8% water. Rosin amounts for 74% from 1 kilogram of crude resin.

Following the primary processing of resin into rosin and turpentine oil, enterprises involved in value enhancement by grading the rosin. Rosin is graded in different grading terms based on its color, texture, luster and transparency. The categorization of grades such as X, WW, WG, N, M, K, D and B with "X" and "WW" represent the highest quality. However, the proportion and frequency of specific grades vary across enterprises. According to result, 33.33% of enterprises categorized rosin in X, WW, WG, N, M, K, D and B with "X" and "WW" represent the highest quality and 44.44% of enterprises categorized rosin in N, M, K, D and B grade with "N" and "M" as highest quality while 22.22% of enterprise categorized into N and B with "N" as highest quality. This grading system helps to enhance the product value as high-quality commands premium price in the international market particularly in India. The average price of high-quality rosin of interviewed enterprises was NPR 130/kg with minimum of NPR 100/kg and Maximum NPR 160/kg and the price difference was only NPR 2-4/kg with lower quality rosin. Similarly, the average price of byproduct turpentine ranges from NPR 180-215/kg, depending on the demand of the international market. Due to the minimal domestic demand (1-5%) of turpentine, the price is lower in the national market as well.

Table 3: Grade and price of resin (1USD= 131.60) (Nepal Rastra Bank, 2023)

Rosin grade	X (high quality)	WW	WG	N	M	K	D	B	J (low quality)
Avg. price (NPR)per/kg	130-160	-	-	-	-	-	-	-	100-105

Source: Field data (2025)

Figure 3**:** Rosin grade box(right), Rosin grade (the more shining the highest quality).

Value capture

Value was captured from collection to export, in all stages of the production network by firm and non-firm actors as shown in figure below.

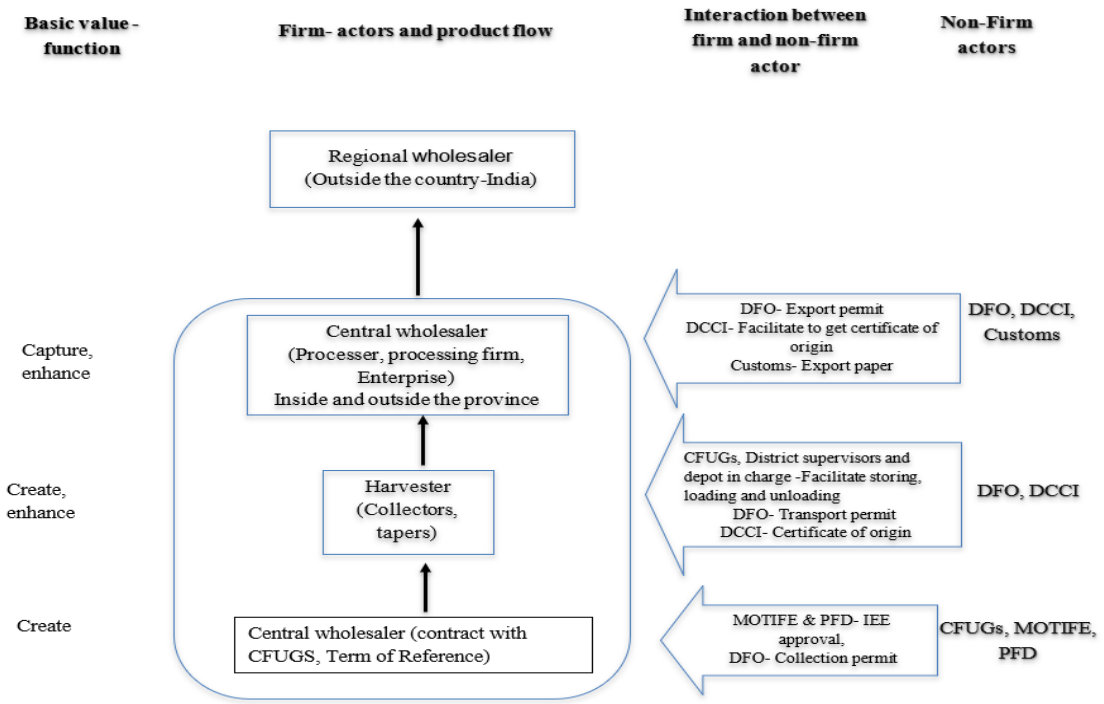

Figure 4**:** Production Network of pine resin enterprises in Sudurpaschim province and Lumbini province. Acronyms: CFUGs: Community Forest User Groups, DCCI: District Chamber of

Commerce and Industries: Division Forest Office, MOTIFE: Ministry of Tourism, Industry, Forest and Environment, PFD: Provincial Forest directorate.

