

Exploring awareness and practices of rural firms towards a circular economy: A study in rural areas of Greece and Romania

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Abstract. Circular Economy (CE) has been promoted during the last decade through the mainstream EU policy as the alternative to the unsustainable current economic model. However, the awareness levels and practices of CE in the different sectors of the economy have been reported as lower than expected in the scant published research on the subject. This knowledge gap is even more significant for the rural sector of the economy. The current paper presents the state of awareness levels and practices of CE in rural firms. The study has been conducted in the rural areas of Drama County in Greece and Bacau County in Romania following a survey questionnaire approach. A total of 47 rural firms responded to the questionnaire and given the exploratory nature of the study, the data were analyzed with descriptive statistics and correlation analysis. The findings of the study showed that in consideration of the three pillars of CE, environmental impact, resource scarcity, and economic benefits the rural firms in Greece placed higher emphasis on the environmental and resource scarcity pillars of CE, while in Romania on the economic pillar of CE. The study adds to the limited empirical research on CE awareness and practices of rural firms.

Keywords: Rural firms, Circular Economy, Awareness, Practices

1. Introduction

Interest on Circular Economy (CE) as an alternative to the traditional linear economy model, which has been proven unsustainable has been growing over the last decade (Lieder and Rashid 2016, Liakos *et al.* 2019, Pieroni *et al.* 2019, van Langen *et al.* 2021, Topliceanu *et al.* 2023). In the EU pursuing CE has turned into a mainstream policy (European Commission 2015). However, the extent of CE implementation in the firms of different sectors of the economy has been reported as lower than expected, mainly due to their low awareness levels and practices (Masi *et al.* 2018, Cristoni and Tonelli 2018, Garcia –Quevedo *et al.*

2020). There is a knowledge gap in empirical studies focusing on CE awareness levels and practices, particularly in rural firms (Rotolo *et al.* 2022). There are also few published CE models able to include all aspects of CE, which moreover lack empirical validation. A comprehensive model to successfully implement CE in firms has been proposed by Lieder and Rashid (2016). The model includes 3 interlinked pillars, namely, environmental impact, resource scarcity and economic benefits and attempts to show how changes affect each other and how different scopes and stakeholders are affecting and be affected by each of the 3 pillars (Liakos *et al.* 2019).

In the current study an attempt is made to contribute to the knowledge gap on CE awareness and practices in rural firms and provide an empirical validation of the three pillars of CE, that is, environmental impact, resource scarcity and economic benefits. To this end an empirical study was initiated with rural firms located in Drama County of Greece and Bacau County of Romania.

2. Methods

The study adopted a survey questionnaire to collect primary data from rural firms.

The survey was designed with a wider scope to identify the knowledge and skills required by the labour market to implement circular economy in rural areas. Part of the survey focused on identification and practices of rural firms towards a circular economy in rural areas. The questionnaire included three parts. The first part was focused on the general business information, such as the size of the firm, the year of the firm establishment, the activities and main products of the firm. The second part included questions about the awareness level and practices of firms towards CE. The third part was focused on the knowledge required by the firms to successfully implement CE in rural areas. The questionnaire was first

validated by eight academic and rural business experts. The feedback from those experts was used to modify the questionnaire before the main survey to the rural firms.

The questionnaire was used for on-site face-to-face interviews with the respondents, mainly managers of the rural firms located in the rural areas of the Drama Regional Unit of the Eastern Macedonia and Thrace Region in Greece and the Bacau County in Romania. To contact the rural firms the databases of the local corresponding Chambers and the personal networks of the authors were used. The snowball sampling method contributed to extend the pool of respondents (Parker et al. 2020). In total, 47 rural firms responded to the survey resulted in estimated response rates of approximately 35% and 30% in Greece and Romania respectively. All the personal data collected through the survey were processed and protected in accordance with the provisions of the Law on Personal Data Protection.

The data collected through the survey were analyzed using SPSS 26.0. The data due to their exploratory nature were first subjected to a descriptive analysis and the findings were presented in the form of charts/diagrams. The reliability of the measures used in the questionnaire was checked with the Cronbach's α test. Finally, correlation analysis was carried out to explore the differences of the measures between the Greek and Romanian rural firms.

