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Circular Economy and Decision Models among European SMEs

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Abstract: While targeting waste reduction and maintaining the value of products and resources in the system as much as possible, undertaking circular economy practices at the company level is a way of achieving entrepreneurial sustainability. This paper explores entrepreneurial decision models for adopting circular economy practices, focusing on European SMEs. Decision tree models are applied on data from Flash Eurobarometer 441 in order to uncover business strategies in relation to the implementation of circular economy practices at the company level and with the optimal level and nature of investments in the circular economy for improving economic performances of companies. The main findings of the article offer a better understanding of the relation between characteristics of European SMEs and their decisions in the field of circular economy. Such results are relevant from both macro and micro perspectives, as they can be used for customizing circular economy programs and intervention strategies for various groups of SMEs, as well as for supporting sustainable entrepreneurial decisions.

Keywords: sustainable business decisions; circular economy; decision tress

1. Introduction

The concept of "sustainability entrepreneurship" was developed practically to provide a conceptual vehicle to the new vision on business and society [1]. By some authors, it is treated as a new area found at the intersection of entrepreneurship and sustainable development [2,3], while others treat it only as a strategic management approach [1].

Even it is easy and intuitive to be defined, the concept of "entrepreneurship" lacked a solid and operational conceptual framework, becoming rather a broader label for a large diversity of issues and approaches [4]. Some authors defining entrepreneurship refer only to small and new business initiatives [4], while others are using entrepreneurship to "cover" the entire sector of SMEs [5], or even the entire business sector plus the opportunities for and the process of entrepreneurial discovery [6]. One of the comprehensive definitions of entrepreneurship refers to it as "any kind of identification, evaluation and exploitation of opportunities" [4].

In a rapidly changing global environment, the free-market economy affects nature, and nature's change affects the life of people and communities, and the lives of those socially and economically disadvantaged most of all. Thus, sustainability entrepreneurship is promoted as a solution both to environmental changes but also to negative social changes [7].

The sustainable entrepreneur is focused at the same time on his or her workforce, family, community, society as whole, the future generation, and on profit [8]. Being sustainable implies costs and evidence suggests that the decision to be a sustainable entrepreneur is not a frequent one among SMEs. There are also studies pointing out that the decision to become sustainable overcomes

the costs, being more linked with opportunity costs and sustainable strategy, and less with the financial resources involved [8].

Masurel [9] describes the sustainable entrepreneur as one focused at the same time on people, the planet, and profit [9]. An operational definition of sustainability entrepreneurship refers to a firm that is developing any kind of environmentally friendly activities [10].

There is a large diversity of concepts that derived from sustainability entrepreneurship, such as "environmental" entrepreneurship, "eco-preneurship", "social entrepreneurship", green entrepreneurship and "circular" entrepreneurship, and "corporate social responsibility", to number only a few of them. They have been developed as a response to the need to make the contribution of each field more visible under the more well-known concept of sustainability entrepreneurship [2,11].

The circular economy practices of the companies fall under the framework of entrepreneurial sustainability as it contributes both to economic growth and environmental resilience. The circular business model is based on the principle of material balance [12], with reference to the idea that circulating matter and energy will diminish the need for new inputs [13]. In the recent period, the circular economy has developed as a new sustainability paradigm [14] or a new economic model that differs from the linear economy ("take-make-use-dispose") [15]. A more circular economy is advocated as an alternative to the linear model as this is no longer considered sustainable [15].

This paper analyzes decision models for undertaking circular economy practices at the company level, focusing on European SMEs. Tree-based models are developed to explore business strategies in relation to the implementation of circular economy practices at the company level. The results of the article uncover key drivers for circular economy-related decisions and their influence on the economic performances of the European SMEs. In relation to other studies, this paper makes a valuable contribution to understanding the core factors that influence SMEs in undertaking circular economy practices, as well as the related economic effects for specific segments of SMEs. The findings of the study, mainly those referring to the benefits of sustainable behavior for business development, can be relevant for the design of entrepreneurial education programs.

2. Key Drivers of the Decision in favor of Sustainability Entrepreneurship

Without a doubt, in order to reach the goals of sustainable development, businesses will need to play a key role [1]. One of the most important difficulties in identifying the literature dedicated to the factors facilitating the development of sustainability entrepreneurship comes from the "broad" concepts of "entrepreneurship" and "sustainability entrepreneurship", along with the newest concepts mentioned above. Another difficulty comes from the variety of methods used to identify the facilitating factors and obstacles, covering the entire range of quantitative and qualitative research methodologies [16].

Most of the literature on sustainability entrepreneurship addresses large and industrial companies, so SMEs are sometimes overlooked, even if the understanding of limiting and facilitating factors for their business decisions could have a significant benefit for management theory and practice [3,10,17–22]. In fact, there are authors that believe that SMEs are generally one step behind in their implementation of environmental measures [9,23].

In most of the economies, SMEs represent the large majority of business entities, even if the share of their contribution to the national product can vary a lot from country to country. So, their determination to sustain and to make operational the objectives involved in moving towards a sustainable economy can play an important role. Moreover, it is very important to understand which are the most dedicated SMEs to sustainable measures, what their characteristics are, and the factors that facilitate the transferability of this strategic orientation to the entire sector.