During the process from production to processing o export rosin in international market, enterprises bore different types of cost from collection permit fee to export permit fee to the regional wholesaler (India) as shown in figure 5. CFUGs captured value through fixed royalty payment, i.e., NPR 12/kg from contracted enterprises for collection. Apart from the royalty, value was captured through the demand set by CFUGs. The demand may be the financial help to renew the operational plan of CF, to hire a forest watch *(ban heralu*), and forest fire monitoring. In the words of focus groups,

"As income of CF is less and we cannot always cover all the expenses to manage CF, we put our demands like financial help to renew operational plans, or to hire forest guard in summer as there is high risk of fire and sometimes plantation".

After the resin collected, it was stored in different depots, where depot in-charges and supervisors captured value in form of monthly salary. The salary increases by a certain amount every year by every enterprise. Non-firm actors namely, DCCI, customs, and local government indirectly captured value through permit fee, tax, transportation fee and compliance fee. Apart from royalties of NPR12/kg and VAT of 13%, enterprises pay different taxes to the local government depending on provinces, and on average it was NPR 0.01-1/kg as *pradeshik kar* or *Sthaniya kar.* For export permit, DCCI captured value through making a certificate of origin fee of 0.12/kg and customs. While not highly visible in field accounts, informal rent-seeking practices exist in the name of different groups (eye witness during interviews).

The total cost of crude pine resin for an enterprise before processing (till gate entry), valued NPR85-122/kg including all the cost as shown in figure 5 below and for processing it cost an average of NPR 10-12/kg.

	Cost (NPR/kg)								
	Enterprise 1	Enterprise 2	Enterprise 3	Enterprise 4	Enterprise 5	Enterprise 6	Enterprise 7	Enterprise 8	Enterprise 9
Labor cost (collectors)	25.5	22	30	30	25	30	35	25	22
Handling cost(loading, unloading)	5	5.5	6	6	6	7	12	12	5.5
transportation cost (truck, animals)	27	25	30	30	28	28	30	30	25
VAT	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Royalty	12	12	12	12	12	12	12	12	12
Staff salary	20	15	18	18	16	15	25	20	17
Provincial tax	0.01	0.01	1	1	1	1	1	1	0.01
Customs	0.5	0.5	1	1	1	1	1	1	0.5
DCCI	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Miscellaneous (Chanda)	5	5	2	1	2	2	5	5	4
Total cost of crude resin till gate entry	95.26	85.26	100.25	99.25	91.25	96.25	121.25	106.25	86.26
Processing of resin	107.26	97.26	112.25	111.25	103.25	108.25	133.25	118.25	98.26
Total cost of whole process	107.26	97.26	112.25	111.25	103.25	108.25	133.25	118.25	98.26
selling price of rosin /kg	120	110	140	130	110	115	160	140	110
Rosin	88.8	81.4	103.6	96.2	81.4	85.1	118.4	103.6	81.4
Turpentine oil	40	36	36	38	42	40	43	36	36
Total selling price of rosin	128.8	117.4	139.6	134.2	123.4	125.1	161.4	139.6	117.4
Net margin	21.54	20.14	27.35	22.95	20.15	16.85	28.15	21.35	19.14

Source: Feld data, 2025

Figure 5: Value capture and net margin of all enterprises (all values in NPR/kg) in production network of resin. Acronym: VAT: value added Tax, DCCI: District chamber of commerce and industries.

The total cost for making resin into 74% of rosin and 20% of turpentine varies across enterprises. After processing, enterprises sold Rosin at maximum NPR 160/kg while minimum at NPR 110/kg depending upon the grade of rosin. Similarly, enterprises sold turpentine oil in a range of NPR 180-215/kg. Hence, the variation on net margin of an enterprise ranges from NPR 16.85- 28.15/kg because of different cost and different rates of enterprises as shown in Figure 5.

4.2.3 Principal component 3: Actors

Societal embeddedness:

The pine resin production network is composed of diverse actors which include community forest user groups, collectors, enterprise as firm actors and Ministry, provincial forest directorate, Divisional Forest office, and customs as non-firm actors as shown in figure 4. Each actor plays a distinct and interconnected role in the pine resin network. For instance, CFUG acts as resource

assessor or decision maker, authorizing the access of resources, while enterprises play a crucial role as operational and logistic intermediaries, coordination between CFUGs, managing harvesters and facilitating trade with regional wholesalers or between firm and non-firm actors. As such key informants and focus groups also ensure the central role of enterprises from resource access to facilitating trade with regional wholesalers as there is absence of middleman and local trader.
"There is no middleman between enterprises and CFUGs, whatever process is done, it's by the enterprise itself in direct contact with CFUGs and related stakeholders".

Furthermore, from the survey, 66.66% of enterprises reported having an experience of operation more than a decade which shows the long-standing informal relation and societal embeddedness between firm and non-firm actors.

