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An Artificial Intelligence Approach to International Market Screening DSS

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ABSTRACT

This paper applies artificial intelligence (AI) computing, Kohonan Self-Organizing Maps (SOMs), to the problem of international market selection (IMS). Broadly speaking, IMS can be summarized to consist of three stages a) screening stage, b) identification stage and, c) selection stage. The screening stage often employs some type of grouping technique so that firms can begin to view the potential markets in terms of similarities and differences over variables of interest. The underlying purpose is to screen out or eliminate markets that do not meet certain criteria established by the firm. Statistical techniques such as cluster analysis, discriminant analysis or factor analysis have long been employed at this stage. This study uses empirical data to demonstrate how an AI approach can assist international firms in the screening process and provide them with information that is not readily available by standard statistical techniques.

INTRODUCTION

The ability of an international firm to correctly select markets for its portfolio of products is paramount to its success. During the process of international market selection (IMS) firms must find markets that offer prospects to grow sales yet, also fit strategically with the firm. Finding these markets is not a minor matter and academic researchers have studied this issue at length (see Cavusgil and Li 1992 for an annotated bibliography on this area of research). There are a number of systematic approaches to IMS that have been developed over the years. Upon review of these efforts, one could conclude that the IMS process has three stages: 1) market screening, 2) market identification and 3) market selection (Cavusgil, 1985; Kumar, Stam and Joachimsthaler, 1993; Anderson and Strandkov, 1998). Although others (Brewer 2001, Rahman 2003, Alon 2004) have subsequently proffered additional approaches, they are essentially elaborations of the above general process.

With the market screening phase the firm is simply attempting to generate a short list of markets for further study, this stage most often involves using macro variables with secondary data. In the market identification stage, information more specific to the product or service is used to reduce the markets under consideration even further. Here micro level data, secondary or primary is employed. In the market selection stage, detailed analysis of the remaining markets occurs; quite often primary data is used to predict consumer response to the market offer, specific competitors are identified and gauged and, the home firm's strategy is considered. It is at the conclusion of this stage that the final IMS decision is made.

The two most widespread mistakes of market screening are ignoring or missing markets that offer good potential for a firm's products and spending too much time researching markets that are poor prospects for the firm (Root, 1998). Although there are both qualitative and quantitative approaches to the problem, this paper focuses on a quantitative methodology to market screening. While Papadopoulos and Denis (1988) credit the qualitative approach to being systematic, they also point out that it is open to bias due to the subjective source of the information or recommendation. A quantitative approach reduces such bias.

Quantitative approaches can range from a simple filtering process to statistical analysis. With the filtering process a country must achieve some level of measure on a set of variables before it can continue in the IMS process. For example, a market may have to have a certain GDP and/or GDP per capita or else it is eliminated from consideration. Walvoord (1980) suggests a series of such filters that countries must clear as they work their way through the IMS procedure. On the other end of the spectrum, statistical analysis such a regression model to predict future demand or, cluster analysis to group similar markets are considered appropriate DSS tools to use (Terpstra and Sarathy, 1994).

The purpose of this paper is to demonstrate an artificial intelligence DSS approach to the problem of market screening in IMS. Self-Organizing Maps (SOMs) are a type of neural network that organize data in a manner that is inspired by how the human brain organizes inputs from its environment. The cerebral cortex contains the centers for activities such as speech, vision, hearing, motor functions and thought. These areas are located relative to one another, with each containing what are known as *ordered feature maps*. For example, the auditory region contains the *tonotopic map* where neighboring neurons respond to similar sound frequencies in an orderly sequence from high pitch to low pitch. An SOM is merely a very simple model of these ordered feature maps. If one were to physically extract, unfold, and examine the cortex of an adult human, one would find an approximately one-meter square and three millimeter thick sheet consisting of six layers of neurons. The model that is used in this study is simply a two-dimensional sheet with two layers of processing elements that are analogous to neurons. The first layer contains the input elements that are connected to the second layer containing the output elements (these output elements are often referred to as Kohonen units). The map is often portrayed as a grid, with the grid cells representing output elements. The output grid in essence, becomes a *topographical map* that displays grouped input data in an order-preserving format. In other words, if two input vectors are similar, then they will be mapped to Kohonen units that are close together in the two-dimensional map that represents the features or clusters. If they are very similar, then they will be placed in the same map cell.