Several studies have aimed to address and understand the factors underlying the decision of business entities for sustainability, with a specific focus on SMEs and on the context in which they are operating [10,22,24]. Factors from the micro-level to the mezzo- and macro- levels were included successively in analyses in order to explain the decision of SMEs in favor of sustainability

entrepreneurship. Some of the findings confirm previous studies, irrespective of their quantitative or qualitative research methodology, while other factors' influence on sustainability entrepreneurship is still a matter of scientific debate. Moreover, there are studies addressing different fields connected with different concepts, such as "eco", "sustainable", "environmental friendly", and "green" that are sometimes used interchangeably [23], even if some of them refer to different content [25]. Some of the factors considered under these studies are also linked with sustainability entrepreneurship.

The main motivations that can be considered with respect to the reasons underlying the decision of SMEs in favor of sustainability are: obeying the law, increasing profits, and making use of existing opportunities in the market [9].

Legal context, as supposed from the beginning, as well as management's values and belief system, and ownership-management structures, play an important role in explaining the business decision in favor of environmental-friendly policies [26]. Often the moral, ethical, economic, and legal causes are combined in the root causes of sustainability entrepreneurship, the moral and ethical decision being made both to avoid penalties but also to collect image-benefits among customers, stakeholders, and the market. Moral and ethical factors coupled with economic development create, in fact, the premises for the emergence of appropriate legal frameworks. On the other hand, the legal framework sustains the development of new market niches that sustainability entrepreneurship could capitalize on [16,27,28].

There are also companies where management adopts environmentally friendly policies mainly by beliefs, irrespective of the market reaction to the increasing costs [26] or if they perceive the sustainability-friendly behavior as being "desirable" and "feasible" [23,29,30]. Also, there are findings showing that preoccupation of SMEs with respect to improving working conditions and workers' motivation leads to increasing investments in sustainability [9].

The attitudes of entrepreneurs with respect to environmental protection seem to be, in fact, under a more general attitude, consisting in placing profit in a secondary role of importance, for the benefit of employers, the community, and nature. This more general attitude can be created by specific historical, socio-cultural, and economic contexts, which are also considered by some authors as key drivers for sustainability entrepreneurship [26,31,32]. Others consider that sustainability entrepreneurship can be developed only if it can adapt to different social and cultural contexts [7]. Sustainability entrepreneurship is by definition linked with nature and people, so the social and economic context is very relevant for the development of sustainability entrepreneurship. If values and attitudes to protect nature and people can be subscribed to the social context, the economic development is also very important. In developed countries, both the legal framework is well developed and the financial resources are accessible, creating a stimulating context for the development of sustainability entrepreneurship [7], while among developing economies the challenges for the sector development can be high in terms of economic and social infrastructure, access to new technologies, or access to an increasingly competitive market.

Similar findings are reinforced by studies addressing the role of attitudes and perceptions for the sustainable-oriented decisions, even if the intentions and values explain the behavior of business entities only to a certain extent [3,22,26,33]. On the other hand, the quantitative approaches found evidence of the role of legal context, but they didn't confirm the role of management's values on sustainability-oriented entrepreneurship [24]. Legal context is one of the factors that varies from country to country, so even if some analyses do not refer directly to the legal context, the 'country' variable can be a proxy for it.

Firms exist in a particular legal context, in a particular cultural context, and in an industry environment [27,28]. Industry-related factors such as firm size, sector, and ownership also play an important role in explaining the decision for sustainability entrepreneurship [3,16,26]. The industry context is very important, as some economic sectors can be more or less permeable to sustainability entrepreneurship. For instance, some specific sectoral regulation can hinder the development of sustainability entrepreneurship in activities such as "hotels and restaurants", where hygienic rules prevail [28]. Moreover, sectoral regulations vary from one country to another.

The receptiveness of the industry depends on the size of the companies and the value created by business. Larger firms, those operating in the so called "tangible products sector" (including agriculture, manufacturing, and construction) and family-owned SMEs proved to be more open to sustainability entrepreneurship [10].

Macro and micro approaches have shown that innovation is one of the most important facilitating factors for sustainability. There is a circle between sustainability entrepreneurship and sustainability innovation, each one contributing to the generation and development of the other one [2,27,34]. Business development is closely linked to the technological life cycle, with new technologies changing rapidly. The eco-innovation level sustains the progress of a country with respect to sustainable development; thus, countries with low levels of eco-innovation are also expected to fall behind with respect to sustainable development [35]. For such countries, the legal framework coupled with innovation and economic development can sustain a plan to move forward with respect to sustainable development [36]. Innovation runs hand in hand with adopting new technologies, with some of the authors treating it as a pre-requisite, others as a covariate. Even if SMEs are not the best performers in terms of innovation, there is a significant financial support for innovation in SMEs at a European level in order to increase their performance in sustainability. Thus, understanding the context and factors facilitating sustainability entrepreneurship can be a very useful asset.