Territorial embeddedness:

Territorial embeddedness of the pine resin production network is shaped by geographical and institutional positioning of firm and non-firm actors. Collectors or tappers from another province employ their physical embeddedness in the community forest of Sudurpaschim province, as enterprises hired tappers from different places within the country. Interviews with enterprises reported that the collectors are from mid- hill other than Sudurpaschim provinces due to the lack of skilled tappers in Sudurpaschim province. Similarly, enterprises themselves exhibit strong territorial embeddedness as the enterprise is located in flat, terai region while they heavily sourced raw resin from mid-hills community forest within and outside of the province. This interprovincial connectedness emphasizes the access infrastructures and road network. Moreover, enterprises or central wholesalers employ physical embeddedness to the regional wholesaler of India which is near (border side) of Sudurpaschim and Lumbini province where enterprises lie.

4.2.4 Principal component 4: Outcomes

Outcomes in the pine resin processing firm production network is indicated by employment generation, social and economic development as processing firms across two provinces employee permanent and temporary employee as shown in table 1.

4.3. Opportunities and constraints

To gain better insights on opportunities and constraining factors influencing pine resin enterprises in its production network, a Likert-scale assessment was conducted across nine processing enterprises in both Sudurpaschim and Lumbini province. The focus group discussion with CFUGs and key informants also gave their insights on the factors which influenced raw resin processing enterprises. The results reveal a combination of opportunities which support growth of the resin sector alongside several constraints that hinder pine resin processing enterprises growth and sustainability. The key findings (table 4) are summarized below:

Table 4: An overview of external and internal factor of Pine resin processing enterprises (n=9)

Enterprises Factors	Mean±SD1	Median	Mode	min	max
External factor					
Local demand(national)	1.2±0.4	1	1	1	2
International demand	5±0	5	5	5	5
Prices of raw	4.3±0.5	4	4	4	5
Competition with other enterprises	3.7±1	4	4	2	5
Availability of new technologies	4.3±0.9	5	5	3	5
Presence of monopolies/Oligopolies	2.7±1.6	2	1	1	5
National resin import/export regulation	2.3±1.6	1	1	1	4
International resin import/export regulation	2.4±1.2	2	2	1	4
Availability of skilled labor in the market	4.6±0.5	5	5	4	5
Cost of labor	3.9±1.1	4	5	2	5
Improvement in infrastructure	4.3±0.7	4	5	3	5
Socio-economic stability	4.0±0.7	4	4	3	5

Government's regulations and requirements	4.4±0.5	4	4	4	5
Governmental taxes	3.1±1.4	4	4	1	4
Governmental subsidies	2.6±0.9	3	3	1	4
Governmental rent-seeking behavior	3.4±0.5	3	3	3	4
Bureaucratic delays	4.0±0.7	4	4	3	5
Internal factor					
Access to Capital and credit	1.9±0.9	2	1	1	3
Access to insurance	3.0±1.2	2	2	2	5
Marketing skills	1±0	1	1	1	1
Decentralized management	4.1±0.8	4	4	3	5
Role of Auditing	5.0±0.0	5	5	5	5
Role of Processor Organization	1±0.0	1	1	1	1
Sharing of any knowledge and good practices	4.2±0.4	4	4	4	5
Sharing of production cost	4.2±0.5	4	4	4	5

Scale1=Insignificant,2=Slightlysignificant,3=Significant,4=Verysignificant,5=Extremelysignificant

(Source: field data, 2025)

Domestic demand:

There is no domestic demand of rosin and little demand (1-2%) of turpentine, with a domestic demand score of 1.2±0.4. However, domestic demand for resin from community forest is believed to have increased as processing enterprises are increasing the area of collection (number of community forest are now more than in the past).

International demand:

Due to the lack of domestic demand, enterprises were heavily reliant on international markets for rosin and turpentine. Moreover, India is the only destination market of rosin and turpentine till now which influences the value. It is also confirmed by the quantitative score of 5±0 which shows the opportunity for business growth to international level as well as heavy reliance on the international market.

Prices of raw material: Enterprises reported to be impacted from the price of raw material before processing resin and after processing resin which is quantitatively confirmed by the score of 4.3±0.5. “While the price of resin depends on different cost factors like labor cost, transportation

cost, permit cost, etc. which varies between provinces every year, shows the limitation in business growth**.**

Competition with other enterprises: This factor was reported as the significant challenge by enterprises with the score of 3.7±1 indicating a moderate to high level of concern among enterprises. Enterprises noted that high competition between them is leading to encouraging CFUGs for more demand during the contracts which leads to difficulty in securing long-term contracts with CFUGs. Furthermore, the challenge is supported by presence of monopolies/oligopolies (2.7±1.6), suggesting multiple actors in the same sourcing areas which can be described as unhealthy competition.

Availability of new technologies: This factor is viewed positively by all enterprises as they reported that the access to road network, communication, new machinery for processing, distillation unit facilitates new opportunities in operation (even though of high investment cost in collection from rural areas) than in the past. Enterprises emphasize the importance of improved infrastructure (4.3±0.7) and technology (4.3±0.9).

