

# THE EMPLOYMENT IN INNOVATIVE ENTERPRISES IN EUROPE

**Lucio Laureti, LUM University**  
**Alberto Costantiello, LUM University**  
**Marco Matarrese, LUM University**  
**Angelo Leogrande, LUM University**

## ABSTRACT

*In this article we evaluate the determinants of the Employment in Innovative Enterprises in Europe. We use data from the European Innovation Scoreboard of the European Commission for 36 countries in the period 2000-2019 with Panel Data with Fixed Effects, Panel Data with Random Effects, Dynamic Panel, WLS and Pooled OLS. We found that the “Employment in Innovative Enterprises in Europe” is positively associated with “Broadband Penetration in Europe”, “Foreign Controlled Enterprises Share of Value Added”, “Innovation Index”, “Medium and High-Tech Product Exports” and negatively associated to “Basic School Entrepreneurial Education and Training”, “International Co-Publications”, and “Marketing or Organizational Innovators”. Secondly, we perform a cluster analysis with the k-Means algorithm optimized with the Silhouette Coefficient and we found the presence of four different clusters. Finally, we perform a comparison among eight different machine learning algorithms to predict the level of “Employment in Innovative Enterprises” in Europe and we found that the Linear Regression is the best predictor.*

**Keywords:** General, Innovation and Invention, Processes and Incentives, Management of Technological Innovation and R&D, Technological Change, Choices and Consequences, Diffusion Processes, Intellectual Property and Intellectual Capital

**JEL CODE:** O30; O31; O32; O33; O34.

## INTRODUCTION

In this article we estimate the value of employment in highly innovative enterprises among European Countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finlandia, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, UK) using data from European Innovation Scoreboard of the European Commission in the period 2010-2019. Innovation has a crucial role in economic growth (Solow, 1956), economic development (Schumpeter, 1961) and, also in endogenous growth theory (Romer 1994). Innovation is positively associated with: design applications (Leogrande et al., 2021), human resources (Leogrande & Costantiello, 2021), venture capital (Leogrande et al., 2021), intellectual assets (Costantiello et al., 2021), broadband penetration (Leogrande et al., 2021), innovators (Costantiello et al., 2021), financial systems (Laureti et al., 2020), business environment (Costantiello et al., 2021), sales (Costantiello et al., 2021), research systems (Leogrande, et al., 2020), investments in Research and Development (Costantiello et al., 2021). But innovation is relevant also for employment (Costantiello & Leogrande, 2021).

Van, et al., (2018) show the positive impact that innovation has on employment in high-

tech manufacturing. Also, eco-innovations have a positive effect on employment even after controlling for firm size in European Union (Madaleno et al., 2020). (Makovskaya, 2018) considers the positive association between fixed terms contracts and Research and Development activities in Small and Medium Enterprises-SMEs in Belarus. Akarsu, et al., (2020) shows the positive relationship between female employment in middle and upper management and the level of innovation. Crespi & Tacsir (2011) find a positive relationship between product innovation and employment in Latin America. (Del Pozo & Juan Fernández, 2021) investigate the relationship between investment in R&D and innovation technology and employment in Ecuador finding that while, on one side, the improvement in R&D expenditure increases the occupation of scientists, on the other side the augmentation of expenditures in innovation technologies increases the occupation of managers, scientists, and technicians.

Neves, et al., (2019) using an agent-based model show that if process innovation is greater than product innovation then the level of wage shares declines. Porath, et al., (2021) analyze the relationship between innovation and employment in Sub-Saharan African countries finding that innovation improves the level of wages and sales and creates new jobs. Goel & Nelson (2021) investigate the impact of innovation and R&D on employment for 127 countries finding that both innovation and R&D have a positive effect on job creation especially in the case of foreign-owned and government owned enterprises. Laforet (2011) shows that innovation in SMEs is positively associated to the hiring of high skilled workers. Otoi, et al., (2017) analyze the relationship between innovation and employment in European regions showing that generally there is a positive relationship between those variables except for the case of Eastern Europe in which the relationship is weaker due to the transition from communism to market economy.

