DO CREATIVE SOCIETIES INNOVATE MORE? EMPIRICAL EVIDENCE FOR 28 EU MEMBERS

Raluca Andreea NERİŞANU

Lucian Blaga University of Sibiu, Romania
raluca.nerisanu@ulbsibiu.ro

Marian Pompiliu CRISTESCU

Lucian Blaga University of Sibiu, Romania
marian.cristescu@ulbsibiu.ro

Miglena STOYANOVA

University of Economics - Varna, Bulgaria,
m_stoyanova@ue-varna.bg

Julian Andreev VASILEV

University of Economics - Varna, Bulgaria
vasiliev@ue-varna.bg

Abstract. *In the context of finding innovation among the top triggers of economic growth, we have questioned what the triggers of innovation itself are. As literature provide us with three types of innovation: micro (applied to individual), medium (organization) and macro (country appliance) we chose the macro innovation as the economic growth models are based on it. Also, previous studies provided us with many variables that could influence innovation, including creativity itself. Thus we argued if creativity could indeed influence innovation, so the countries that are more creative tend to innovate more. We have selected two geographically similar indexes and targeted the most complex ones. We have analyzed the relationship between this indexes throw correlation matrixes and regression analysis and found out that creativity and innovation have a strong positive correlation. We have also found a direct tendency between the two variables and the fact that innovation is most influenced by national price level indexes, Property Rights score, R&D expenditure (measured as % of GDP) and share of resource and technology employment. Thus, in order to achieve economic growth throw innovation, societies should pay more attention to International Propriety Right Index, R&D expenditure (measured as % of GDP) and creative industries turnover.*

Keywords: creativity, innovation, economic growth.

JEL classification: O35, O30, O47

DOI: 10.24818/ie2020.05.02

1. Introduction

The Schumpeter's theory of growth prevail, as a central role, the innovation waves that generate new or improved imputes in the economic output, thus creating a "disturbance of the center of equilibrium" that determine the "Spontaneous and discontinuous changes in the channel of circular flow" [1]. The mentioned disturbances and changes, manifested as technological innovation do not perform on the market of the final products, but on the industrial and commercial phase.

Recent studies provide evidence that innovation is positively correlated with economic growth, fosters productivity, encourages the competitiveness and facilitates the knowledge based economy [2], [3]. In [3] is stated that innovation is novelty, by definition and in [4] are proposed two stages of innovation, namely the “economic creativity” and “innovation implementation”. Although in [5] it is stated that “the word innovation and creativity are often used interchangeably”, Hall argued that creativity is the generation of ideas thus innovation being the implementation of those ideas [6]. The same distinction between creativity and innovation is led by Amabile in [7], relating to “moderately creative work” of all humans. Thus, it is contextually appropriate to argue the connection between creativity and innovation.

2. Literature review

Schumpeter integrates innovation as the epicenter of the economic development, as other theoreticians have done, performing the foundations of the conceptualized innovation growth on different models. As [8] mentioned, Schumpeter is a representative for the evolutionary growth view, demanding that economy is changing by evolutionary factors. As [3] mentioned, Solow uses innovation to extend the neo-classical production function, expressing it as technological progress [9] and neutral technological change [10]. Innovation was also used in the post-Keynesian theory of economic growth [3] by Kaldor, as he used “the flow of innovation”, savings propensities and population growth as the original parameters of growth model and introduced “functional relationships (like supply or demand curves)” in the model [11]. Romer identified within endogenous growth theoreticians who targeted the “endogenous technological change” or technological change that is based on “intentional investment decisions” as a model of long-run economic growth, in a competitive equilibrium or monopolistic competition model [12], [13]. Also, Aghion and Howitt introduced innovation in their endogenous growth model [14], [15].

We are focusing on the evolutionary Schumpeterian innovation-led growth, which is based on three drivers: (a) the fact that innovation results from investments in R&D, (b) the necessity of the creative destruction in order to create new innovations and (c) the essential truth that long-run growth rely on innovation [14], [15].

If innovation is considered a driver of economic growth, what are the main predictions and implications that effect innovation?

