

Review

The Processing of Non-Timber Forest Products through Small and Medium Enterprises—A Review of Enabling and Constraining Factors

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Abstract: Research Highlights: This study reviews the available literature on processed non-timber forest products (NTFPs) in order to comprehensively identify relevant factors enabling or constraining their potential to contribute to rural development. Background and Objectives: NTFPs, such as wild foods, medicinal plants, and raw materials for handicrafts, make significant contributions to rural livelihoods. NTFPs can help fulfil households' subsistence and consumption needs, serve as a safety-net in times of crises, and provide cash income. In particular, the processing of NTFPs has often been suggested to positively influence sustainable economic development in rural areas. However, despite rising interest and recognition of the potential contributions of such industries as key sources of employment and their strategic role in overall growth strategies of developing countries, many NTFP processing enterprises remain in the informal sector and an in-depth understanding of the underlying factors is lacking. This review aims to identify enabling and constraining factors affecting NTFP processing enterprises. Materials and Methods: Using systematic review methodology, studies investigating commercialized, processed NTFPs and their economic impacts have been identified and the current evidence base with regard to NTFP processing and small and medium sized enterprise (SME) development synthesized. Results: Despite the diverse nature of NTFPs, a number of constraining and enabling factors affecting NTFP processing and commercialization were identified. The former includes aspects such as the lack of resource access (finances, skills, technologies, etc.), market information, and basic infrastructure; the latter, amongst others, the role of key entrepreneurs; and cooperation across the value chain, amongst producers, and among members of the institutional environment or an abundant resource base. Moving from small-scale NTFP commercialization in local markets to more mature NTFP value chains reaching export markets, the increasing role of cooperation and having a supportive institutional framework in place, becomes apparent. Conclusions: Overall, successful NTFP processing strongly depends on the socio-economic and environmental context in question, requiring a holistic approach tailored to the respective context and value chain.

Keywords: NTFP; commercialization; processing; SME

1. Introduction

The role of non-timber forest products (NTFPs), including wild foods, forage, medicinal plants, construction materials, fuelwood, and raw materials for handicrafts is increasingly being recognized. Many studies have demonstrated the important contribution of NTFPs to fulfilling households' subsistence and consumption needs [1–14]. Evidence suggests that poorer households are often more dependent or derive greater benefits from NTFPs for their livelihoods [5,15–18]. NTFPs can also serve

food security objectives by contributing to diet diversification, providing micronutrients [19–21], and providing safety-nets in times of crises [12,22–27]. However, fluctuations in NTFP availability may limit this buffer function [28,29]. Provisions of cash income and subsequent entry into the cash economy are further benefits of NTFPs [30,31], although income contribution may strongly vary depending on ecological and socioeconomic settings [32]. The often-overlooked contribution of NTFPs to national economies can be substantial [33–35].

Against this background, the commercialization of NTFPs, which can occur via selling raw or processed resources, has often been promoted, since it can potentially fulfil both conservation and development objectives and lead to livelihood diversification [36]. Commercialization of NTFPs has been demonstrated to be financially competitive in comparison to crop production [37]. However, the conservation-through-use approach often does not hold in practice [38–41]. Common problems include environmental implications, such as overexploitation or alteration of the resource and encompassing ecosystems [36,42]. Benefits to local livelihoods have also been questioned [36,43]. However, often no distinction is made between different commercialization strategies. The value addition of NTFP resources via processing and enterprise development deserves particular attention, since it may have more potential to contribute to employment opportunities and income generation [21,44–51]. Despite widespread use for subsistence, more professional NTFP commercialization is often still in its infancy, particularly in the global south [21,52,53]. However, the processing of NTFPs, and the subsequent enterprise development, is one of few options rural economies have [43,52]. The benefits of processing NTFPs are potentially significant in terms of improved livelihoods for these communities [53]. With increasing processing and commercialization of NTFPs, however, the question remains, at which stage these can still be classified as NTFPs. It is currently disputed whether products collected at industrial scale can still be associated with the NTFP category [54]. Through cultivation and domestication, NTFPs can start to enter agricultural value chains [55].

Against this background, this review aims to identify enabling and constraining factors affecting pro-poor NTFP commercialization and the development of small and medium sized enterprises (SMEs) based on processing the resources. Using systematic review methodology, studies investigating processed, commercialized NTFPs and their economic impacts have been identified and categorized depending on their levels of commercialization. Naturally, upgrading opportunities do not prevail for all NTFPs but often concentrate on selected species, serving niche or export markets. Nevertheless, such markets may still be substantial and benefit many [43].

Previously conducted reviews have not approached NTFP processing in depth, but focused on the ecological implications of NTFP harvesting (e.g., [56–61]), the safety net function of NTFPs (e.g., [12,62]), or their role in nutrition security (e.g., [19,63]). Others have critically reflected on the question of whether forest conservation can occur through the commercialization of NTFPs [36,38,39,64,65]. Several reviews have investigated the contributions of NTFPs, and more generally, of forest or environmental incomes on livelihoods and poverty alleviation (e.g., [1,14,66–74]). However, these typically do not specifically focus on commercialized NTFPs. Reviews which do focus on the role of commercialized NTFPs in livelihoods [75,76], do not specifically address processing activities.

2. Materials and Methods

In order to consolidate the current evidence base on processed, commercialized NTFPs, the systematic review approach, as illustrated by Petticrew and Roberts 2012, was applied. It provides clear procedures, starting from refining the research question, moving on to retrieving the literature, and finishing with synthesizing the evidence [77]. Keywords for the literature search were divided into two categories, the first of which considered NTFPs and synonyms such as “non-wood forest product,” “NWFP,” or “edible wild plants.” The second category reflected keywords associated with commercialization and processing, such as “product develop*,” “market*,” “upgrad*,” “process*,” “enterprise,” or “SME.” The combination of the keywords of both categories using the Boolean operator “and” across five different scientific search engines (Web of Science, Science direct, T&F online, and

Emerald, Springer online) led to the identification of 16,951 articles. Studies were included in the final database based on the adoption of exclusion and inclusion criteria defined in Table 1. The selection process was conducted in three steps, first via screening the titles, secondly the abstracts, and finally, by screening the specific content of the full-text articles against the inclusion and exclusion criteria. In addition to the keyword-search, citation searching in full-text articles was conducted to identify further candidate studies. Overall, the literature search and application of the inclusion and exclusion criteria resulted in the identification of 83 studies focusing on commercialized, processed NTFPs (Figure 1). The literature search was conducted early 2019 and repeated in July 2019 to cover for newly published articles. It is anticipated that the database comprehensively captures the rapidly expanding literature on NTFP processing. Nevertheless, it cannot be ruled out that a small number of relevant studies have been excluded.

