

# A CLUSTER ANALYSIS ON SUSTAINED GLOBAL COMPETITIVENESS FOR EUROPEAN COUNTRIES

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## ABSTRACT

The Global Competitiveness Index (GCI) developed by Xavier Salai-Martín, in collaboration with the World Economic Forum, has been measuring the factors that drive the growth and prosperity since 2005. This paper focuses on grouping the European nations according to global competitiveness. It uses the hierarchical and K-means cluster with a particular focus to examine the grouping of countries from 2008 to 2017 and to reduce the complexity in examining the relationship between European countries. The drivers of competitiveness are grouped into 12 critical pillars, namely, institutions, macroeconomic environment, infrastructure, higher education and training, health and primary education, goods market efficiency, financial market development, labor market efficiency, technological readiness, market size, business sophistication, and innovation respectively. The mean score of Europe during the study period was 4.7 and 40% of the European countries were found to be above the average and have been consistently performing well ahead of the average on competitiveness. This study can be generalized to other nations as well as compared with other indexes for exhaustive research that can be useful for policymakers.

### **Keywords:**

Cluster Analysis; Global Competitiveness; Europe; European Countries, World Economic Forum; K-Means Cluster; Hierarchical Cluster; Global Competitive Index

**JEL: F0, F5, F6, P5, Y1, H1, H7, H4**

## INTRODUCTION

The global business environment has become highly volatile and dynamic. The world has witnessed enormous growth in economic and international trade. Two main factors that govern the economy of the world are globalization and technology. Both of them influence the performance of organizations and countries. The new economic order is witnessing a fusion of globalization and the fourth industrial revolution, which increases the complexity of borderless trade. Economies of today are facing many challenges to growth like slow growth rate, growth of high-tech industries, and the development of emerging economies. In such a business environment, a country's competitiveness takes precedence. The competitiveness of a region plays a vital role in determining a country's sustainable development. A large number of international institutions design models that demonstrate the practical importance of competitiveness, such kind of research is done by 'The World Economic Forum-Global Competitiveness Report', 'International Institute for Management Development- The World Competitiveness Yearbook', 'World Bank-Doing Business', and 'The European Commission- European Competitiveness Report'. Economists and policymakers define and analyze the competitiveness of a country in different perspectives. Krugman (1994) argues that a country's productivity level determines its competitiveness. Lankhuizen (2000) is of the notion that exports are a link between a country's external and internal performance. There are other organizations like the World Economic Forum, the World Competitiveness Center that determine the competitiveness of countries by calculating various complex indexes. The World Economic Forum (nd) defines the competitiveness of a nation "as a set of institutions, policies, and factors that determine the level of productivity of a country." It can also be understood as the ability of a country to provide residents with high standards of living coupled with employment on a sustainable basis. World Economic Forum is an independent international organization committed to improving the state of the world by engaging business, political, academic, and other leaders of society to shape global, regional, and industry agendas. Over the past 30 years, this institution has published annual reports regarding the world economy status, has also analyzed policies and economic indicators. Starting with the year 2005, the World Economic Forum underlies its competitiveness analysis, defined as being an ensemble of political factors plus the Global Competitiveness Index (GCI). This aggregate index was developed by Prof. Xavier Sala I Martin in 2010. The index quantifies the country performances, by including certain complex aspects, appropriate to the multidimensional phenomenon. The global competitiveness index segregates the 12 pillars into three groups. The groups are namely, essential requirements, efficiency enhancers, and innovation and sophistication. Each pillar relates to five factors and their variables, which measure various aspects of regional competitiveness. These represent a second and third level of disaggregation, which contributes to the performance of analysis with the results obtained. The GCI report includes two types of data; statistical (from IMF, UN) and surveys made to capture the respondents' opinions from various countries.

Though the 12 pillars are described separately, they are interrelated to each other. The competitiveness score of a country reflects the aggregation of all the 12 components. The global competitiveness report (GCR) has global recognition for its ranking of country competitiveness. Competitiveness arises from microeconomic and macroeconomic factors, includes the robust model of competitiveness adopted by the World Economic Forum. A country's competitiveness explains the extent to which it can provide prosperity to its citizens.

**Table 1.** Pillars of global competitiveness index

Sl. No	Pillars
1	Institutions
2	Infrastructure
3	Macroeconomic environment
4	Health and primary education
5	Higher education and training
6	Goods market efficiency
7	Labor market efficiency
8	Financial market development
9	Technological readiness
10	Market size
11	Business sophistication
12	Innovation

Source: The WEF Global Competitiveness Report- 2017

Today's complicated and unpredictable economic environment underscores the importance of not losing sight of competitiveness fundamentals amid short term urgencies. Over the years, Europe has been witnessed to many dynamic changes on the political and economic frontiers, yet Europe features prominently among the most competitive regions of the world. In such a complicated and volatile international environment, understanding the competitiveness of European countries will throw some light on the relationships between the European countries. The results of this study are of significance to both academic and professional communities. They are of particular interest to European policymakers as this paper discusses the cluster formation pattern of European countries based on the global competitiveness indicator (Kabók, Radišić, & Kuzmanović, 2017). In 2018, the World Economic Forum decided to incorporate the 4.0 factor in the definition of competitiveness. they have contributed to global thinking and policy making by integrating the development of 4.0 Industry. The Global Competitiveness Index introduces a new progress score ranging from 0 to 100, unlike the previous years prior to 2018. From 2018 the frontier of (100) corresponds to the global post of each indicator and typically represents a policy target. In order to keep our data consistent, we had to choose our study period from 2008 to 2017.