Import/ export regulation: This factor presents mixed constraints for enterprises. Specifically, national import/ export regulation scored 2.3±1.6 indicating variable challenges for enterprises while international import/export regulation scored 2.4±1.2 which indicate a consistent concern among enterprises. During import of resin between provinces and while exporting rosin and turpentine to international markets (India), the main challenge is tedious paper work, taxes, and delays in operation which consistently impact the growth of enterprises.

Availability of skilled labor in the market: Skilled labor is a main and top most constraint as the score of Likert-scale is 4.6±0.5. Enterprises noted that problems existed for the availability of skilled labors as a result, they faced high training cost, slow work which impacted the net margin of enterprises and also on the quality of rosin due to long storage periods from the depot. From the focus group discussion on this factor, they also respond that companies offer low wages and no proper training which leads them for foreign employment rather than local employment. Similarly, enterprises report that labor cost (3.9±1.1) is higher in terms of cost of production due to which enterprises do not meet their resin collection capacity.

Socio-economic instability: Enterprises identified socio-economic instability as a moderate to significant constraint to their operation with a score of 4.0±0.7. Incidents like Maoist insurgency to the 2015 Indian-Nepal border blockade, COVID-2019 pandemic, and periodic local strikes have had negative impact on the efficiency of enterprises. In particular, enterprises operating in Sudurpaschim province reported challenges arising from informal political pressure including frequent financial demand in the name of political and social development indirectly reflected in rent-seeking behaviors (3.4±0.5), suggesting a constant issue increasing operation limitation.

Government's regulations and requirements: There are various rules and regulation from tapping of resin to export of rosin and turpentine, rating 4.4 ± 0.5, which indicates the cumbersome process and layers of regulatory steps. Similarly, delay process of bureaucratic scored 4.0 ± 0.7 which indicates the slow process from IEE approval to custom clearance. Additionally, new taxation rule of provinces and local government (3.1 ± 1.4) shows inconsistence in tax obligation across enterprise.

Governmental subsidies: Enterprises reported subsidies as huge opportunity as well as encourage the growth of resin sector, particularly through incentivizing exports of rosin and turpentine on international market but rated lower (2.6 ± 0.9), implying that the subsidy is either holded or insufficient for most of the enterprises. This reflects a gap between policy intent and practical implementation.

Internal factors:

The functional effectiveness and whole operation of an enterprises is influenced by several factors from collection to export of processed products. Result shows that access to capital and credit was identified as a significant limitation, with a mean score of 1.9 ± 0.9, suggesting the difficulties in obtaining sufficient financial resources for expansion, investment and operational cost. Similarly, access to insurance scored 3.0 ± 1.2, was limited (as insurance scheme prevalent for the processing unit only) leading to increased vulnerability to raw material loss or fire in resin in field, or accident of labor, or unexpected production disruption. Furthermore, marketing skills received the lowest

score (1.0 ± 0.0), indicating widespread gap in capacity for end product producing, branding and marketing. This issue directly impacts national market diversification and profit margins.

Despite with these constraints, enterprises demonstrated strengths in internal areas like auditing compliance scored 5.0 ± 0.0) and decentralized management (mean 4.1 ± 0.8), indicating organizational maturity and accountability in internal governance. Cost sharing practices along with knowledge sharing (4.2 4.0), suggest increase in cooperation and peer learning in the sector. However, the absence role of processor organization was rated low (1.0 ± 0.0), indicating the collective institutional support or advocacy is still underdeveloped. These internal factors represent a operational and critical gap and necessity of targeted intervention.

Chapter-5
Discussion

This chapter discusses the key findings of the study on the pine resin enterprises operating within Sudurpaschim province and Lumbini province although the resource base primarily lies in Sudurpaschim province and a significant share of resin is transported and processed in enterprises of Lumbini provinces. Findings are discussed below in relation to the reviewed literature.

The annual volume of crude resin collected from Sudurpaschim province only is 5505.61 Metric tons in the fiscal year (2023/2024) worth of maximum of NPR 853094.2695 and minimum of NPR 596257.563 (1USD= 131.60) (Nepal Rastra Bank, 2023). Out of the total volume, 4074.1514 metric ton of rosin was produced and 935.9537 metric ton of turpentine oil, which later exported to international market i.e., India. According to the Sudurpaschim Province's Annual Report, this is a significant increase over the estimated 2,500 metric tons collected in 2022/2023. This significant increase in resin production or resin collection volume signifies a more than twofold increase in a single year, which shows the enterprises' expanding operational capacities and potential for growth of National Bioeconomy through resin tapping. This production capacity of only one province is low compared to the annual potential of Nepal (with seven provinces), estimated at 60,000 metric tons (Subedi, 2010; Chhetri & Timilsina, 2021).