Seen from afar, competition integrates within innovation process, as Blundell and Griffith acquire in [16] positive correlations among “product market competition and economic growth”. Contradictory, in [15] is stated that innovation-led growth is discouraged by more competition. Few years later, [17] is provided evidence for positive correlation between innovation-led growth and competition by accepting “step-by-step innovation”. Construction of the Schumpeterian effect in [17], [18] presumes that neck-by-neck firms will always innovate to maintain their position, opposite to laggard firms that tend to relinquish to innovation, thus losing the short-term profit. Also, in [19] is also argued the positive effect that competition has on growth, by an inverted-U shape. In [20], Porter finds positive correlation between the rapidity of generating and adopting the innovation and the local competition that identifies within industry clusters. Industry clusters have also the effect of spillover the knowledge, that positively impact economic growth [21].

Studies like [22], [23], provide evidence for decreasing returns to scale to firm size established by firm sales in generating output of innovation, highlighting the dissimilarity between high-tech and low-tech firms, relating that in high-tech firms “small increments to existing knowledge are required to innovate” and in low-tech firms, a big amount of knowledge is necessary in order to gain innovation. Also, in [23]–[25] it is stated that differentiation in

technological opportunities and investments are important parameters that influence the innovative output of firms.

A positive significant relationship between intelligence, measured by IQ, and economic growth was found in [26], [27]. In [3] is stated that “intelligence, measured by IQ has a direct positive effect on innovation” and makes a rationale connection that there is an “indirect positive effect from intelligence to growth via innovation”. In [28] is tested “fluid intelligence and creativity” and argue that creativity and intelligence are more strongly connected than conventional thoughts relate. In [29] Jacobs states that the principal source of innovation is knowledge transfer across industries.

William and McGuire found that culture does have a direct relation with economic creativity, which also is positively correlated with innovation (thus enforcing national propensity) [4]. Lee, Florida and Gates found that creativity, diversity and human capital work together toward generating innovation [30]. Also Knudsen, Florida and Stolarick found that innovative activity is positively correlated with the density of the population and the percentage of the creative class workforce [31]. In [32], Lucas used human capital as the very engine of the economic growth, generating a model based on the neoclassical production, advanced by physical capital and “human capital that enhances the productivity”. Zucker, Darbry and Armstrong found evidence that innovation is most directly related to the number of products in development, that are influenced by the “geographically localized knowledge spillover”, as an effect of the number of local universities and disinterested basic research, which can be quickly commercialized [33].

In [34] is argued that innovation is direct influenced by ratio of public expenditure on innovation and the extension of staff training. [35] provides evidence for direct correlation between tertiary education and economic growth in regions that are “closer to the technology frontier”.

In [36] is highlighted that average growth has an decreasing rate as an economy approaches the world technological frontier if country’s openness is low. Also, appropriateness to frontier determine the state where growth relies on basic research (load in education) and a positive correlation between democracy and innovation [36].

Innovation is defined as a process that generated “new solutions” in products, marketing and technology [37] or as a process of implementing new ideas in order to gain a new process or product [38]. Schumpeter proposed many dimensions of organizational innovation, including the product innovation, new forms of organization, new markets or new source of materials.

Studies have defined innovation as multi-stages processes [4], [39]–[41], that are similar or include also the creativity stages. In [42], Kaufman and Plucker stated there is a structural difference between creativity and innovation, based on the fact that they are “constructed differently... in theoretical and psychometrical level”. Positive correlation between creativity and innovation was enhanced in [34], stating that “creativity and design are important features of a well-developed knowledge economy, both having a positive impact on countries innovation performance”.

Also, there is evidence of direct relation between country creativity and the value of country exports, being positively correlated [43]. Also [20], [44] provide evidence that creativity is an element of competitive advantage.

In the field of economic growth theories, creativity appears as three concepts: creative economy, economic creativity, creativity destruction and the creative class. In [45] is stated that the “most popular approach to the creative economy is an industry approach” and creative industries or sectors. The creative industries are often the clusters that host the creative individuals that are part of the creative class [46], [47].