## 1. LITERATURE REVIEW

Competition is very significant for the joint European market. Bruneckiene and Paltanaviciene (2012) show that various indexes measure the competitive ability of a country and competition cannot be defined clearly by one or more several economic and social indicators. It requires a sophisticated measurement of competitiveness. The World Economic Forum is the only institution that calculates several country indexes measuring competition from different angles. Artto (1987) defines competitiveness as a degree to which a nation can under free-market condition, produce goods and services that meet the test of international markets while simultaneously expanding the real income of its citizens. According to the work Aiginger (2006), a high level of GDP means a high level of living standards in the country. He believes that a high level of living standards is essential for the competitiveness of the country. The GCR 2007, defines competitiveness as the ability of a nation to provide citizens with high rising standards of living and high rates of employment on a sustainable basis. Jelinek and Porter (1992) explain how a country's competitiveness depends not only on exports but also on the overall economic success of a nation. Cantwell and Zaman (2018) state a broader concept of competitiveness, which explains that competitiveness is also influenced by the environment, which enables and provides a stimulus for organizations to improve and innovate

faster than foreign rivals. Aghion (2006) states that a competitive country is one that can ensure a high level of social welfare to its citizens. Though the concept of competitiveness is still allusive, many researchers have attempted to define and evaluate the phenomena of country's competitiveness. The world economic forum includes several aspects like legal, financial, cultural, and technological to calculate complex indices that assess the competitiveness of a country. Though some authors like Mohan and Ajina (2011) provide an impact study of various sub index of competitiveness and build theoretical and methodological foundation, they seem to combine various viewpoints and thoroughly analyze countries' performance. Diebold, Scott and Lodge (1985) state that, more the competitive economy is, the more likely it is to grow faster over time and study was for the US economy. Petryle (2017) studies the relationship between global competitiveness and economic growth of countries. His research proves that though the competitiveness index does not predict the future GDP, it indicates that the countries with higher GCI value will grow steadier and will experience fewer fluctuations as compared to economies with lower GCI scores.

According to Ketels (2006), the term competitiveness is often associated with productivity. Budd and Hirmis (2004) state that competition is a broader perspective and can be better understood by analyzing the relative performance of economies. Mahmood (1998) share that a countries prosperity is based on its capacity to compete in the global market. He further frames the competitive situation of countries from their grouping into three stages viz., factor driven, efficiency-driven, and innovation-driven. Fang (2014) discuss that the structural changes of the economy usually leads to an alteration of the regional balance within and between countries. Kabók, Radišić, & Kuzmanović (2017) and Fontela (1991) note that the EU countries are becoming the competitive and dynamic as they have an original international orientation of universities in EU countries. Ferrer and Kernohan (2006) state that with the financial crises and pressure of globalization, policymakers have turned their attention to national competitiveness as a policy objective. The GCI is viewed as a proxy for economic growth and moreover growth is considered by many macroeconomists to be the most important economic issue.

Vila-Artadi and Sala-i-Martin (2003) state that the International Monetary Fund (IMF), the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the World Health Organization (WHO) contribute to the statistical data of GCI reports. It also includes data from the World Economic Forum's Annual Executive Opinion Survey to capture concepts that require a more qualitative assessment (Tsouli & Elabbadi, 2018). Initiation of the global competitiveness index was led by Professor Xavier Sala-i-Martin, Chief Adviser to the WEF Global Competitiveness Network (2018). The index is based on 12 competitiveness pillars and offers a detailed overview of the competitiveness scenario of the world's countries at all levels of development. Fagerberg (1988) points out that the important sources of competitiveness in today's turbulent business environment are dynamic capabilities, flexibility, agility, speed, and adaptability. Munda et al. (2009) discuss that competitiveness cannot be completely defined by one or several economic and social indicators. Thus, complex measurement of competitiveness is a must. The researches proved that the measurement by a composite index helps to solve the problem of complexity. It is quite common to use composite indicators for evaluating various objects such as industrial competitiveness, sustainable development, quality of life assessment, globalization, innovation or academic performance. The literature review is indicative that competitiveness of nation is a complicated measurement which involves various aspects of a country (Normantiene, and Snieska, 2014). There is vast knowledge available on the competitiveness of European counties and global competitiveness index. Competitiveness is a central focus of concern for both developed and emerging economies of the world. The literature review demonstrates the reliability of the global competitiveness index and that the scope of competitiveness will remain a work in progress, either as a definition or in its sphere of application. Our research attempts to add a drop of water to the ocean of knowledge to understand the competitiveness within the European region using cluster analysis as a tool of investigation.