Table 1. Eligibility criteria.

Criteria	Inclusion	Exclusion
Publication type	Selection of peer-reviewed academic journals in English from all times	Exclusion of books, book chapters, reports, conference proceedings, or dissertations
Study design	Inclusion of both quantitative and qualitative empirical studies	Exclusion of studies assessing potential of a NTFP theoretically
NTFP	Selection of NTFPs across all regions	Exclusion of animal products, illegal activities and tourism
Commercialization	Inclusion of studies focusing on processed NTFPs	Exclusion of studies with main research focus on subsistence use and sole marketing of raw NTFPs

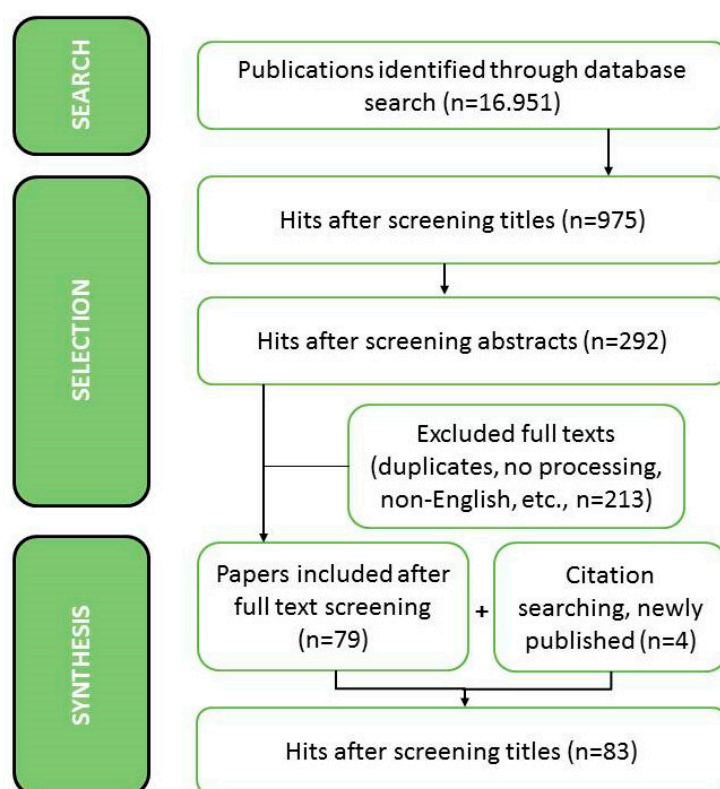


Figure 1. Flowchart illustrating the literature search and selection process.

Data was extracted from each identified study using a pre-defined data extraction tool. This included information on the study area, study objectives, data source and collection methods, information on the NTFP product in question, processing activities, value chain characteristics starting

from raw material acquisition to final marketing, the institutional environment, ecological, economic, and social impacts, and success factors, constraints, and recommendations as stated by the authors. The rationale for the data categories included was based on recommendations by Belcher and Pérez 2001 [78], but was refined to suit the study objectives. Because of data limitations, the quantification of effects due to processing activities (meta-analysis) could not be conducted. Therefore, textual data was analyzed using the qualitative data analysis tool MAXQDA 2018, coding present enabling and constraining factors of NTFP processing [79]. The factors identified were then categorized into common themes and grouped according to their scale (raw material, product, enterprise, market, value chain, and macro level). Besides success and constraining factors, negative environmental implications and strategies to overcome these were considered. In a second step, the identified studies were categorized according to the level of commercialization, whereas four different categories were distinguished (Table 2). The studies were then evaluated against identified factors for success, following the principle that only when the factor was clearly stated as present by the respective authors was the study included in the frequency analysis.

Table 2. Categorization of the studies identified on NTFP processing.

Category of Commercialization	Characterization	No. of Studies
low	NTFP source: wild	30
	Market: regional	
	Processing: only limited value addition, simple tools	
medium-A	NTFP source: cultivation (at least partly)	11
	Market: regional	
	Processing: only limited value addition, simple tools	
medium-B	NTFP source: wild	19
	Market: export and/or national	
	Processing: only limited value addition, simple tools	
high	At least two of the following: NTFP source: cultivation (at least partly)	27
	Market: export and/or national	
	Processing: professional, mechanized value addition	

3. Results

3.1. An Overview of the NTFP Studies

The identified articles were published between 1989 and 2019 (Figure 2). However, over 70% of the studies were published from 2011 onwards, indicating the rising scholarly interest in NTFP commercialization. Almost half of the articles ($n = 39$) were based on studies in Africa. Next were articles from Asia ($n = 17$) and South America ($n = 13$), whereas relatively few articles featured studies from Europe, North America, or Australia. A total of 73 different NTFP species were investigated; however, 28 articles did not provide in-depth taxonomic information on the species utilized. The most commonly investigated, processed NTFP species included the Brazil nut *Bertholletia excelsa* Bonpl. [80–82]; the processed kernels of *Ricinodendron heudelotii* (Baill.) Heckel, which are used as a flavoring agent [83–86]; butter derived from the fruits of the shea tree *Vitellaria paradoxa* C.F.Gaertn. [87–89]; and beverages made from the fruits of the Marula tree *Sclerocarya birrea* (A.Rich.) Hochst. [90–92]. Besides food products, the articles also encompassed a wide variety of other product categories, including different types of household goods (e.g., brushes and brooms, baskets and handbags, mats, ropes, etc.), artwork, and cosmetic products (Table 3). These findings are in line with the often-cited diverse nature of NTFPs. In approximately half of the case studies, the NTFP collectors were directly involved in processing activities, although these were typically only basic value-addition activities. In other cases, more or less formal arrangements with processors were observed. In over 70% of the studies, NTFPs originated from

wild sources; approximately 11% were cultivated and 17% stemmed from both cultivated and wild sources. Approximately half of end products were targeted solely towards local and regional markets; 26% of NTFPs targeted export markets; and the remaining either national markets (6%) or a mixture of domestic and export markets (18%). More commonly identified processed NTFPs targeted niche markets (57%) in comparison to mass markets (43%). In roughly a third of the case studies identified, NTFP development received external support, most commonly through development initiatives.