(Subrahmanya, 2010) demonstrates that the implementation of innovation in 76 firms in Bangalore in the auto component sector has lacked to produce a positive effect on labour productivity since the presence of high turnover either in skilled and in unskilled workers. Pantea (2018) analyzes sociologically the controversial relationship existing among entrepreneurship, innovators and employment showing that innovators, that in the article are young workers that received a grant for their innovations, do not always choose entrepreneurship over employment. Doussard, et al., (2017) shows the presence of a positive relationship between innovation and employment in USA especially for high tech manufacturing firms. (Mustafa, 2021) investigates the positive relationship between digital innovation and employment in Malaysia where many young workers escaped from unemployment thanks to gig economy. Wu (2021) investigates the connection between innovation and education and their combined positive effect on employment in a technological environment. Oware & Mallikarjunappa (2021) show that innovation in engineering and software firms promote employment in manufacturing industries only in the presence of a significant financial performance. (Dachs, et al., 2017) indicate the presence of a positive effect of innovation on employment in Europe in manufacturing industries except for recession periods. Peluffo (2020) find the presence of a positive relationship between innovation and employment in manufacturing industries in Uruguay. Gao & Zhang (2017) analyze the positive relationship between the Employment Non-Discrimination Act-ENDA in the USA and innovation i.e. regions that have more inclusive policies in the labour markets also show greater levels of innovation.

The article continues as follows: the second paragraph contains the econometric analysis of the estimated model, the third paragraph shows the cluster analysis with the k-Means algorithm, the fourth paragraph predict the value of employment in highly innovative enterprises using eight machine learning algorithms, the fifth paragraph concludes. The appendix contains the estimations and the graphs of cluster and machine learning analysis.

## The Econometric Model

We have estimated the following econometric model:

Employment in Innovative Enterprises $_{it}$

$$\begin{aligned}
 &= a_1 + b_1(\text{Basic School Entrepreneurial Education and Training})_{it} \\
 &+ b_2(\text{Broadband Penetration})_{it} \\
 &+ b_3(\text{Foreign Controlled Enterprises Share of Value Added})_{it} \\
 &+ b_4(\text{Innovation Index})_{it} \\
 &+ b_5(\text{International CoPublications})_{it} \\
 &+ b_6(\text{Marketing Or Organisational Innovators})_{it} \\
 &+ b_7(\text{Medium And Hightech Product Exports})_{it}
 \end{aligned}$$

Where  $i = 36$  and  $t = 2010 - 2019$ . We have estimated the model using Panel Data with Fixed Effects, Panel Data with Random Effects, Pooled OLS, Dynamic Panel and WLS. Data are collected from the European Innovation Scoreboard-EIS of the European Commission. We find that employment in innovative enterprises is positively associated with:

- **Broadband Penetration:** is defined as the number of enterprises with a maximum contracted download speed of the fastest fixed internet connection of at least 100 Mb/s over the total number of enterprises. The greater the broadband penetration the greater the level of employment in innovative enterprises. The positive relationship between these two variables can be better understood since innovative enterprises require digital infrastructures that are generally based on higher broadband penetration. And if firms can have access to digitalization infrastructures, then they also can increase their labour force with more high- skilled employees.
- **Foreign Controlled Enterprises Share of Value Added:** is calculated as the value added by foreign controlled enterprises at factor cost in million euros for non-financial business economy as a percentage of the gross value added. The variable controls for the presence of foreign controlled enterprises that can be considered as an index of internationalization of the country. The econometric model shows that where the percentage of foreign controlled enterprises grows also the level of employment in innovative enterprises increases. International investors are interested in promoting local activities in foreign countries that are profitable and innovative. And generally, innovativeness, in the context of innovation technology, also imply firms that employ high qualified human resources.
- **Innovation Index:** is a global measure of the innovativeness of a country in the sense of technology and Research and Development in STEM disciplines. There is a positive relationship between the Innovation Index and the level of employment in innovative enterprises. The positive relationship is because more innovative countries also have a large amount of high skilled workers in STEM disciplines. Innovative enterprises require a significant amount of high skilled workers and, tautologically, high skilled workers are positive associated to more innovative enterprises. The presence of innovative enterprises and high level of employment in innovative firms are both components of innovative systems able to promote competitiveness at a country level.
- **Medium and High-Tech Product Exports:** is the value of medium and high-tech exports divided by the value of total product exports. The index measures the competitiveness of European countries in the export of products that are generated as result of Research and Development-R&D. There is a positive relationship between the level of medium and high- tech products and the level of employment in innovative enterprises. Since innovative enterprises require an increasing level of human resources in STEM disciplines applied in Research and Development then the greater the presence of employment in innovative enterprises the higher the export of medium and high-tech products. In effect, if on the one side while low and medium tech products can be realized with automation and a low-skilled labour force, on the other side the ability of a country to export medium and high-tech