Meinhold & Darr (2019; p.14) note that the expanding operation and potential success of environmental product processing enterprises depends on the species, value-chain set-up, type of market, institution, or on the species production network. Hence, there is no singular true path for the success of environmental products processing enterprises. In line with this, study showed that 55.55%) of enterprises were operating at breakeven levels while remaining 44.44% were at profit, indicating that performance is closely tied to production network strength and stable resource access (Cunningham, 2011; Astutik et al.,2019; Caporale et al., 2020). Furthermore, the absence of middlemen contributes to the growing capacities of pine resin enterprises, as collection, processing, and export are handled by the same actors (enterprises). This direct value is captured by a firm actor. i.e. enterprises reduce income loss and increase profits, which is consistent with Meinhold & Darr's (2019) findings that integrating all stages of environmental product production

within one actor benefits processors. Similarly, advancement in infrastructures like road extension, easy communication due to mobile phones (Pyakurel et al., 2018), new machineries allow more efficient trade throughout the year (Cunningham, 2011; Caporale et al., 2020). Cooperation is also considered as opportunities for enterprises as they can share knowledge, skills and cost, scale, limitation amongst the member which they together can overcome the barrier existing within the production network (Zivojonovic et al., 2017) which aligns with the findings of this study.

While enterprise growth and profit indicate opportunity, success in environmental product value chains is rarely without constraints (Meinhold & Darr, 2019). The main constraint in result showed that only 2-5% of processed pine resin products, mainly turpentine oil, are consumed in the domestic market, while 95-98% are exported to the international market mostly to India limiting opportunities for domestic value addition and industrial development (Caporale et al., 2020, Gotame, 2014, p.131). For example, Nepal exports approximately 95% of its production to India (Chhetri &Timilsina, 2021) but it also receives millions of rupees as subsidies each year which was seen as both opportunities and constraint for enterprises. According to the 2075/76 sales report, products made from Mount Rosin and Turpentine have helped Nepal's market reduce imports from other countries worth million rupees (Chhetri & Timilsina, 2021) which aligns with the finding of this study as the government pays a 5% subsidy of export amount because of the contribution in export to international market. Similarly, as a result of dependency to the international market, prices of processed rosin and turpentine were offered by Indian regional wholesalers to Nepalese rosin enterprises which resembles with other study of medicinal plant trade in Nepal (Pyakurel et al., 2025, p;19; Pyakurel et al., 2018). Despite the fact that community user groups owned the access of resource base, competition between enterprises for resource base emphasizes the increased risk of negotiation difficulties and delays (Ofundem et al., 2017; Meinhold & Darr, 2019,) as well as social conflict which in some cases were accompanied by signs of bureaucratic inefficiencies and informal rent-seeking behavior (Pyakurel et al., 2025) by CFUGs. Such practices, although not systematically documented, suggest that tenure allocation is not always transparent or predictable, potentially undermining trust and long-term coordination between enterprises and community institution (Shackleton& Shackleton, 2005 as cited in Meinhold & Darr, 2019).There exist regulatory framework for access and management in place, but unfortunately they are not effectively implemented due to excessive bureaucracy (Zivojonovic

et al., 2017; Shackleton & Campbell, 2007; Smith et al., 2017; Smith et al., 2019; Abtew et al., 20212; Meinhold & Darr, 2019), a lack of monitoring and enforcement (Shackleton & Campbell, 2007; Meinhold & Darr, 2019) among the firm and non-firm actors of resin processing enterprise production network. Since the value creation in the production network begins with collectors (Pyakurel et al., 2025; Pouliot et al., 2018), unskilled laborers lead to inefficiency of enterprises (Caporale et al., 2020). Although wage labor is generally accessible in some areas due to limited employment opportunities (Meinhold & Darr, 2019), resin enterprises in Nepal still experience labor shortage. This is primarily driven by the outmigration of experienced male workers, which in turn increases labor costs and high turnover (Caporale et al., 2020). As a result, enterprises outsource more skilled laborers from outside the region and in contrast, local labor is typically employed for lower-paid and less-technical work like loading, unloading, transporting resin containers to accessible depots and road points (Parajuli et al., 2025).

Potential of resin enterprises in National bioeconomy

The resin processing sector could contribute toward the national bioeconomy (economic growth and environmental sustainability as the introduction of such processing firms has already been prioritize by government (MoC Nepal, 2016). Millions of rupees as subsidies contributing to the national bioeconomy however- transformation requires from supplier of raw materials to end products (Caporale et al., 2020). As study also found, 5% subsidies from government to promote export, however, lack of end product manufacturing unit limits the contribution in Bioeconomy. Therefore, the limitation exist within production network of resin firm needs to be solved. Unskilled labors (Parajuli et al, 2025) due to large-scale outmigration, Export to international market in absence of domestic end product manufacturing unit, and inefficiency in bureaucracy, these barriers are faced by other processing firms somewhere else (Caporale et al.,2020) but addressing them through different initiatives helps to focus in contributing National economy. Therefore, through secure tenure, addressing labor migration, market development (domestic market) and cooperation and coordination between enterprises can address barrier in knowledge, technology and market.

