CONSTRUCTION INDUSTRY: ENTREPRENEURSHIP, CIRCULAR ECONOMY AND ENVIRONMENT PROTECTION. CASE STUDY OF ROMANIAN MOUNTAINS AREA

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Abstract
The article analyzes the construction sector in the Romanian mountains area and in the North-East region of Romania, in order to offer solid solutions for functional growth, especially through the circular economy applied in environment protection desiderata. According to EU statistics, the construction sector is among the emergent industries and creates one of the largest numbers of jobs at the Community level. In the Romanian mountains area and in the North-East region of Romania, this sector can be developed, because the main purpose of the Romanian emigrants is to be given abroad to the works and main goal of returning home is to build a house. In general, home constructions are an urgent necessity, but many times homes are oversized and it is difficult to achieve the goal. Thus, this sector is being investigated in sustainable growth and continues to increase because the Romanian emigrants to various countries of the world will not come home before succeed in completing the main purpose for working abroad in difficult conditions and away from family, friends, etc., respectively building their own home. The circular economy applied in the construction sector is directly connected by the environment protection, and the growth of the entrepreneurship must be analyzed through business demography indices.

Key words: correlation, climate-yield, irrigation, de Martonne aridity index wheat, crop rotation

INTRODUCTION

The circular economy is applied for environment protection and based on several principles, which are applicable throughout the economy, but especially in the industry and especially in the construction sector. This branch of industry - construction - present interest for this paper because, based on statistical data, the author considers that it is one of the solutions to revive the economy of Romanian mountains area and North-East region.

The circular economy involves the transition from linear thinking models to circular models. This can be achieved by applying the principles of the circular economy, which are also applicable in construction, respectively: waste is a raw material, diversity is power, energy must come from renewable sources, and system-level thinking. In order to have a sustainable development, entrepreneurship, especially in construction sector, should apply the principles of the circular economy. (Driga and Lafuente, 2009)

As Nasi et. all (Nasi et. all, 2018, 22) postulates, "in the last decades, green and sustainable supply chain management practices have been

developed, trying to reduce the negative consequences of production and consumption processes on the environment. In parallel to this, the circular economy discourse has been propagated in the industrial ecology literature and practice. Circular economy pushes the frontiers of environmental sustainability by emphasizing the idea of transforming products in such a way that there are workable relationships between ecological systems and economic growth."

Circular economy in construction industry suppose environment protection and carefully using of building materials. Building materials and how they are used in buildings are the keys to minimal environmental impact. The impact of building materials on the environment is found in alteration of the environment through various human actions, energy required for the entire life cycle of the product (from raw material to product and then recycling), energy used for transport, energy required for end of life cycle, impact of adjacent actions, maintenance required during the life cycle. In order to minimize the impact of building materials on the environment, it is necessary to use them flexibly, monitor performance throughout the construction process (fast execution, light weight, etc.), be energy efficient, durable, without impact on the whole living, disposable, recyclable and reusable. Methods of making and using low impact materials according to the EPA (Environmental Protection Agency) are use of products resulting from industrial processes, existing materials locally (to minimize energy required for transportation), prefabricated materials and systems, materials and prefabricated systems (to minimize the realization energy). The most used materials with low impact on the environment are - natural organic materials with rapid growth (bamboo, straw), or animal origin (wool); natural stone, recycled stone; recycled materials (metal, copper) and non-toxic products. (Ciutina, 2020)

MATERIAL AND METHOD

The construction sector is one of the largest waste generators worldwide, but especially in Romania and North-East region. The construction sector has a contribution to the EU's GDP of 9%, providing about 18 million jobs. (European Commision, 2018)

The main cause of the construction sector impact on the environment is the use of non-renewable materials, which produce waste that is impossible to reuse. (Nuñez-Cacho et. al, 2018)

In Romania, the culture regarding the use of renewable construction materials is no very well developed. This is why the circular economy is having problems in implementation.

Decisions to apply the circular economy in construction are related to the operational sphere (with reference to certain parts of production processing), tactical (with application to the whole process), and strategic (with implementation to the entire organization). (Nuñez-Cacho et. al, 2018)

The circular economy in the construction sector is directly connected by the business demography and enterprises growth, and represents the main preoccupation of the paper.