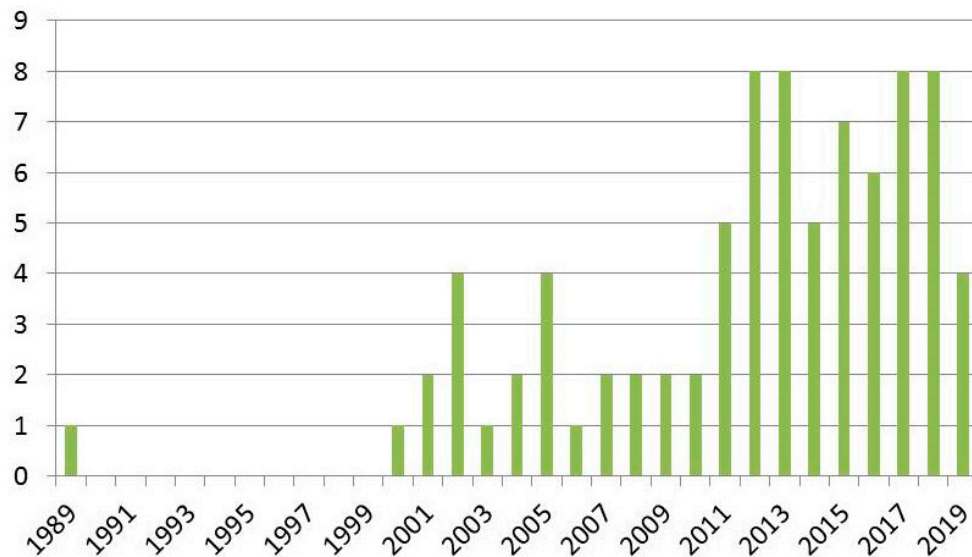


Figure 2. Number of articles per year.

Table 3. Overview of identified commercialized and processed NTFPs.

Product Category	NTFP Product	Species	Countries	References
Foodstuff (n = 33)	Honey	<i>Apis mellifera</i> Linnaeus, <i>Apis dorsata</i> Fabricius.	Cameroon, Ethiopia, Kenya, Philippines	[93–98]
	Fruit pulp, juices	<i>Euterpe edulis</i> Mart., <i>Mauritia flexuosa</i> L.f.	Brazil	[99,100]
	Mushrooms	Various, such as <i>Boletus</i> spp. (often not specified)	Finland, Italy	[101,102]
	Flavoring agents	<i>Ricinodendron heudelotii</i> (Baill.) Heckel (njansang), <i>Iringia</i> spp.	Cameroon	[83–86,103]
	Tea	<i>Ilex guayusa</i> Loes., different herbs (often not specified)	Ecuador, European countries	[104–106]
	Nuts, Seeds	<i>Bertholletia excelsa</i> Bonpl., <i>Cola anomala</i> K.Schum.	Bolivia, Cameroon, Peru	[81,82,85]
	Alcoholic beverages	<i>Sclerocarya birrea</i> (A.Rich.) Hochst. (Marula)	South Africa, Namibia	[90–92]
		<i>Agave potatorum</i> Zucc. (Mescal)	Mexico	[107]
		<i>Elaeis guineensis</i> Jacq., <i>Hyphaene coriacea</i> Gaertn., or <i>Phoenix reclinata</i> Jacq. (Palm wine)	Mozambique, Sierra Leone	[108,109]
	Bamboo shoots	<i>Bambusa</i> spp.	China	[110]
Various	Various (mixture of mushrooms, honey, forest berries, etc.)	Cameroon, European countries	[105,106,111]; [112,113]	

Table 3. Cont.

Product Category	NTFP Product	Species	Countries	References	
Handicraft (n = 25)	Baskets, mats, hammocks, etc.	Various, such as <i>Adansonia digitata</i> L., <i>Aechmea magdalenae</i> (André) André ex Baker, <i>Astrocaryum</i> spp., <i>Bambusa</i> spp., <i>Calamus</i> spp., <i>Cyperus</i> spp., <i>Flagellaria guineensis</i> Schumach., <i>Geonoma deversa</i> (Poit.) Kunth, <i>Gynerium sagittatum</i> (Aubl.) P.Beauv., <i>Juncus kraussii</i> Hochst., <i>Schoenoplectus corymbosus</i> (Roth ex Roem. & Schult.) J.Raynal, <i>Schumannianthus dichotomus</i> (Roxb.) Gagnep., <i>Thoracocarpus bissectus</i> (Vell.) Harling.	Various (Bangladesh, Bolivia, Brazil, Indonesia, Panama, Peru, South Africa, USA, Zimbabwe)	[80,91,114–127]	
	Brushes and brooms	Various, such as <i>Athrixia phylloides</i> DC., <i>Chamaedorea</i> spp., <i>Festuca costata</i> Nees, or <i>Phoenix reclinata</i> Jacq..	Mexico, South Africa	[128–131]	
	Art objects	Various, such as <i>Berchemia discolor</i> (Klotzsch) Hemsl., <i>Bombax ceiba</i> L., <i>Brachychiton diversifolius</i> R.Br., <i>Dalbergia melanoxylon</i> Guill. & Perr., <i>Mauritia flexuosa</i> L.f., <i>Pinus montezumae</i> Lamb., <i>Pterocarpus angolensis</i> DC., <i>Spirostachys Africana</i> Sond..	Various (Australia, Brazil, European countries, Mexico, Puerto Rico, South Africa)	[91,106,132–135]	
Other (n = 26)	Charcoal, fuelwood	Various, such as <i>Dipteryx</i> spp. (often not specified).	Congo, Ghana, Malawi, Mozambique, Peru, Uganda	[136–142]	
	Saps and resins	Various, such as <i>Acacia senegal</i> (L.) Willd. (Gum arabic), <i>Agathis philippinensis</i> Warb., <i>Boswellia papyrifera</i> (Caill. ex Delile) Hochst. (Frankincense), <i>Daemonorops</i> spp., <i>Pistacia atlantica</i> Desf..	Ethiopia, Indonesia, Iran, Philippines, Senegal, Sudan	[143–149]	
	Cosmetic oils, essential oils	Various, such as <i>Aquilaria agallocha</i> Roxb., <i>Astrocaryum murumuru</i> Mart., <i>Bertholletia excelsa</i> Bonpl., <i>Carapa guianensis</i> Aubl., <i>Commiphora wildii</i> Merxm., <i>Gaultheria fragrantissima</i> Wall..	Bangladesh, Bolivia, Brazil, India, Namibia, Nepal	[80,150–154]	
	Miscellaneous	<i>Anaphe panda</i> Boisduval (silk production)		Kenya	[93]
		<i>Daphne bholua</i> Buch.-Ham. ex D.Don and <i>Edgeworthia gardeneri</i> (Wall.) Meisn. (paper production)		Nepal	[151]
		Shells (input ceramics industry)		Cameroon	[155]
		<i>Dimorphandra gardneriana</i> Tul. (input pharmaceutical industry)		Brazil	[156]
<i>Diospyros melanoxylon</i> Roxb. (Cigarettes)			India	[46]	
	<i>Kerria lacca</i> Kerr or <i>Laccifer lacca</i> (Shellac)		India	[46,157]	
Mixed (n = 7)	Butter derived from nuts (for cosmetics and food ingredient)	<i>Pentadesma butyracea</i> Sabine, <i>Vitellaria paradoxa</i> C.F.Gaertn.	Benin, Burkina Faso, Ghana	[87–89,158]	
	Oils (both for food and cosmetic purposes)	<i>Argania spinosa</i> (L.) Skeels, <i>Caryocar coriaceum</i> Wittm.	Brazil, Morocco	[156,159,160]	