products is positively associated to the presence of innovative firms that are able to hire high qualified human resources to improve the level of Research and Development.

Synthesis of the Main Econometric Results of the Estimation of Employment Fast-Growing Enterprises of Innovative Sectors							
Variables	Label	Pooled OLS		Fixed Effects		Dynamic Panel	
		Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
const		★ 3.32792		★ 1.85967		★ -7.53592	***
Basic-school entrepreneurial education and training (SD)	A4	★ -0.37613	***	★ -0.29351	***	★ -0.537297	***
Broadband penetration	A5	★ 0.131812	***	★ 0.097209	***	★ 0.225432	***
Foreign-controlled enterprises – share of value added (SD)	A20	★ 0.710903	***	★ 0.705515	***	★ 1.09458	***
Innovation index	A24	★ 0.662942	***	★ 0.687009	***	★ 0.690526	***
International co-publications	A30	★ -0.15774	***	★ -0.17912	***	★ -0.172928	***
Marketing or organisational innovators	A34	★ -0.36991	***	★ -0.25936	***	★ -0.340886	*
Medium and high-tech product exports	A35	★ 0.601917	***	★ 0.577252	***	★ 0.648605	***
Employment in Innovative Enterprises						★ 0.27006	***
Variables	Label	WLS		Random Effects		Mean	Median
		Coefficient	p-value	Coefficient	p-value		
const		★ 0.091611		★ 1.95503			
Basic-school entrepreneurial education and training (SD)	A4	★ -0.35289	***	★ -0.30451	***	★ -0.3728686	★ -0.352894
Broadband penetration	A5	★ 0.146643	***	★ 0.100999	***	★ 0.14041892	★ 0.131812
Foreign-controlled enterprises – share of value added (SD)	A20	★ 0.704675	***	★ 0.704351	***	★ 0.7840048	★ 0.705515
Innovation index	A24	★ 0.566927	***	★ 0.684532	***	★ 0.6583872	★ 0.684532
International co-publications	A30	★ -0.15042	***	★ -0.17778	***	★ -0.1675976	★ -0.172928
Marketing or organisational innovators	A34	★ -0.31109	***	★ -0.2702	***	★ -0.3102892	★ -0.311092
Medium and high-tech product exports	A35	★ 0.606512	***	★ 0.581677	***	★ 0.6031926	★ 0.601917

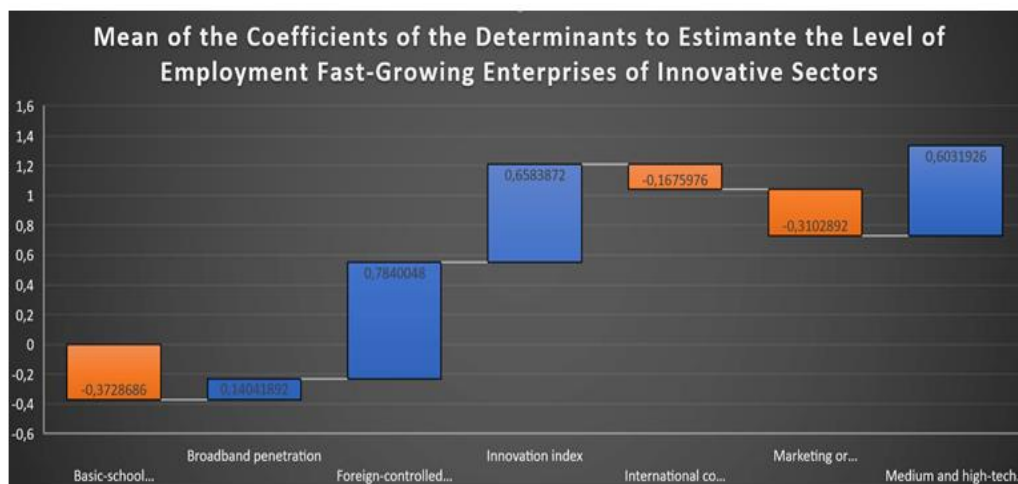
**FIGURE 1**  
**SYNTHESIS OF THE MAIN ECONOMETRIC RESULTS OF THE ESTIMATION OF EMPLOYMENT FAST-GROWING ENTERPRISES OF INNOVATIVE SECTORS**