According to Eurostat data for the construction industry, the evolution of the business demography indices of the North-East region of Romania shows an increase in population of active enterprises in the 2011-2015 period, from 6049 units to 8078. It is understandable, from the data presented, that the construction sector in the North-East region has improved positively, especially in the context of increasing the employability of newly established companies.

Benefit for the construction sector in the North-East region of Romania, especially in the North-East region, is applicable because many of the Romanian emigrants work in other developed countries in the construction sector. They have the opportunity to discover new methods and working materials. These are taken over and can be built in their own construction in terms of sea and beautiful houses in Romania.

The construction industry in Romania is part, through which it can be heated, over another upper part of the industries. Also, they can be used for reusable materials, of good quality, as well as can be efficient in terms of Romanian constructions. Thus, the construction industry is constantly created in Romania, motivating the care of entrepreneurship and can support businesses that can function properly in this sector.

To verify the affirmations presented above, it has been formulated through the paper the following hypothesis: the alternative hypothesis H1 is The probability of recession across the construction industry is positively correlated with the central tendencies in this sector and with the circular economy. For the purposes of calibrating and supporting the settled hypothesis, its zero hypotheses are formulated thus: the null hypothesis H0 is The probability of recession across the listed sector is not positively correlated with the central tendencies in this sector (Zaman, Goschin and Vasile, 2013; Covaci B., Suciu and Covaci M, 2018). The hypothesis has been verified through descriptive statistics and analysis.

Methods of the paper are proposing the analysis of the descriptive statistics combined with exploratory research. The hypothesis is focused on using a circular economy in developing the construction industry in Romania (Covaci M., 2009; Covaci M., 2017; Covaci M., 2019), clusterization of the developed/emergent construction industry.

RESULTS AND DISCUSSION

Business demography and high growth enterprise activity for construction industry in Romanian mountain regions present between 2008-2016 period an important fluctuation, in general decrease, in values (tab. 1). The construction industry sector decline in Romanian mountain regions is explained by the contraction of activity due to insufficient policies regarding environment protection and not well applied of circular economy desiderata. Some indices, in general those with impact of future trends (with horizon of 2020) presented increases of the activity, as follow I1. by 24,28%; I4. 28,54%; I14. 338,64%; I18. 4,94%; I19. 3,41%. Still, the rest of the indices show that the construction industry in Romanian mountain regions decreased and trends for 2020 are uncertain, respectively I2. by -40,20%; I3. -18,08%; I5. -77,00%; I6. -24,31%; I7. -32,24%; I8. -44,14%; I9. -52,44%; I10. -33,08%; I9. -47,11%; I12. -33,91%; I13. -9,01%; I15. -44,28%; I16. -51,89%; I17. -30,29%; I20. -26,15%; I21. -6,41%; I22. -14,86%; I23. -7,05%; I24. -18,50%; I25. -51,37%; I26. -12,71%.

The fluctuation presented show that in the Romanian mountain regions is necessary to apply more the environment protection and the circular economy desiderata.

Table 1

Business demography and high growth enterprise by NACE Rev. 2 activity and other typologies for Construction Industry in Romanian mountain regions

Indicator	2008	2014	2015	2016
I1. Population of active enterprises in t - number	20.182	23.314	23.711	25.083
I2. Births of enterprises in t - number	5.298	2.602	3.040	3.168
I3. Deaths of enterprises in t - number	2.605	2.511	2.134	:
I4. Enterprises newly born in t-3 having survived to t – number	1.773	1.679	1.541	2.279
I5. High growth enterprises measured in employment (growth by 10% or more) - number	213	38	46	49
I6. Persons employed in the population of active enterprises in t - number	167.163	119.603	120.394	126.518
I7. Employees in the population of active enterprises in t - number	163.604	108.643	108.878	110.860
I8. Persons employed in the population of births in t - number	12.407	6.422	6.235	6.930
I9. Employees in the population of births in t - number	10.957	5.352	4.596	5.211
I10. Persons employed in the population of deaths in t - number	5.211	3.165	3.487	:

I11. Employees in the population of deaths in t - number	4.139	2.242	2.189	:
I12. Persons employed in the population of enterprises newly born in t-3 having survived to t - number	10.777	5.713	5.443	7.123
I13. Persons employed in the year of birth in the population of enterprises newly born in t-3 having survived to t - number	5.037	3.987	4.288	4.583
I14. Net business population growth - percentage	:	-0,2	1,7	5,79
I15. Business churn: birth rate + death rate - percentage	39,16	21,93	21,82	:
I16. Birth rate: number of enterprise births in the reference period (t) divided by the number of enterprises active in t - percentage	26,25	11,16	12,82	12,63
I17. Death rate: number of enterprise deaths in the reference period (t) divided by the number of enterprises active in t - percentage	12,91	10,77	9	:
I18. Survival rate 3: number of enterprises in the reference period (t) newly born in t-3 having survived to t divided by the number of enterprise births in t-3 - percentage	:	50,93	54,26	46,13
I19. 3 year old enterprises' share of the business population - percentage	8,79	7,2	6,5	9,09
I20. Employment share of enterprise births: number of persons employed in the reference period (t) among enterprises newly born in t divided by the number of persons employed in t among the stock of enterprises active in t - percentage	7,42	5,37	5,18	5,48
I21. Average size of newly born enterprises: number of persons employed in the reference period (t) among enterprises newly born in t divided by the number of enterprises newly born in t - number	2,34	2,47	2,05	2,19
I21. New enterprise paid employment rate: number of employees in the reference period (t) among enterprises newly born in t divided by the number of persons employed in t among enterprises newly born in t - percentage	88,31	83,34	73,71	75,19

I22. Employment share of enterprise deaths: number of persons employed in the reference period (t) among enterprise deaths divided by the number of persons employed in t among the stock of active enterprises in t - percentage	3,12	2,65	2,9	:
I23. Average employment in enterprise deaths: number of persons employed in the reference period (t) among enterprise deaths in t divided by the number of enterprise deaths in t – number	2	1,26	1,63	:
I24. Three-year old enterprises employment growth rate: number of persons employed in the reference period (t) among enterprises newly born in t-3 having survived to t divided by the number of persons employed in t-3 by the same enterprises, expressed as a percentage growth rate - percentage	113,96	43,29	26,94	55,42
I25. Employment share of 3 year old enterprises: Number of persons employed in enterprises newly born in t-3 having survived to t, divided by the number of persons employed in the population of active enterprises in t – percentage	6,45	4,78	4,52	5,63

Source: Author processing according Eurostat - Business Demography Statistics

Regarding the North-East region of Romania, statistics for the construction industry – the histogram (fig. 1) and the indices presented forwards (including tab. 2) - show an average of 6846.00 with a standard error of 375,063, a 95% confidence interval with a lower limit of 5959.12 and an upper limit of 7732.88, lower average value of 5% of 6875.94, a median of 6828.50, a variance of 1125377.143, a standard deviation of 1060.838, minimum of 5075 in 2015, maximum of 8078 in 2015, an interval of 3003, interquartile range of 1815, a gap of -373 with a standard error of .752, Kurtosis of -841 with a standard error of 1,481.

The values recorded by M-Estimators for various sectors of activity: Huber's M-Estimatora is 6927.41, Tukey's Biweightb - 6884.03, Hampel's M-Estimatorc - 6882.22 and Andrews' Waved - 6883.71 (a. The evaluation of the constant is 1,339; b. The evaluation of the constant is 4,685; c. The evaluation of constants has 1,700, 3,400 and 8,500; d. The constant valuation is 1,340 * pi). The percentiles in the evaluation average scenario are: for 5 percentiles - 5075.00, for 10 percentiles - 5075.00, for 25 percentiles - 6078.25 and for 50 percentiles - 6828.50. The percentiles in the

Tukey's Hinges scenario are: for 25 percentiles - 6107.50 and for 50 percentiles - 6828.50.
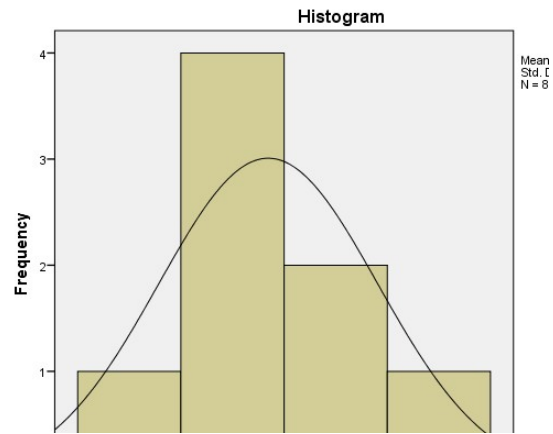

Fig. 1. Histogram for the construction sector in the North-East region of Romania (2008-2015)
Source: Author processing according to Eurostat - Business Demography Statistics

The normality tests through Kolmogorov-Smirnova scenario are Statistic of .198, df of 8 and Sig. of .200* and through Shapiro-Wilk scenario are Statistic of .932, df of 8 and Sig. of .530* (*. This is the lower limit of true meaning, a. Lilliefors Corrected meaning).