3.2. Identification of Enabling and Constraining Factors

Despite the diverse nature of NTFPs, recurrent factors for success and failure can be distinguished. An overall enabling environment for successful NTFP processing has been derived, categorizing the factors identified across the value chain while considering the broader institutional environment

(Figure 3). In the following sections, enabling and constraining factors of NTFP processing at critical points of the value chain, their respective degrees of importance, and potential pathways of intervention are presented.

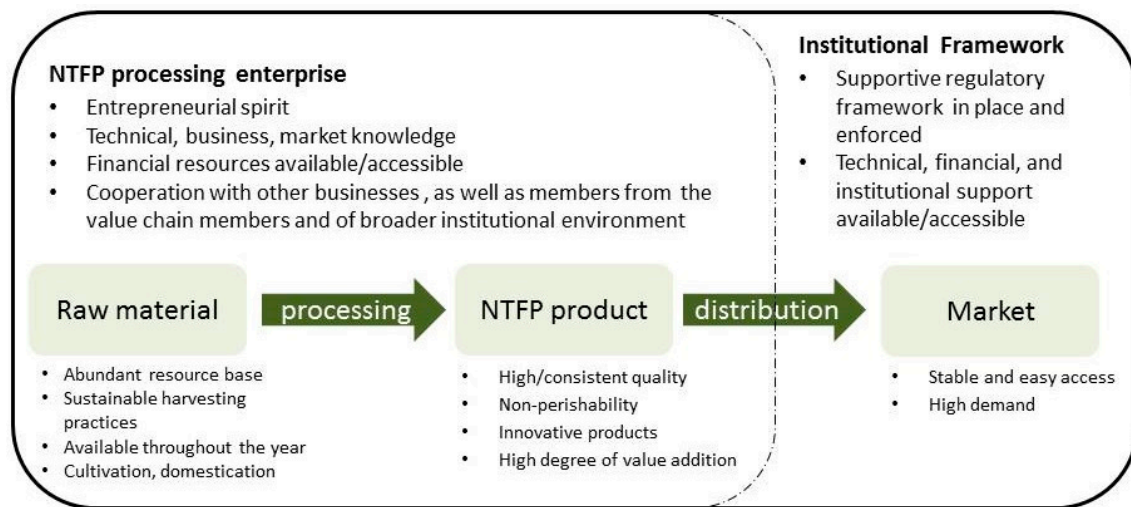


Figure 3. The enabling environment for successful NTFP processing.

3.2.1. Raw Material Acquisition

An abundant NTFP resource base is a prerequisite for the further development of the industry. This can be complicated by the fact that many NTFP species such as fruits or mushrooms are seasonal which is obstructive for business development—in particular, when processing cannot increase the shelf life of the product. Nevertheless, some NTFP species are available throughout the year, including selected materials for handicrafts [134] or for the production of palm wine [109]. In any case, harvesting activities should not compromise the resource base, should have minimal environmental implications, and should not imply health threats (e.g., due to conflicts with wildlife or climbing of trees [128]). Furthermore, subsistence use of the local population should not be compromised by NTFP harvesting for commercial purposes [161].

Unfortunately, however, resource scarcity due to overharvesting and unsustainable harvesting practices is a common problem in the sector. Although the environmental implications of NTFP harvesting and processing were not the main focus of the articles identified, over 40% mentioned negative ecological effects—most commonly, overexploitation of the resource in question. Increased harvesting pressure due to high demand of the resource and unsustainable harvesting techniques, such as destructive harvesting [126,127] or harvesting before sexual reproduction is reached [107], can lead to an overall decline of the resource and a lower productivity of the NTFP species in question. The harvesting pressure can be exacerbated due to potentially substantial post-harvest losses caused by a lack of or inappropriate storage facilities which may lead to insect infestation or microbiological contamination. Indirect negative environmental implications can occur as well, such as the need for other natural resources, in particular firewood, for processing activities [87,107] or pollution and hunting during NTFP harvesting trips [97], leading to further environmental degradation.

Different pathways exist which may assist in overcoming such raw material challenges. These include the cultivation and/or domestication of the resource and having a supportive regulatory framework in place addressing the access and management of the NTFP in question. Replacing traditional NTFP gathering from wild sources by plantations is a common feature in more intensely managed NTFP value chains. Cultivation can take place in various forms, including the integration of NTFP species into agricultural production systems, particularly agroforestry systems, the use of fallow lands or planting NTFPs in publicly or privately owned primary and secondary forests. Besides causing less environmental damage, NTFP cultivation is associated with a variety of other benefits.

Cultivated NTFP species can more easily be taken care of [126], time requirements for harvesting may be reduced, and having clear access rights in place can improve harvest success and reduce the potential for social conflict [103]. Thus, cultivation of NTFPs can improve the overall return of efforts [130]. However, with regard to species conservation, the benefits of cultivation may not be as straightforward as expected [162]. Agroforestry tree domestication has made great progress in the last decades, and it is seen as an important contributor for enhanced economic returns [55,163,164]. NTFP species for which domestication efforts have been initiated include, for example, *Ricnodendron heudelotii* and *Cola anomala* [85].