The economic creativity refers to creativity that generates results that present “potential economic value” [4]. As stated in [48] and Thomas (1994) cited in [4], economic creativity include research and idea generation, in contrast to the classical four steps of creativity. In [1], Schumpeter introduces the creative destruction, as the creative process that replaces old technologies with new ones, thus generating innovation waves (if the replacement is on big proportions). B. A. Lundvall (2008), cited in [49], states that the economies that are based on the process of engaging ordinary workers in creative thinking processes or creative skills development are the most successful in the world. There is to be found a strong correlation among the level of identification of the creative class with the rest of the society and the success of a learning economy.

3. Methodology

Data is selected by taking in consideration the best variables that represent innovation and creativity. In this perspective, recent studies in the field used few common variables that best represent innovation, as for example, Aghion and Griffith stated that innovation can be measured in “R&D expenditure”, “bibliometric indicators” like “publications or citations and patent data like utility patents” [19]. Also, in [3] is constructed a regression function representing the utility patents per million people, based on empirical research, that includes variables like IQ, income in quadratic form, land area share per population number, doctorates in domains like science and engineering and R&D expenditure (measured as % of GDP). In [50], authors have used the share of the information and communications technology (ICT) in GDP, the percent of information and communications technology investment reported to total investment, the private investments reported to total, the investment rate correspondent for information and communications technology, the full investments, the percent of public investments and of R&D expenditure in GDP as variables regarding innovation and production. In [4], innovation is measured by the level of self-employment, trade-marks and royalties or license fees. Computing the innovation equation, some innovation indexes have been constructed. European Innovation Scoreboard [34], [51], EIS, is based on a list of 27 indicators of the innovation level and cover the EU countries in comparison with Regional Innovation Scoreboard (RIS), which is an expansion of the previous and cover 23 countries from within Europe, using 18 parameters [52]. Oslo manual propose an innovation index based on measurement of knowledge, novelty, implementation and value creation variables [53], [54]. Also, same source establish that economic creativity is measured in patents, publications and R&D activity. Several parameters of creativity were computed in composite equations that tend to measure national creativity, generating the creativity indexes that are now to be found in the field. In [55] is made a structural selection of the most important three creativity indexes that targets European countries. The most representative index for the creative class is Euro-creativity index, that is based on variables that are able to boost the creative class to a location (as creative class is identified as creative industries in NACE rev 2), sustaining on pillars like technology, talent and tolerance [56], [57]. The Hong Kong creativity index [58] compute the values that interplay with the creative outputs, including cognitive, environmental and personality variables. In [59], Florida and Tinagli constructed the Flemish index on the basis of technical innovation, entrepreneurship and openness. Also, in [60] is developed the Creative Space Index (CSI) as a composite index based on “talent, openness, culture, technology, innovation, industry, regulation and incentives, entrepreneurship, accessibility and livability”. The largest index taken in consideration the geographically coverage is the Global Creativity Index, a composite index based on “creative class and human capital, openness, diversity and tolerance and technology and innovation” [61]. In [60] a structural comparison of the present indexes and others (Creative City Index; Silicon Valley’s Creative Community Index;

Baltimore Creativity Index; Czech Creative Index; Composite Index of the Creative Economy; Euro Creativity Index; Landry's Creative City Index) is made. The same source structured the variables used in the indexes in ten dimensions, thus observing that Human Capital, Creative Class and Education and technology and innovations are to be found to all of the analyzed creativity indexes.

We know that creativity and innovation are connected through their inside processes and phases, exposed before, and we are arguing if this is applied also to the macro level of creativity and innovation (specifically the national level).

H₁: Countries with higher creativity level tend to innovate more.

For this we use the secondary analysis of data as a method of research. The procedure implies correlating a creativity index with an innovation index. For our research we selected the Creativity Space Index [60], being one of the most complex and representative creativity indexes and including 37 indicators in 9 dimensions, along with European Innovation Scoreboard [62], that integrates 27 indicators in 4 dimensions. All the indicators were normalized by ln normalization procedure. Data implementation in the creativity indicators was made using average and linear interpolation. In the creativity index, the aggregation implied equal weights for all the dimensions, excluding the first and the second one (compared by value, to each country), which were weighted by 3, respectively 2. The null hypothesis used in this paper is:

H₀: There is no difference between countries innovation score based on level of creativity.