## 2. METHOD

Global Competitiveness data for a period of 2008 to 2017 has been taken from World Economic Forum as the data set. A total of 35 European countries have been taken into consideration (Table A-1). European Union consisting of 27 countries is included in these 35 countries. Ukraine and the Russian federation have not been included as the Global Competitiveness Report categories them in Euroasia region. This paper is based on data used as a starting point of terms of indicators of global competitiveness as the set of institutions, policies, and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the economy can achieve (GCI, 2017-18). The research covers a ten-year period, from 2008 to 2017 including a descriptive statistics table and a trend chart for a quick reference of individual country performance. The method used to classify countries in our study is the technique of cluster analysis. Cluster analysis is a combination of mathematical and statistical method that apply the procedure of combining a set of different objects into clusters or groups, thereby ensuring that the objects in the clusters are mutually as similar as possible, but also as different as possible from the objects in other clusters (Hennig, 2007). In other words, it is a class of techniques used to classify cases into groups that are relatively homogeneous within themselves and heterogeneous between each other, on the basis of a defined set of variables (Uprichard and Byrne, 2012). This paper applies the hierarchical cluster method or agglomeration method. It assumes that each object is treated in the first step as a separate cluster. In the following step, the two closest objects merge into the first cluster, either an object is added to that cluster or two clusters are connected to the second cluster. In each following step some objects are either combined into new clusters, or the already existing clusters are interconnected (Romesburg, 1979). In the method of agglomeration, a cluster once formed cannot be separated subsequently, but can only be connected to other clusters (Stahl and Sallis, 2012). We also apply K-means cluster as it generally gives more stable clusters. It is an interactive procedure compared with the single-pass hierarchical methods and needs a pre-specified number of starting points, to get an initial position. Therefore, it is best used in combination with hierarchical procedure (Rajendra, 2008). Clustering of country serves to identify groups of countries with some degree of similarity, as well as explain what factors account for these similarities. The cluster analysis conducted in this paper shows countries that have a similar situation in terms of global competitiveness measured by the 12 pillars mentioned in Table-1.

### 3. RESULTS

Before we begin the analysis of our result from clustering the European countries, a bird's eye view of the charts would give us a fundamental information on behavior of GCI. Chart 4.1 provides mean score of individual countries of Europe vis-a vis total mean score of Europe as a cut-off and a comparison point. The mean score of Europe during the study period was 4.7 and 40% of the European countries are above the average Europe score which includes Switzerland, Netherlands, Germany, Sweden, UK, Finland, Norway, Denmark, Austria, Luxemburg, Belgium and France. These countries have been consistently performing well ahead of the average on competitiveness. Few countries like Albania, Serbia, Greece and Bosnia have shown evidence on scope for improvement on the competitiveness at Europe level. These countries have shown an upward trend on the competitive score over a period of ten years. The same is evident from Chart-2 that talks about the trend in the global competitive score for Europe from 2008 to 2017. There has been a growth of around 3 % over the decade. There has been a decline on score in the year 2013 preceded by a slow growth since 2011 and a slump in the year 2010.

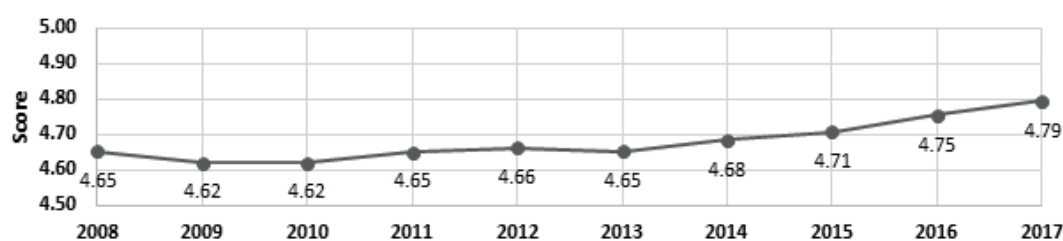
In Table 4.1, agglomeration schedule is listed for 35 European countries and the procedure followed by cluster analysis at stage-1 is to cluster the two cases that have the smallest squared Euclidean distance between them. At stage-1, case-2 is clustered with case-3. The squared Euclidean distance between these two cases is 0.020. Both the variables has not been previously clustered (the zeros under cluster 1 and 2 in the 5th and 6th column). It is visible from column 7 that case- 2 combines with another case- 6 during stage-9. The cluster process would iterate till all the cases are linked together to form a big one cluster. For example, in stage- 20, the cluster containing case 26 and case 27 are joined. Case 26 has been previously clustered with case 35, and case 27 has been previously clustered with case 31, thus forming a cluster of 4 cases (26, 27, 31, 35). The squared Euclidean distance is 0.294. Case 26 was previously joined at stage 11 with case 35 and case 27 was joined at stage 16 with case 31. At stage- 26, case 26 will join case 22 and so on. To identify the number of clusters, we use the difference between rows in a measure called coefficient, also known as fusion coefficient, in column 4. The numbers from last row upwards gives us the lowest possible number of clusters for reasons of economy and ease of interpretation. We see that there is a difference of  $(11.760 - 2.974 = 8.786)$  in the coefficient between the 1-cluster solution of stage-34 and the 2-cluster solution of stage-33. The next difference is of  $(2.974 - 2.790 = 0.184)$  between stage 33, the 2-cluster solution and the stage 32, the 3-cluster solution. The next one after that is  $(2.790 - 1.776 = 1.014)$  is between stage 32 and stage 31 and so on. The chart 4.5 on elbow rule also indicates the desired cluster number for this study. We get two elbow cluster solution and the closer study depicts a sharp elbow formation occurs between case 32 and case 31 pointing towards 4 cluster solution.