We also find that employment in innovative enterprises is negatively associated with:

- Basic School Entrepreneurial Education and Training:** is an index that measures the level of education of entrepreneurship and business management in the primary and secondary school at a country level. There is a negative relationship between basic school entrepreneurial education and training and the level of employment in innovative enterprises. The negative relationship can be better understood considering that the level of employment in innovative enterprises tends to be associated to STEM disciplines that are generally not strictly managerial and are typically offered by universities in postgraduate courses. Even if the investment in entrepreneurship and business management in basic school is relevant to improve the economic culture and attitude there is no direct positive effect, in the estimated model, of the variable on employment in innovative enterprises. The main explanation for this negative relationship can be found in the fact that basic school education has not a direct effect on employment in innovative enterprises. To find a positive relationship between the educational system and the employment in innovative enterprises it should be necessary to consider the level of higher education, especially post-graduate, and tertiary education in STEM disciplines.
- International Co-Publications:** is defined as the number of scientific publications with at least one co-author based abroad on the total population. The index is a measure of the quality of scientific research and academic system at a country level. There is a negative relationship between international scientific co-publication and the level of employment in innovative enterprises. This negative relationship can be considered as counterfactual. But effectively international scientific co-publication is a measure that can be used to evaluate the efficiency and efficacy of academic systems instead of innovative enterprises. Even if international co- publication is an index able to evaluate the capacity of academic human resources in research and development, it is necessary to underline that the definition of R&D in the academic system differs significantly from the application of R&D in the industrial sector. In effect R&D in the industrial sector is more oriented toward results, marketable outputs, and products. To evaluate the level of internationalization of industrial R&D it should be considered the level of international co-patents i.e. the number of patents that are realized in

collaboration among individuals, organizations and institutions in different countries.

- **Marketing or Organisational Innovators:** Is an index that calculate the number of small and medium sized enterprises-SMEs that have introduced organizational or marketing innovation on the total number of SMES. The index is considered as a tool to evaluate the ability of firms to innovate even using non-technological tools. There is a negative relationship between marketing or organisational innovators and the level of employment in innovative enterprises that employ high skilled human resources. Marketing or organizational innovators not necessarily are implemented in high innovative enterprises. But, at the contrary, generally, firms that have low level of technology and low high skilled human resources can try to overcome the technological scarcity of competence through a compensation realized with marketing and organizational innovation. Even if organizational and marketing innovation can be very profitable for SMEs and, in the end, can promote technological development, knowledge management and the orientation towards medium and high-level tech products, marketing and organizational innovation are not the main tool to promote technological change in more innovative enterprises. More innovative enterprises generally promote innovative products and services through the investment in high skilled human resources employed in R&D.



**FIGURE 2**

**MEAN OF THE COEFFICIENTS OF THE DETERMINANTS TO ESTIMATE THE LEVEL OF EMPLOYMENT FAST-GROWING ENTERPRISES OF INNOVATIVE SECTORS**

Among the variables of the model there are some that have greater impact, in terms of coefficient, on the level of employment in innovative firms. In this case we have computed the mean of the coefficient for each variable in every estimated econometric model. Specifically, the main effect is produced by the “*Foreign Controlled Enterprises Share of Value Added*” with a mean value of 0,78, followed by “*Innovation Index*” with a mean value of 0,65 and “*Medium and High-Tech Product Exports*” with a mean value of 0,60. While, “*Basic School Entrepreneurial Education and Training*” has the main negative effect on the value of employment in innovative enterprises with a mean value of -0,3. This means that if politicians are interested in promoting employment among innovative enterprises in Europe, they should improve the internationalization of ownership of firms in a global environment positively oriented to innovation with a specialization for export of medium and high tech products.

