

# **Application of the Self-Organizing Map (SOM) to Analyze the Multiple Perspectives on Cross-National Culture**

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## **Abstract**

Organizational behavior in different countries and cultures has been the focus of studies in recent years. Following a literature review, we find that there are many different perspectives and features in the related cross-cultural studies. However, whether the analysis methods of these different cultural dimensions can fit into the increasingly complex and diverse topics of cross-cultural studies have not been determined, which is also a topic of great interest to scholars. Therefore, this study integrates the previous cross-cultural literature and aims to construct an analysis model of cross-national culture with multiple dimensions from three important cultural dimension theoretical models commonly used in cross-cultural studies: Hofstede, Global Leadership and Organizational Effectiveness (GLOBE) and World Values Survey (WVS). Traditional statistical analysis seems to be unable to solve the problem of the integration of relevant scales and units in different dimensions of cultural analysis. Therefore, this study uses a self-organizing map (SOM) as an analysis method to integrate 17 cultural variables from this multicultural dimension for cluster analysis and explains the cultural types in 26 countries based on the results. This study explores the differences and similarities of different countries in different cultural dimension analyses and provides a comparative model of multicultural analysis. This study takes samples from three cross-cultural analysis databases as data sources and employs the self-organizing map for analysis based on a neural network algorithm that can be used for type discrimination, map analysis, process monitoring, and error analysis. The results identify the cross-cultural groups of 26 countries and reveal their key cultural similarities and differences. We also elaborate upon the findings of these cultural characteristics and multi-cultural dimensions. The signification of this study is presented as a reference for subsequent studies of transnational and cross-cultural analysis and its applications.

*Keywords: Cross-Culture, Self-Organizing Map (SOM), Hofstede GLOBE WVS*

## **1. Introduction**

At the end of the 20th century, many scholars adopted large sample empirical methods, which have become the mainstream of current research on cultural differences. Representative scholars include Hofstede (1980, 1991), Trompenaars & Hampden-Turner (1993, 1998), Schwartz (1997), and House, Hanges, & Ruiz-Quintanilla (1997).

Although Hofstede's theory is the most representative, there are still some bottlenecks. For example, the samples are from the employees of a single company (IBM), the dimensions of cultural differences are insufficient, the sampling is limited, and the cultural dimensions are not dynamic and developmental. Many studies on national culture have emerged successively, such as the GLOBE (Global Leadership and Organizational

Effectiveness) project conducted by House, Hanges, & Ruiz-Quintanilla (1997). GLOBE expanded Hofstede's five dimensions into nine dimensions, retaining "power distance" and "uncertainty avoidance". Hofstede's "individualism and collectivism" were divided into "group collectivism" and "public collectivism", while "masculine and feminine culture" was divided into "gender equality and decisiveness". The "short- and long-term orientation" was changed to "future orientation". "Humanistic orientation" is consistent with Kluckhohn's dimension of "views on human nature", and the dimension of "performance-orientation" was added.

In addition to the above two analysis models of cross-national culture, the World Values Survey (WVS) has also gained increasing attention in recent years. WVS originated from the European Values Survey (EVS) conducted in 1981 for 10 countries of Western Europe. The findings are instructive in terms of cultural change and can be extended globally. Generally speaking, this transnational survey covers a wide range of topics, including social values, social norms, social issues, social distance, work issues, labor organization, employment issues, political attitudes, national democracy, gender issues, environmental issues, marriage, and family and child rearing issues. The literature of the past decade shows that cross-national culture is an important topic in the field of international enterprise research (Breuer, Ghufan, & Salzmann, 2018; Chand & Ghorbani, 2011). Relevant contextual factors such as cultural distance, cultural value, long-term orientation, individualism and physical distance can all predict different national cultures (Beugelsdijk, Maseland, Onrust, Van Hoorn, & Slangen, 2015; Malik & Zhao, 2013).