Most of the studies have presented analyses of existing SMEs/firms and factors contributing to and sustaining their development, thus referring only to the "tangible" dimension of entrepreneurship. The dimensions of identification and the evaluation of opportunities have been rarely addressed. They are linked both to personal features of individuals/future entrepreneurs, as well as to the existing market and economic opportunities. The scientific literature on the readiness of individuals for entrepreneurship has evidenced that social factors such as gender, age, education, skills, family, and community background, previous working experience or career expectations, psychological factors, and immigration background could influence entrepreneurial behavior, and by a matter of consequence, the behavior related to sustainability entrepreneurship [36–39]. Choongo et al. (2016) examine the factors influencing the identification of opportunities in Zambia, finding that entrepreneurial knowledge is not enough for a positive attitude towards environment, their recommendation consisting in the necessity to increase awareness among existing and future entrepreneurs with respect to the consequences of business activities on the environment [40]. The analyses reinforce practically the research on the influence that social and cultural context has on entrepreneurship development. And if the context is unstimulating, then there is a need to sustain the creation and development of entrepreneurial responsibility towards people, communities, and society through effective entrepreneurship education [41–43] and awareness raising.

A large spectrum of methods was employed in order to identify factors facilitating the entrepreneurial decision in favor of sustainability. Among the methods employed by the studies screened in the literature review, we mention qualitative approaches such as case studies [22,26,31,39] and narratives [17,32], as well as quantitative ones such as cluster analysis [35] and factors analysis [10]. So, the methodology employed for this study is also a novelty in this field of research, complementing the findings of existing qualitative and quantitative approaches.

3. Methodology

Although numerous classification methods have been developed (logistic regression, multivariate discriminate regression, and neuronal network models), decision tree models have been advocated for several advantages: they are able to identify patterns in data that display any probability distribution, their output is easy to understand and interpret, and they are efficient in case of a large amount of data [44]. This study applies the decision trees method in order to uncover relationships between characteristics of European SMEs and their behavior in relation with circular economy. This procedure develops tree-based classification models that group companies based on their characteristics with respect of their likelihood to belong to one of the classes of the target variables [45]. The resulted

groups of companies represent parent and child nodes of the trees. The analysis is applied to microdata from the Flash Eurobarometer 441 covering the topic of circular economy at the level of SMEs from 28 Member States. 10,618 companies from manufacturing, industry, retail, and service sectors were interviewed in April 2016 [46].

Almost three quarters of SMEs have undertaken some activities related to circular economy in the last three years. Most of them targeted waste reduction by recycling, reusing, or selling it to other companies (55%), and the reduction of energy consumption by re-planning its usage (38%). 34% of the SMEs have redesigned their products and services in order to reduce the use of materials or to use recycled materials, while 19% have aimed to minimize the usage of water by re-planning how water is used. 16% of the companies have adopted practices related to the use of renewable energy [46].

In order to explore which were the key drivers for the decision of European SMEs to adopt circular economy practices, a first decision tree model was constructed having as a dependent variable whether the companies have undertaken any activity related to circular economy in the last three years. The country of origin, sector of activity, size of the company (by the number of the full-time equivalent employees), and total turnover have been considered as independent variables in this model. All the predictors have been found to be statistically significant with respect to the decision of the companies to adopt circular economy-related activities, except the size of the company. The model was limited to a maximum of three levels in depth, while the minimum number of companies per node has been established at 100 for parent nodes and 30 for child nodes (Table 1).

Table 1. Design of the tree-based models.

	Dependent Variable (Categories)	Independent Variables
Tree-based Model 1	Whether the companies have undertaken circular economy-related activities in the last three years (undertook some circular economy related activity; did not undertake circular economy related activity)	- Country - Sector of activity - Size of the company - Total turnover in 2015
Tree-based Model 2	Evolution of the company's turnover since the beginning of the 2015 (the turnover has increased; the turnover has remained the same or decreased)	- Country - Sector of activity - Size of the company - % of the company's turnover that has been invested in research and development - % of the company's turnover that has been invested in circular economy related activities in the last three years
Tree-based Model 3	Evolution of the company's turnover since the beginning of the 2015 (the turnover has increased; the turnover has remained the same or decreased)	- Country - Sector of activity - Size of the company - Re-plan of the way water is used to minimize usage and maximize re-usage - Use of renewable energy - Re-plan energy usage to minimize consumption - Minimize waste by recycling and reusing waste or selling it to another company - Redesign products and services to minimize the use of materials or use recycled materials

Two other tree-based models have been developed in order to understand how the level and nature of investments in circular economy practices interact with various characteristics of the companies and influence the economic performances of the SMEs. Thus, both models have as a dependent variable the evolution of the company's turnover since the beginning of the 2015, with two categories: (1) the turnover has increased; and (2) the turnover has remained the same or decreased. One model has used as predictors variables such as country, sector of activity, size of the company, percentage of the company's turnover that has been invested in research, and the development and percentage of the company's turnover that has been invested in circular economy-related activities in the last three years. All predictors were statistically significant in relation to the independent variable, and the established

depth of the tree was of a maximum of four levels, while the maximum number of companies per node has been limited to 100 for parent nodes and 30 for child nodes.

The third model targeting the evolution of the company's turnover since the beginning of 2015 included among the independent variables various types of circular economy activities that have or have not been implemented by the companies in the last three years: (1) re-planning of the way water is used to minimize usage and maximize re-usage; (2) use of renewable energy; (3) re-planning energy usage to minimize consumption; (4) minimizing waste by recycling and reusing waste or selling it to another company; and (5) redesigning products and services to minimize the use of materials or use recycled materials. Also, country, the sector of activity, and the size of the company have been included as independent variables in the model. All the predictors were found to be significant, except the sector of activity. The tree has been defined in the same way as the previous one. The maximum tree depth was of four levels and the maximum number of SMEs per node was 100 in the case of parent nodes and 30 for child nodes.