**Chart 4.1.** A country wise mean score of global competitiveness for Europe covering period 2008- 2017



Source: Author's compilation from various sources of "The Global Competitiveness Report: 2008- 2017"

**Chart 4.2.** Mean score of European countries on global competitiveness from 2008- 2017



Source: Author's compilation from various sources of "The Global competitiveness report: 2008- 2017"

The icicle plot in chart 4.3 displays the same information graphically. The shaded portion towards the left indicate the number of clusters formed. For example, case 28, 30 and 32 would form a cluster and the arrow toward left indicate the same. The dendrogram, a tree-type display of the clustering process in chart 4.4, provides a rescaled distance measure between clusters at various stages (similar to the coefficient in the agglomeration schedule but depicted in the rescaled distance measure). We, therefore, proceed with 4 cluster solution for our study and take this as a seed to confirm country membership through K – means analysis. The K-means cluster gives a more stable clusters, since it is an interactive procedure compared with single-pass hierarchical methods. From our hierarchical analysis, we chose to give 4 cluster solutions and confirmed the result through multiple procedures stated above. Table 4.2 presents the number of countries in each cluster based on global competitiveness for a decade, from year 2008- 2017 respectively. The ANOVA table 4.3 depicts that all the ten variables are significantly different across the 4 clusters.

## 4. DISCUSSION

From our results of cluster analysis, we clearly see four clusters being formed. The cluster 1 and 2 are the more resilient and less vulnerable economies. These economies have maintained a sustained global competitive score compared to countries in cluster 3 and 4. The factors driving the competitiveness challenges stem from the aftermath of the financial crisis. The year before 2006 and 2008, Europe was in a confident stage of buoyant growth, decreasing unemployment, and rising standard of living and their accession to the European Union (EU) in 2004. But all these was topsy-turvy by global economic downturn in 2009 and the region became more vulnerable to contagion during the economic crisis. The cascading impact of global recession of 2008 is visible in the forthcoming years of their performance. Huge capital inflows were required to finance balance-of-payment deficits. Given this high dependence on outside finance, it is not surprising that Eastern European countries were heavily affected when liquidity dried up. The second global problem was of steep drop in global demand specially in European Union, which remains the main export destination for these countries.

**Table 4.1.** Agglomeration schedule of global competitiveness of european countries

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
Column-1	Column-2	Column-3	Column-4	Column-5	Column-6	Column-7
1	2	3	.020	0	0	9
2	9	11	.022	0	0	5
3	18	19	.027	0	0	7
4	20	34	.039	0	0	6
5	9	12	.044	2	0	28
6	17	20	.055	0	4	7
7	17	18	.065	6	3	19
8	16	33	.074	0	0	14
9	2	6	.079	1	0	15
10	25	29	.113	0	0	17
11	26	35	.114	0	0	20
12	5	7	.116	0	0	21
13	22	23	.118	0	0	24
14	15	16	.123	0	8	27
15	2	4	.131	9	0	22
16	27	31	.175	0	0	20
17	24	25	.188	0	10	24
18	28	30	.197	0	0	25
19	17	21	.282	7	0	27
20	26	27	.294	11	16	26
21	5	8	.306	12	0	22
22	2	5	.322	15	21	28
23	13	14	.334	0	0	32
24	22	24	.380	13	17	26
25	28	32	.417	18	0	33
26	22	26	.472	24	20	29
27	15	17	.475	14	19	29



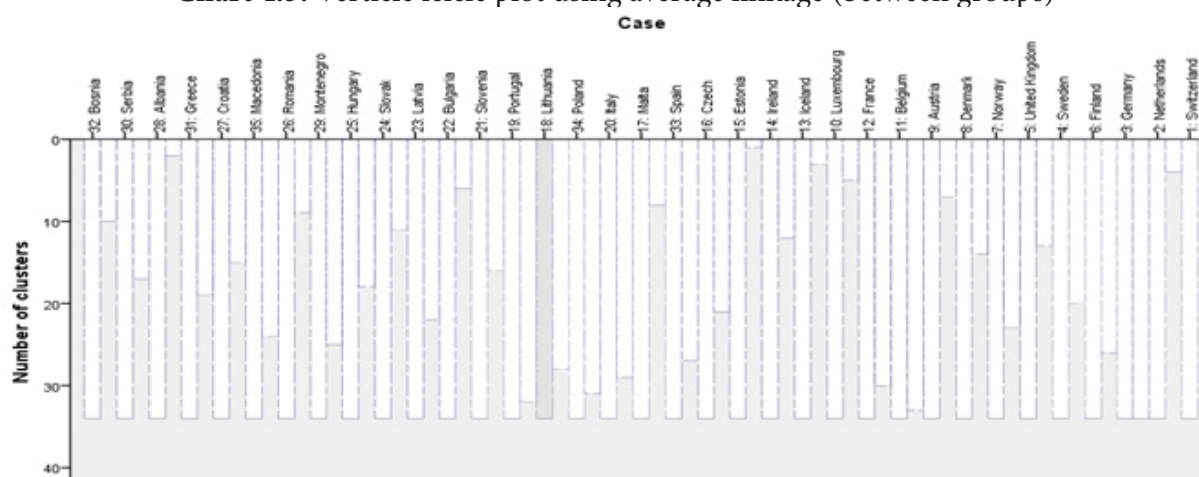
28	2	9	.815	22	5	30
29	15	22	1.289	27	26	33
30	2	10	1.333	28	0	31
31	1	2	1.776	0	30	32
32	1	13	2.790	31	23	34
33	15	28	2.974	29	25	34
34	1	15	11.760	32	33	0