Chapter: 6
Conclusion

In conclusion, this study investigates the production network of pines resin in Nepal by focusing on processing firm sourcing from Sudurpaschim province and operating across two provinces. The finding provides a comprehensive analysis of GPN component, value creation, capture, enhancement, embeddedness with opportunities and limitation of processing firm shaping forest-based bioeconomy.

In year 2023/24, around 5,505.61 metric tons of resin was collected from Sudurpaschim province which was more than double if compared to the annual report of MOTIFE 2021/22 which indicated rising demand, and potential of resin in bioeconomy. The export-driven model (as 95% of processed rosin and turpentine oil to India) brings in foreign currency and helps reduce Nepal's dependency on imported industrial inputs. Furthermore, enterprises benefit from vertical integration: collection, processing, and export are managed directly by them, limiting income loss to intermediaries. Tenure rights secured by Community Forest user groups form a strong pillar as enterprises depends long-term tapping access through contracts based on the operational plan of CF. Nevertheless, competition in tenure security, delays in bureaucratic work, and informal rent-seeking in the name of donations at firm level were identified as significant barriers. These factors indicate a weak institutional environment which may undermine long-term planning of national development through forest-based bioeconomy.

Furthermore, the success of enterprises is limited by lack of skilled labor. The seasonal tapping of Resin is labor-intensive with low wage so enterprises face high turnover and shortage of skilled tappers as they need to hire skilled from other provinces by paying high operational cost. While local labors are only available for basic loading/unloading work. The study also finds that while enterprises receive subsidies for export performance, the support is inconsistent and delayed. Moreover, with less than 5% of products being consumed domestically, Nepal loses out on opportunities for local value addition and industrial diversification. Finally, the study conclude that processing firms have a huge potential to contribute bioeconomy if the limitations are addressed by related stakeholder.

Recommendations

For enterprises

- Reduce dependency on India by exploring new market linkages within global context.
- Value addition through investing in end product manufacturing unit (adhesive, varnishes) to capture higher value within country.
- Provide skilled labor trainings to locals, prioritize women, disadvantage groups to reduce reliance on outsourcing or labor shortage.
- Collaborate with other enterprises to support for new and reliable policy initiatives**.**

For local government

- Develop labor retention strategy by vocational training on rein tapping to avoid outsourcing of labor.
- Simplify the procedure during permit, transportation from one to another province.
- Support processing firm in facilitating domestic market for processed products instead of export.
- Prioritize in developing infrastructure like roads, communication to ease processing firms.

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Appendices

Appendix A: Consent for interview

University of Copenhagen, Denmark

I would like to thank you for taking the time to have this interview with me. My name is Radha Joshi, a graduate student in Master of Global Forestry. I would like to talk to you about the resin enterprises, its production network, role, and every information. This interview is part of the data required in the study I am pursuing for my Masters' Degree.

The interview should take less than an hour. I will be taping the session because I do not want to miss any of your comments. Although I will be taking some notes during the session, I cannot possibly write fast enough to get it all down. I kindly request you to be willing for this. I assure you that all the information of the interview shall be kept confidential and your anonymity shall be secured. This means that your interview responses will by no means pass to a third party and

any information I include in my report does not identify you as the participant. Remember, you do not have to talk about anything you do not want to and you may end the interview at any time. Please sign here to affirm your consent. Thank you.

Signature_____

Date_____

Appendix B: Semi-Structured Interview Guide for the Key Informants of the Study
Guidelines:

Before starting the key informant interview questions, copies of informed consent and confidentiality forms will be provided to each participant and read aloud for the benefit of those who cannot read. Participants will also be provided an opportunity to ask any questions. Verbal agreement should also be taped. Before proceeding to the questions, the interviewer explains the ground rules as follows: Before we start, I would like to remind you that there is no right or wrong answers in this discussion. I am interested in knowing what you think, so please feel free to be frank and to share your point of view. It is very important that I hear your opinion;

Interview date: _____ Interview time _____**Designation:**

1.What is the current legal requirement and regulation in resin collection? Community forest? national forest and others (if any)?

2. Who collects the resin and where does it go after its collection?

3.Who are the key actors involved in the resin production network? (Are there any actors between the producers and the enterprises, such as traders that purchase resin from the CFUGs and then sell to the enterprises).

4. What are the permits and requirements an enterprise must obtain to operate in the resin sector?

5. Are there any restrictions on resin harvesting from forests? (Community, national and others if any)?

6. What taxes and levies apply to resin enterprises at different stages (harvesting, processing, export)?

7. Are there subsidies or incentives (grants, funds) available for resin enterprises?

8.What do you think are the biggest regulatory hurdles faced by resin enterprises?

9. How can policies be improved to support sustainable resin enterprises?

Appendix C: Focus Group Discussion Questions for Executive committee and User groups of Community Forest

Part One: Demographic Characteristics Questionnaires

Age: _____

Sex: _____

Place of Birth: _____

Name of cf and designation _____

Years of experience in field of resin (in cf) _____

Part Two: Focus Group Discussion Questions

1.How long have your user groups been involved in resin collection?

