FORESTRY IDEAS, 2021, vol. 27, No 1 (61): 46–58

CHAIN OF CUSTODY AND LABELLING OF FOREST PRODUCTS IN ROMANIA

Adelin-Ionuț Nicorescu[1], Aureliu Florin Hălălișan[1*], and Nikolay Neykov[2]

[1]Faculty of Silviculture and Forest Engineering, Transilvania University of Brasov, 1 Sirul Beethowen Str., Brasov, 500123, Romania. E-mails: adelin.nicorescu@student.unitbv.ro, aureliu.halalisan@unitbv.ro*

[2]Faculty of Business Management, University of Forestry, 10 Kliment Ohridsky Blvd., Sofia 1797, Bulgaria. E-mail: nneykov@ltu.bg

Received: 23 November 2020 Accepted: 29 March 2021

Abstract

The aim of this paper is to analyse the history and the current situation of FSC CoC certified companies in Romania, to present an overview of the distribution of those companies in the country's regions, to highlight the FSC product category adopted by Romanian companies and which label type is the most common. In addition, the paper will outline a brief comparison between FSC CoC and PEFC CoC. The FSC database was accessed for the analysis. Then an excel spreadsheet was created starting from the name of the certified company, its location, the certification code, FSC certificate period of validity, the standard utilized for certification, types of certificated products traded, claims of the products, primary and secondary activity at certification. The data were processed using STATISTICA 7.0. Normality of distribution was tested using Kolmogorov-Smirnov and Shapiro-Wilk tests. Compared with Europe, Romania is the third country by number of the FSC CoC certified companies. Their distribution shows a high concentration in North Romania. The main activity is primary processing (32 %) and the dominants FSC certified products found in Romania are part of the following categories: W1-Rough wood, W5-Solid wood (sawn, chipped, peeled), W3-Wood in chips or particles, W12-Indoor furniture, P5-Packaging and wrappings of paper. Among all FSC products types sold, the most frequent is FSC 100%. Therefore, the companies' efforts must be appreciated in this respect. These efforts require the use of a range of resources, including financial ones, to demonstrate the fulfilment of all the requirements of the voluntary FSC standard.

Key words: forest certification, FSC, standards, sustainability, wood products.

Introduction

United Nation Conference on Environment and Development (ONCED) held in 1992 in Rio de Janeiro, Brazil was the official staring point toward sustainable forest management (SFM) (Diaz-Balteiro and de Jalón 2017). The principal output after the summit was to highlight the deforestation in the tropics by SFM means. The aim of SFM is to provide the necessary information to customers about the forest and forest products (wood and non-wood products). SFM also assures that all the processes are held into environment, social and economic considerations (Marx 2010, Lewis and Davis 2015, Michal et al. 2019, Santoso et al. 2019), and to the bene-

fits of next generations (Clark and Kozar 2011). SFM is dealing with subjects related to deforestation in the tropics, maintenance of biodiversity, the quality of forest management (Rametsteiner and Simula 2003), circular economy (Näyhä 2019), and resources efficiency (Husgafvel et al. 2018).

The first forest certification label appeared with the establishment of Forest Stewardship Council in 1993. The following were Sustainable Forestry Initiative (SFI) in 1995, the Canadian Sustainability Association – Sustainable Forestry Management System (CSA) in 1996 and the Programme for the Endorsement of Forest Certification (PEFC) in 1999 (Ozinga 2010, Klarić et al. 2016, Halalisan et al. 2019). A number of certification schemes appeared at national level such as China Forest Certification Council (CFCC) in China, the Japanese Sustainable Green Ecosystem Council (SGEC), and Indonesian Ecolabelling Institute and Indonesian Forestry Certification Cooperation (IFCC) (Halalisan et al. 2018). The purpose of the certification system is to guarantee that all products are certified (Clark and Kozar 2011). Therefore, forests, as well as all processes, from timber extraction to the final product, are certified. The certified area has dramatically increased in the last decade. However, almost 90 % of the globally certified area is in the northern hemisphere (Kraxner et al. 2017). FSC has two types of certification. One of them is responsible for forest management (FM) certification and the other one is responsible for chain of custody certification (CoC) (Owari and Sawanobori 2008, Paluš et al. 2018).

The most important and widespread forestry certification schemes are FSC and PEFC. There are 320 million ha globally certified by PEFC (PEFC 2020), 212 million ha globally certified by FSC (FSC 2020a), and 92 million ha certified by both FSC and PEFC (FSC and PEFC 2020). Hence, 10 % of the global forests is certified by those two certification schemes (Enescu et al. 2019).

In stark contrast with this world perspective, Romania applied for FSC forest management certification and there are 2.8 million ha certified by FSC (FSC 2020a), and that represents 43.1 % from the forested area. Hence, there are no certified areas by PEFC in Romania (Gavrilut et al. 2015, Enescu et al. 2019). Our further analysis will focus on FSC. The FSC certification process is completely voluntary and provides, among other advantages, some benefits to stakeholders (Auld et al. 2008, Paluš and Kaputa 2009, Guan et al. 2019, Michal et al. 2019). The CoC process requires a level of coordination among all the parts involved in the process (Vidal et al. 2005). The certification procedure represents a 'third party audit' (Masters et al. 2010, Halalisan et al. 2018) and implies an independent certification body (CB) that carries out the assessment. Furthermore, those CB are controlled and periodically verified by Accreditation Service International (ASI). The most important features of audits are transparency, objectivity and efficiency (Cook et al. 2016).