The decision tree models have been developed in SPSS 23. For all the three tree-based classification models, the Chi-squared Automatic Interaction Detection (CHAID) growing method has been used. At each step of the growing tree, the algorithm chooses the predictor variable that has the strongest interaction with the target variable. Categories of predictors are merged in the case that they do not differ significantly with respect to the dependent variable. Significance level for splitting nodes and merging categories in the models has been considered to be 0.05. In order to produce the simplest tress that describe the models, the specifications didn't allow re-splitting of merged categories within a node. Considering the sample size, the Pearson method has been used for determining node splitting and category merging. Multiple comparisons for merging and splitting categories of the predictors were based on the Bonferroni method. The maximum number of interactions for constructing the models has been established as 100.

4. Results

4.1. Key Drivers for Adopting Circular Economy Practices among SMEs

The first tree-based model was constructed for understanding which characteristics of the European SMEs act as main drivers for the decision of adopting circular economy practices at company level, and how they do this (Figure 1). The resulting model comprises 43 nodes, out of which 30 are final nodes. The overall percentage of the correct classification of the SMEs is 74%. The strongest predictor of whether companies have adopted or not circular economy practices is the country where companies are located as it is the first most important variable that the tree indicates.

For SMEs from Belgium, Spain, and the United Kingdom, the next most important predictor of whether they have implemented any circular economy activities is the sector of activity. The results show that 88% of companies from this group of countries that activate in manufacturing and retail undertook some circular economy-related activity in the last three years. For the SMEs from the rest of the sectors, total turnover of the company is relevant to predicting their behavior in relation to circular economy. Thus, SMEs with lower levels of the turnover display lower propensity to circular economy, while 98% of the companies having a total turnover of more than 10 million euros undertook such activities.

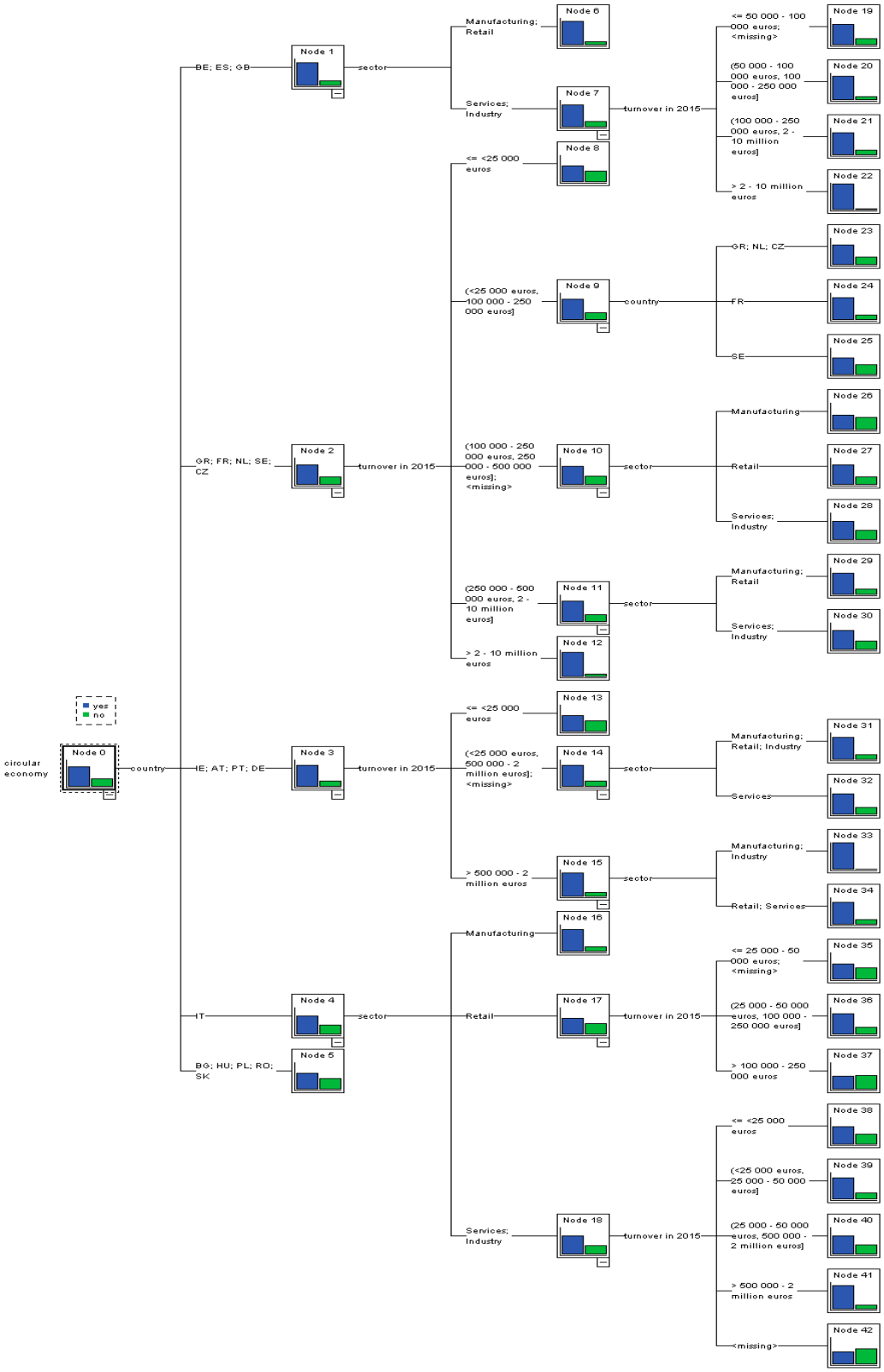

Figure 1. Tree-based Model 1 of the decision of European SMEs to adopt circular economy practices. Source: authors' calculation on the base of microdata from Flash Eurobarometer 441 [47].