In order to support or reject the null hypothesis we ran a regression analysis and compared the p-values to the considered α . The regression function was achieved using ordinary least square method (OLS), with an α of .05. In order to achieve our purpose we will use panel data for 28 EU countries, from 2011 to 2018.

We also ran two correlation matrixes, one between all the indicators of the two indexes and one between the innovation index and all the creativity indicators, to see which of the creative variables tend to have the strongest correlation with innovation.

The sampling methods allows us to analyze the countries within EU, thus providing sufficient statistical support to our purpose.

4. Results

4.1 Correlation of indicators

Creativity Space Index is measured as a composite index of 37 indicators, aggregated in 9 dimensions, as Innovation index is composed by 27 indicators, constructed in 4 dimensions. Firstly we aim to see which the most correlated indicators from the mentioned indexes are.

As *Table 1* shows, the most correlated indicators are patent registered with patent application (.98) or public, private co-publications (.90). Next, creative industries value added (measured as % of GDP) are most correlated with patent application (.95). National price level indexes is .92 correlated with scientific publications among top 10% most cited. National bachelors per capita is .88 correlated with population completed tertiary education. R&D expenditure (measured as % of GDP) is .88 positively correlated with business R&D expenditure. It is also .86 correlated with lifelong learning and private-public publications and .84 with public R&D expenditure. Next, turnover in creative industries (per capita) is most correlated with scientific publications among top 10% most cited (.84), private-public publications (.83), R&D expenditure in business sector (.79), patent applications (.78) and foreign doctorate students (.77). Property Rights score is most correlated with lifelong learning (.82) and "scientific publications among top 10% most cited" [60] and patent applications (.81).

A surprise for us was the negative correlation between the degree of personal importance of culture and almost all of the innovation indicators, most negatively correlated being with

lifelong learning, foreign doctorate students and public R&D expenditure (all .60 negatively correlated). Also, strong negative correlation was found between level of easiness of starting a business and new doctorate graduates (.60 negatively correlated).

Table 1. Correlations among indicators of creativity and innovation indexes

CREATIVITY INNOVATION	1.1.1 New doctorate graduates	1.1.2 Population completed tertiary	1.1.3 Lifelong learning	1.2.1 International scientific co-	1.2.2 Scientific publications among	1.2.3 Foreign doctorate students	1.3.2 Opportunity-driven	2.1.1 Public R&D expenditure	2.2.1 Business R&D expenditure	3.2.2 Public-private co-publications	3.3.1 PCT patent applications	4.1.1 Employment in knowledge-intensive	4.2.2 Knowledge-intensive services
Number of bachelors per capita		0,88											
Human resources in creative industries / capita			0,75										
Share of foreign students in tertiary education						0,77							
Personal importance of culture			-0,6			-0,6		-0,6					
Cultural household expenses												0,78	
R&D expenditure (measured as % of GDP)			0,86					0,84	0,88	0,86	0,95		
Share of resource and technology employment			0,77	0,79									
Level of internet access at home			0,76		0,79								
Patents registered / mil inhabitants			0,78					0,84	0,89	0,9	0,98		
Turnover in creative industries per capita				0,75	0,84	0,77			0,79	0,83	0,78		
Property Rights score			0,82	0,79	0,81	0,79				0,79	0,81		
Score of easiness of starting a business	-0,6												
National price level indexes (EU27=100)			0,8	0,85	0,92	0,82				0,83	0,81	0,79	0,78
Recreational and leisure use land percent			0,77				0,79				0,79		

4.2 Correlation of indicators

From Figure 1 we see that the homoscedasticity assumption is respected and the fact that there is a strong positive relationship among the two variables.

Figure 1. The relationship between the Creativity Space Index and European Innovation Scoreboard

In Figure 1 we can observe the linear function between the Creativity Space Index and European Innovation Scoreboard. The results show a strong positive correlation between creativity and innovation. The correlation between the two variables vary from .92 in 2011 to .89 in 2018. Countries that have a high Innovation Score do also present a high Creativity

Index. Thus, theoretically we have provided evidence for our hypothesis. Now let's see if the stats do the same.