This study uses a simplified definition of a topographical map, output elements located physically next to each other will respond similarly to classes of input vectors that are similar. This mapping allows users to visualize important relationships among the data that otherwise may go unobserved. The salient benefit of the SOMs is their ability to take classes of vectors that are similar in high-dimensional space and display them in two-dimensional space, where humans more easily visualize them. In this regard they are a type of DSS model that is distinct and different from standard clustering techniques. The DSS is an easily interpretable map that displays markets which are very similar to each other in the same cells. Markets that are somewhat similar are grouped in neighboring cells and, markets that are very different are found in cells that are a great distance away on the map.

This paper will first review the literature involving quantitative approaches to market screening, as well as, the SOM algorithm. Next, empirical data with variables that are suitable for a market screening process will be used to demonstrate the applicability of SOMs to the problem. The result is an illustrative example of an SOM that could be used by an international firm as a DSS in the market screening process.

IMS SCREENING PROCESS

Determinants of internationalization success may include the capacity to utilize the Internet (Thomas and Bridgewater 2004), the ability to leverage business relationships (Zain and NG 2006), as well as, the talent to innovate (Bell, Crick and Young 2004; Hessels 2005). Most firms that engage in a systematic methodology in selecting foreign markets perform better than those that use an ad hoc methodology (Brouthers and Nakos 2005). A systematic methodology of international marketing opportunities usually begins with a screening process that involves gathering relevant information on each country and removing the less desirable countries from consideration (Jeanette and Hennessey, 2001; Koch, 2001; Robertson and Wood 2001). During the first stages of this process, macro variables are often used to discriminate between countries that represent potential markets and those with little opportunity. General market indicators include economic, political, cultural measures. Economic measures may include GNP per capita, cars per capita or, income per capita. While political measures may include a political risk index that may be used to exclude countries with political instability. Cultural measures such as Hofstede's Cultural Dimensions can be used to screen out countries that may be considered risky due to large cultural differences between the marketer's home country and potential foreign markets. The exact process and criteria chosen are up to each individual company and can vary greatly among global firms. The purpose of the screening process is not to select foreign markets, but to allow the international firm to quickly focus efforts on the most promising markets by developing a group of markets that merit further research.

The major advantages of a quantitative approach to market screening are that they reduce subjectivity in the process and, they make it possible to evaluate a large number of markets (Kumar, Stam and Joachimsthaler, 1994). An initial attempt at employing quantitative methods to assist in market grouping was made by Sethi (1971), who used factor analysis and then cluster analysis to analyze data from ninety-one countries and twenty-nine variables of interest to create four variable clusters that yielded seven country clusters. Although the stated purpose of his

research was to assist firms in grouping their world markets so that they may apply uniform marketing approaches, the concept of grouping markets under consideration became another use of clustering. Previously, Liander, Terpstra, Yoshino and Sherbini (1967) had argued for the grouping of international markets due to the increased efficiencies in international operations gained by clustering markets into similar groups. Today one of the most common strategies that has been adopted by the quantitative approach is market clustering based on similarities of criteria (Kumar, Stam and Joachimsthaler, 1994).

Most of the market screening research conducted during the seventies dealt with methodological issues (Rao 1979, Pezeshkpur 1979), however, a few novel advances occurred in the early eighties. Davidson (1983) found that international firms exhibited a preference for markets similar to the home market. For example, a U.S. firm will likely enter Canada, Australia, and the United Kingdom before entering less similar markets such as Spain, South Korea, or India (Jeanette and Hennessey, 2001). Indicators of similarity include (1) aggregate production and transportation, (2) personal consumption, (3) trade, and (4) health and education. Thus finding and grouping countries that are similar to the home country becomes a strategy for market screening.

Kumar, Stam and Joachimsthaler (1994) propose a methodology that concurrently considers the objectives of the firm, its resource limitations and expansion strategies when identifying potential markets. Anderson and Strandkov (1998) argue that managerial cognition is more important to IMS than information processing that previous studies imply. To select among international markets managers impose mental maps to recognize market opportunities.