2. How many households in the community participate in resin tapping? What is the basis to participate in tapping? (If there are more user groups in a community forest).

3. Can you briefly explain the process of resin tapping from your forest?

4. Which method is used for tapping in your forest? Why?

5. What is the average resin yield per tree per year in your forest?

6. Who do you sell the resin and at what price? (Direct to the enterprise, auction)? On what basis? (Like agreement on duration, pricing?

7. Do you make competition for enterprises in resin collection? For sourcing

8. How do you negotiate contracts with private enterprises?

9. How are profits from resin sales distributed among CFUG members.

10. What percentage of revenue is reinvested in community development?

11. What kinds of support does the Division Forest office provide during resin tapping?

12. What are the biggest challenges your CFUG faces in resin collection? (Pricing, labor, skills, technology, climate, others)?

13. Do you think CFUGs get fair share of the value from resin tapping companies? Why? Or why not?

14.What do you think is the future possibility of CFUG benefiting more from resin enterprises? How?

Thank you for your time!!

Appendix D: Semi-structure interview for Enterprises

Semi-Structured Interview Form

Note: *All the information collected through this interview is highly confidential and purely for research purposes. Respondents' comments, suggestions, and personal information will not be used beyond research purposes.*

District	
Village	
Date of interview	

Name of interviewer	
GPS coordinates	

SET I: Demographic profile of an enterprise

This section will talk about the questions regarding the general profile of resin enterprises using supplementary material of Smith-Hall et al., 2018.

1.	Name of the firm:	
2.	Year of establishment:	……. years
3.	Ownership type:	a. Private b. Cooperative c. Private Partnership d. Other - specify

4.	Number of employees: (of last 5 years if possible)	a. Temporary: b. Permanent:
5	Mode of operation of firm	a. Seasonal b. Continuous
6	Main objective of the firm: Does your enterprise produce different qualities of raw material? If yes, then what are those qualities? And what is the price of those according to their qualities?	a. only raw material collection b. Processing & value addition c. Both Other - specify)
7.	What is your firm's production capacity? (Tons of resin processed annually)	Processed raw rosin (1kg of resin = how much rosin or turpentine it produces)

8.	Profit, loss, break even, No answer	
9.	How would you describe the current stage of your resin firm in industrial life cycle	Is it in the introduction, growth, maturity, or decline phase? Why?

SET II: Production network aspect

10.	What is your primary source of resin?	a. Self-collection b. Purchase from contractor (who is the contractor) c. Both d. others (if any specify)
11.	What is an estimate of the distribution of supplies across the various sources if(they may get their resin from more than one source)? (From how many districts they purchase and how much volume they purchase from each district(annually))	Volume from different source: (at least of 5 years if possible)
12.	Do you know the source of resin collection you get for your enterprise?	a. Community Forest b. Government Forest c. Private Forest d. Others-specify
13.	Are you involved in resin collection process from forest?	a. Yes, how? b. No then how you get the resin for your enterprise?
14.	Do you directly employ harvesters, or do you only purchase from forests?" If you employ harvesters directly: "How many harvesters do you employ?" and how do you pay for harvester?	a. Yes, how and why? b. No, why?

SET III

This section will talk about the questions regarding the factors impacting resin enterprises using supplementary material of Chaporale et al. 2018. Each question will ask about the overall impact on resin enterprise of every specific factor (graded in a scale from 1 to 5, 1 represent low and 5 represent high) and the reasons why (recorded as qualitative comments about the meaning of the numerical grade given).

External factors

15. How much does local demand impact the operation of your resin enterprise?

(Follow up question: How important is local demand (within Nepal, especially nearby districts and provinces) for your resin business? If local buyers (factories, processors, or local traders) demand more resin, does that lead you to increase collection and processing? On the other hand, if local demand is weak, does that force you to focus on export markets (like India)? Does local demand affect prices, production planning, or product choices (e.g., selling raw resin vs. processing into rosin/turpentine)

1 2 3 4 5

Explanation and comment(s):

percentage of your total resin sales (raw or processed) is distributed to local markets?"(or in kg or tons as well in last 5 years if possible*) (price in local market)*

16. How much does international demand impact your resin enterprise? (India /china/ other part of world).

1 2 3 4 5

Explanation and comment(s):

Percentage of your total resin sales (raw or processed) is distributed to international?"(or in kg or tons as well in last 5 years export to which country? (Price in international market)

17.To what extent do prices of raw resin impact your enterprise?

(*How much of your total production cost comes from buying raw resin?) (Cost of raw resin per kg and cost of processed resin per kg)*

1 2 3 4 5

Explanation and comment(s):

18. How much does competitiveness with other companies impact your enterprise?
Has competition increased or decreased over the past 5 years?

1 2 3 4 5

Explanation and comment(s):

(Is sourcing of raw material easy? Are there any completions?)