H₀: There is no difference between countries innovation score based on level of creativity.

For this we ran a linear regression and here are the results. Our R^2 is .8487, providing a very good fit of the regression function generated upward ($\text{Innovation} = 0.1095 * \text{Creativity} - 0.1044$), confirming that 84.87% of the variation of macro innovation (measured on the dimensions used in the present study) is explained by the variation of macro creativity (the independent variable measured based on the creativity dimensions used in this study). The autoregressive function and the correlation between the two variables has an F-significance value of .000 (under considered α of .05), assuring the reliability of our results. The probability of the relation to appear in the null hypothesis (p-value) is equal to .00, thus, statistically, our alternative hypothesis (Countries with higher creativity level tend to innovate more) is adopted as valid. Our coefficients, as shown in *Figure 1* are .1095 (slope) and -0.1044 (intercept).

4.3 Correlation between innovation and creativity indicators

The correlation table shows that Innovation is strong correlated with national price level indexes (EU27=100) and Property Rights score. It is also highly correlated with R&D expenditure (measured as % of GDP) and share of resource and technology employment. Negative correlation is there to be found among innovation and personal importance of culture and score of easiness of starting a business.

Table 2. Correlation between creativity indicators and European Innovation Scoreboard Index

Creativity indicators	European Innovation Scoreboard
<i>Number of bachelors per capita</i>	0,670
<i>Human resources in creative industries / capita</i>	0,683
<i>FRA1's multiple discrimination index</i>	-0,391
<i>Share of foreign students in tertiary education</i>	0,501
<i>Personal importance of culture</i>	-0,603
<i>R&D expenditure (measured as % of GDP)</i>	0,853
<i>Share of resource and technology employment</i>	0,834
<i>Level of internet access at home</i>	0,830
<i>Patents registered/ mil inhabitants</i>	0,839
<i>Turnover in creative industries per capita</i>	0,843
<i>Property Rights score</i>	0,932
<i>Score of easiness of starting a business</i>	-0,438
<i>National price level indexes (EU27=100)</i>	0,944
<i>Recreational and leisure use land percent</i>	0,692
<i>Number of bachelors per capita</i>	0,670

5. Discussion

The validity of our construct is based on the structure of innovation, its phases, which compete to obtain the innovation index and the integration of the creativity among the innovation phases. The alternative hypothesis is argued before, thus validating that **Countries with higher creativity level tend to innovate more**. The present study also shows that creativity has a positive impact over innovation performance, results that were also found in [34], where two dimensions were correlated with Innovation (also measured in EIS), namely the creative climate and design & creativity dimensions. The study also shows that "Creative education is the dimension which shows the strongest relation to innovation." Our study show strong

positive relationship between R&D expenditure (measured as % of GDP) (.85) or share of resource and technology employment (.83) with innovation.

Also, in [4] positive correlation was found between culture and economic creativity, and, as phase two, between economic creativity and innovation. Our study show contradictory results in the cultural dimension, the correlations between innovation and personal importance of culture being strongly negative. Also, the correlation of innovation and direct expenditure on culture per capita being almost insignificant (.08). Also, in [30], is presented evidence that creativity, diversity and human capital is strong positively correlated with innovation. Our research strengthens the relationship between creativity and innovation and between diversity and innovation. We found a strong negative relationship between discrimination and innovation, enforcing the state mentioned above.

In [31] is found positive correlation between innovative activity and percentage of creative class workforce. Our study confirmed strong relationship between innovation and share of employment in creative class (.68) and positive moderate relationship between innovation and number of creative enterprises per capita (.38).

Positive correlation between number of local universities, disinterested basic research (conducted, usually in universities) or extension of staff training and innovation was found in [33]. The direct relation between extension of staff training and innovation was also found in [34]. Also, a positive correlation of .49 was found between number of universities registered in THEWUR per million inhabitants and innovation, in our study. In [34] was also found relationship among innovation and innovation public expenditure. Also, [36] provided evidence for the relationship between innovation and democracy.