Note: a. Squared Euclidean Distance used;

b. Average Linkage (Between Groups);

c. Authors calculation

**Chart 4.3.** Verticle icicle plot using average linkage (between groups)



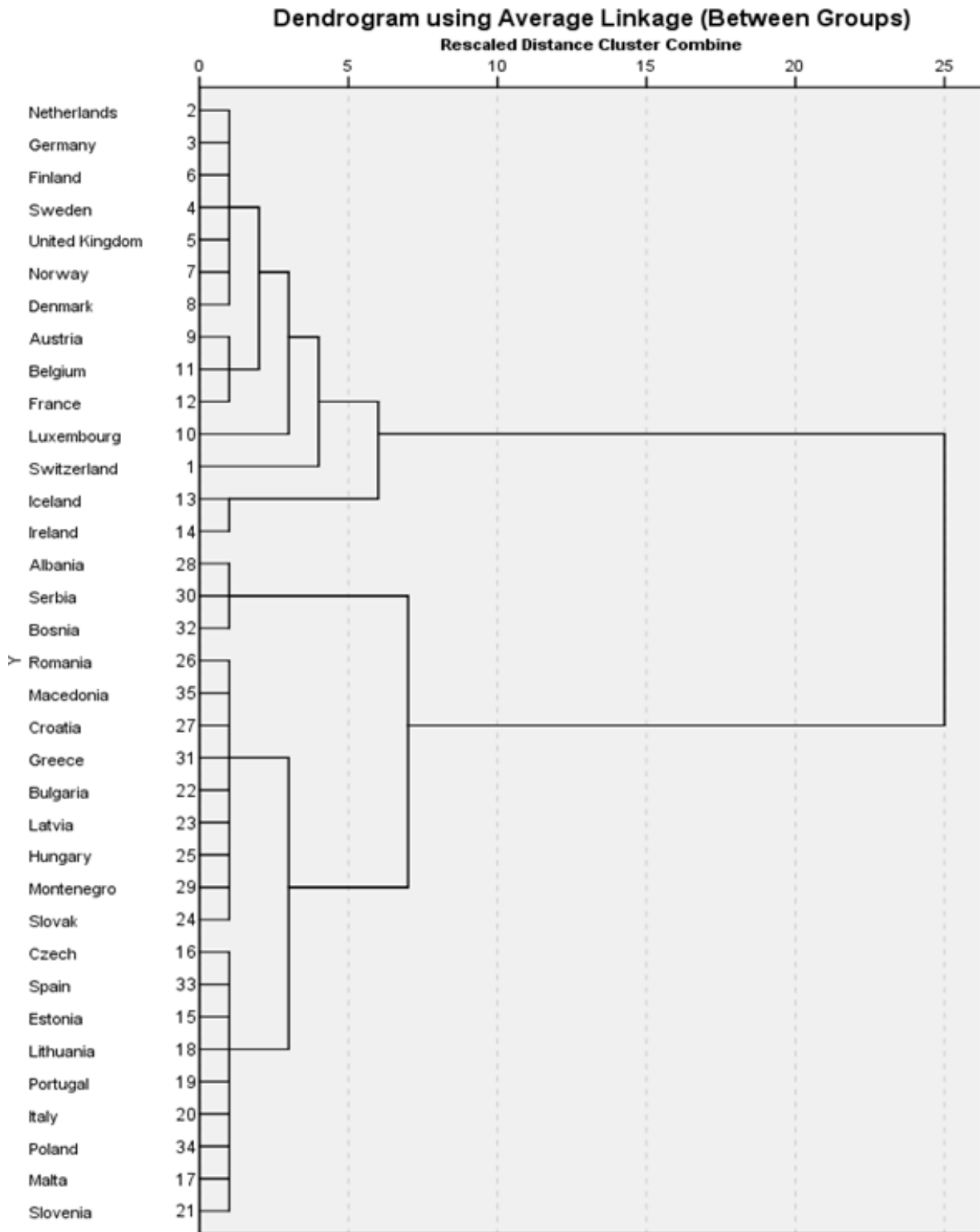
Source: Author's calculation

**Table 4.2.** Country classification based on gci from 2008- 2017

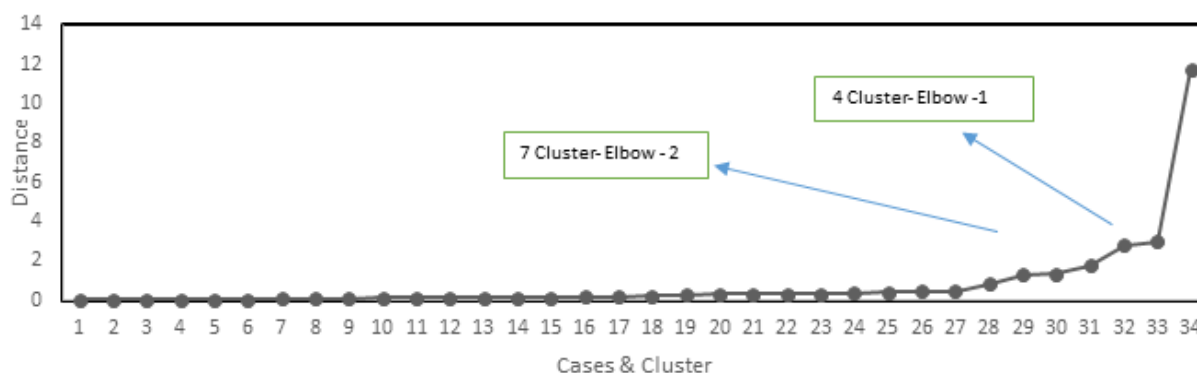
Cluster	Number of Countries	Country Members	Average GCI Score	Cluster Label
1	6	Switzerland, Netherlands, Germany, Sweden, UK, Finland	5.50	<b>Sophisticated Innovator Driven Economies</b>
2	7	Norway, Denmark, Austria, Luxemburg, Belgium, France, Ireland	5.18	<b>Innovator Driven Economies</b>
3	18	Iceland, Estonia, Czech, Malta, Lithuania, Portugal, Italy, Slovenia, Bulgaria, Latvia, Slovak, Hungary, Romania, Croatia, Montenegro, Spain, Poland, Macedonia	4.39	<b>Transition from Efficiency to Innovation</b>
4	4	Albania, Serbia, Greece, Bosnia	3.89	<b>Efficiency Driven</b>

Source: Author's calculation

Chart 4.4. Dendrogram using average linkage (between groups)



Source: Author's calculation

**Chart 4.5.** Elbow rule and the scree diagram

Source: Author's calculation

**Table 4.3.** Analysis of variance

Variables	Cluster		Error		F	Significance
	Mean Square	df	Mean Square	df		
2008	3.460	3	.063	31	54.507	.000
2009	3.744	3	.061	31	60.922	.000
2010	2.987	3	.031	31	97.059	.000
2011	3.252	3	.032	31	101.964	.000
2012	3.477	3	.028	31	122.487	.000
2013	3.245	3	.023	31	139.935	.000
2014	3.229	3	.024	31	135.645	.000
2015	3.284	3	.030	31	111.262	.000
2016	3.300	3	.036	31	90.926	.000
2017	3.017	3	.045	31	66.325	.000

This brought more recession. But different countries of Europe were affected to different degrees depending on their initial conditions and government policies. Baltic States and the like open economies were hit hard due to their exposure to foreign currency borrowing. They ran into large current account deficits. Poland, the Slovak Republic, and the Czech Republic suffered from much