FSC (2004) defines 'Chain of Custody' as 'an information trail about the path taken by products from the forest or, in the case of recycled materials, from the reclamation site to the consumer including each stage of processing, transformation, manufacturing, and distribution where progress to the next stage of the supply chain involves a change of ownership'. In order to sell products as FSC-certified or FSC-labelled and promote it with the FSC trademark, the organization must hold a

valid FSC CoC certificate and a signed trademark license agreement with FSC (Paluš and Kaputa 2009, Paluš et al. 2017, Brotto and Pettenella 2018). FSC CoC can be applied alone (FSC CoC certificate is issued) or along with Forest Management (Combined FSC FM/CoC certificate is issued) (Galati et al. 2017, Halalisan et al. 2019).

The aim of this paper is to analyse the history and the current situation of FSC CoC certified companies in Romania, to present an overview of the distribution of those companies on the country's regions, to highlight the FSC product category adopted by Romanian companies and which type of label is the most common. In addition, the paper will outline a brief comparison between FSC CoC and PEFC CoC.

FSC certification process

FSC CoC includes all the processes, from the certified forest to the final product, which included all the steps (e.g. primary manufacture, secondary manufacture etc.). Two types of wood are eligible to be used in FSC CoC certification process. The first one is the FSC-certified wood (origin is from FSC-certified forests) and the second one is FSC controlled wood. FSC controlled wood is described by FSC (2004) as a 'Virgin material originating in non FSC-certified forests or plantations supplied with an FSC claim by a supplier which has been assessed by an FSC-accredited certification body for conformity with FSC CoC and/or FSC Controlled Wood requirements (FSC-STD-40-005 or FSC-STD-30-010)'. Each FSC certified products might differ from each other; they can have different composition of FSC-certified wood, as FSC forest certified material (FSC 100%), controlled wood or recycled material.

There are three FSC label types: FSC Mix, FSC 100% and FSC Recycled (FSC 2016). FSC 100% refers only to wood originating from FSC-certified forests. Within FSC Mix there can be a combination between wood coming from FSC-certified forests and FSC controlled wood. Within FSC Recycled there is only recycled material.

The five FSC controlled wood categories of unacceptable sources (referred to as 'controlled wood categories') are: i) Illegally harvested wood; ii) Wood harvested in violation of traditional and human rights; iii) Wood from forests in which high conservation values are threatened by management activities; iv) Wood from forests being converted into plantations or non-forest use; v) Wood from forests in which genetically modified trees are planted (FSC 2016).

Materials and Methods

The FSC database (FSC 2020a) was accessed for the FSC CoC analysis in Romania. Information was collected regarding the name of the certified company, location of the certified company and FSC certification code, FSC certificate period of validity, use standard utilized for certification, types of certified products traded, FSC products' claims, primary and secondary activity.

Available data on all 800 FSC CoC certified companies (with active certificate on 31 December 2019) were analysed together with all the annual reports (FSC certification situation – November 2019 Facts and figures) published at www.fsc.org. An excel database was created based on the official data from FSC website. Ac-

cumulated data were processed by use of program product STATISTICA 7.0.

Normality of distribution was tested using Kolmogorov-Smirnov and Shapiro-Wilk tests. Normality tests were used to determine if a set of data is well shaped by a normal distribution. Moreover, these were used to calculate how likely it is that a random variable underlying the dataset will be distributed normally. Kolmogorov-Smirnov test allows comparison of empiric distribution with theoretic distribution, usually a normal one, starting from the null hypothesis that the two distributions do not differ. Value resulting from the test is reported to critical threshold of 0.05. Thus, if the resulting value is greater than 0.05 the test is insignificant, null hypothesis is accepted and the distribution can be considered normal.

Results and Discussions

FSC CoC evolution

Even though the FSC appeared in 1993, the global interest for FSC certification started mostly after 1999 (Tuppura et al. 2016). The first FSC CoC certification of a Romanian company happened in 2001 (Halalisan et al. 2013). As a general trend, Romania followed the global one, as the first certified company appeared just two years after the global company was established. Between 2001 and 2012, the number of the FSC certified companies constantly rose, albeit slowly. In 2012, the number of companies hit 93 (Fig. 1). Since then, a significant increase was observed and by the end of 2019, the number of certified companies was 800.