For SMEs from Greece, France, The Netherlands, Sweden, and Czech Republic, the company's total turnover is the next most important predictor for its decision in relation to the circular economy.

Companies with the lowest and highest turnover display very different behavior when adopting circular economy practices. 61% of companies that have a turnover below 25,000 euros have undertaken circular economy activities, as compared to 92% of companies registering a turnover above 10 million euros. For companies that have a total turnover of between 25,000 and 250,000 euros, the country in which they are located represents a new predictor of circular economy-related decisions. Those located in Greece, The Netherlands, and the Czech Republic undertook some circular economy-related practices in the proportion of 73%, and those in France in 83%, while SMEs from Sweden display the lowest propensity to circular economy with a proportion of 62%. In the case of SMEs from Greece, France, The Netherlands, Sweden, and the Czech Republic, registering a total turnover of between 250,000 and 500,000 euros, the sector of activity predicts the propensity to circular economy. Companies from manufacturing and retail are more active in this field than the others.

Another distinct group of SMEs are those located in Ireland, Austria, Portugal, and Germany. Among them, companies with a total turnover lower than 25,000 euros show the lowest interest for circular economy practices. The decision to adopt circular economy practices at the level of SMEs from this group of countries that register a total turnover of between 25,000 and 2 million euros is influenced also by their sector of activity. SMEs activating in the industry, manufacturing, and retail sectors show a higher propensity for circular economy than other companies. On the other hand, all companies with a total turnover of more than 500,000 euros that activate in the manufacturing and industry sectors have undertaken some circular economy practices.

SMEs from Italy display a very heterogeneous behavior in adopting circular economy practices. In their case, the sector of activity is the next strongest predictor for the explained variable. Thus, SMES from Italy that activate in the manufacturing sector are the most active in the field of circular economy. For companies from the other sectors, the level of the company's turnover influences the propensity to circular economy. Three quarters of the Italian SMEs from retail that have a turnover of between 50,000 and 250,000 undertook some circular economy activities in the last three years. The other Italian retail companies display less interest in circular economy. Notably, more than half of those registering a turnover higher than 250,000 euros did not undertake circular economy-related activities. The openness of Italian SMEs from services and industry to circular economy is also influenced by their total turnover. Companies with lower levels of turnover are less interested in circular economy than those with a higher turnover.

Finally, SMEs from Bulgaria, Hungary, Poland, Romania, and Slovakia present the lowest share of those that have undertaken some activities of circular economy (60%). No further predictors for the circular economy-related decisions have been found to be significant by the model for this node of SMEs.

4.2. Influence of Circular Economy-Related Decisions on Economic Performances of SMEs

Overall, 41% of European SMEs have declared that the company's turnover has increased since the beginning of 2015. The economic performances of the companies are influenced by complex macro-, mezzo-, and micro-level factors such as the economic cycle, the features of the institutional framework, the characteristics of the market, the available skill and resource supply, the participation of economic networks, and the company's strategy and investments, etc.

Figure 2 presents a second tree-based model that aims to highlight how investing in circular economy activities interacts with other characteristics of the companies and influences their economic performance. The resulted tree presents 55 nodes, out of which 34 are terminal. The percent of correct classification is 63%, which is not low considering that there are many unobserved variables in the available data set that influence the economic performances of the European SMEs.