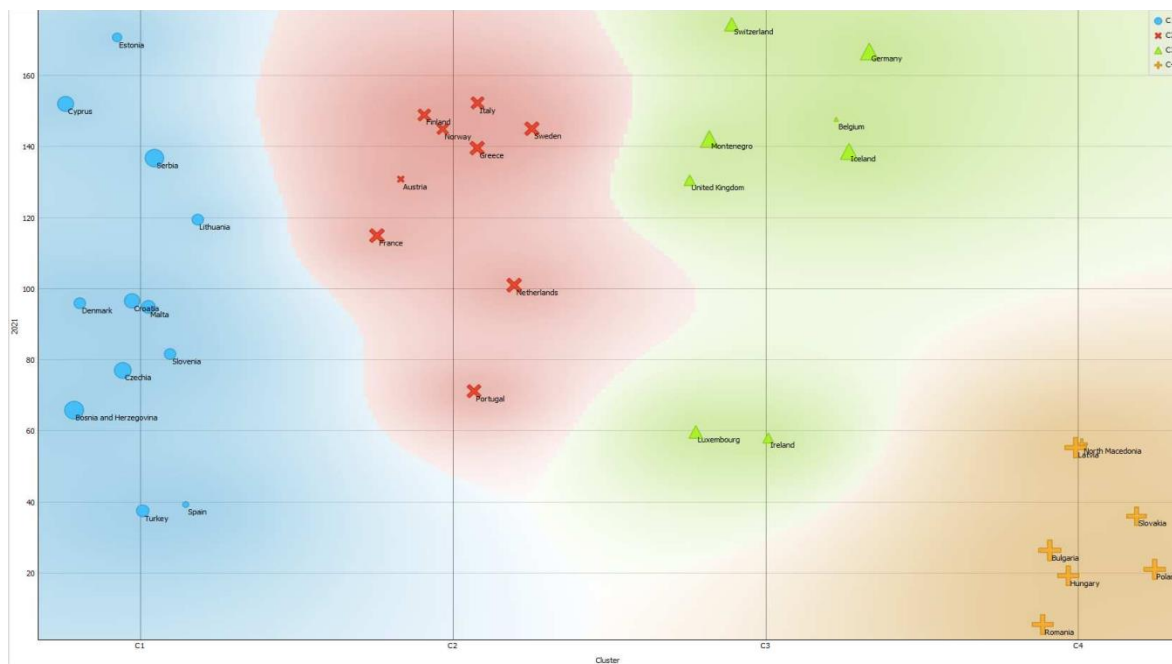
### Clusterization

We perform a clusterization analysis with the use of k-Means algorithm optimized with

the Silhouette Coefficient. We use data from the European Innovation Scoreboard of the European Commission for 38 countries in the period 2014-2021. We choose the optimal number of clusters considering the highest value of Silhouette Coefficient compatible with the highest number of clusters with at least two elements. We choose to optimize the Silhouette Coefficient based on Euclidean difference. We found the presence of four clusters that are:

- Cluster 1: Bosnia and Herzegovina, Serbia, Czechia, Cyprus, Croatia, Malta, Turkey, Slovenia, Denmark, Lithuania, Estonia, Spain;
- Cluster 2: Greece, France, Netherlands, Sweden, Portugal, Italy, Finland, Norway, Austria;
- Cluster 3: Germany, Montenegro, Iceland, Switzerland, Luxembourg, United Kingdom, Ireland, Belgium;
- Cluster 4: Bulgaria, Latvia, Poland, Hungary, Romania, Slovakia, North Macedonia.

It is possible to order the clusters based on the median value. Specifically, the cluster 2 has a level of median value equal to 137,13, followed by the cluster 3 with a level of the median equivalent to 135,072, and by the cluster 1 with a level of 95,14 and the cluster 4 with a level of median equivalent to 30,35. Based on the level of the median value we found the following order:  $C2 > C3 > C1 > C4$ . As it is clear in the cluster analysis there is a dominance of the Central and Northern Europe in respect to Southern and Eastern Europe in the sense of Employment in Innovation Enterprises.