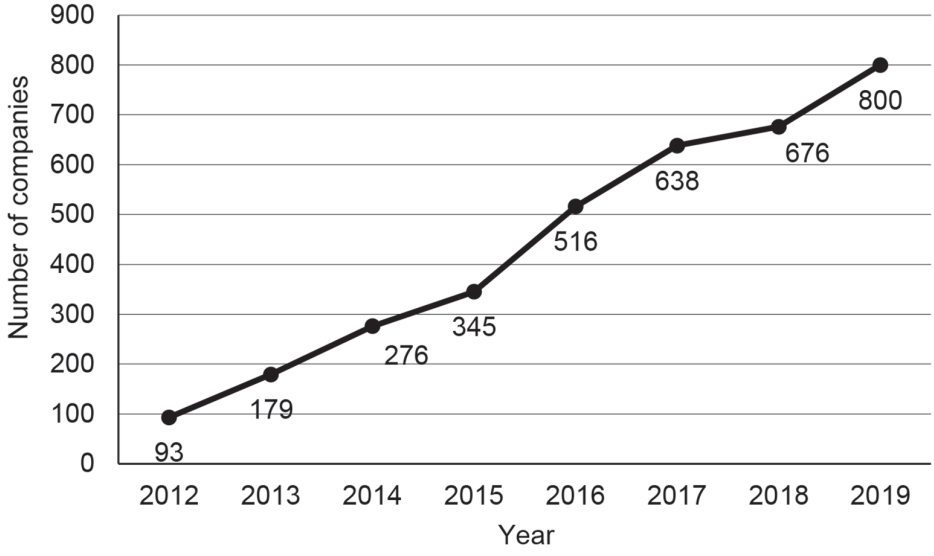

Fig. 1. FSC CoC evolution in Romania.

The increase interest for FSC begun in 2012, when there were 93 FSC CoC certified companies and 717,055 ha of FSC certified forest (Table 1). The interest in the FSC certified forest area skyrocketed between 2012 and 2013. This is mostly due to the fact that the National Forest Administration ROMSILVA started to certi-

fy their forest districts under FSC scheme. Currently, there are just 27 private companies or forest districts, which have certified their FM (FSC 2020b). Now, there are more than 2.8 million ha of forest certified by FSC (FSC 2020a).

Table 1. Correlation between FSC-certified area and the number of FSC CoC certified companies.

Year	FSC certified area, ha	No. of FSC CoC companies
2012	717,055	93
2013	2,445,082	179
2014	2,552,563	276
2015	2,529,605	345
2016	2,591,243	516
2017	2,659,538	638
2018	2,820,078	676
2019	2,836,078	800

The area was somehow limited and the development of companies was limited, too. In contrast, the forest certificated area in 2019 vas four times higher (2,836,078 ha) and the companies have enough area to expand and enough experience in the certification process.

The connection between the FSC certified forest area and the number of FSC CoC certified companies was analysed using Spearman correlation, applying the two nonparametric variables. The results (Table 2) show a strong connection between the two variables: the increase of certified forest area is followed by an increase of the number of certified companies. This is reasonable, since when the source of FSC-certified wood (certified forest area) increases, the interest of companies for this segment (FSC-certified products) also rises.

Table 2. Spearman correlation between FSC forest certified area and the number of FSC CoC certified companies in Romania.

Indicator	Certified area	Number of FSC CoC certified companies
Certified area	1.000	0.976
Number of FSC CoC certified companies	0.976	1.000

Note: Spearman correlation (significant for $p < 0.05$).

Comparison between FSC CoC certification in Romania and other European countries

Romania has the most certified companies from Eastern Europe (Fig. 2). It even has more than France, but France has significantly more PEFC certified companies (PEFC 2020).

Germany and Poland are the top of the list because their certified forest area is much higher than in Romania, therefore the number of the companies is very high too. However, such a comparison is somehow biased, because there are countries that have applied for other certification schemes (e.g. PEFC). Therefore, this analysis is just from the FSC CoC certified companies' point of view.

FSC CoC vs PEFC CoC in Romania

The trend for the global PEFC certification did not affect Romania, since by the end of 2018 there were only 43 PEFC CoC certified companies in the country. Since then, a slow increase in the number of companies PEFC CoC certified compa-

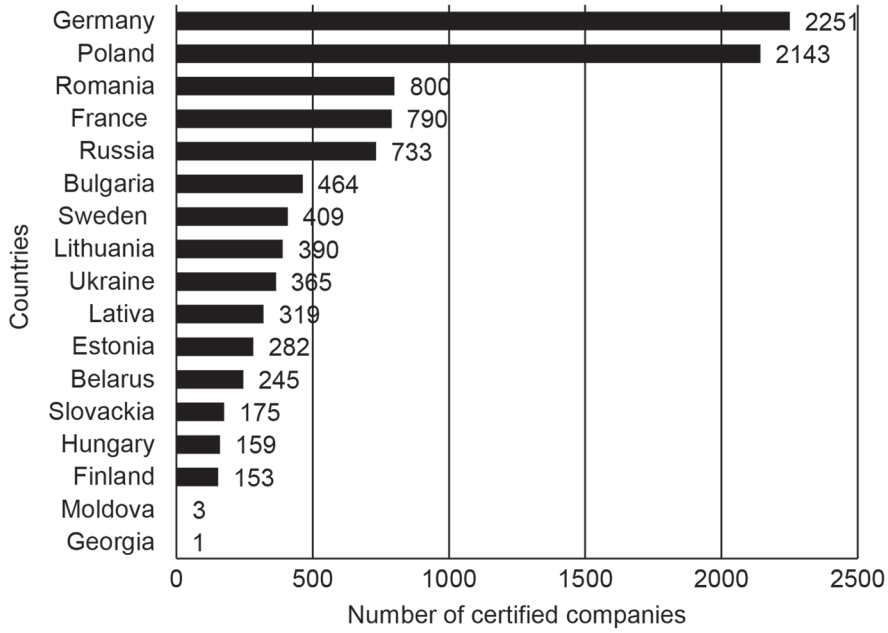

Fig. 2. FSC CoC companies in some European Countries.

