

TABLE V. ENHANCED CLUSTERING USING A 3X3 SOM FOR YEARS 2000 AND 2015

CLUSTER	1	2	3	4	5
YEAR=2000	Austria, Chile, Estonia, Finland, Hungary, Iceland, Ireland, Latvia, Lithuania, Luxembourg, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Sweden, Switzerland	Australia, Canada, France, Italy, Mexico, Netherlands, Turkey, United Kingdom	Belgium, Czech Republic, Greece, Poland, Spain, Korea	Germany, Japan	United States of America
YEAR=2015	Austria, Belgium, Chile, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Ireland, Israel, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland	Canada, France, Italy, Korea, Mexico, Poland, Turkey	Australia, United Kingdom	Germany, Japan	United States of America

A larger topology of 3x3 SOM has been used to obtain a fine grained clustering. The plots of neurons and the distances between them are shown in Fig. 3 and Fig. 4 respectively. For both 2000 and 2015, one cluster (USA only) is located far from the others. Closest to USA is the cluster made up of Germany and Japan in 2000. In 2015, Germany and Japan appear in two close neighbors, again both of them are the closest clusters to USA, hence, Germany and Japan can be merged into a single cluster.

When the clusters of 2000 are examined, the three clusters forming a triangle in the top-left corner of the map in Fig. 1 can be merged since the distances between the neighboring neurons are low indicating high similarity. Similarly, three clusters in the bottom-right of the map are merged. For the year 2015, two clusters on the left of row-1 (with 3 and 4 instances) and the two clusters on the right of row-2 are merged to obtain five clusters based on topological neighborhood and weight similarity. The enhanced clusters are given in Table V.

Looking at the transfer of countries among clusters from 2000 to 2015, it is evident that Australia and UK have formed a cluster separated from the cluster made up of Australia, Canada, France, Italy, Mexico, Netherlands, Turkey, and United Kingdom. Other countries that have witnessed a transfer are Belgium, Czech Republic, Greece, Poland, Spain, and Korea which formed a cluster in 2000. This cluster has dissolved in 2015 where the countries are transferred into two other clusters however it should be noted that the distance of this cluster is not very large from the two clusters they merged in 2000.

IV. CONCLUSION

Clustering of OECD countries based on their social and economic data, and a comparison between 2000 and 2015 give interesting clues about the countries. Regarding the research questions, it can be concluded that the results of both methods, k-means and SOM, are in agreement. This can be verified by the following evidences:

1. Both methods classify USA as a cluster of a single country for both 2000 and 2015.
2. Germany and Japan are clustered together for the case where we have 5 clusters.
3. The group of countries made up of Australia, Canada, France, Germany, Italy, Japan, Korea, Mexico,

Poland, Turkey, and United Kingdom, is clustered separately from the largest cluster made up of approximately 20-25 countries.

The transfer of countries is also in agreement between the methods and it can be observed that Turkey is the only country that is transferred for the case of three clusters. For the fine grain clustering, the set of countries that have experienced a transition in both methods between 2000 and 2015, is made up of Korea and UK. In summary, both clustering methods can be utilized to identify similar countries and their transition among clusters. This work can be extended in several ways. Firstly, the validity of the clustering process can be tested using appropriate evaluation indicators [8]. Secondly, clustering efforts can be extended to more countries using the same set of indicators or more indicators can be included for analysis or both. The availability of valid data is a major concern for this purpose. Last but not least, this quantitative analysis can be combined with political and economic developments during this period for further analysis.

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