milder recessions as they were less leveraged and were members of the euro zone. Their dependency was less on exports and benefited from stimulus packages of EU. To counteract countries have deregulated, privatized, and stabilized their economies and opened their markets—including their financial sectors—to trade and investment. The relative stability that was associated with fixed exchange rates, along with EU membership, gave rise to high inflows of lending as well as direct and portfolio investment from European countries. It increased the credit growth and imports. The great recession led many advanced economies to implement very loose monetary policy, leading boom in the global commodities market (World Bank, 2017). Faced with looming Brexit and geopolitical crises spilling over into the region, Europe found itself in critical condition in economic and political aspects. However, the countries, Iceland, Norway, Switzerland, the Balkans, and Turkey still performs above the global average in terms of competitiveness. This is driven by the performance of a group of regional champions, notably Switzerland, which leads the global rankings for the eighth consecutive year. The top 12 includes seven more European countries: the Netherlands (4th), Germany (5th), Sweden (6th), the United Kingdom (7th), Finland (10th),

Norway (11th), and Denmark (12th). Although the top European countries are pushing the frontier in almost all areas, there is wide dispersion in regional performance on several pillars. The largest gap is in the macroeconomic environment pillar, a reflection of the fact that the region has been recovering unevenly from the global financial crisis. Europe's median performance comes from our cluster 3 and 4. These median performers include, Iceland, Estonia, Czech, Malta, Lithuania, Portugal, Italy, Slovenia, Bulgaria, Latvia, Slovak, Hungary, Romania, Croatia, Montenegro, Spain, Poland, Macedonia, Albania, Serbia, Greece and Bosnia.