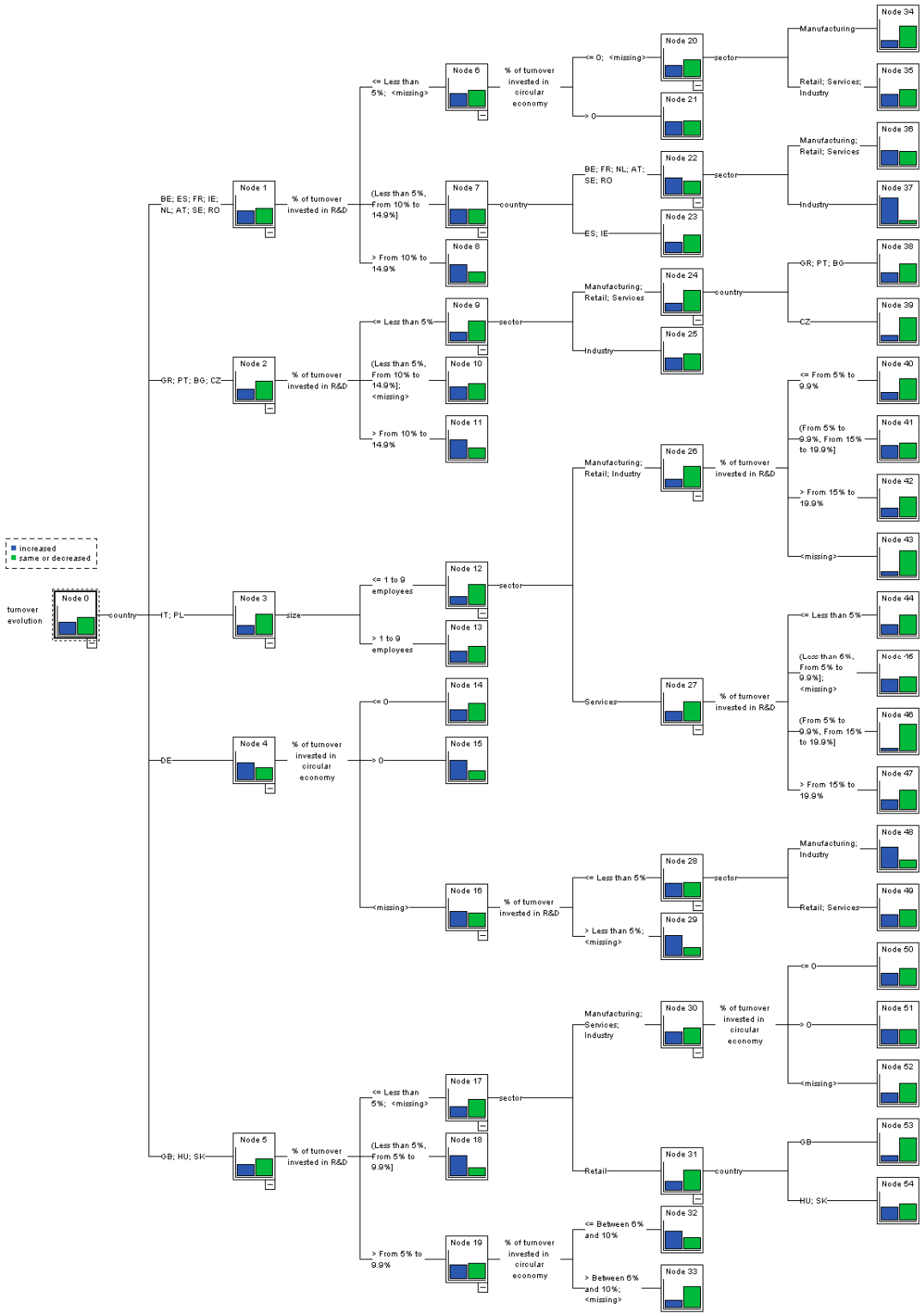

Figure 2. Tree-based Model 2 of the economic performance of European Small and Medium-Sized Enterprises (SMEs). Source: authors' calculation of the base of microdata from Flash Eurobarometer 441 [47].

The country variable is the most powerful predictor of the economic performance of the companies. For SMEs that are located in Belgium, Spain, France, Ireland, The Netherlands, Austria, Sweden, and Romania, the company's investment in research and development is the next most important factor

that predicts economic performance. 63% of SMEs from this group of countries that have invested more than 10% of their annual turnover in research and development activities declare that their total turnover has increased since the beginning of 2015. Companies from Spain and Ireland that invest 5% to 14.9% of the total turnover register an improved economic performance in a significantly lower percentage (37%). On the other hand, the economic performances of SMEs with similar investments in R&D from Belgium, France, The Netherlands, Austria, Sweden, and Romania vary in relation to their sector of activity. SMEs from industry display a much higher share of those with increased turnover as compared with the other sectors. For SMEs from Belgium, Spain, France, Ireland, The Netherlands, Austria, Sweden, and Romania that invest less than 5% of the turnover in R&D activities, additional investments in circular economy influence their economic performances. Thus, for this category of SMEs, the most positive economic performances are registered by companies investing in circular economy. For those with no investments in circular economy, the sector further influences their economic performances, with SMEs from manufacturing presenting poorer performances as compared with the other sectors.

At the same time, for SMEs from Greece, Portugal, Bulgaria, and Czech Republic, investments in R&D and the sector of activity act as key drivers for their economic performances. Best economic results are obtained by SMEs investing more than 10% of the turnover in R&D, irrespective of their sector of activity, while the poorest performances are registered by SMEs from Czech Republic that invest less than 5% and activate in manufacturing.

Also, for the population of SMEs located in Italy and Poland, the size class, sector of activity, and investments in R&D predict the evolution of the total turnover.

For SMEs from Germany, the next most important independent variable is the level of investments in circular economy activities. Thus, 68% of the companies that have chosen to invest their resources in circular economy practices register an increased turnover which is higher as compared with the other SMEs.

For SMEs from the United Kingdom, Hungary, and Slovakia, the most important factor influencing their economic performances is the level of investment in R&D. The most positive results are obtained by companies investing 5% to 9.9% of total turnover in R&D. For SMEs investing more than 10% in R&D, the amount of additional investments in circular economy further influences their economic performance. Those investing 10% or less of the total turnover in circular economy register much better economic performances as compared with those that invest more than 10% or those that do not invest at all. For SMEs from the United Kingdom, Hungary, and Slovakia that invest 5% or less of total turnover in R&D and activate in manufacturing, services, and industry, additional investments in circular economy influence their economic performance in a positive manner.

