Application of the typical enterprise approach in forestry: a pilot study to collect economic key figures in small-scale private forest enterprises in five EU countries

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ABSTRACT

The European small-scale private forest is facing major challenges as a result of climate change and increasing societal demands. For evidence-based decision-making e.g., for economic impact assessments, comparable information on the economic situation of small-scale private forest enterprises is of growing importance. So far, however, there are no or only few economic key figures on forest management available for small-scale private forest enterprises (SSPFE) in many EU Member States. Furthermore, the few existing key figures are hardly internationally comparable. Therefore, in a pilot-study within the joint research project "Valorising small-scale forestry for a bio-based economy (ValoFor)" comparable key figures on forest management in SSPFE in Germany, Finland, Austria, Sweden and Slovenia were collected for the first time, using a modified "typical enterprise approach". For each country, a typical SSPFE with typical management measures and economic indicators was created through in-depth literature analysis and expert interviews. For example, it was found that in the reference year 2021, the highest timber revenues in typical SSPFE were achieved in Austria (66 €/m^3). This was followed by Germany with 57 €/m^3. For the typical enterprises in Finland, Sweden and Slovenia, timber revenues of 41 - 42 €/m^3 were calculated. The "typical forest enterprise" approach, which can be realized with comparatively little effort, can serve as a valuable basis for further forest economic impact assessments for EU policy processes.

KEYWORDS

Typical enterprise, small-scale private forest, EU, key figures of forest management

1 INTRODUCTION

Forestry in Europe is economically significant and an important source of employment and income, especially in rural areas. To date, about 50% of the forest area in the EU is privately owned. Private forests under 20 ha have a share of 33% of the total EU private forest area (Hirsch et al., 2007).

Currently, the (small-scale) private forest in the EU is confronted with increasingly competing demands. On the one hand, there is the growing demand for wood for bioeconomy, and on the other hand, the provision of ecosystem services such as climate and biodiversity protection, which are not necessarily in line with timber use. Similarly, small-scale private forest enterprises (SSPFE) are challenged by the consequences of climate change and the resulting need to adapt forest management.

Against this background, information on the economic situation of SSPFE is of great importance as a foundation for evidence-based decision-making on enterprise and political level, e.g., for economic impact assessments of modified forest management to provide additional ecosystem services. In many European countries, however, key figures on forest management in SSPFE are not available at national level or are collected in a time-consuming and costly manner in national forest accountancy data networks for medium and large forest enterprises (Bürgi et al., 2016). Therefore, in a pilot study within the research project "Valorising small-scale forestry for a bio-based economy (ValoFor)", the "typical enterprise approach" was applied for the first time to collect key figures of SSPFE in Germany, Finland, Austria, Sweden and Slovenia.

2 METHODS

In the "typical enterprise approach", instead of a complex data collection in many (sample) enterprises, one type of enterprise, which represents a large (= typical) group of enterprises according to expert assessment, is examined in detail. Thus, the aim is not to map average values representing the entirety of enterprises but to represent one (or more) typical group. The research economic advantage of this approach is the relatively low-cost data collection in a few case study enterprises and/or by expert assessments, supplemented by secondary data. The approach is already successfully applied in agriculture and fisheries worldwide (Deblitz et al., 1998; Lasner et al., 2016; Chibanda et al., 2020; Lasner, 2020).

Due to the corona situation, a "fast-track approach" (Deblitz et al., 1998) was applied for defining and for collecting data on the typical SSPFE, with its characteristic management measures and economic key figures, in each ValoFor partner country. For this purpose, a typical SSPFE per country was first pre-defined from literature research and a profile was created for it (Table 1). Furthermore, a simplified and standardized operational accounting sheet for forest management was developed for all partner countries (Table 2), based on the operational accounting sheet of the German forest accountancy data network and including natural and economic key figures. For the simplified operational accounting sheet, the following cost centers structured in operational activities were chosen: forest protection, forest infrastructure, regeneration, pre-commercial thinning, thinning and final felling. Further, we classified a cost center for consulting and support as well as for forest owner associations. In order to reduce the effort for the interview partners, all other costs were subsumed in the position "remaining fixed costs".

The operational accounting sheet was pre-filled as far as possible by in-depth data research in literature, statistics and websites of forestry stakeholders. In the next step, by means of 14 in-depth expert-interviews, the pre-defined data was discussed and adapted were necessary and data gaps were filled. These interviews were conducted online in the year 2021 with a representative of a forest owners association, a forestry association and of forest economic science in each country. After the synoptic evaluation of the collected key figures, they were validated again by the national experts and the project partners. The key economic figures were, in a next step, used for a calculation of the contribution margins and the net yields.

3 RESULTS

3.1 Country profiles of the typical SSPFE forest enterprises

Table 1 shows the country profiles of the typical SSPFE developed in this way. The typical SSPFE in the five ValoFor project partner countries show similarities and differences. Noteworthy are the significant differences in the definition of SSPFE by forest area in the Scandinavian countries (35 ha and 50 ha) and the Central European countries (1.5 ha to 5 ha). Due to the different ownership sizes, the opposite is true for the relative own consumption of raw wood (depicted as share of total harvest). This is relatively low for Scandinavian SSPFE (5% to 10%) and significantly higher for Central European SSPFE (30% to 50%).