Limitations of the present study should focus on the absence of a multiple regression, which may include all the relevant indicators from creativity and innovation as parameters or extension of other multiple regressions (ex. [4], [30]) with all the variables that were found to be positively correlated in the literature. Future recommendations involve extending the Schumpeterian model of economic growth, by including the creativity parameter.

6. Conclusion

As literature in the field provide evidence that innovation enhances creativity [3], [9]–[15] and there is also to be found positive correlation among innovation and other factors [3], [4], [31]–[36], [43], [44], [15], [16], [19]–[21], [28]–[30], we aim to argue the relationship between innovative performance and creativity. Our research conducted a secondary analysis of data, constructing a relationship between the mentioned variables, as innovation being the dependent variable and creativity the independent variable. The results show strong correlation among creativity and innovation (from .92 in 2011 to .89 in 2018) and a strong fit of our regression analysis (with R^2 of .84). The alternative hypothesis of this study, namely that *Countries with higher creativity level tend to innovate more*, is confirmed by the F significance of .000 and p-value of .000.

Strong correlation was found among patent registered and patent application (.98), patent registered and public (.90), patent registered and private co-publications (.90), creative industries value added (measured as % of GDP) and patent application (.95) and national price level indexes and scientific publications among top 10% most cited (.92).

Present study may be useful for researchers in the field, for decisional factors in R&D investment and financing and for organizations, although the study is focusing on macro innovation. In order to achieve economic growth throw innovation, societies should pay more attention to International Propriety Right Index (.932 correlated), R&D expenditure as a percentage of GDP (.835 correlated) and turnover in creative industries per capita (.843 correlated).

7. References

- [1] J. Schumpeter, *The theory of economic development – An inquiry into profits, capital, credit, interest and the business cycle*, 1934.
- [2] D. Guellec and B. van Pottelsberghe de la Potterie, “R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries,” *OECD Econ. Stud.*, vol. 2001, no. 2, pp. 103–126, 2003.
- [3] J. Squalli and K. Wilson, “Intelligence, creativity, and innovation,” *Intelligence*, vol. 46, no. 1, pp. 250–257, 2014.
- [4] L. K. Williams and S. J. McGuire, “Economic creativity and innovation implementation: The entrepreneurial drivers of growth? Evidence from 63 countries,” *Small Bus. Econ.*, vol. 34, no. 4, pp. 391–412, 2008.
- [5] J. Man, “Creating innovation,” *Work Study*, vol. 50, no. 6, pp. 229–234, 2001.
- [6] C. M. Hall, A. M. Williams, C. M. Hall, and A. M. Williams, “Knowledge, creativity, and innovation,” *Tour. Innov.*, pp. 84–133, 2019.
- [7] T. M. Amabile, “A Model of Creativity and Innovation in Organizations,” *Research in Organizational Behavior*, vol. 10, p. 123, 1988.
- [8] B. J. Loasby, R. R. Nelson and S. G. Winter, “An Evolutionary Theory of Economic Change,” *Econ. J.*, 1983.
- [9] R. Solow, “Technical Change and the Aggregate Production Function,” *Real Bus. Cycles*, vol. 39, no. 3, pp. 543–551, 1957.
- [10] R. M. SOLOW, “A Contribution to the Theory of Economic Growth,” *Quartely J. Econ.*, vol. 70, no. 1, pp. 65–94, 1956.
- [11] N. Kaldor, “A Model of Economic Growth,” *Econ. Growth Canada*, vol. 67, no. 268, pp. 5–7, 2019.
- [12] P. M. Romer, “Increasing Returns and Long-Run Growth,” vol. 94, no. 5, pp. 1002–1037, 1986.
- [13] P. M. Romer, “Endogenous technological change,” *J. Polit. Econ.*, vol. 98, no. 5, pp. S71–S102, 1990.
- [14] P. Howitt and P. Aghion, “Capital Accumulation and Innovation as Capital Accumulation in Long-Run Growth,” *J. Econ. Growth*, vol. 3, no. June, pp. 111–130, 1998.
- [15] P. Aghion and P. Howitt, “A Model of Growth Through Creative Destruction,” *Econometrica*, vol. 60, no. 2, p. 323, 1992.
- [16] R. Blundell, R. Griffith and J. Van Reenen, “Dynamic Count Data Models of Technological Innovation,” *Econ. J.*, vol. 105, no. 429, p. 333, 1995.
- [17] P. Aghion, C. Harris and J. Vickers, “Competition and growth with step-by-step innovation: An example,” *Eur. Econ. Rev.*, vol. 41, no. 3–5, pp. 771–782, 1997.
- [18] P. Aghion, C. Harris, P. Howitt and J. Vickers, “Competition, imitation and growth with step-by-step innovation,” *Rev. Econ. Stud.*, vol. 68, no. 3, pp. 467–492, 2001.
- [19] P. Aghion, N. Bloom, R. Blundell, R. Griffith, and P. Howitt, “Competition and Innovation: an Inverted-U Relationship,” *Q. J. Econ.*, vol. 120, no. 2, pp. 701–728, 2005.
- [20] S. Pressman, “Book Review: *The Competitive Advantage of Nations*,” *J. Manage.*, vol. 17, no. 1, pp. 213–215, 1991.
- [21] A. Marshall, *On principles of economy*, vol. 53, no. 9, 2013.
- [22] D. B. Audretsch and Z. J. Acs, “Innovation and Size at the Firm Level,” *South. Econ. J.*, vol. 57, no. 3, p. 739, 1991.
- [23] F. M. Scherer, “Firm Size, Market Structure, Opportunity, and the Output of Patented Inventions,” *Am. Econ. Rev.*, vol. 55, no. 5, p. 1, 1965.
- [24] S. L. Levin and F. M. Scherer, “Innovation and Growth: Schumpeterian Perspectives,” *South. Econ. J.*, 1986.