Besides cultivation and domestication efforts, a supportive regulatory framework ranging from national and international laws and regulations to informal rules within the communities involved can improve the access and sustainable management of NTFPs. Although NTFP-specific laws seldom exist, basic frameworks with regard to the import, export, or transit of wild plant species and their derivatives can provide guidance, in particular, where protected species are concerned. Regulations which are too stringent, such as the European Union's Novel Food Regulation (NFR), however, may be too high a burden and discourage investment in supply chains and market development [165].

Tenure rights are of particular importance, since NTFPs are often harvested from the wild. Although the open access of the resource is often a starting point for NTFP collection and business development, case studies emphasize the increased risk of overharvesting and resource scarcity under such conditions (e.g., [116,149]) and social conflict; e.g., due to competition amongst resource collectors [90,145]. With clear ownership arrangements in place, problems and conflicts occurring due to the open access of the resource can be reduced [100,166]. For selected, often high-value NTFPs, specific management plans have been developed which provide guidance on sustainable management, in particular harvesting practices (e.g., [82,97,108,130,141,142,145,150,160]). Strategies included strongly vary depending on the resource; however, common principles include preference for non-destructive, minimal impact harvesting and spatial and/or temporal regeneration periods. Commercial collection of NTFPs is often also regulated by collection permits which may be granted based on payment of royalties. This may be facilitated by regional or national authorities, particularly forest departments [102,107,108,124,131], but can also occur on a more informal level, such as by the granting of access rights by traditional leaders or councils [86,109]. Scientifically determined maximum sustainable harvest amounts should provide the basis for the number of collection permits provided, although this is seldom the case. Unfortunately, even if regulatory frameworks with regard to NTFP access and management have been put into place, they are often insufficiently implemented. Common problems include high levels of bureaucracy [106,131,141,142,144], a lack of monitoring and low enforcement [131,145], corruption [86], and low levels of awareness and capacity building amongst NTFP collectors.

Ideally, a portion of the profits generated from NTFP commercialization should feed into conservation and/or rural development programs to ensure future availability of the resource and a sustainable development of the sector. This, for instance can be achieved via redistribution of funds obtained from access permits [102] or via afforestation and forest management activities facilitated by NTFP cooperatives [96,146]. Unfortunately, profits obtained from NTFP commercialization alone are seldom a sufficient stimulus for conservation of the resource, an exception being the production of honey [94,95].

3.2.2. NTFP Processing

Following raw material acquisition, different enabling and constraining factors can also be distinguished at the actual NTFP processing step—both at product level and at the level of the involved enterprise, as illustrated in the following sections.

Product Characteristics

Several product parameters can give an indication about the potential of a value-added NTFP. Enabling factors for processed NTFPs include high quality of the end product in question, the innovativeness of the product, and non-perishability. By focusing on achieving high and consistent quality, producers may be able to obtain price premiums; for instance, in export markets where compliance with a variety of quality standards is a basic necessity. Although the degree of possible value addition depends on the NTFP in question [167], a high degree of value addition via processing of NTFPs can in general positively influence income and profits generated [46,86,119,156]. Furthermore, the possibility of co-production of multiple products from a single source can increase the total value added [167]. Innovative products, in contrast to traditional and often very similar or even identical products, have the advantage that new and larger markets may be accessed [105,106,126]. Products which can be stored for a longer time period can be sold throughout the year; for instance, when a better price can be fetched. This has, for instance, been observed for honey/beeswax [96] and charcoal, which can be used as a savings account [140].

Critical is the prevalence of product substitutes, which may be more appealing to consumers due to, for instance, their cheaper prices, resulting in a generally lower demand for NTFPs. Further constraints include a relatively low or variable product quality, perishable products, products lacking innovation, or only basic value addition. NTFP value addition often remains limited due to financial constraints reducing the economic impact that could be achieved. Traditional, often cumbersome processing with basic, outdated equipment also may not achieve the quality demanded by higher return markets, as demonstrated, for instance, for shea butter [88], Brazil nuts [82], bush mangos [103], attar oil [154], and argan oil [160].

Enterprise Characteristics

The entry into the NTFP sector is often seen as relatively easy with only few requirements in terms of resource needs and skills. Furthermore, labor is often readily available, enhanced by the fact that opportunities for wage labor are often limited in rural areas with high dependencies on NTFPs. However, in order to be successful in the market and grow, different skill sets are needed, including technical know-how for processing—in particular to reach higher quality standards—and business skills and market knowledge [105]. Such skill sets and knowledge can be obtained by prior experiences in similar businesses [105,106] and through targeted capacity building initiatives, which are often included in NTFP development initiatives. Such training can contribute to helping producers meet quality requirements by improved storage and processing technologies [82,96,157], but also provide the required marketing, business, and organizational skills to successfully run a small-scale enterprise [123,135,153].

Successful NTFP enterprises often also feature a particular entrepreneurial spirit of the founder which can help gain and sustain a competitive advantage. Key entrepreneurs often are a driving force for success and govern entire value chains [168]. Examples for such industry champions include commercializing African honey [95,96] and mushrooms from Finland [102]. Successful entrepreneurs are often characterized by having high levels of personal interest and engagement in the sector and persistence to acquire needed knowledge of business necessities and opportunities [105,106]. Besides industry champions, microenterprises within a traditional NTFP sector featuring higher entrepreneurial flair have been demonstrated to be more successful than others [131].

Cooperation is also considered beneficial for successful small-scale NTFP processing enterprises. By joining marketing groups and cooperatives, knowledge and skills can be shared amongst members, scale and cost inefficiencies can be overcome, and better bargaining power can be obtained for traders, which can potentially result in increased prices [113]. Furthermore, participation in producer cooperatives may have other benefits, such as enhancing feelings of self-worth amongst members [159]. Positive examples exist, e.g., for njansang [85], argan oil [159], Brazil nuts [82], and crafted products [123]. However, effects strongly depend on the cooperative's operating procedures [160], and a scattered

distribution of producers can also limit the effectiveness of group activities [85]. Besides cooperation with other businesses, cooperation with value chain members, and with members from the broader institutional environment (e.g., research institutes, authorities, NGOs, etc.) can also contribute to business success. Close cooperation and partnerships of NTFP processing enterprises with members of the broader institutional environment, such as local authorities, NGOs, and research institutions can help reduce market inefficiencies and administrative barriers [106]. This has been observed for honey [94–96], Brazil nuts [82], medicinal and aromatic plants [153], and mushrooms [102]. In select cases, such initiatives can even guide the way for new formal standards [95].