After reviewing the past studies, we find that there are many different perspectives and features in the related cross-cultural studies. However, whether the analysis methods of these different cultural dimensions can fit into the increasingly complex and diverse topics of cross-cultural studies have not been determined, which is also a topic of great interest to scholars. Therefore, this study integrates the previous cross-cultural literature and aims to construct an analysis model of cross-national culture with multiple integration dimensions from three

important cultural dimension theoretical models commonly used in cross-cultural studies: Hofstede, Global Leadership and Organizational Effectiveness (GLOBE) and World Values Survey (WVS). This study focuses on the application of the self-organizing map to explore the multi-dimensional cross-cultural analysis model. A self-organizing map neural network can gather a large amount of information with similar characteristics through the self-organizing map and then compare and analyze multiple models based on the cluster data. Therefore, this study explores the differences and similarities of various countries under different cultural dimension analyses and provides a comparative model of multicultural analysis. Samples from three cross-cultural analysis databases are used as data sources.

## **2. Research Design**

### **2.1. Research Method: Self-Organizing Map**

A self-organizing map neural network can gather a large amount of information with similar characteristics through the self-organizing map. Since SOM is a neural network for unsupervised learning, the target output value of web-based learning does not have to be defined in advance. Cluster rules can be derived according to data similarity in order to distinguish the differences among data groups. It is an effective analysis tool for Data Mining. Self-Organizing Map (SOM) is an unsupervised artificial neural network model, proposed by Kohonen (1982). SOM is especially suitable for representing the distribution of high-dimensional data vectors in a multidimensional space. The high-dimensional data vectors can be mapped into two-dimensional space, so that a user can understand the relationship between the original data structures, and the number of data groups can be reduced.

### **2.2. Research Subjects and Data Sources**

The data sources for this study are from three important cultural dimension theoretical documents and databases commonly used in cross-cultural studies: Hofstede (Geert Hofstede's Websites),

Global Leadership and Organizational Effectiveness (GLOBE), and World Values Survey (WVS). Table 1 lists the data of the cultural dimensions of 26 countries.

Table 1 List Of Country Information

Country Information		
<i>Culture Cluster</i>	<i>Country</i>	<i>Ctry. Code</i>
<b>Anglo Cultures</b>	USA	US
	Canada	CA
	England	UK
	Ireland	IE
	New Zealand	NZ
	South Africa	ZA
	Australia	AU
<b>Latin Europe</b>	France	FR
	Italy	IT
	Portugal	PT
	Spain	ES
	Swiss	CH
<b>Middle East Cultures</b>	Morocco	MA
	Turkey	TR
	China	CN
	Hong Kong	HK
<b>Confucian Asia</b>	Japan	JP
	Singapore	SG
	South Korea	KP
	Taiwan	TW
	Brazil	BR
<b>Latin America</b>	Argentina	AR
	Colombia	CO
	El Salvador	SV
	Mexico	MX
	Venezuela	VE

Date source : World Value Survey

### 3. Conclusion

This study used a self-organizing map (SOM) as an analysis method to integrate 17 cultural variables from this multicultural dimension for cluster analysis and explains the cultural types in 26 countries based on the results. Moreover, this study explored the differences and similarities of different countries under various cultural dimension analyses, and provided a comparative model of multicultural analysis. It sourced samples from three cross-cultural analysis databases. The self-organizing map is for analysis based on a neural network algorithm that can be employed for type discrimination, map analysis, process monitoring, and error analysis. The results identify the cross-cultural groups of 26 countries, reveal their key cultural similarities and differences, and help elaborate upon these cultural characteristics and multi-cultural dimensions. The significance of this study is presented as a reference for subsequent studies of transnational and cross-cultural analysis and its applications.

According to the results in Figures 2 to 5, Table 2 summarizes the comparisons of cross-cultural analysis patterns in multiple dimensions. Table 2 shows that there are Eastern cultural group and Western cultural group in Hofstede 6 analysis. There are three groups in the analysis of GLOBE 9: high, medium, and low GLOBE cultural groups. WVS 2 analysis shows four groups of country clustering: W1 (High T/R & LOW S/S) culture group, W2 (High T/R & High S/S) culture group, W3 (Low T/R & Low S/S) culture group, and W4 (Low T/R & High S/S) culture group. Among them, most east Asian regions or countries such as Taiwan, Japan, China, Hong Kong, and South Korea are in the W1 (High T/R & LOW S/S) culture group.