Table 1. Characteristics of typical SSPFE in the five ValoFor partner countries.

	Finland	Sweden	Germany	Austria	Slovenia
Forest area	35 ha	50 ha	2.5 ha	5 ha	1.5 ha
Forest owner	Sole owner or family ownership	Family ownership or multiple owners	Sole owner or family ownership	No information available	Fragmented with about three parcels, several owners.
Relation to agriculture	Hardly any agricultural background	No agricultural background	No agricultural background	With agricultural background	No agricultural background
Operational goals	Interested in forestry income, but not dependent on it	Interested in forestry income, but not dependent on it	Low economic orientation	Interested in forestry income, but not dependent on it	Low economic orientation
Own consumption (share of total logging)	5%	5-10%	30%	40%	50%

Forest infrastructure (maintenance and new construction)	Maintenance of forest roads by service providers	Maintenance of forest roads by service providers; annual fee according to cutting volume	Investments in forest roads only irregularly	No information available	Maintenance of forest roads by public service providers; annual charge
Regeneration	Artificial regeneration by service provider	Artificial regeneration by service provider	Natural regeneration supplemented by planting in own activity	Natural regeneration supplemented by planting in own activity	Mainly natural regeneration
Pre-commercial thinning	service provider	motor-manual; own activity	motor-manual; own activity	motor-manual; own activity	motor-manual; own activity
Thinning and timber felling	Clearcutting; highly mechanized timber harvesting; Service provider	Clearcutting; highly mechanized timber harvesting; Service provider	Single log harvesting; motorized (manual) harvesting; own activity.	Single log harvesting; motorized (manual) harvesting; own activity.	motorized (manual) harvesting; own activity.
Timber marketing	Stumpage sale to wood processing companies	Stumpage sale to wood processing companies	Delivery sale „at the forest road", from forest owner directly to wood processing companies	Delivery sale „at the forest road", from forest owner directly to wood processing companies	Delivery sale „at the forest road", from forest owner directly to timber merchant
Member in Forest Ownership Association	Yes	No, but long-standing relationship with companies	No	No	No
Consultation	Forest Owner Associations, Service providers	Forest Owner Associations; wood processing companies	Forest Service	Chamber of Agriculture	Forest Service
Additional costs	Fee for Forest Owner Association, marketing costs	Consulting and support	Consulting and support	--	--
Remaining fixed costs	Insurance, administrative expenses, depreciation	Insurance	Insurance, taxes, administrative costs	Insurance, taxes, administrative costs, fee for Chamber of Agriculture	---

Similarly, in terms of timber harvesting and sales, highly mechanized harvesting by service providers and stumpage sales of raw timber are common among Scandinavian SSPFE, while motorized harvesting by own activity and delivery sales at the forest road are considered characteristic among Central European forest enterprises. In order to establish comparability between these two groups, delivery timber sales were also calculated for the Scandinavian SSPFE in Table 2. Also, the own consumption in Table 2 was valued at market prices. Except for Austria, the typical SSPFE in all ValoFor countries have in common that there is no/hardly any agricultural background anymore.

3.2 Comparison of key figures of typical SSPFE

Table 2 presents the results in the form of a contribution margin accounting for an average hectare and cubic meter in each country. In Finland and Sweden, there are no direct property tax and Chamber of Agriculture levies; instead, these are collected via an increased income tax rate, which complicates the comparison between the countries. A direct comparison of subsidies and government support between countries is also limited, as some measures receive indirect public support and do not reflect actual costs. Future forest management in SSPFE was modelled by the ValoFor project partners based on national inventory data and using country specific forest growth models. The typical SSPFE are therefore based on the tree species and age class distribution in the national average small private forest. Stands were assumed to be managed on a regular basis (i.e., no intermittent management). As a result, Table 2 shows the (future) potential volume of raw logs of a "status quo management" rather than actual raw logging.

- Logging: In the "status quo management", modeled by the project partners, Germany and Austria showed the highest volume of raw wood with 8.2 and 7.2 m^3/ha/a, respectively. The Scandinavian countries and Slovenia ranged at 3.5 - 4.4 m^3/ha/a. The economic indicators per hectare are therefore significantly influenced by the amount of raw wood. However, when interpreting the total operating result, the forest area size of typical SSPFE should also be considered.
- Revenues: The highest timber revenues were achieved by the typical SSPFE in Austria with 471 €/ha/a (66 €/m^3) followed by Germany with 464 €/ha/a (57 €/m^3). For Finland, Sweden and Slovenia, timber revenues of 41 - 42 €/m^3 were calculated. In relation to the hectare, this results in 186 €/ha/a (Sweden), 149 €/ha/a (Finland) and 144 €/ha/a (Slovenia).
- Costs: The costs for stand establishment were highest in Germany and Austria, which is due to own work and a high imputed entrepreneurial salary (33 €/h and 25 €/h). In Finland and Sweden, only low costs are listed for establishing a stand, as service providers offer efficient planting procedures. The lowest stand establishment costs were reported in Slovenia, as this is mainly based on natural regeneration and subsidized by the state.
- The highest harvesting costs in the final felling were recorded in Austria with 263 €/ha/a (46 €/m^3), followed by Germany with 151 €/ha/a (28 €/m^3). The high harvesting costs in Austria are due to high logging costs in steep slope terrain and a high imputed entrepreneurial salary for own work. In Finland and Sweden, imputed harvesting costs are lowest at 25 €/ha/a (10 €/m^3) and 28 €/ha/a (11 €/m^3), respectively, primarily due to highly mechanized harvesting

methods used by service providers. Slovenia is in the middle of the five countries with 57 €/ha/a (18 €/m^3).