The most common constraining factor NTFP processing enterprises face is their limited financial position. Capital requirement for business establishment predominantly stems from own resources [169]. This may make it difficult to invest in e.g., further value addition activities and machinery and thus limit growth and performance of these enterprises, as shown for example for shea [88], argan [160], or agar oil [152]. This can potentially be exacerbated by lack of needed inputs for processing activities, such as fuel wood or electricity. Lack of financial resources can also lead to elite capture, whereas benefits of NTFP commercialization are captured by few, successful enterprises pushing smaller producers out of the market. Poor producers may not afford credit needed between the harvest and sale period [137], do not have resources to cultivate the resource on their lands, but solely rely on increasingly scarce wild sources [116,130,139], cannot afford permits or fees needed for production [143,144], or cannot invest into new technologies with which quality requirement demanded by the market can be reached [160]. Furthermore, small scale producers often have a diversified livelihood strategy in place and may consider it a high risk to invest their limited financial resources solely into NTFPs [104].

Individualistic approaches to business [107,132] and a lack of technical or business skills and particular limited market knowledge are further constraints for NTFP processing enterprises, which may lead to bargaining power remaining with downstream actors [88,97]. Collective NTFP commercialization via associations or cooperatives may not always lead to price premiums, often due to organizational constraints within the cooperatives and mismanagement, discouraging further participation of smallholders [84,85,98,146,159]. Collective entrepreneurial capacity and contribution to household economy may vary significantly depending on organizational setup [170,171]. Benefits of collective action must be evident for smallholders to participate [95].

3.2.3. Marketing of Processed NTFPs

An enabling framework for NTFP processing also features common characteristics on the market level and in value chain setup.

Market Characteristics

Easy access to markets, both spatially and temporally contributes to business success. This can be facilitated via presence of NGOs and development projects [123,153], however, such initiatives will only be viable in case of sufficient demand of the product. High demand is a prerequisite for NTFP business establishment, as seen for instance for charcoal [137], brooms [131], amarula products [92], or agar oil [154]. Creation of demand often does not go without intense marketing efforts, in particular for novel products entering international markets [104,105], funds for which are often not readily available. Nevertheless, studies have demonstrated that demand potential for NTFP products can be considerable, with quality and environmental friendliness being the most important attributes [172,173]. Projects focusing on NTFP business development without considering the demand may fail since the increased supply of products cannot be absorbed, resulting in low prices of the products [82,93,104,121,127,153]. Further constraints persist due to often fluctuating NTFP markets and price oscillations [82,156,159], boom-bust cycles, or the presence of only one or few buyers [93,104]. Under such conditions, it may be too big a risk for small-scale producers to professionalize their NTFP businesses and forsake other income-generating opportunities [95].

Value Chain Setup

Certain value chain setups have been demonstrated to fetch larger benefits for NTFP-processing enterprises. Short value chains are seen as beneficial, since the role of middlemen is restricted and producers can potentially obtain higher prices [100,102,127,149]. Furthermore, shorter chains may also ease implementation and control of standards [104]. The critical role of intermediaries, appropriating benefits and contributing to poor marketing margins for producers has often been demonstrated [143,145,152]. However, with limited market information available, poor infrastructure and financial constraints, middlemen may sometimes be the only pathway for producers to access markets at all.

Integrated value chains with close cooperation amongst members are also commonly associated with economic benefits. Close cooperation between collectors and processors may result in cost reduction and ensure that high-quality raw material is sourced; for instance, via setup of collection centers or pick-up events [101,102,106]. Such arrangements can also provide collectors with market assurance [147]. Via contracts, small-scale producers may be linked to international markets with premium prices improving their income [94,104]. Such cooperation may also occur via informal social norms, binding value chain members together, and providing mutual benefits [108]. However, cooperation amongst value chain members should not be seen as a golden bullet, but strongly depends on the respective setting. For instance, small-scale producers may be limited in their economic freedom and left in a subordinate position depending on the conditions set [82]. Furthermore, they may be restricted to low value-added NTFP development, whereas actors further downstream may capture higher profits [97].

3.2.4. Features of the Broader Institutional Environment

NTFP governance can be characterized as a complex and dynamic hybrid of institutional arrangements, norms, and collective social practices in a multilevel and multi-actor environment [174]. A supportive legislative framework in place can boost the sector, as demonstrated, for instance, for wild mushrooms in Finland, where tax benefits led to a development of the sector [101]. Creating and enabling a business environment for small and medium forest enterprises can be achieved by adapting land tenure arrangements, coupled with capacity building and support activities [175]. For a variety of often high-value species, NTFP management plans have been developed which may offer an opportunity on a more local scale for the sustainable management and upgrading of the resource; for instance, by providing harvesting rules to avoid overexploitation [82,120,130,151]. However, overall supportive legislative and institutional frameworks with regard to NTFPs are often lacking or weak [93,95,97,106]. Where regulations with regard to access and marketing NTFPs do exist, lack of law enforcement and corruption are further obstacles to professionalizing NTFP value chains [86,144,145,176]. A high level of bureaucracy and unclear or unrealistic procedures to follow also inhibit a further development of the sector [131,141,142,144], particularly since NTFP regulations are often embedded in broader frameworks considering rural development or agriculture [106]. NTFP innovations are typically generated from the bottom-up, due to the limited influence of institutional systems [177].

Such issues may often be further exacerbated by poor infrastructure (in particular roads and electricity), restricting market access and the setting of competitive prices [86,103,160]. Necessary technical or financial support from authorities, extension agencies, NGOs, research, and/or financial institutions to assist small-scale producers and to professionalize the sector are often lacking or insufficient [105,106,112,132]. Furthermore, capacity building efforts may not be effective per se, as demonstrated, for instance, by beekeeping [94] and Brazil nut processing—with project lifecycles and their limited timeframes further complicating long-term, sustainable development of the sector in question [82,178]. Established cooperative enterprises may not be able to sustain themselves once external support is gone [171]. It is, therefore, vital that development initiatives reflect the needs of the sector in question on a case-by-case basis. Positive results have, e.g., been obtained for lac

production [157], medicinal plant cultivation and marketing [153], Brazil nuts [178], njansang [84], and artwork [132,133]. However, the long-term sustainability of such initiatives often remains to be seen and the personal initiative of each entrepreneur involved is often viewed to be more important [105,106]. Through building partnerships, many such NTFP governance challenges can be met [179].