19. How much does the availability of new technologies impact your enterprise? *Please provide example(s) of new technology in the comments below (such as mobile phones, distillation units, new machinery, etc.).*

1 2 3 4 5

Explanation and comment(s):

20. To what extent does the presence of monopolies/oligopolies in the market impact your business? Please provide example(s) in the comments below. (other market set low prices? If any)

1 2 3 4 5

Explanation and comment(s):

21. How much do any national resin import/ export regulations impact your enterprise?

1 2 3 4 5

Explanation and comment(s):

Details on tax, VAT,

22. How much do any international resin import/ export regulations impact your enterprise?

1 2 3 4 5

Explanation and comment(s):

Certification?

23. How much does the availability of skilled labor in the market impact your enterprise? Please provide additional comments below (if any).

(Do you have enough skilled workers available for resin tapping, processing, or trading? If skilled workers are lacking, does that cause problems for your business (like lower quality resin, slower work, higher training costs)? Or is labor availability not a big issue for you)

1 2 3 4 5

Explanation and comment(s):

24. How much does cost of labor impact your enterprise? Please provide additional comments below (if any).

(Are wages (daily or seasonal) for resin tappers and processing workers a significant cost for your business? Do rising wages (due to labor shortages or competition) make it harder for you to stay profitable? Is labor your biggest cost, or are other things (like transport, resin royalties, or processing machinery) more important?)

1 2 3 4 5

Explanation and comment(s):

25. How much does improvement in infrastructure (roads, markets, transportation, telecommunications, etc.) impact your enterprise? Please provide example(s) of specific improvements.

1 2 3 4 5

Explanation and comment(s):

26. How much does socio-economic stability impact your enterprise? Please provide examples if instability (e.g., communist insurgency) caused problems in the past. (Political situation,)

1 2 3 4 5

Explanation and comment(s):

27. How much do Nepalese Government's regulations and requirements impact your enterprise?

1 2 3 4 5

Explanation and comment(s):

Do you know, what are those requirement and regulation?

28. How much do governmental taxes impact your enterprise? Kindly provide specific types of taxes in comments below.

1 2 3 4 5

Explanation and comment(s):

How much tax you have to pay per year? VAT?

29. How much do governmental subsidies impact your business? Kindly provide specific types of subsidies (if any) in comments below.

1 2 3 4 5

Explanation and comment(s):

30. To what extent does governmental authorities' rent-seeking behaviors impact your business? Kindy specify types of rent-seeking that you have experienced.

1 2 3 4 5

Explanation and comment(s):

31. To what extent do bureaucratic delays impact your business? Kindly provide examples (if any).
(This could mean delays in: Getting permits to tap resin, renewing licenses, receiving approvals from Division Forest Office or CFUG, clearing resin for export, Accessing subsidies or grants.

1 2 3 4 5
Explanation and comment(s):

Internal factors

32. How much does access to capital and credit impact your business?
(What is the main source of capital? (own savings, bank loan, cooperative loan, grant) (loan from bank,)
Please comment below (if any).

1 2 3 4 5
Explanation and comment(s):

33. How much does access to insurance impact your enterprise? (Like from forest fire, resin theft, or accidental damages during transport)
Please comment below (if any).

1 2 3 4 5
Explanation and comment(s):

34. How much do marketing skills impact your enterprise?
Please comment below (if any).
(Do you directly find buyers yourself, or do you rely on middlemen?
(Have you ever received training in marketing (from government, NGOs, business associations)?
(Do you think better marketing skills would improve your profits? Why)

1 2 3 4 5

Explanation and comment(s):

35. To what extent does decentralized management impact your enterprise?

CFUG contract easy or do you find it easier or harder to work with CFUGs compared to government offices???)
Please comment below (if any).

1 2 3 4 5
Explanation and comment(s):

36. To what extent is the role of auditing important for your enterprise?

(How often are you audited?
Are the rules for auditing clear or confusing?
Has a past audit ever helped you (e.g., get a loan or government approval)?

1 2 3 4 5
Explanation and comment(s):

37. Are you a member of any processor organization(s)? Who?
YES/ NO?
If YES, then how much does the role of processor organization(s) impact your enterprise? Please provide comments below (if any).

1 2 3 4 5

Explanation and comment(s):

38. Do you share any knowledge and/or good practices with other (member) companies?
YES/ NO?
If YES, then how much does this sharing impact your business? Please provide comment(s) below indicating the types of knowledge and/or good practices shared.

1 2 3 4 5

Explanation and comment(s):

39. Do you share any production costs with other (member) companies?
YES/ NO?

If YES, then how much does this sharing impact your business? Please provide comment(s) below indicating the types of costs shared.

1 2 3 4 5

Explanation and comment(s):

40. What are the opportunities do you see for your resin enterprises? Please explain.

Field Photos

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Pine tree setting for resin extraction

Resin collected in tinas (1 tina =17kg)

Resin pouring into stem distillation

Resin pouring into stem distillation

Resin after processing- Rosin

Visit to enterprise

Resin processed into turpentine oil

Focus group discussion with CFUGS