3. Results and Discussion

3.1 Rural firms characteristics

About 48.9% of the rural firms which participated in the survey were located in the Drama Regional Unit of northeastern Greece and 51.1% in the Bacau County of northeastern Romania. In terms of the firms' size approximately 49% were very small (1-9 employees), 21% small (11-49 employees), 19% medium-sized (50-249 employees) and 11% large (250 or more employees). More than half (51%) of the rural firms which participated in the survey were established 21 to 40 years ago, 25.6% of them 11 to 20 years ago, 10.64% of firms 6 to 10 years ago, 10.64% were in business for over 40 years and just 2.1% were established 5 years ago or less. About 76.6% of the survey rural firms stated that they were not involved in any research projects over the past 5 years, while the remaining 23.4% stated that they were involved in research projects. Figure 1 shows the percent distribution of the survey rural firms in relation to the main products they produce. The majority of the survey rural firms in both countries (41.3%) produce food and beverages, about 19.5% produce dairy products, 13% meat products and 8.7% wine products.

3.2 CE awareness

Almost 30% of the survey rural firms stated that they had never heard about CE before the survey, while 10.64% first heard about CE in the last year before the survey (Figure 2).

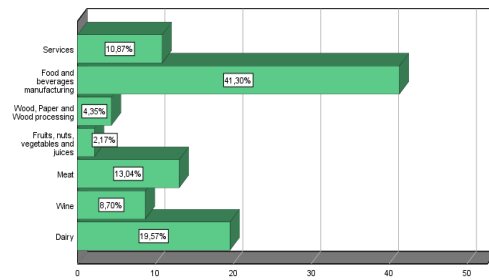


Figure 1. Main products produced by the survey rural firms in Greece and Romania

However, it is encouraging that the remaining 60% of the firms appeared aware of the CE model. These findings comply with the results reported by Liakos *et al.* (2019) and Masi *et al.* (2018) for manufacturing firms, but contradict the low levels of awareness reported by Ormazabal *et al.* (2016) and Cristoni and Tonelli (2018). On the other hand, much higher levels of awareness (90% of respondents) were reported by Liu and Bai (2014) for firms in China, which is expected because China started pursuing CE far earlier than the European countries.

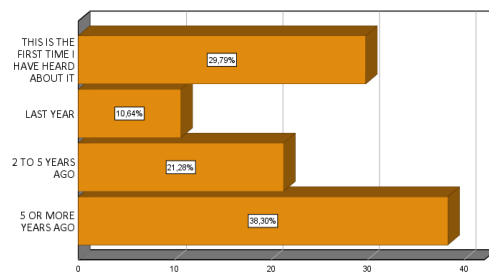


Figure 2. Distribution of rural firms in Greece and Romania according to when they first heard about CE

Figure 3 shows the percent distribution of the survey rural firms in Greece and Romania with regard to the conceived benefits of CE business models in rural areas. The expected benefits of CE can be grouped in a fashion analogous to the 3 pillars of CE as described by Lieder and Rashid (2016), namely, environmental (fewer greenhouse gas emissions, better management of natural resources including land, water, air and soil and better exploitation of renewable energy sources), resource scarcity (more resources saved, safeguard supplies) and economic (economic growth, new profit opportunities, demand for new services, getting to know clients better, employment growth). It appears that the rural firms both in Greece and Romania have similar high expectations through a CE implementation with regard to economic benefits and in particular economic growth and new profit opportunities. However, with regard to the anticipated environmental benefits from CE business models in rural areas, as well as benefits related to resource scarcity are considered higher from the Greek rural firms than the Romanian ones. It worth to note that in both countries the survey rural firms

appeared to have very low expectations about potential employment growth as a result of CE business application in the rural areas (8.5% and 6.4% approximately in Greece and Romania respectively). Overall, there is a higher emphasis on the environmental and resource scarcity pillars of CE for the rural firms in Greece, while for the rural firms in Romania the economic pillar of CE receives a higher consideration.