nies can be observed. There are 73 PEFC CoC certified companies on the official website. Therefore, the number increased with 20 companies in the last year and a half (from mid 2018 to 2020) despite that there is no PEFC certified area. As presented, there are 800 FSC CoC certified companies in Romania, and the FSC certified forest area is 2.8 million ha. The PEFC CoC certification had a slow adoption process, but should the PEFC certification scheme appear in Romania, there will be a gradual increase in the number of the PEFC CoC certified companies, as they will have the actual PEFC certified forest and the proper PEFC certified wood to use for processing.

Distribution by region

For a detailed analysis of the distribution, we grouped the companies in the eight development regions of Romania (Table 3).

The analysis of the number of compa-

Table 3. Development regions.

Development region	County
North-East	Bacau, Botosani, Iasi, Neamt, Suceava and Vaslui
South-East	Braila, Buzau, Constanta, Galati, Tulcea and Vrancea
South-Muntenia	Arges, Calarasi, Dambovita, Giurgiu, Ialomita, Prahova and Teleorman
South-West Oltenia	Dolj, Gorj, Mehedinti, Olt and Valcea
West	Arad, Caras-Severin, Hunedoara and Timis
North-West	Bihor, Bistrita-Nasaud, Cluj, Maramures, Satu-Mare and Salaj
Centre	Alba, Brasov, Covasna, Harghita, Mures and Sibiu
Bucharest-Ilfov	Bucharest municipality and Ilfov county

nies depending on the development regions (Fig. 3), shows that 30 % of them are situated Northwest region, 21 % are in the Central region and 12 % are in the Northeast region. The region with the smallest number of certified companies is the Southwest Oltenia.

All of the counties were grouped into development regions. The mean of FSC CoC certified companies represent the number of companies from that region divided by the number of the counties

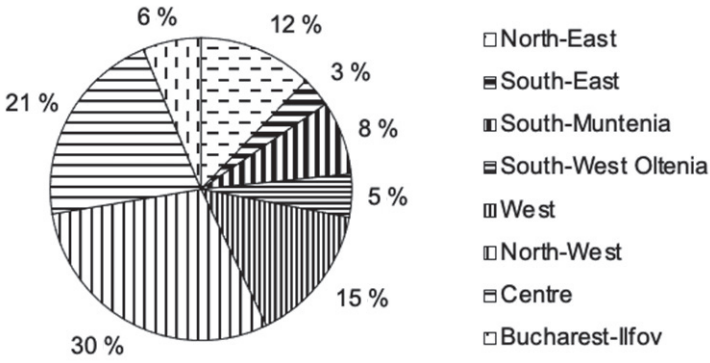

Fig. 3. FSC certified company distribution by development regions.

within that region. North-West and West regions present the greater means (32.5, and 32 respectively) of the certified companies. The following is the centre one (25.5) (Fig. 4).

Northwest region has the maximum number of FSC certified companies in one county (120), Maramures county.

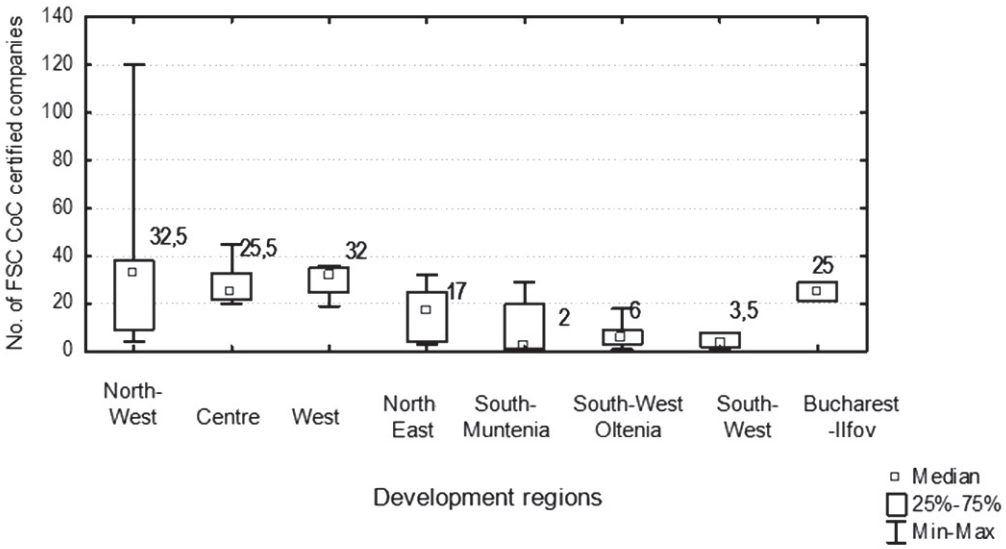

Fig. 4. FSC CoC certified companies statistic depending on the development regions.