Thus, our cluster result table 4.2 shows that the region's countries are clearly divided with a significant gap between the innovation assessment for Northern and Western European countries versus Central, Eastern, and Southern European ones. Accelerating innovation efforts will be crucial to maintain current levels of prosperity, and Europe can expect high returns from focusing its resources on nurturing its talent. On attracting and retaining international talent, although one European country (Switzerland) achieves the top global scores, the average for the region as a whole is low; this does not bode well for the creation of a vibrant European knowledge economy. The United Kingdom is currently still the most attractive EU destination for talent, yet the Brexit vote has created significant uncertainty over the conditions under which workers from EU countries will be able to participate in the UK economy in the future. With unemployment—and youth unemployment, in particular—still high across the region, Europe is leaving large numbers of its citizens behind. Yet good practice examples in this area exist on the continent, with countries such as Switzerland and Denmark striking a balance between high labor market flexibility and strong social safety nets.

The Nordic members of the EU continue to hold privileged positions in the rankings. Sweden, Finland, and Denmark hold the first and fourth cluster member group and continue to lead the ranking in individual areas. For example, they are all ranked among the top 15 countries with regard to macroeconomic stability, low levels of public indebtedness, high national savings and best functioning and most transparent institutions in the world. Finland, Denmark, and Sweden also continue to occupy the top three positions in the higher education and training pillar, the result of a strong focus on education over recent decades. This has provided the workforce with the skills needed to adapt rapidly to a changing environment and has laid the ground for their high levels of technological adoption and innovation, which is crucial for countries at their advanced stage of economic development. A marked difference among these three Nordic countries relates to labor market flexibility. Denmark continues to distinguish itself as having one of the most flexible and efficient labor markets internationally. In Finland and Sweden, however—as in a number of other European countries—companies have less flexibility in setting wages, and firing and therefore hiring workers is deemed expensive, although cooperation in labor-employer relations is good in all three countries. Germany is ranked 1st for the quality of its infrastructure, a position it has held for some time, with particularly good marks for its transport and telephony infrastructure. Its goods market is assessed as being efficient with a high level of competition among companies. The financial market also continues to receive relatively good marks, although the ranking has dropped due to concerns about the soundness of banks and more difficult access to capital for business development. Germany has very sophisticated businesses but rigid labor market due to lack of flexibility in wage determination and the high cost of firing provide a hindrance to job creation. Netherlands is equally highly sophisticated business with aggressive internationally in absorbing new technologies. It is complimented with excellent educational system and efficient factor markets, especially goods markets and overall, hence has a stable macroeconomic environment. Cluster 3 and 4 countries thus have a ample scope to improve on the above discussed drivers of competitiveness.

## CONCLUSION

Due to its sustained performance, excellent capacity for innovation and sophisticated business culture Switzerland overtakes the United States in the year 2015-2016 as the world's most competitive economy. With a 2019 GCI score of 84.8 out of 100, Singapore is the country closest to the frontier of competitiveness. The country ranks first in terms of infrastructure, health, labor market functioning and financial system. The United States has taken the lead followed by Netherlands, Switzerland, Germany, Sweden, the United Kingdom and Denmark. Hence, the countries falling into cluster 3 and 4 need to improve on the drivers of competitiveness given as 12 critical pillars so shift to cluster 2 and then to 1, respectively. The clusters are ranked in ascending order based on their competitiveness with first rank representing the highest scorer countries. It is the sustained effort and good governance that keeps the members of cluster 1 in the position of higher global competitiveness. This study can be further expanded to other nations and can be used to study cross country comparison.

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## APPENDIX

A:1 List of European countries with their Global competitiveness score from 2008- 2017