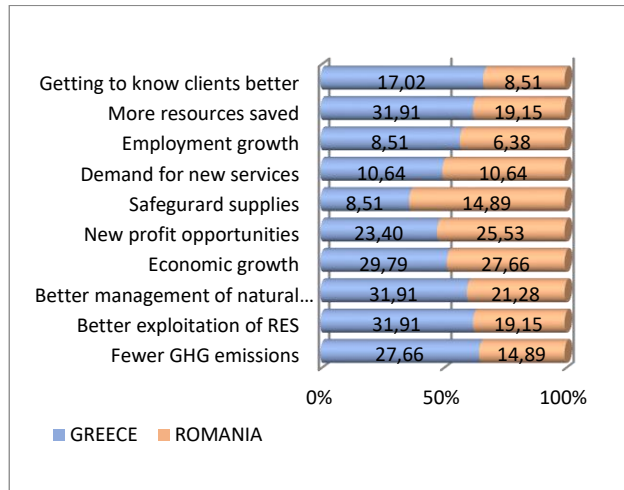


Figure 3. Perceptions of the survey rural firms in Greece and Romania with regard to CE benefits

3.3 CE practices

Figure 4 presents the percent distribution of the survey rural firms in Greece and Romania with regard to specific practices that were implemented by the firms over the past 5 years. About 47% and 32% of the firms in Greece and Romania respectively declared that they implemented actions for minimizing waste by recycling or re-using waste or selling it to another company. Almost 21% and 17% of the firms in Greece and Romania correspondingly implemented actions for re-planning energy usage to minimize consumption, 21% of the Greek rural firms and 11% of the Romanian ones adopted actions for re-planning the water use to minimize water usage and maximize water re-usage and 21% and 19% of the firms respectively in Greece and Romania applied for and/or obtained environmental certifications. About 15% and 17% of the firms in Greece and Romania redesigned their products and services to minimize the use of materials or they used recycled materials, 11% and 17% of the firms in Greece and Romania were engaged in analysis of the material and energy flows, which is used in their companies, while about 17% and 6% of the firms in Greece and Romania respectively used renewable energy. Very few firms (2% and 4% in Greece and Romania) made a Lifecycle Assessment.

Figure 5 presents the CE practices, which the survey rural firms in Greece and Romania stated that they plan to implement over the next 5 years.

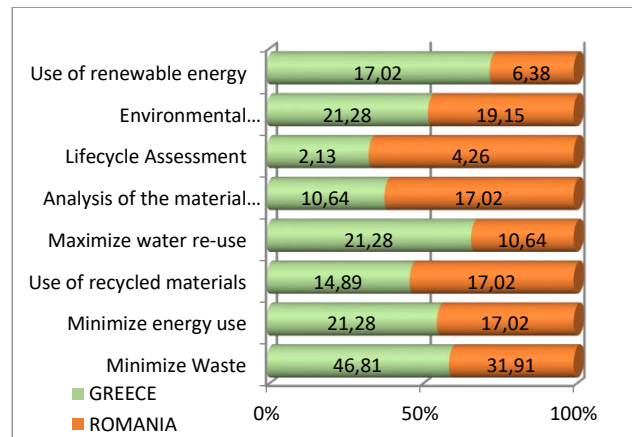


Figure 4. CE practices implemented by rural firms in Greece and Romania over the LAST 5 years

The rural firms will place emphasis on actions for minimizing waste, minimizing energy consumption, using renewable energy and analyzing the material and energy flows that are used by their firms.

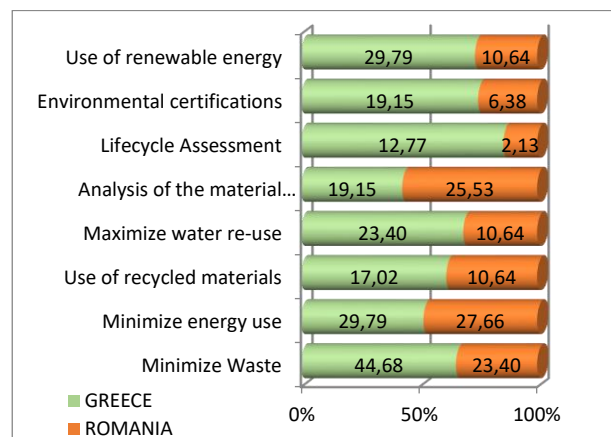


Figure 5. CE practices to be implemented by rural firms in Greece and Romania over the NEXT 5 years

Table 1. Correlations

	New Profit	More resources saved
Opportunities		
Better exploitation of RES		
Pearson		
Correlation		0.489**
0.447**		0.000
Sig. (two-tailed)	0.002	47
N	47	
Economic Growth		
Pearson		
Correlation		0.363*
Sig. (two-tailed)		0.012
N		47