**FIGURE 3**  
**CLUSTERIZATION USING THE K-MEANS ALGORITHM OPTIMIZED WITH THE SILHOUETTE COEFFICIENT**

## Machine Learning and Prediction

We perform eight different machine learning algorithms to predict the level of Employment in Innovative Enterprises in Europe. We use data from the European Innovation Scoreboard of the European Commission for 38 countries in the period 2014-2021. We use the 70% of data to train the algorithm and the remaining 30% of the data are used for the prediction. We choose the best predictor based on the minimization of the following statistical error i.e.: “Mean absolute error”, “Mean squared error”, “Root mean squared error”, “Mean signed

*difference*". Based on the minimization of statistical errors we found the following order:

- *Linear Regression* with a payoff equal to 4;
- *Gradient Boosted Tree Regression* with a payoff equal to 9;
- *Polynomial Regression* with a payoff equal to 14;
- *Simple Regression Tree* with a payoff equal to 15;
- *Random Forest Regression* with a payoff equal to 19;
- *Probabilistic Neural Networks-PNN* with a payoff equal to 23;
- *ANN-Artificial Neural Networks* with a payoff equal to 29;
- *Tree Ensemble Regression* with a payoff equal to 31;

Predicted Values Using Linear Regression as Machine Learning Algorithm					
Countries	2021	Prediction	Absolute Variation	Percentage Variation	
<i>Austria</i>	★ 137,14	★ 128,041	★ -9,10	★ -6,63	
<i>Bosnia</i>	★ 74,248	★ 86,657	★ 12,41	★ 16,71	
<i>Spain</i>	★ 32,448	★ 68,794	★ 36,35	★ 112,01	
<i>Finland</i>	★ 139,709	★ 106,732	★ -32,98	★ -23,60	
<i>Italy</i>	★ 138,894	★ 109,762	★ -29,13	★ -20,97	
<i>Luxembourg</i>	★ 73,821	★ 124,532	★ 50,71	★ 68,69	
<i>Latvia</i>	★ 41,164	★ 53,041	★ 11,88	★ 28,85	
<i>Malta</i>	★ 93,141	★ 47,186	★ -45,96	★ -49,34	
<i>Norway</i>	★ 146,941	★ 98,793	★ -48,15	★ -32,77	
<i>Sweden</i>	★ 137,134	★ 114,594	★ -22,54	★ -16,44	
<i>Slovenia</i>	★ 88,614	★ 86,969	★ -1,65	★ -1,86	
<i>Mean</i>	★ 100,30	★ 93,19	★ -7,10	★ 6,79	

**FIGURE 4**  
**PREDICTED VALUES USING LINEAR REGRESSION MACHINE LEARNING ALGORITHM**

Using the Linear Regression algorithm, we have the following predictions for the level of Employment in Innovative Enterprises:

- *Austria* with a decrease from 137,14 to 128,041 equivalent to an absolute variation of -9,10 and a percentage variation of -6,63;
- *Bosnia and Herzegovina* with an increase from 74,24 to 86,65 equivalent to an absolute variation of +12,41 and a percentage variation of +16,71;
- *Spain* with an increase from 32,44 to 68,79 equivalent to an absolute variation of 36,35 and a percentage variation of 112,01;
- *Finland* with a decrease from 139,709 to 106,732 equivalent to an absolute variation of -32,98 and a percentage variation of -23,60;
- *Italy* with a decrease from 138,89 to 109,76 equivalent to an absolute variation of -29,13 and a percentage variation of -20,97;
- *Luxembourg* with an increase from 73,82 to 124,53 equivalent to an absolute variation of +50,71 and a percentage variation of +68,69;
- *Latvia* with an increase from 41,16 to 53,04 equivalent to an absolute variation of +11,88 and a percentage variation of +28,85%;
- *Malta* with a decrease from 93,14 to 47,18 equivalent to a reduction of -45,96 in absolute variation and a percentage variation of -49,34;
- *Norway* with a decrease from 146,94 to 98,79 equivalent to a reduction in -48,15 equivalent to a reduction of -32,77%;

- *Sweden* with a reduction from 137,134 to 114,59 equivalent to a reduction of -22,54 equivalent to -16,44%;
- *Slovenia* with a decrease from 88,61 to 86,96 equivalent to a reduction of -1,65 in absolute value and of -1,86%.