More recently, normative models for small and medium firms have emerged. Rahman's (2003) two-stage model first evaluates market size attractiveness that considers both macro and micro as well as firm related variables and then evaluates potential markets' structural attractiveness. Using a case study, Allon (2004) proposes a six-step model that may be used by small, high-tech firms, that includes, among other things web site hit analysis. Dikmen and Birgonul (2004) provide the first use of artificial intelligence computing for as a DSS for international market selection. They use a back propagation trained neural network to determine attractiveness and competitiveness factors in the international construction market. While their study demonstrates how a neural network receiving training direction can develop variables to be used in international market screening; this study will demonstrate how another type of neural network, an SOM using competitive, undirected training, can become a DSS directly involved in the screening process.

SELF-ORGANIZING MAPS

An interesting analogy of the SOM learning process is provided by Berry and Linoff (1997, p.327):

“Imagine one of the booths at a carnival where you throw balls at a wall filled with holes. If the ball lands in one of the holes, then you have your choice of prizes. Training an SOM is like being at the booth blindfolded and initially the wall has no holes, very similar to the situation when you start looking for patterns in large amounts of data and don't know where to start. Each time you throw the ball, it dents the wall a little bit. Eventually, when enough balls land in the same vicinity, the indentation breaks through the wall, forming a hole. Now, when another ball lands at that location, it goes through the hole. You get a prize at the carnival, this is a cheap stuffed animal; with an SOM, it is an identifiable cluster.”

In general terms, to begin the process an input vector $x(t)$ is submitted to the network and then it is compared with all the model or weight vectors $w_i(t)$. The best-matching unit *i.e.*, the node or also, grid cell, most similar to the input vector as determined by some metric *e.g.*, Euclidian distance, is called the winner. The model vectors of the winning node (cell), along with its neighbors are changed towards the input vector according to a learning rule. For each input vector (observation) $x(t)$, the winning node and its neighbors are changed to be closer to $x(t)$. Without this adjustment of neighboring weights, the network tends to find as many clusters in the data as there are cells in the grid which would introduce a bias into the cluster detection. The observations are submitted in an iterative fashion until ordered values for the $x_i(t)$ emerge over the grid.

In actual SOM training, a two-dimensional weight vector is assigned to each Kohonen unit. It is the weight space of these vectors that forms the axes of the SOM. However, at the beginning of training, all of the weights are very small with values close to the center of the map. As training progress and the map evolves, the weights spread out from the center. Eventually the final structure of the map begins to emerge until the weight vectors reflect a grid.

The following training algorithm guides the SOM development (Murray 1996):

- Step 1 – Initialize connection weights with small random values.
- Step 2 – Present an input vector from the bottom layer.
- Step 3 – Calculate the Euclidian distance between the input vector and its weights, for every Kohonen unit.
- Step 4 – Select the Kohonen unit with the smallest Euclidian distance and declare it the “winning unit.”
- Step 5 – Adjust the weights on the winning unit closer to input vector, move the weights of the neighboring Kohonen units slightly less close, move the weights of all other Kohonen units slightly further away.
- Step 6 – Return to Step 2 with a new input vector.

The purpose of Steps 3 and 4 is to determine a "winning" Kohonen unit. The Euclidian distance (d_i) for each unit is determined by simply taking the absolute value of the difference between the input vector (x_i) and the weight vector (w_i):

$$d_i = \|x_i - w_i\| \quad (1)$$

The unit with the lowest value of d_i is declared the winner and, as a reward, it has its connection weights adjusted to be closer to the values of the input vector (the first part of Step 5). Therefore the winning unit, in a measurable way, is closest to the input vector and, represents the input vector. It is worth noting that the connection weights are *not* multiplied by its inputs, as with other neural networks. They are simply used to reflect the input patterns clustered around a particular Kohonen unit.

During the learning process, changes to the model vectors may take place according to the following equation:

$$\begin{aligned} w_i(t+1) &= w_i(t) + \alpha(t)[x(t) - w_i(t)] \text{ for each } i \in N_c(t), \\ \text{otherwise } w_i(t+1) &= w_i(t), \end{aligned} \quad (2)$$

where t is the discrete-time index of the variables, $\alpha(t) \in [0,1]$ is a scalar that defines the size of the learning step, and $N_c(t)$ defines the neighborhood around the winning cell of the grid. Nodes directly outside of the winner's neighborhood are not adjusted at all, yet nodes a great distance from the winner may be moved further away.

Step 5 also requires that Kohonen units in the "neighborhood" of the winning unit be adjusted as well. The adjustment is to move all of those units' connection weights slightly closer to the values of the input vector. This adjustment is made to preserve the order of the input space - one of the most useful aspects of the SOM. The neighborhood size is determined *a priori* and usually begins large (maybe all adjacent Kohonen units) and as training continues, the neighborhoods and weight adjustments decrease in size.