- The highest total costs were incurred in Austria at 402 €/ha/a. In Germany, the calculated total costs were 343 €/ha/a. In Finland and Sweden, the total costs are in the middle range with 98 €/ha/a, and 92 €/ha/a, respectively. The lowest total costs were in Slovenia with 70 €/ha/a.
- Net yields: The highest net yields were achieved in Germany with 125 €/ha/a (15 €/m^3), which is primarily due to the felling amounts. In Sweden, net yields of 94 €/ha/a (21 €/m^3) were calculated for the typical SSPFE. In Finland, the lowest net yields per hectare were achieved with 55 €/ha/a (15 €/m^3). The main factors influencing this are the low timber revenues per hectare, due to the low volume of raw timber, and the comparatively high fixed costs. The highest timber revenues were achieved in Austria. Due to the high total costs for forest management, this country, with 76 €/ha/a (11 €/m^3) net yields, is only in the middle of the ValoFor country comparison. Slovenia recorded the lowest average felling, but management costs are heavily subsidized and there are no significant fixed operational costs. However, with 74 €/ha/a (21 €/m^3) net yields, a comparable result to Austria was achieved.

Table 2. Simplified operational accounting sheet of typical SSPFE in the five project partner countries (including own consumption valued at market prices).
Notes: In italics and gray are shown the key figures for a stock sale of raw wood. For the calculation of costs per m^3, average costs for final felling and thinning are assumed. Proportionate costs for end-use and thinning are used to calculate the sum of variable costs of timber revenues per m^3. (see next page)

	Finland		Sweden		Germany		Austria		Slovenia	
I.) Raw wood potential	**m^3/ha**		**m^3/ha**		**m^3/ha**		**m^3/ha**		**m^3/ha**	
Average amount from thinning	1.2		1.9		2.8		1.4		0.3	
Average amount from final felling	2.4		2.5		5.4		5.7		3.2	
Total amount of timber	**3.6**		**4.4**		**8.2**		**7.2**		**3.5**	
II.) Income	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**
Timber production	149	42	186	42	464	57	471	66	144	41
	105	29	124	28						
Subsidies	4	1	-	-	4	0.5	7	1	-	-
Total income	153	43	186	42	468	57	478	67	144	41
	108	*30*	*124*	*28*						
III.) Costs	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**
Forest protection	-	-	-	-	-	-	-	-	1	0.3
Forest infrastructure	2	0.4	11	3	-	-	-	-	4	1
Regeneration	13	4	8	2	46	6	41	6	2	1
Pre-commercial thinning	5	1	3	1	5	1	-	-	-	-
Final felling	44	12	62	18	229	28	329	46	63	18
	-	-	-	-						
Subtotal of costs	**64**	**18**	**84**	**23**	**280**	**34**	**370**	**52**	**69**	**20**
	19	*5*	*22*	*5*						
Consulting and support	-	-	2	1	15	2	-	-	-	-
Forest Management Association	-	-	-	-	-	-	-	-	-	-
Annual fee	2	1	-	-	-	-	-	-	-	-
Timber marketing	4	1	-	-	-	-	-	-	-	-
Subtotal of costs	**6**	**2**	**2**	**1**	**15**	**2**	**0**	**0**	**0**	**0**
Remaining fixed costs	28	8	5	1	48	6	32	4	0	0
Total costs	**98**	**28**	**92**	**21**	**343**	**42**	**402**	**56**	**70**	**20**
	54	*15*	*30*	*7*						
IV.) Total revenues	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**	**€/ha/a**	**€/m^3**
Contribution margin	**105**	**30**	**124**	**28**	**235**	**29**	**142**	**21**	**81**	**23**
Net yield	**55**	**15**	**94**	**21**	**125**	**15**	**76**	**11**	**74**	**21**

4 DISCUSSION AND CONCLUSION

With this pilot study, the "typical enterprise approach" in SSPFE was applied in several European countries for the first time. Based on the collected data and modelling of a status quo forest management, it was also possible in the ValoFor project to further evaluate the impacts of alternative forest management scenarios in a comparative manner. The approach of the "typical forest enterprise" offers a promising possibility to realize forest economic impact assessments for ongoing EU policy processes with reasonable effort (e.g., EU biodiversity strategy). For this purpose, it would be desirable to establish a permanent, international, forestry indicator network, which in particular also allows time series analyses. There is a need for research, among other things, in the delimitation and identification of different national forms of indirect subsidization of small private forests.

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