Counter	Country	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean Score Country
1	Switzerland	5.61	5.60	5.63	5.74	5.72	5.67	5.70	5.76	5.81	5.86	5.71
2	Netherlands	5.41	5.32	5.33	5.41	5.50	5.42	5.45	5.50	5.57	5.66	5.46
3	Germany	5.46	5.37	5.39	5.41	5.48	5.51	5.49	5.53	5.57	5.65	5.49
4	Sweden	5.53	5.51	5.56	5.61	5.53	5.48	5.41	5.43	5.53	5.52	5.51
5	United Kingdom	5.30	5.19	5.25	5.39	5.45	5.37	5.41	5.43	5.49	5.51	5.38
6	Finland	5.50	5.43	5.37	5.47	5.55	5.54	5.50	5.45	5.44	5.49	5.47
7	Norway	5.22	5.17	5.14	5.18	5.27	5.33	5.35	5.41	5.44	5.40	5.29
8	Denmark	5.58	5.46	5.32	5.40	5.29	5.18	5.29	5.33	5.35	5.39	5.36
9	Austria	5.23	5.13	5.09	5.14	5.22	5.15	5.16	5.12	5.22	5.25	5.17
10	Luxembourg	4.85	5.96	5.05	5.03	5.09	5.09	5.17	5.20	5.22	5.23	5.19
11	Belgium	5.14	5.09	5.07	5.20	5.21	5.13	5.18	5.20	5.25	5.23	5.17
12	France	5.22	5.13	5.13	5.14	5.11	5.05	5.08	5.13	5.20	5.18	5.14
13	Iceland	5.05	4.80	4.68	4.75	4.74	4.66	4.71	4.83	4.96	5.16	4.83
14	Ireland	4.99	4.84	4.74	4.77	4.91	4.92	4.98	5.11	5.18	4.99	4.94
15	Estonia	4.67	4.56	4.61	4.62	4.64	4.65	4.71	4.74	4.78	4.85	4.68
16	Czech	4.67	4.45	4.57	4.52	4.51	4.43	4.53	4.69	4.72	4.77	4.59
17	Malta	4.31	4.30	4.34	4.33	4.41	4.50	4.45	4.39	4.52	4.65	4.42
18	Lithuania	4.45	4.30	4.38	4.41	4.41	4.41	4.51	4.55	4.60	4.58	4.46
19	Portugal	4.47	4.40	4.38	4.40	4.40	4.40	4.54	4.52	4.48	4.57	4.46
20	Italy	4.35	4.31	4.37	4.43	4.46	4.41	4.42	4.46	4.50	4.54	4.43
21	Slovenia	4.50	4.55	4.42	4.30	4.34	4.25	4.22	4.28	4.39	4.48	4.37
22	Bulgaria	4.03	4.02	4.13	4.16	4.27	4.30	4.37	4.32	4.44	4.46	4.25
23	Latvia	4.26	4.06	4.14	4.24	4.35	4.40	4.51	4.45	4.45	4.40	4.33
24	Slovak	4.40	4.31	4.25	4.19	4.14	4.10	4.15	4.22	4.28	4.33	4.24
25	Hungary	4.22	4.22	4.33	4.36	4.30	4.25	4.28	4.25	4.20	4.33	4.27
26	Romania	4.10	4.11	4.16	4.08	4.07	4.13	4.30	4.32	4.30	4.28	4.19
27	Croatia	4.22	4.03	4.04	4.08	4.04	4.13	4.13	4.07	4.15	4.19	4.11
28	Albania	3.55	3.72	3.94	4.06	3.91	3.85	3.80	3.93	4.06	4.18	3.90
29	Montenegro	4.11	4.16	4.36	4.27	4.14	4.20	4.23	4.20	4.05	4.15	4.19
30	Serbia	3.90	3.77	3.84	3.88	3.87	3.77	3.90	3.89	3.97	4.14	3.89
31	Greece	4.11	4.04	3.99	3.92	3.86	3.93	4.04	4.02	4.00	4.02	3.99
32	Bosnia	3.56	3.53	3.70	3.83	3.93	4.02	3.70	3.71	3.80	3.87	3.77
33	Spain	4.72	4.59	4.49	4.54	4.60	4.57	4.55	4.59	4.68	4.70	4.60
34	Poland	4.28	4.33	4.51	4.46	4.46	4.46	4.48	4.49	4.56	4.59	4.46
35	Macedonia	3.87	3.95	4.02	4.05	4.04	4.14	4.26	4.28	4.23	4.20	4.10
	Europe Annual Score	4.65	4.62	4.62	4.65	4.66	4.65	4.68	4.71	4.75	4.79	4.68

A:2 Descriptive Statistics on Years from 2008 - 2017

Year	Number of Cases	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
2008	35	2.06	3.55	5.61	4.65	0.60	0.05	-1.10
2009	35	2.43	3.53	5.96	4.62	0.62	0.32	-0.91
2010	35	1.93	3.70	5.63	4.62	0.54	0.30	-1.09
2011	35	1.91	3.83	5.74	4.65	0.56	0.41	-1.16
2012	35	1.86	3.86	5.72	4.66	0.58	0.34	-1.26
2013	35	1.90	3.77	5.67	4.65	0.55	0.35	-1.17
2014	35	2.00	3.70	5.70	4.68	0.55	0.20	-1.11
2015	35	2.05	3.71	5.76	4.71	0.56	0.19	-1.18
2016	35	2.01	3.80	5.81	4.75	0.57	0.19	-1.27
2017	35	1.99	3.87	5.86	4.79	0.55	0.26	-1.19

Source: Authors calculation based on the information available in table A:1

The table A:2 is the descriptive statistics on variables (Years from 2008 to 2017). The range was highest during 2009 and the visible reason is the jump in the maximum competitive score by Luxembourg as it surpassed the consistent scorer Switzerland. Luxembourg has moved from factor driven economy to innovation driven economy. On a 7-point scale score of GCI, it is close to the score of 6 on institutions, Macroeconomic stability, technology readiness, and health and primary education. With a GDP per capita (2008) of USD 1,16,639 as against world average of USD 11,312 (World Bank), it has a competitive advantage on the aforesaid pillars but needs to improve on labor market efficiency, higher education and training and market size respectively. A Skewness depicts symmetry in a distribution. From the above table its visible that year 2011 has tilt toward positive skew, meaning most of the European nations have been ranked on a better performance in comparison to their own records. The skewness and kurtosis indicate that majority of European countries have their GCI scores fairly symmetrical.