Table 2

Extreme values[a] - construction industry, North-East region of Romania

Constructions			Case number	Value
	Superior	1	8	8078
		2	6	7914
		3	7	7829
		4	5	6924
	Inferior	1	3	5075
		2	1	6049
		3	2	6166
		4	4	6733

Source: Author processing according Eurostat - Business Demography Statistics

At a first analysis, the distribution curve is relatively symmetrically central, and the scores around the average are very concentrated, with the appearance of leptocurticity, although the distribution is unimodal. (fig. 2) Working hypothesis: the distribution of scores is considered normal and,

therefore, parametric tests will be applied. The extreme values of the distribution, although they are in very small numbers, change the appearance of the histogram, by inducing a positive asymmetry, being still clinically important. The concentration of a large number of scores around the average (M = 6846) produces a certain leptocurticity of the distribution, due to the related phenomena in the Romanian economy. The logarithm of the values obtained, according to the universally accepted statistical rules, allowed to balance the distribution according to the normal Gauss-Laplace curve.
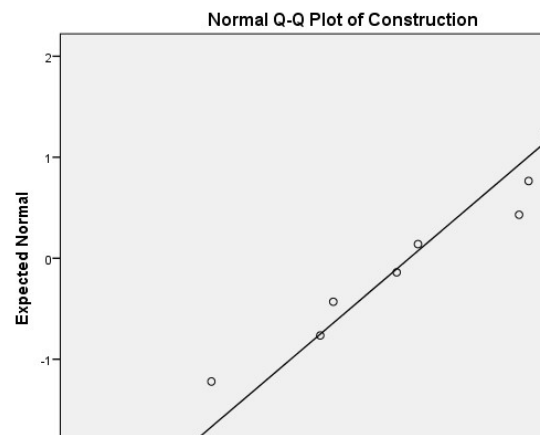

Fig. 2. Distribution graph Q-Q normal plot for constructions in the North-East region of Romania - by logarithm (2008-2015)
Source: Author processing based on Eurostat data - Business Demography Statistics

The normal Q-Q plot test, after logarithm, shows a distribution of real scores around normal values, represented by the oblique line in the graph, which corresponds to a normal distribution.

The Q-Q descended plot test, on the dispersion of empirical scores to normal, represented by the right with the score z = 0 for the mean and standard deviation 1, after logarithm, shows that they fall within a standard deviation, corresponding to a normal distribution. (fig. 3)

By logarithm, the scores obtained were subjected to statistical processing, after which all the factors involved in the study were taken into account, in order to obtain data as close as possible to the reality recorded in the North-East region of Romania, even if the measures taken in the economy they unbalanced the distribution of scores for a short period of time.
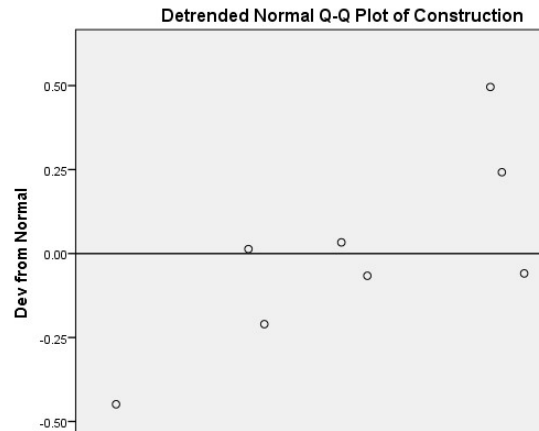
Fig. 3. Dispersion of the scores observed, compared to normal, by the Q-Q descended plot test - after logarithm, the construction sector in the North-East region of Romania (2008-2015)
Source: Author processing according to Eurostat data - Business Demography Statistics

The importance of these tests is given by the need to carefully observe the influences of certain factors in the evolution of the construction sectors (fig. 4). Following the application of normality tests, after logarithmization, the null hypothesis must be rejected and the working hypothesis can be analyzed. The descriptive and inferential analysis will be done considering the distribution of scores within normal limits, according to the working hypothesis, for which the parametric tests are applied.