3.3. Differentiation Depending on Level of Commercialisation

The frequencies of the selected success factors amongst the case studies reviewed (such as product innovativeness, entrepreneurial spirit of the founder, and the presence of a supportive regulatory framework) differ depending on the intensity of commercialization of processed NTFPs, as categorized in Table 2 (Figure 4).

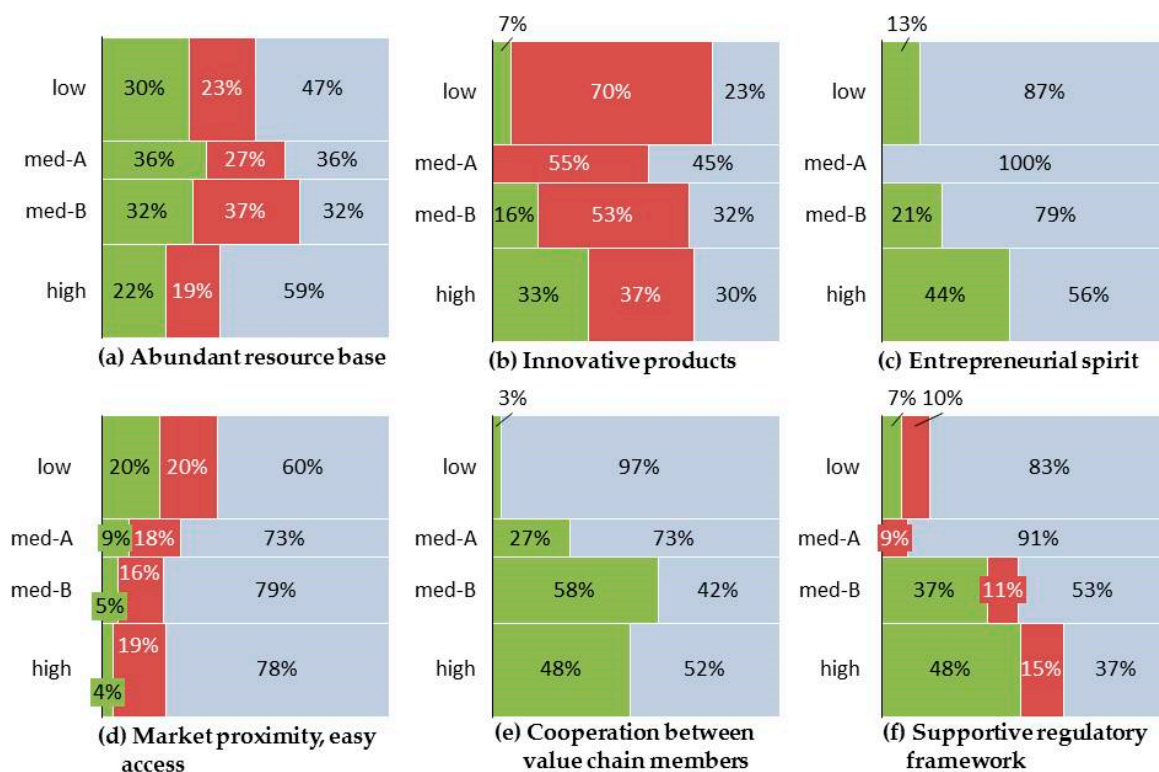


Figure 4. Frequency distribution (%) of selected success factors (panels a–f) depending on level of commercialization (green: factor present in case study; red: factor not present; grey: not sufficient or inconclusive information provided).

Considering the resource base, the data is not very conclusive. Overexploitation of the resource and destructive or unsustainable harvesting practices can occur at all levels of commercialization, although the latter was more present in the lower commercialized categories (low: 20%, med-A: 36%, med-B: 10%, and high: 11% of studies, respectively). Lack of resources in the wild gives a strong incentive for cultivation and sustainable management practices, particularly in cases of strong demand for the product in question, as seen in a number of cases for more highly commercialized NTFPs, such as charcoal production [138–140], juçara berries [99], agar oil production [152,154], chamaedorea palms [130], bamboo products [125], and jernang production [149].

Processed NTFP products commercialized on a low level predominantly are traditional, identical, or very similar products with only limited value addition. Moving towards a higher degree of commercialization, the level of more innovative products increases; however, also in the field of highly commercialized NTFPs, many products have still only undergone basic processing steps (30% of studies in the highly commercialized category) with further value addition taking place only in the countries of import. Nevertheless, 40% of studies in the highly commercialized category indicate that

reaching high quality is a critical factor for success, whereas quality was of no concern in the low and medium level-of-commercialization studies focusing on regional markets.

With regard to the processing enterprises themselves, the existence of industry champions is more prevalent in the case of more highly commercialized NTFPs and exported goods; however, it can also occur on a regional level with individual SMEs standing out, for instance, due to innovative ideas concerning the marketing of their products. In contrast, elite capture of benefits was shown to occur in all settings (low: 10%, med-A: 27%, med-B: 32%, high: 15% of studies, respectively). Cooperation with other enterprises and with members from the institutional environment was judged as a positive success factor in approximately 50% of studies targeting export markets (med-B and high level of commercialization)—in contrast to 23% in the low level of commercialization category which was mainly due to the formation of cooperatives.

Short value chains are judged to be a successful approach for NTFP products commercialized regionally. When the collection of NTFPs, their processing, and their selling is all performed by the same actors, appropriation of benefits by middlemen can be avoided and higher incomes are achieved by small-scale NTFP processors. With increasing intensity of commercialization and targeting of international markets, cooperation between value chain members gains importance. Successful chains for highly commercialized NTFPs are strongly integrated, e.g., by having contracts in place between different value chain members. However, marketing processed NTFPs internationally is not straightforward, with 25%–32% of studies on exporting NTFPs mentioning fluctuating markets and difficult access as major constraints, and only approximately 5% mentioning easy market access as a success factor. For lower and regionally commercialized NTFPs, the picture is less clear, with access to markets being judged as an enabling and a constraining factor more evenly across studies, strongly depending on the respective context and product. This holds true for demand of processed NTFP products as well, which is highly dependent on the product in question.