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Finally, on the basis of the correlation analysis carried out for all the variables used in the survey to reflect the rural firms' awareness levels of CE in Greece and Romania regarding the conceived benefits of CE business models in rural areas, Table 1 presents the variables that showed significant correlations. Better exploitation of renewable energy (environmental pillar of CE) is significantly correlated with more profits opportunities (economic pillar of CE) and more resources saved (resource scarcity pillar of CE). Moreover, economic growth (economic pillar of CE) is also significantly correlated with more resources saved (resource scarcity pillar of CE). This finding complies to an extent with the work of Liakos *et al.* (2019), who reported a strong interdependence of the three pillars of CE. In this respect, the current study reinforces the assumption that once a rural firm considers one pillar of CE, all three are also considered as part of CE.

4. Conclusions

The current study provides an understanding of the awareness level and practices of CE implementation through empirical research on rural firms in two European countries, Greece and Romania. The findings of the study show 60% awareness levels, which is an encouraging result. The main CE practices that the rural firms adopted

in both countries included minimization of waste through recycling or re-using waste or selling it to another company, re-planning of energy usage to minimize consumption, and applications for and/or acquiring environmental certifications. Regarding CE implementation in the following years, rural firms will focus on the minimization of waste, minimization of energy consumption and analysis of the material and energy flows which are used in the firms. Moreover, the current study adds to an extent to the empirical validation of the Lieder and Rashid CE model, which includes 3 pillars, environmental impact, resource scarcity and economic benefits. Overall, the study adds to the knowledge gap on CE rural business awareness and practices. However, there are certain limitations to this study. The main one concerns the limited survey rural firm responses. Future research should aim to a larger number of responses and geographical coverage, as well as more elaborated statistical analysis, so as to improve the credibility of the findings.

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References

- Cristoni N. and Tonelli M. (2018), Perceptions of Firms Participating in a Circular Economy, *European Journal of Sustainable Development*, **7(4)**, 105-118.
- García-Quevedo J., Jové-Llopis E., and Martínez-Ros E. (2020), Barriers to the circular economy in European small and medium-sized firms. *Business Strategy and the Environment*, **29**, 2450– 2464.
- Liakos N., Kumar V., Pongsakornrungsilp S., Garza-Reyes J.A., Gupta B. and Pongsakornrungsilp P. (2019), Understanding circular economy awareness and practices in manufacturing firms. *Journal of Enterprise Information Management*, **32(4)**, 563-584.
- Lieder M. and Rashid A. (2016), Towards circular economy implementation: a comprehensive review in context of manufacturing industry, *Journal of Cleaner Production*, **115**, 36-51.
- Liu Y. and Bai Y. (2014), An exploration of firms' awareness and behaviour of developing circular economy: an empirical research in China, *Resources, Conservation and Recycling*, **87**, 145-152.
- Masi D., Kumar V., Garza-Reyes J.A. and Godsell J. (2018), Towards a more circular economy: exploring the awareness, practices, and barriers from a focal firm perspective, *Production Planning & Control*, **29(6)**, 539-550.
- Ormazabal M., Prieto-Sandoval V., Jaca C. and Santos J. (2016), An overview of the circular economy among SMEs in the basque country: a multiple case study, *Journal of Industrial Engineering and Management*, **9(5)**, 1047-1058.
- Parker C., Scott S. and Geddes A. (2020), Snowball Sampling. In Sage Research Methods Foundations, edited by: Atkinson P., Delamont S., Cernat A., Sakshaug J.W. and Williams R.A., Sage Publications Limited, DOI: 10.4135/ 9781526421036831710
- Pironi M.P.P., McAloone T.C. and Pigosso D.C.A. (2019), Configuring New Business Models for Circular Economy through Product-Service Systems, *Sustainability*, **2019**, **11**, 3227.
- Rótolo G.C., Vassillo C., Rodriguez A.A., Magnano L., Milo Vaccaro M., Civit B.M., Covacevich M.S., Arena A.P. and Ulgiati S. (2022), Perception and awareness of circular economy options within sectors related to agriculture in Argentina, *Journal of Cleaner Production*, **373(2022)** 133805.
- Topliceanu L., Puiu P.G., Drob C. and Topliceanu V.V. (2023), Analysis Regarding the Implementation of the Circular Economy in Romania, *Sustainability*, **2023**, **15**, 333.