- [25] F. M. Scherer, "The propensity to patent," *Int. J. Ind. Organ.*, vol. 1, pp. 107–128, 1983.
- [26] E. Weede and S. Kämpf, "The impact of intelligence and institutional improvements on economic growth," *Kyklos*, vol. 55, no. 3, pp. 361–380, 2002.
- [27] G. Jones and W. J. Schneider, "Intelligence, human capital, and economic growth: A Bayesian Averaging of Classical Estimates (BACE) approach", *J. Econ. Growth*, vol. 11, no. 1, pp. 71–93, 2006.
- [28] E. C. Nusbaum and P. J. Silvia, "Are intelligence and creativity really so different?. Fluid intelligence, executive processes, and strategy use in divergent thinking", *Intelligence*, vol. 39, no.1, pp.36–45, 2011.
- [29] J. Jacobs, *The economy of cities*. New York: Random House, 1970.
- [30] S. Y. Lee, R. Florida, and G. Gates, "Innovation, human capital, and creativity," *Int. Rev. Public Adm.*, vol. 14, no. 3, pp. 13–24, 2010.
- [31] B. Knudsen, R. R. Florida and K. Stolarick, *Beyond Spillovers: The Effects of Creative Density on Innovation*, no. September, 2005.
- [32] R. E. Lucas, "On the mechanics of economic development," *J. Monet. Econ.*, vol. 22, no. 1, pp. 3–42, 1988.
- [33] L. G. Zucker, M. R. Darby, and J. Armstrong, "Geographically localized knowledge: Spillovers or markets?," *Econ. Inq.*, vol. 36, no. 1, pp. 65–86, 1998.
- [34] H. Hollanders and A. Van Cruysen, "Design , Creativity and Innovation : A Scoreboard Approach," *Pro Inno Eur. Inno Metrics*, no. February, pp. 1–37, 2009.
- [35] J. Vandenbussche, P. Aghion, and C. Meghir, "Growth, distance to frontier and composition of human capital," *J. Econ. Growth*, vol. 11, no. 2, pp. 97–127, 2006.
- [36] D. Acemoglu, P. Aghion, and F. Zilibotti, "Distance to Frontier, Selection, and Economic Growth," *J. Eur. Econ. Assoc.*, vol. 4, no. 1, pp. 37–74, 2006.
- [37] M. L. Tushman, "Tamura_SOC.PRL66.1991.pdf," p. 62, 2007.
- [38] J. R. Galbraith, "Designing the Innovating Organization," *Organ. Dyn.*, pp. 5–25, 1982.
- [39] C.-F. von Braun, *The Innovation War*. New Jersey: Pearson Technology Group, 1997.
- [40] G. Lynne, J. Morone and A. Paulson, "Marketing and discontinuous innovation: The probe and learn process," in *Winning through innovation, III.*, M.I.T. & C.A. O'Reilly, Ed. Harvard: Harvard Business School Press, pp. 353–375.
- [41] A. M. Glynn, "Innovative genius : A framework for relating individual and organizational in ...," *Management*, vol. 21, no. 4, pp. 1081–1111, 1996.
- [42] J. C. Kaufman and J. A. Plucker, "Intelligence and Creativity," *Princ. Classr. Learn. Percept.*, pp. 126–158, 2011.
- [43] W. R. DiPietro and E. Anoruo, "Creativity, innovation, and export performance," *J. Policy Model.*, vol. 28, no. 2, pp. 133–139, 2006.
- [44] P. Cook, "The creativity advantage - is your organization the leader of the pack?," *Ind. Commer. Train.*, vol. 30, no. 5, pp. 179–184, 1998.
- [45] I. N. Dubina, E. G. Carayannis, and D. F. J. Campbell, "Creativity Economy and a Crisis of the Economy? Coevolution of Knowledge, Innovation, and Creativity, and of the Knowledge Economy and Knowledge Society," *J. Knowl. Econ.*, vol. 3, no. 1, pp. 1–24, 2012.
- [46] R. Florida, "Cities and the Creative Class," *City Community*, vol. 2, no. 1, pp. 3–19, 2003.
- [47] J. Peck, "Struggling with the Rise of the Creative Class," *Int. J. Urban Reg. Res.*, vol. 29, no. 4, pp. 740–770, 2005.
- [48] J. M. Howell and C. A. Higgins, "Champions of Technological Innovation," *Adm. Sci. Q.*, vol. 35, no. 2, pp. 317–341, 1990.
- [49] G. B. Campbell, E. G. Carayannis and F. J. David, *The Future of Education and Labor*, Springer Nature, 2019.