Having a supportive legislative framework in place is more prevalent in case NTFP products are exported, potentially since the importance of the NTFP in question has already been realized and supporting corresponding legislations have been put into place. Furthermore, different quality standards need to be fulfilled. Institutional support, for instance via financial support programs (loans and subsidies), and activities from research agencies, NGOs, and development organizations, is also more prevalent for more highly commercialized NTFPs—although often judged not to be sufficient or difficult to access due to bureaucratic reasons and lack of information.

4. Discussion

The literature identified encompasses a broad body of different NTFP species, processing techniques, and products. Overall, the potential for NTFP processing enterprises to benefit from NTFP commoditization varies strongly depending on species and product, value chain set-up, the type of market, etc. No singular true path for successful NTFP processing exists, but interventions need to be context specific. Strategies commonly employed, such as group marketing and other forms of collective action, for instance, can have strongly varying effects [84,170]. Different types of value chain setup and organizational models may be advantageous—even for similar products [102]. Furthermore, it has to be stressed that depicted outcomes need to be seen under the condition that NTFP processing studies are difficult to compare due to the high variability amongst products and contexts. Individually, the studies identified, with their varying aims and objectives, typically addressed only selected aspects of pro-poor NTFP processing, neglecting other important issues. For example, extensive information on cooperation may have been provided, with little attention to raw material issue or product characteristics. This inhibits the potential to draw conclusions on inter-linkages and the level of importance of a respective factor. This is further complicated by varying study designs and use of different indicators across studies [180]. Different methods for calculating the economic importance of NTFPs extracted by rural populations can lead to serious uncertainties [181].

Nevertheless, the tendencies revealed are in line with outcomes of other authors who have previously investigated NTFP commercialization. Marshall et al. identified success and constraining factors across the following processes of NTFP commercialization: production, collection, processing, storage, transport, marketing, and sale, with marketing and sale being the key processes constraining successful commercialization [182]. Cunningham identified the need to understand supply chains, consumers, middlemen, prices, roles, and market potential as being of particular importance [43]. Highlighted constraints included the inability to get large volumes to meet market demand, and a lack of attention to quality, quantity, and on-time production. Furthermore, Cunningham et al. identified key barriers of NTFP enterprises to enter commercial markets as resource base, capital, scale, quality, market knowledge, trade network, inventory turnover, policy and regulation, marketing partners, and producer support needs [183]. Badini et al. identified and characterized twelve critical success factors of enabling business environments for forest SMEs as macroeconomic setting, regulatory frameworks, forest law enforcement, tenure and ownership rights, management and land use planning rights, markets, natural capital, financial capital, forest management capacities, business management capacities, organizational capacities, and clustering [184]. Macqueen et al. highlights the importance of democratic oversight, bodies governing environmental and cultural stewardship, negotiated benefit distribution and financial vigilance mechanisms, networks for better access to markets and decision-making, processes for conflict resolution and justice, processes of entrepreneurial training and empowerment, and branding that reinforces local visions of prosperity, as success factors for locally-controlled forestry businesses [185]. According to Pettenella et al., the differentiation, integration, and creation of networking among both private and public actors and the development of the territorial marketing are considered the most important tools for improving the economic value of small-scale forestry in marginal areas—without leaving the resource base overlooked [186]. Newton established five conditions necessary in order to achieve the sustainable use of NTFPs: the harvesting of forest products must be sustainable and must not interact positively with other threats; commercialization of the forest product must be economically viable; economic benefits from commercialization must be received by producers; and the income received from commercialization must support conservation action [40]. Shackleton and Pandey propose eight steps to facilitate integration of NTFPs for the benefit of local communities: proper inventory of NTFP stocks; research on NTFP ecology and sustainable harvest levels; the introduction of extension services for NTFPs; the inclusion of NTFPs in land management and trade-off decisions; the integration of NTFPs into sectoral policies; ensuring NTFP commercialization does not inhibit local livelihood needs; promoting security of access and use; and finally, the examination of local contextual drivers of unsustainable use [187].

Focusing on NTFP processing, the importance of the development and promotion of small-scale processing technologies in order to achieve high-quality products with longer shelf lives needs to be highlighted. Processed NTFP products often remain traditional, although there is great potential for innovative products with higher degrees of value addition, given the increasing consumer demand for specialty products and the variety of NTFPs. Nevertheless, open questions remain, such as when and how, with increasing commercialization, NTFPs are transformed from being extracted products to being included into more advanced, industrial production systems. How this transition will affect local consumption and use patterns, and whether and under which circumstances cultivation and extractivism can occur in parallel or at the risk of exclusion or marginalization of smallholders in this context are further issues to be more deeply investigated in the future. Furthermore, the effects of individual in contrast to collective actions at different stages of the value chain (harvesting, processing, marketing, etc.) need to be more fully addressed.

5. Conclusions

It needs to be emphasized that the enabling framework illustrated for successful NTFP processing cannot provide a straightforward pathway for NTFP commercialization, but rather draws attention to key issues when, for instance, planning NTFP development initiatives. While NTFP value chains

may seem rather straightforward, there may be considerable complexities and challenges involved which may inhibit upstream actors from fully benefiting from commercialization activities. Policy support to enhance the successful processing of NTFPs, thus, needs to be tailored to the respective contexts and value chains. The potential of an NTFP is not solely characterized by the product itself, but also by its socio-economic and environmental context, taking the entire value chain and the surrounding institutional framework into account [188]. Hence, a nuanced and holistic view needs to be emphasized [38].

Furthermore, it should be stressed that use of NTFPs for subsistence and their safety net function may be of higher importance than their role in creation of job opportunities and contributing to rural development [189]. In order to stimulate benefits, NTFP commercialization needs to generate sufficient profits for re-investment—which is most often not the case. This may be complicated by the fact that benefits from NTFP commercialization can be captured by elites. Nevertheless, the processing of NTFPs can raise income levels and provide a stepping stone out of poverty for some in selected contexts and circumstances. Last but not least, it should not be overlooked that NTFP commodification has other benefits as well, such as contributing to livelihood diversification, enhancing the self-worth of producers, and providing an opportunity to enter the cash economy in the first place, particularly in rural settings with limited options for wage labor.

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