The results in Table 2 help us analyze the distribution of 26 countries after the analysis of four cross-national cultural analysis modes by SOM. It is interesting to find that there are two groups in Hofstede 6 analysis: H1 and H2; and the countries of H2 are the same as the countries of G1 and G3 after GLOBE 9 analysis; i.e., Hofstede's Western culture group is equal to the high and low cultural groups of GLOBE, and Taiwan belongs to G2 (i.e., medium GLOBE culture group) in GLOBE 9 analysis. Among the 26 regions or countries, only Taiwan belongs to this group. The cultural attribute and

classification of Taiwan are worth discussing, and subsequent research should further analyze its causes.

WVS 2 cultural dimension clustering analysis presents four groups of country clustering. Most countries fall into two of these categories. One part is in the W1 (High T/R and LOW S/S) cultural group, and Taiwan belongs to this group. The other part is in the W4 (Low T/R and High S/S) cultural

group, and many advanced countries belong to this group. The W2 (High T/R and High S/S) culture group has both tradition and self-expression ability, represented by two countries: New Zealand and Switzerland. Countries in the W3 (Low T/R & Low S/S) culture group are Australia, Morocco, Turkey, and Singapore. The analysis results of the above three cultural dimensions are close to the clustering results of GLOBE 9 cultural dimension analysis.

Table 2

Country	cultural dimension	Hofstede		GLOBE			WVS			Integration model		
		H1	H2	G1	G2	G3	W1	W2	W3	W4	M1	M2
USA(US)			✓	✓						✓		✓
Canada(CA)			✓	✓						✓		✓
England(UK)			✓	✓						✓		✓
Ireland(IE)			✓	✓						✓		✓
New Zealand(NZ)			✓	✓				✓		✓		✓
South Africa(ZA)			✓	✓						✓		✓
Australia(AU)			✓	✓					✓			✓
France(FR)	✓			✓			✓				✓	
Italy(IT)	✓					✓	✓					✓
Portugal(PT)	✓					✓				✓	✓	
Spain(ES)	✓					✓	✓				✓	
Swiss(CH)			✓	✓				✓				✓
Morocco(MA)	✓					✓			✓		✓	
Turkey(TR)	✓					✓			✓		✓	
China(CN)	✓			✓			✓					✓
Hong Kong(HK)	✓			✓			✓					✓
Japan(JP)	✓			✓			✓				✓	
Singapore(SG)	✓			✓					✓			✓
South Korea(KP)	✓					✓	✓				✓	
Taiwan(TW)	✓				✓		✓				✓	
Brazil(BR)	✓			✓						✓	✓	
Argentina(AR)			✓			✓				✓	✓	
Colombia(CO)			✓			✓				✓	✓	
El Salvador(SV)			✓			✓				✓	✓	
Mexico(MX)			✓			✓				✓	✓	
Venezuela(VE)			✓			✓				✓	✓	

(www.worldvaluessurvey.org). Aggregate File  
Producer: ASEP/JDS, Madrid., 2009.

## References

1. House, R. J., Hanges, P., Ruiz-Quintanilla, S. A., & Dickson, M. W. The development and validation of scales to measure societal and organizational culture. Under review, 1997.
2. Inglehart, R., & Welzel, C. Modernization, cultural change, and democracy: The human development sequence. Cambridge Univ Pr, 2005.
3. Trompenaars A., Hampden-Turner C.. Riding the waves of culture: Understanding cultural diversity in business[M]. London: Nicholas Brealey, 1997.
4. WORLD VALUES SURVEY 1981-2008 OFFICIAL AGGREGATE v.20090901, World Values Survey Association

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