The central tendency for this sector in the analyzed period, amounting to 6846.00 (average), shows that the northeastern population of the active enterprises in the analyzed sector increased from 2008 (6049) to 2015 (8078), even if the rate of growth decreased. This has been realized in concordance with the application of the circular economy.

Some solutions for the circular economy in the construction industry propose "technical challenges including the lack of recovery routes and the complex design of buildings, whilst significant, are likely to be overcome to some extent through further research on enabling technologies and sharing of knowledge. A larger obstacle is the existing stock of buildings and infrastructure where circularity principles have not been adopted. That said, there are many opportunities to advance the circular economy through the enabling factors identified. Ones that ranked highly significant include the greater recovery of materials through viable take-back schemes and higher

value markets, assurance schemes for reused materials, best practice exemplar case studies, and an awareness scheme." (Adams et. all, 2017, 22)
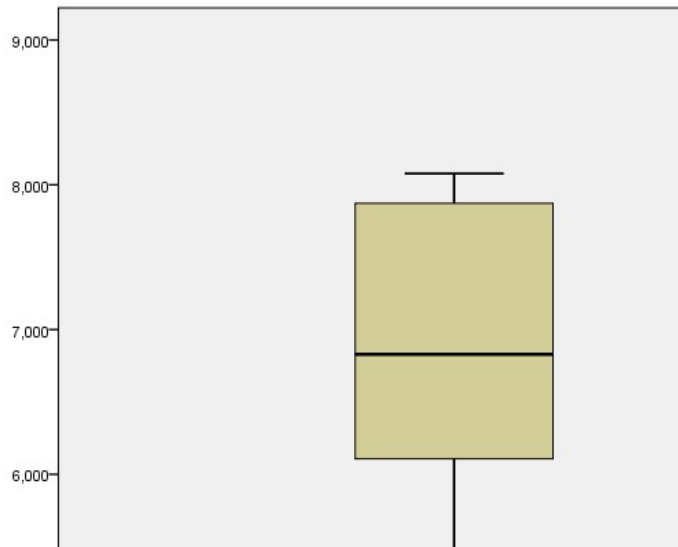

Fig. 4. Inter-quartile diagram for the construction sector in North-East region of Romania (2008-2015)
Source: Author processing based on Eurostat data - Business Demography Statistics

CONCLUSIONS

The Romanian construction industry, especially from North-East region and from mountain area, should follow the idea of environment protection in order to apply circular economy.

The article meets the following needs, and analyzed the industrial constructions in the Romanian mountains area and North-East regions, and offered solutions for entrepreneurs in this sector.

The construction industry sector decline in Romanian mountain regions is explained by the contraction of activity due to insufficient policies regarding environment protection and not well applied of circular economy desiderata.

The central tendency for the construction industry during the analyzed period, with the value of 6846.00 (average), shows that the active enterprises of the construction sector in the North-East region of Romania, for the analyzed sector increased even though the growth rate decreased. And more, this is correlated with the circular economy. Construction entrepreneurs are encouraged to use reusable materials, including all waste from the construction process.

206

During the analyzed period, the H1 hypothesis was verified (activity intensification), the frequency having a total variation of 2.5 - from 0.5 to 3. The statistics presented above, and the histogram confirm the low congestion and the tendency to give up this sector in the northeastern region of Romania. At the same time, statistics confirm the slowdown in this sector.

The paper presents entrepreneurship, using a circular economy, as a key success for Romania, especially for the Romanian North-East region. The 2000-2007 period, but especially 2008-2015, was characterized by a major increase in the population of the active enterprises and of the occupied population in construction small businesses. (Covaci B., Suciu and Covaci M, 2018).

The major growth of the population of active enterprises in the construction sector is correlated with a strong drawing of the North-Eastern economy. The influence of clusterization and involvement of the academic environment in the North-East region and European funding to this specific industry must be considerable. (Covaci B., Suciu and Covaci M, 2018; Covaci M., 2014; Covaci B., 2019)

The paper demonstrates that circular economy must be applied for environment protection in the construction sector, especially in the Romanian mountains area and in the North-East region of Romania, and is directly connected by the population of active enterprises. The solutions for reviving this industry in the environment protection desiderata are correlated with responsible entrepreneurship according to the circular economy principles.

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