- [50] P. Aghion, P. Askenazy, R. Boursès, G. Crette and N. Dromel, “Education, market rigidities and growth”, *Econ. Lett.*, vol. 102, no. 1, pp. 62–65, 2009.
- [51] European Commission, *European Innovation Scoreboard*, vol. 18, no. 2, 2019.
- [52] European Commission, *Regional Innovation Scorecard*, vol. 18, no. 2, 2019.
- [53] OECD/Eurostat (2019), “Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation”, 2018.
- [54] F. Gault, *Handbook of Innovation Indicators and Measurement*, 2014.
- [55] P. Kern and J. Runge, “KEA briefing: towards a European creativity index,” in *Creativity and key competences*, pp. 257–278, 2009.
- [56] R. G. Picard, M. Gronlund and T. Toivonen, “Means for overall assessment of cultural life and measuring the involvement of the cultural sector in the information society”, 2003.
- [57] UNU-MERIT, “2007 European Innovation Scoreboard”, 2008.
- [58] Home Affairs Bureau The Hong Kong Special Administrative Region Government, “A study on Creativity Index,” *A Study Creat. Index*, pp. 1–100, 2005.
- [59] R. Florida and I. Tinagli, “Europe in the creative age,” *Creat. Cl. Gr.*, no. February, p. 48, 2004.
- [60] C. M. Correia, J. Da, S. Costa, 8 Correia, and C. M. Costa, “Measuring Creativity in the EU Member States Medición de la Creatividad en los Estados Miembros de la UE,” *Investig. Reg.*, vol. 30, no. 30, pp. 7–26, 2014.
- [61] R. Florida, C. Mellander, K. Stolarick, K. Silk, Z. Matheson, and M. Hopgood, “Creativity and Prosperity : The Global Creativity Index,” p. 43, 2011.
- [62] European Commission, *European Innovation Scoreboard 2001*. 2001.