Figure 3 presents the third tree-based model that analyzes which types of circular economy activities undertaken by European SMEs interact with other characteristics of the companies and influence their economic performances. The constructed model comprises 46 nodes, out of which 25 are terminal ones. The percentage of correct classification is 62%.

The model shows that the country of the SMEs is the main predictor of their economic results. The resulting nodes of the SMEs based by the country variable are similar to those in the previous model. For SMEs from Belgium, Spain, France, Ireland, The Netherlands, Austria, Sweden, and Romania, the use of renewable energy influences their economic performances in a positive manner. For SMEs that didn't undertake the use of renewable energy, redesigning products and services to minimize the use of materials or the use of recycled materials results in better economic results, especially in sectors such as manufacturing, retail, and industry. For SMEs that undertook some activities related to the use of renewable energy, the activities of redesigning products and services to minimize the use of materials or the use of recycled materials are not associated with improved economic results. So, for SMEs from Belgium, Spain, France, Ireland, The Netherlands, Austria, Sweden, and Romania, improved economic results are obtained by those undertaking the use of renewable energy (54%). The improved economic performances are even wider spread among SMEs from France that use renewable energy in their current activity (89%). Also, increased turnover is

registered by SMEs from this group of countries that redesign products and services to minimize the use of materials or the use of recycled materials (49%), especially in the case of the manufacturing, retail, and industry sectors (54%).

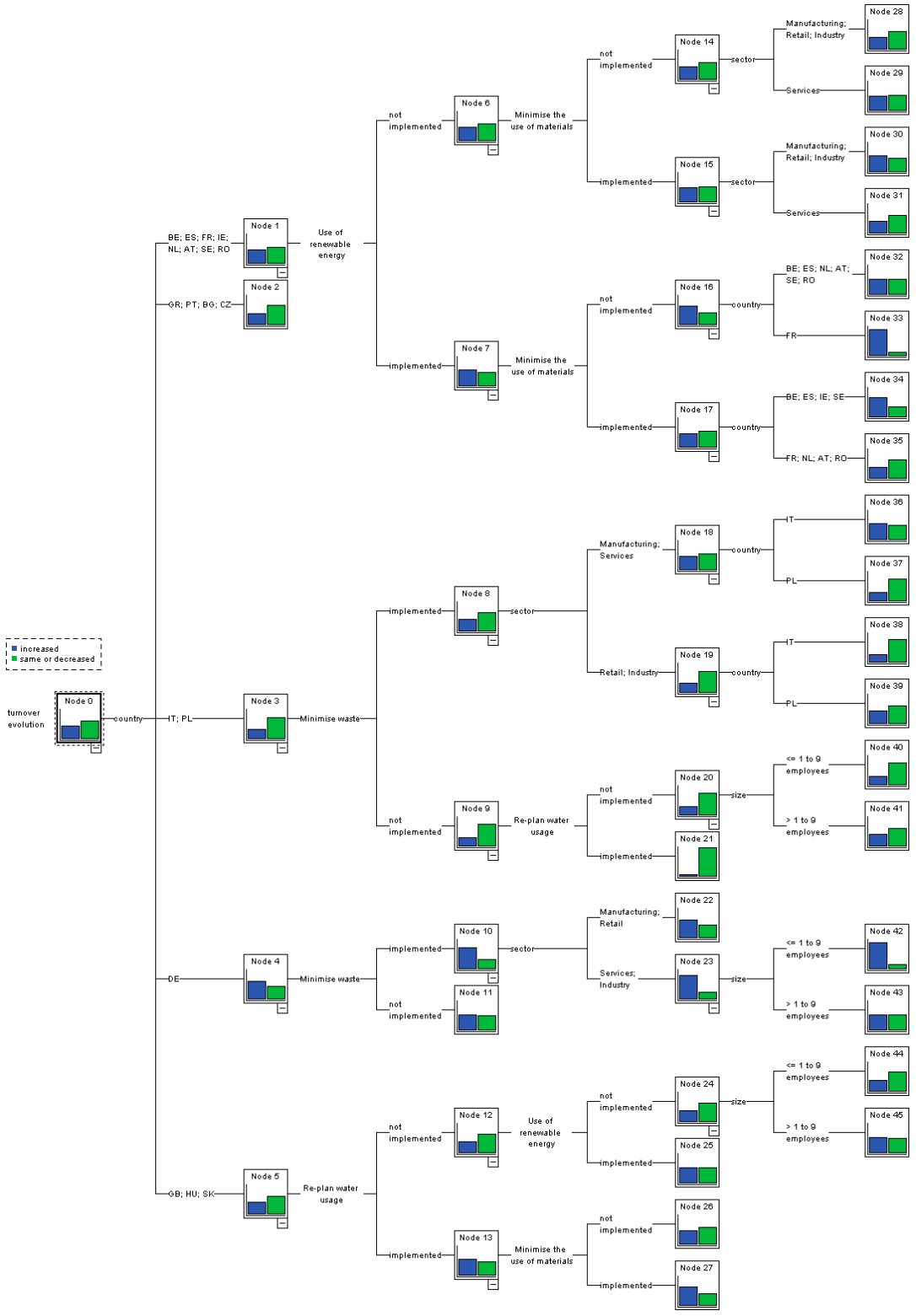

Figure 3. Tree-based Model 3 of the economic performance of European SMEs. Source: authors' calculation on the base of microdata from Flash Eurobarometer 441 [47].