Kruskal-Wallis ANOVA was used (Table 4) to test the statistic differences between regions (considered groups). The results show that the statistic differences between the groups (those 8 development regions) are significant.

Table 4. Statistic difference test between groups and the number of the FSC CoC certified companies.

Region	Cod	Valid – N (county)	The sum of the ranks
North-West	101	6	181.0
Centre	102	6	184.5
West	103	4	131.0
North-East	104	6	133.0
South-Muntenia	105	7	89.5
South-West Oltenia	107	5	65.0
South-East	108	6	61.5
Bucharest-Ilfov	109	2	57.5

Note: Kruskal-Wallis ANOVA H (7, N = 42) = 21.52, p = 0.0031.

The certified companies are unevenly distributed within the country's territory. The Spearman correlation between the number of CoC FSC certified companies per county and certified forest area was conducted. The results (r = 0.63, significant for $p < 0.05$) show that the distribution of certified companies is moderate depending on the FSC certified forest area.

The north part of the country is leading with the highest number of companies. In Maramures county alone, there are 120. The next one has almost one third of the number of the first county, Mures county has 45 companies. The gap between the second and the third one, Bistrita-Nasaud (38) is not as wide. After that, the number of companies per count slowly decreases. Olt, Teleorman, Tulcea, Vaslui, Ialomita, Giurgiu, Galati, Dolj, Constanta, and Calarasi have no more than 3 each. The small number of certified companies in Giurgiu, Ialomita, Olt, Teleorman counties is due to the lack of certified forest area. Meanwhile, the high number of companies in the north part is due to a high demand of FSC-certified products (e.g. from IKEA, which started to purchase only FSC-certified wood) and the available certified forest area.

Distribution by activity type

Primary processing is the main activity (32 %) of the certified companies and the least represented is the paper making industry (6 %) (Fig. 5).

FSC product types

One of the FSC CoC certification outcome is the sale of FSC-certified products. The type of products determined according to the standard FSC-STD-40-004a (V2-1), EN which serves for product classification (FSC 2013). The percentage distribution of offered FSC-certified products by Romanian companies is presented in Figure 6.

The prevailing part of offered products is represented by W1 – rough wood (39 %), W5 – Solid wood (sawn, chipped, peeled) (22 %), W3 – Wood in chips or particles (6 %), W12 – Indoor furniture (6 %) and P5 – Packaging and wrappings of paper (5 %). The rest of the products is not so well represented in Romania.

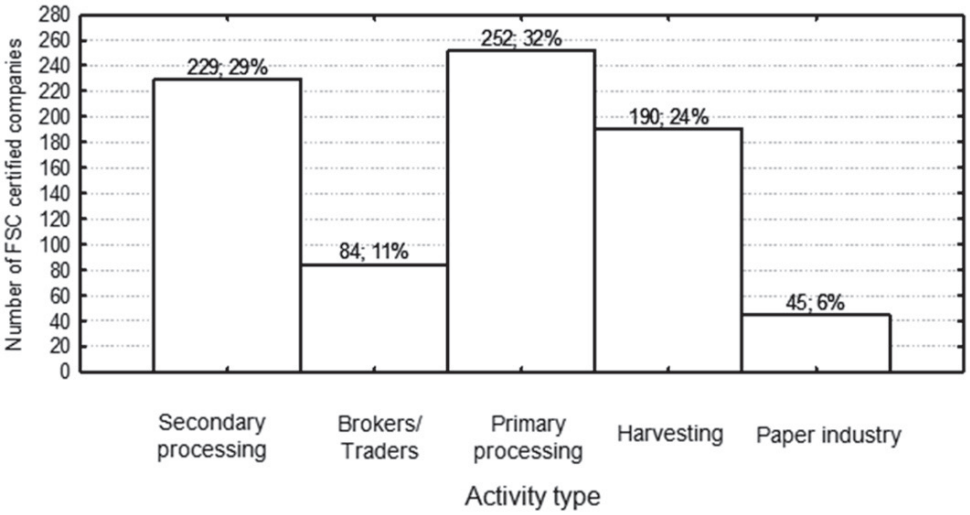

Fig. 5. Distribution by activity type.

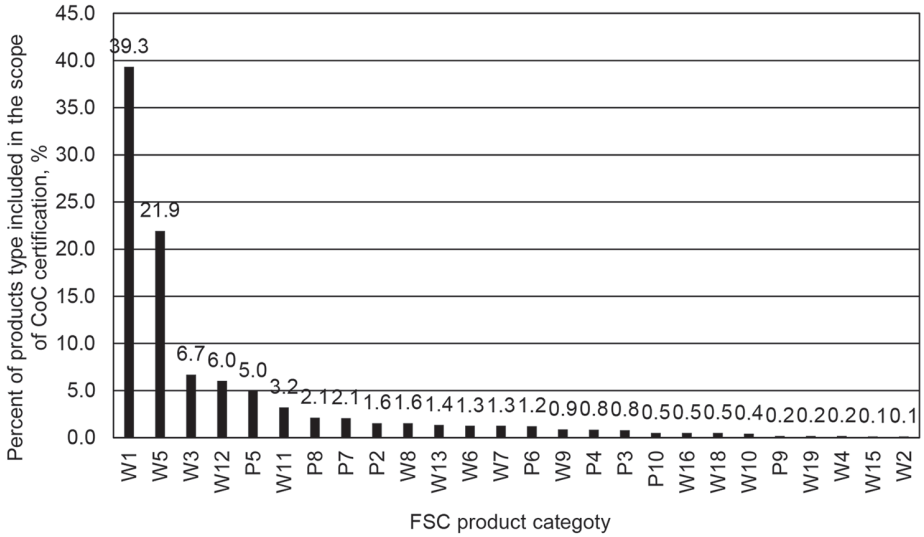

Fig. 6. Product categories.