The value of the Employment in Innovative Enterprises for the analyzed countries is expected to decrease in mean from 100,30 to 93,19 based on Linear Regression algorithm.

## CONCLUSION

In this article the determinants of the Employment in Innovative Enterprises in Europe are analyzed. Data is collected from the European Innovation Scoreboard of the European Commission for 36 countries in the period 2000-2019 with Panel Data with Fixed Effects, Panel Data with Random Effects, Dynamic Panel, WLS and Pooled OLS. In the first paragraph a short review of the more recent literature is presented. The literature review shows the presence of a positive relationship between innovation and employment, specially in the case of high-manufacturing firms. The second paragraph present the results of the econometric model. The outputs show that the “*Employment in Innovative Enterprises in Europe*” is positively associated with “*Broadband Penetration in Europe*”, “*Foreign Controlled Enterprises Share of Value Added*”, “*Innovation Index*”, “*Medium and High- Tech Product Exports*” and negatively associated to “*Basic School Entrepreneurial Education and Training*”, “*International Co-Publications*”, and “*Marketing or Organizational Innovators*”. Specifically, the results indicate that the “*Foreign Controlled Enterprises Share of Value Added*” and “*Innovation Index*” have the greatest positive impacts on “*Employment in Innovative Enterprises*”. Secondly, a cluster analysis is performed with the k-Means algorithm optimized with the Silhouette Coefficient and we found the presence of four different clusters. The cluster analysis shows the presence of a Europe with a clear division between the Center-Northern countries, that have the highest levels of “*Employment in Innovative Enterprises*” and the Southern-Eastern countries that have lower levels of the investigated variables. Finally, a comparison among eight different machine learning algorithms is realized to predict the level of “*Employment in Innovative Enterprises*” in Europe and we found that the Linear Regression is the best predictor. The prediction with Linear Regression indicates a mean reduction in the observed variable for the selected countries of -7,10%.

## REFERENCES

- Akarsu, Y., Kurt, S. & Alacahan, N. D., 2020. The contribution of women's employment to entrepreneurship and innovation in senior and middle management. *FORCE: Focus on Research in Contemporary Economics*, 1(1), 46-59.
- Costantiello, A., Laureti, L., De Cristoforo, G., & Leogrande, A. (2021). The innovation-sales growth nexus in Europe.
- Costantiello, A., Laureti, L., & Leogrande, A. (2021). The innovation-friendly environment in Europe. Available at SSRN.
- Costantiello, A., Laureti, L., & Leogrande, A. (2021). The intellectual assets in Europe. Available at SSRN 3956755.
- Costantiello, A., Laureti, L., & Leogrande, A. (2021). The SMEs innovation in Europe. FEMIB, 23-32.
- Costantiello, A., & Leogrande, A. (2021). The innovation-employment nexus in Europe. *American Journal of Humanities and Social Sciences Research (AJHSSR)*, 4(11), 166-187.
- Costantiello, A., Leogrande, A., & Laureti, L. (2021). The Corporate Innovation in Europe. Available at SSRN.
- Crespi, G., & Tacsir, E. (2011). Effects of innovation on employment in Latin America. 2011 Atlanta conference on science and innovation policy, Issue IEEE, 1-11.
- Dachs, B., Hud, M., Koehler, C. & Peters, B., 2017. Innovation, creative destruction and structural change: firm-level evidence from European countries. *Industry and Innovation*, 24(4), 346-381.
- Del Pozo, D., & Juan Fernández, S. (2021). Employment and investment in innovation activities without introduction of new technologies: a study on Ecuador. *Estudios de economía*, 48(2), 219-248.
- Doussard, M., Schrock, G., & Lester, T.W. (2017). Did US regions with manufacturing design generate more