For SMEs from Greece, Portugal, Bulgaria, and Czech Republic, undertaking activities related to circular economy do not interact with other characteristics of the companies in order to influence their economic performances.

In the case of SMEs from Italy and Poland, undertaking activities to minimize waste by recycling or reusing waste or selling it to another company improves the economic results of the companies. The most wide-spread improvement is for SMEs activating in manufacturing and services from Italy. SMEs from Italy and Poland that didn't undertake actions for minimizing waste by recycling or reusing waste or selling it to another company, but re-planned the way water was used to minimize usage and maximize re-usage in the last three years, obtained poorer economic results as compared with those that didn't undertake circular economy activities.

In the case of SMEs from Germany, minimizing waste by recycling, reusing waste, or selling it to another company influences the economic results in a positive manner. This effect is more present among German SMEs from services and industry sectors that have nine employees or less.

For SMEs located in the United Kingdom, Hungary, and Slovakia, re-planning the way water is used to minimize usage and maximize re-usage is associated with the improved economic performance of the company. In the case of companies that didn't undertake such measures, the use of renewable energy results in a higher chance of obtaining an increased turnover. Moreover, at the level of SMEs from the United Kingdom, Hungary, and Slovakia, those that re-plan the way water is used to minimize usage and maximize re-usage, and redesign products and services to minimize the use of materials or use recycled materials, display the best economic results.

5. Discussion and Conclusions

The method of analysis used in this paper makes an important contribution to understanding the entrepreneurial decisions with respect to adopting sustainability-oriented behavior. Applying tree-based models to the population of European SMEs shows that the country in which they operate represents the most important factor that influences the decision of companies to adopt circular economy practices. It means that economic development, national programs, funding mechanisms, the institutional framework, and incentives are still very heterogeneous across countries and this situation influences the participation of SMEs with regard to circular economy to a significant extent.

Countries such as Bulgaria, Hungary, Poland, Romania, and Slovakia do not offer a framework as stimulating as the other countries in order for the SMEs to adopt circular economy practices. One important finding of this paper is that the participation of SMEs from Bulgaria, Hungary, Poland, Romania, and Slovakia with regard to circular economy is the weakest in Europe, and that it presents no important variation in relation to the sector of activity, size, or turnover of the company.

On the other hand, even within countries that offer more favorable conditions for stimulating SMEs to adopt circular economy practices, their behavior varies significantly across sectors and in relation to the company's turnover. There are segments of SME population where circular economy-related behavior remains week, as well as segments in which the high majority or even all the companies are active in the field of circular economy. Such results are relevant both for companies that need to decide whether to adopt or not circular economy practices and for national and European authorities that aim to design or improve programs and initiatives targeting the development of circular economy.

Another valuable result of this paper is the fact that it shows how entrepreneurial decisions in the field of circular economy interact with other factors and influence the economic performances of the SMEs. As expected, structural factors enclosed in the country variable have the highest influence on the economic performances of the SMEs. Along with the national context and sector of activity, investment decisions in research and development and in circular economy also influence the economic results of the European SMEs. Our results show how the level of investment in circular economy influences companies' economic performances for specific categories of SMEs. Moreover, this paper highlights the fact that the companies' investments in circular economy complement investments in research and development and impact the economic results of the SMEs for some segments of SMEs.

Additionally, this paper shows what activities of circular economy are to be undertaken by SMEs with various characteristics in order for their economic performances to be improved. Out of five potential types of circular economy activities to be implemented by European SMEs, only re-planning the energy usage to minimize consumption does not influence the economic performances of the companies. On the other hand, the use of renewable energy, as well as the re-planning of water usage, the minimization of waste, and the minimization of the use of materials represent decisions that are both favorable for the environment and produce improved economic performances in the case of the specific categories of SMEs.

Our results are in line with previous studies, confirming the influence of the national context, as well as of the sector-related factors and size of the companies with regard to sustainable business decisions [3,7,16,26]. Additionally, the findings of the present study show how these factors interact and influence the transition from a linear economic model to circular economy practices. At the same time, by linking specific circular economy decisions to well identified segments of SMEs, this paper offers additional indications of the potential environmental benefits in relation to material flows and resource use.

By linking circular economy emergence to the national and sectoral contexts, our results support the view of the European Commission that has proposed a framework for action and called for an integrate approach across various policy areas and levels. The need for moving from a linear economic model to more circular economic solutions has to be further fueled by increased efforts for designing and innovating for circular economy and by increased investments in this field. As businesses remain one of the key actors in this transition, their needs, in particular the ones of SMEs, have to be better addressed by programs supporting relevant investments, infrastructure, technology, and skills [48]. Moreover, as suggested by our results, the persisting high heterogeneity across the Member States with respect to circular economy development needs to be in the center of the future European policy framework in this field.

The limitation of this study is related to the fact that the analysis includes mostly mezzo-level data. For improving the explanatory power of our analysis, our future research will test a multi-level approach, allowing for the economic performances of the companies to be better explained by additional macro- (variation of economic development, % of high tech sectors, etc.) and micro-level factors (such as entrepreneur's age, gender, education, etc.). Such further developments will allow for the identification of the main challenges hindering the emergence of circular economy, as well as the assessment of the potential for job growth, innovative business models, and organization change.

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