FSC product categories: W1 – Rough wood; W5 – Solid wood (sawn, chipped, peeled); W3 – Wood in chips or particles; W12 – Indoor furniture; P5 – Packaging and wrappings of paper; W11 – Wood for construction; P8 – Printed materials; P7 – Stationery of paper; P2 – Paper; W8 – Wood panels; W13 – Outdoor furniture and gardening; W6 – Products from planning mill; W7 – Veneer; P6 – Household and sanitary pulp and paper products; W9 – Engineered wood products; P4 – Corrugated paper and paperboard; P3 – Paperboard; P10 – Other pulp and paper products not elsewhere classified; W16 – Household articles; W18 – Other manufactured wood products; W10 – Wood package and similar; P9 – Bobbins, spools, rolls and similar; W19 – Other wood products not elsewhere classified; W4 – Impregnated/treated wood; W15 – Recreational goods; W2 – Wood charcoal.

Companies are not restricted to only one product type and can choose different products, listed in the standard depending on their processing/trade capacities; they can choose a wide range of products.

FSC output categories

Applicable FSC output categories' (FSC 100%, FSC Mix, FSC Recycled and FSC controlled wood) percentage distribution is presented in Figure 7.

The prevailing part of offered certified products are FSC 100% claimed (66 %), followed by FSC Mix claimed (22 %). The FSC Recycled and FSC Controlled wood claims are both represented by less than 10 %. FSC 100% claimed is the raw material, which comes from FSC certified forests and which has not been mixed with material from another category. It is eligible to be used in all FSC product groups, however other materials cannot be used for FSC 100% product groups (FSC 2015).

Conclusions

FSC certification in Romania has become a reality in the forestry sector. Both the customers' demand (Howe et al. 2005) from the external markets and the interest in demonstrating compliance with an international standard have contributed to the increased interest in FSC certification. Following up the area distribution of the certified companies, we noted that those are concentrated close to large processors, which demand the FSC certified products. The results show a strong corelation (Spearman corelation was used) between the evolution of the FSC forest certified area and the number of FSC CoC certified companies. The comparison with the other European countries is strictly from the FSC point of view, because there can be other certification schemes of even other standards, which ensure compliance with the environmental requirements (e.g. ISO 140001), which were not the purpose of this study. Similarly, there is just a brief comparison between Romanian certified companies (FSC CoC vs PEFC CoC), just to highlight the fact that FSC is currently leading at the national level. However, PEFC has certified some companies even without having any PEFC certified forest area, if PEFC starts to certify forest area, the number of PEFC CoC certified companies can dramatically increase.

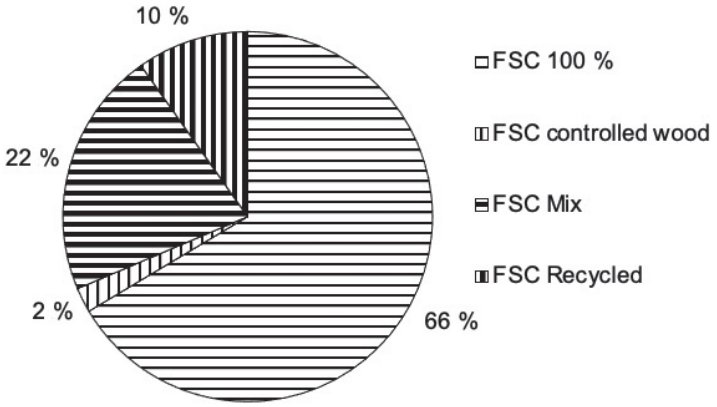

Fig. 7. Output categories percentage distribution.

The North-western part of Romania has the highest proportion of the certified companies and the highest number of FSC CoC certified companies in one country only. The three largest regions have 66 % of the Romania FSC CoC certified companies. Most of the certified companies focus their activity on secondary processing. The main FSC-certified products offered by Romanian companies are: W1 – Rough wood, W5 – Solid wood (sawn, chipped or peeled), W3 – Wood in chips or particles, W12 – Indoor furniture, P5 – Packaging and wrappings of paper. The most frequent claim is for the FSC 100%.

The companies' efforts for FSC CoC certification must be highly appreciated. These efforts require many resources, including human and financial ones, in order to demonstrate the fulfilment of all the requirements of the voluntary FSC CoC standards.