- production jobs in the 2000s? New evidence on innovation and regional development. *Urban Studies*, 54(13), 3119-3137.
- Gao, H., & Zhang, W. (2017). Employment nondiscrimination acts and corporate innovation. *Management Science*, 63(9), 2982-2999.
- Goel, R.K., & Nelson, M.A. (2021). Employment effects of R&D and innovation: Evidence from small and medium-sized firms in emerging markets. Kiel Working Paper, 2196.
- Laforet, S. (2011). A framework of organisational innovation and outcomes in SMEs. *International Journal of Entrepreneurial Behavior & Research*.
- Laureti, L., Costantiello, A., & Leogrande, A. (2020). The finance-innovation nexus in Europe. *IJSET International Journal of Innovative Science, Engineering & Technology*, 7(12).
- Leogrande, A. & Costantiello, A., 2021. Human resources in europe. estimation, clusterization, machinelearning and prediction. machine learning and prediction. *American Journal of Humanities and Social Sciences Research (AJHSSR)*.
- Leogrande, A., Costantiello, A., & Laureti, L. (2021). The broadband penetration in Europe. Available at SSRN 3953683.
- Leogrande, A., Costantiello, A., & Laureti, L. (2021). The impact of venture capital expenditures on innovation in europe. Available at SSRN.
- Leogrande, A., Costantiello, A., Laureti, L., & Leogrande, D. (2021). The determinants of design applications in Europe. Available at SSRN 3956853.
- Madaleno, M., Robaina, M., Dias, M.F., & Meireles, M. (2020). Dimension effects in the relationship between eco-innovation and firm performance: A European comparison. *Energy Reports*, 6, 631-637.
- Mustafa, A.F. (2021). Digital innovation is pivotal to employment in the long run. *New Straits Times*, 1.
- Neves, F., Campos, P., & Silva, S. (2019). Innovation and employment: An agent-based. *Journal of Artificial Societies and Social Simulation*, 1(8), 22.
- Otoiu, A., Bere, R., & Silvestru, C. (2017). An assessment of the first round impact of innovation industries on europe's regional economies. *Amfiteatru Economic*, 19(44), 289-301.
- Oware, K.M., & Mallikarjunappa, T. (2021). Does technological innovation compete or complement job employment? Effect of technological innovation and financial performance. *The Indian Journal of Labour Economics*, 64(4), 899-922.
- Pantea, M.C. (2018). Employment-to-entrepreneurship interface in the context of tech innovation. A Qualitative Analysis in Romania. *JEEMS Journal of East European Management Studies*, 23(1), 128-146.
- Peluffo, A. (2020). Does innovation affect the demand for employment and skilled labor?. *Serie Documentos de Trabajo*, 13(20).
- Porath, D., Nabachwa, S., Agasha, E., & Kijjambu, N.F. (2021). Innovation and employment in Sub-Saharan Africa. UASM Discussion Paper Series.
- Romer, P.M. (1994). The origins of endogenous growth. *Journal of Economic perspectives*, 8(1), 3-22.
- Schumpeter, J. (1961). *The theory of economic development : an inquiry into profits, capital, credit, interest, and the business cycle translated from the German by Redvers Opie*. New York: OUP.
- Solow, R.M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics*, 70(1), 65-94.
- Subrahmanya, M. B., 2010. Auto SMEs in Bangalore: does innovation promote employment and labour productivity?. *Economic and Political Weekly*, 59-66.
- Van Roy, V., Vértesy, D., & Vivarelli, M. (2018). Technology and employment: Mass unemployment or job creation? Empirical evidence from European patenting firms. *Research Policy*, 47(9), 1762-1776.
- Wu, X. (2021). Discussion on the organic integration of innovation and entrepreneurship education and employment guidance education under internet+. *International Conference on Application of Intelligent Systems in Multi-modal Information Analytics*, 17-22.

**Received:** 11-Apr-2022, Manuscript No. ije-22-11500; **Editor assigned:** 13-Apr-2022, PreQC No. ije-22-11500 (PQ); **Reviewed:** 27-Apr-2022, QC No. ije-22-11500; **Revised:** 09-May-2022, Manuscript No. ije-22-11500 (R); **Published:** 30-May-2022.