References

Araujo M., Kant S., Couto L. 2009. Why Brazilian companies are certifying their forests? Forest Policy and Economics 11(8): 579–585. Available at: https://doi.org/10.1016/j.forpol.2009.07.008

Auld G., Gulbrandsen L.H., McDermott C.L. 2008. Certification Schemes and the Impacts on Forests and Forestry. Annual Review of Environment and Resources 33: 187–211. Available at: https://doi.org/10.1146/annurev.environ.33.013007.103754

Basso V.M., Andrade B.G., Jacovine L.A.G., Silva E.V., Alves R.R., Nardelli A.M.B. 2020. Forest management certification in the Americas: difficulties in complying with the requirements of the FSC system. International Forestry Review 22(2): 169–188. Available at: https://doi.org/10.1505/146554820829403478

Brotto L., Pettenella D. 2018. Forest Management Auditing: Certification of Forest Products and Services. Routledge. 248 p.

Carlsen K., Hansen C.P., Lund J.F. 2012. Factors affecting certification uptake – Perspectives from the timber industry in Ghana. Forest Policy and Economics 25: 83–92. Available at: https://doi.org/10.1016/j.forpol.2012.08.011

Clark M.R., Kozar J.S. 2011. Comparing Sustainable Forest Management Certifications Standards: A Meta-analysis. Ecology and Society 16(1), 3. Available at: https://doi.org/10.5751/ES-03736-160103

Cook W., van Bommel S., Turnhout E. 2016. Inside environmental auditing: effectiveness, objectivity, and transparency. Current Opinion in Environmental Sustainability 18: 33–39. Available at: https://doi.org/10.1016/j.cosust.2015.07.016

Diaz-Balteiro L., de Jalón S.G. 2017. Certifying forests to achieve sustainability in industrial plantations: opinions of stakeholders in Spain. Forests 8(12), 502. DOI: 10.3390/f8120502

Enescu C.M., Apăfăian A., Hălălișan A.F., Puicea D.R.E. 2019. Current profile of PEFC Chain of Custody certified companies in Romania. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development 19(1): 189–192.

Faggi A.M., Zuleta G.A., Homberg M. 2014. Motivations for implementing voluntary environmental actions in Argentine forest companies. Land Use Policy 41: 541–549. Available at: https://doi.org/10.1016/j.landusepol.2014.04.011

FSC 2013. FSC Product Classification. Available at: https://fsc.org/en/document-centre/documents/resource/258 (Accessed on September 2, 2020).

FSC 2015. FSC® International standard. Available at: https://ic.fsc.org/preview.fsc-principles-and-criteria-for-forest-stewardship-fsc-std-01-001-v5-2-en-print-version.a-4843.pdf (Accessed on August 27, 2020).

FSC 2020a. Facts and figures. Available at: https://fsc.org/sites/fsc.org/files/2019-12/Facts_and_Figures_2019-12-04.pdf (Ac-

cessed on August 27, 2020).

FSC 2020b. FSC certificate search. Available at: https://info.fsc.org/certificate.php (March 15, 2021).

FSC and PEFC 2020. Double Certification FSC and PEFC. Available at: https://cdn.pefc.org/pefc.org/media/2020-01/de73c4e1-7a28-46d2-b71d-b86100497b9d/f995b54a-aab1-52af-a47e-83ddc9825712.pdf (Accessed on August 27, 2020).

Galati A., Gianguzzi G., Tinervia S., Crescimanno M., Veca D.S.L.M. 2017. Motivations, adoption and impact of voluntary environmental certification in the Italian Forest based industry: The case of the FSC standard. Forest Policy and Economics 83: 169–176. Available at: https://doi.org/10.1016/j.forpol.2017.08.002

Gavrilut I., Halalisan A.F., Giurca A., Sotirov M. 2015. The Interaction between FSC Certification and the Implementation of the EU Timber Regulation in Romania. Forests 7(1), 3. DOI: 10.3390/f7010003

Guan Z., Xu Y., Sheong J.I.P. 2019. The impact of application of FSC Chain of Custody certification on global wood products trade. European Journal of Wood and Wood Products 77: 633–643. Available at: https://doi.org/10.1007/s00107-019-01404-z

Halalisan A.F., Marinchescu M., Popa B., Abrudan I.V. 2013. Chain of Custody certification in Romania: profile and perceptions of FSC certified companies. International Forestry Review 15(3): 305–314. Available at: https://doi.org/10.1505/146554813807700137

Halalisan A.F., Abrudan I.V., Popa B. 2018. Forest Management Certification in Romania: Motivations and Perceptions. Forests 9(7), 425. DOI: 10.3390/f9070425

Halalisan A.F., Popa B., Heras-Saizarbitoria I., Ioras F., Abrudan I.V. 2019. Drivers, perceived benefits and impacts of FSC Chain of Custody Certification in a challenging sectoral context: the case of Romania. International Forestry Review 21(2): 195–211. Available at: https://doi.org/10.1505/146554819826606595

Howe J., Bowyer J., Guillery P., Fernholz K. 2005. Chain-of custody certification: What is it, why do it, and how? Dovetail Partners Inc., White Bear Lake, Minnesota. 12 p.

Husgafvel R., Linkosalmi L., Hughes M., Kanerva J., Dahl O. 2018. Forest sector circular economy development in Finland: A regional study on sustainability driven competitive advantage and an assessment of the potential for cascading recovered solid wood. Journal of Cleaner Production 181: 483–497. Available at: https://doi.org/10.1016/j.jclepro.2017.12.176

Klarić K., Greger K., Klarić M., Andrić T., Hitka M., Kropivšek J. 2016. An exploratory assessment of FSC chain of custody certification benefits in Croatian wood industry. Drvna industrija: Znanstveni časopis za pitanja drvne tehnologije 67: 241–248. Available at: https://doi.org/10.5552/drind.2016.1540

Kraxner F., Schepaschenko D., Fuss S., Lunnan A., Kindermann G., Aoki K., Dürauer M., Shvidenko A., See L. 2017. Mapping certified forests for sustainable management - A global tool for information improvement through participatory and collaborative mapping. Forest Policy and Economics 83: 10–18. Available at: https://doi.org/10.1016/j.forpol.2017.04.014

Lewis R.A., Davis S.R. 2015. Forest certification, institutional capacity, and learning: An analysis of the impacts of the Malaysian Timber Certification Scheme. Forest Policy and Economics 52: 18–26. Available at: https://doi.org/10.1016/j.forpol.2014.12.011

Marx A. 2010. Global Governance and the Certification Revolution: Types, Trends and Challenges. SSRN Electronic Journal. Available at: https://doi.org/10.2139/ssrn.1764563

Masters M., Tikina A., Larson B. 2010. Forest certification audit results as potential changes in forest management in Canada. The Forestry Chronicle 86(4): 455–460. Available at: https://doi.org/10.5558/tfc86455-4

Michal J., Březina D., Šafařík D., Kupčák V., Sujová A., Fialová J. 2019. Analysis of Socio-economic Impacts of the FSC and PEFC Certification Systems on Business Entities and Consumers. Sustainability 11(15),

4122. DOI: 10.3390/su11154122

Näyhä A. 2019. Transition in the Finnish forest-based sector: Company perspectives on the bioeconomy, circular economy and sustainability. Journal of Cleaner Production 209: 1294–1306. Available at: https://doi.org/10.1016/j.jclepro.2018.10.260

Owari T., Sawanobori Y. 2008. Market Benefits of Chain of Custody Certification: Perspectives of Japanese Suppliers. FORMATH 7: 121–133. Available at: https://doi.org/10.15684/formath.07.007

Ozinga S. 2010. Time to measure the impacts of certification on sustainable forest management. Retrieved 9th April: 33–38. Available at: http://www.fao.org/tempref/docrep/fao/008/y5918e/y5918e09.pdf

Paluš H., Kaputa V. 2009. Survey of attitudes towards forest and chain of custody certification in the Slovak Republic. Drewno: prace naukowe, doniesienia, komunikaty 52(182): 65–81.

Paluš H., Parobek J., Dudík R., Šupín M. 2017. Assessment of Chain-of-Custody Certification in the Czech and Slovak Republic. Sustainability 9(10), 1898. DOI: 10.3390/su9101898

Paluš H., Parobek J., Vlosky R.P., Motik D., Oblak L., Jošt M., Glavonjić B., Dudík R., Wanat L. 2018. The status of chain-of-custody certification in the countries of Central and South Europe. European Journal of Wood and Wood Products 76: 699–710. Available at: https://doi.org/10.1007/s00107-017-1261-0

PEFC 2020. Facts and figures. Available at: https://www.pefc.org/discover-pefc/facts-and-figures (Accessed on September 27, 2020).

Rametsteiner E., Simula M. 2003. Forest certification – an instrument to promote sustainable forest management? Journal of Environmental Management 67(1): 87–98. Available at: https://doi.org/10.1016/S0301-4797(02)00191-3

Santoso P.B., Purwanto A., Asbari M. 2019. Influence of Implementation Chain of Custody Forest Management System FSC-STD-40-004 V3-0 to Business Performance of Paper Industriesia in Banten Indonesia. International Journal of Management and Humanities (IJMH) 4(4): 32–36. DOI: 10.35940/ijmh.D0482.124419

Tolunay A., Türkoğlu T. 2014. Perspectives and Attitudes of Forest Products Industry Companies on the Chain of Custody Certification: A Case Study from Turkey. Sustainability 6(2): 857–871. DOI: 10.3390/su6020857

Trishkin M., Lopatin E., Karjalainen T. 2014. Assessment of motivation and attitudes of forest industry companies toward forest certification in northwestern Russia. Scandinavian Journal of Forest Research 29(3): 1–11. Available at: https://doi.org/10.1080/02827581.2014.896938

Tuppura A., Toppinen A., Puumalainen K. 2016. Forest Certification and ISO 14001: Current State and Motivation in Forest Companies: Certification: Current State and Motivation in Forest Companies. Business Strategy and the Environment 25(5): 355–368. Available at: https://doi.org/10.1002/bse.1878

Vidal N., Kozak R., Cohen D. 2005. Chain of custody certification: an assessment of the North American solid wood sector. Forest Policy and Economics 7(3): 345–355. Available at: https://doi.org/10.1016/S1389-9341(03)00071-6