The last part of Step 5 requires that units outside of the winning unit's neighborhood be adjusted in a fashion that moves all of those units' connection weights slightly farther away than the input vector. In the end, clusters (of input data) similar to each other should be located closer together than dissimilar clusters. This allows for a group of Kohonen units to represent a single cluster of input data, without it the SOM would find as many clusters in data as there are units in the Kohonen layer. For detailed discussion of the above process, the reader is referred Kohonen's book on the subject matter (Kohonen 1984).

DATA

The data file used in this study reflects screening variables that a US firm selling hospital supplies and equipment might employ. Many of the data used for are found in the World Development Indicators 2002 database maintained by The World Bank. The database contains more than five hundred time series indicators covering the years 1960 through 2000. From it two macro indicators, one economic, the other market proxy, both from a recent year, were selected for use. For the purposes of this study, it is assumed that some of the equipment is very expensive and may require some financing or other long-term relationship. Thus the firm also considers political risk in its screening and will utilize the Political Risk Index (July 1999 for study) as the third variable. Additionally, it is assumed that this firm wishes to use a standardized promotional approach and is therefore interested in finding markets with similar cultures. The firm elects to use all four of Hofstede's cultural dimension indices in the screening process. Forty-seven countries are included in the data file. The SOM will attempt place these countries in groups based on their data for each of the seven variables that are discussed and justified below.

GDP per capita (constant 1995 US\$) is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant U.S. dollars. GDP or GNP per capita is often used as a screening variable as it gives an economic measure that accounts for the size of the country (Jeanette and Hennessey 2001, Helsen, Jedidi and DeSarbo 1993).

Total health expenditure per capita (current US\$) is the sum of public and private health expenditures as a ratio of total population. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation. Data are in current U.S. dollars. This variable gives a measure of the healthcare system of a potential market, which is mentioned as a screening variable in both previous research and textbooks (Helsen, Jedidi and DeSarbo, 1993 and Jain 1993, Jeanette and Hennessey, 2001). Also, since this example is for a firm selling kidney dialysis it can be used as a initial market proxy.

Political Risk Index (July 1999) is found in the *International Country Risk Guide* published monthly by Political Risk Services. The ratings in it vary from 100 for minimum risk, to 0 for maximum risk. The index not only considers economic expectations but other issues such as political terrorism, corruption in government, political stability and quality of bureaucracy (Jeanette and Hennessey, 2001). Previous studies that confirm the use of political risk as a screening variable include Green and Allaway (1985) and, Anderson and Strandskov (1998). It is also mentioned in most international marketing textbooks.

Hofstede's Cultural Dimensions (Hofstede 1980) were developed after he studied fifty national cultures, plus three regional cultures, and found four underlying cultural dimensions – *Power Distance*, *Uncertainty Avoidance*, *Individualism/Collectivism* and, *Masculinity/Femininity*. There has been a plethora of studies involving these dimensions, resulting in Hofstede being one of the most cited management authors of the day. Hofstede quantifies these constructs by developing one hundred point indexes for each of the dimensions. Thus, each of the fifty-three cultures contains an index score on each of the dimensions. In a later study, a fifth dimension, *Long-term orientation/short-term orientation*, was proffered and has been generally accepted, however that work only covered twenty-three cultures so it is not included in this study.

Power Distance is defined as the extent to which the less powerful members of institutions and organizations accept that power is distributed unequally. A large power index (PDI) means that inequalities among people are both expected and desired. Whereas in a small power distance culture (low PDI) inequalities among people should be minimized.

Uncertainty Avoidance is the extent to which the members of a culture feel threatened by uncertain or unknown situations. In a high uncertainty avoidance (high UAI) culture members feel that what is different is dangerous and, that uncertainty is felt as a continuous threat that must be fought. In contrast, a low uncertainty

avoidance culture's (low UAI) people feel that what is different is curious and, that uncertainty is a normal feature of life and it must be accepted as it comes.

Individualism/Collectivism is a construct that measures whether or not a culture's members tend to look after only themselves and their immediate family (IDV) or, whether they tend to belong to in-groups or collectivities that are suppose to look after them in exchange for loyalty. A culture that scores high on individualism (high IDV index) has members whose identity is based in the individual whereas collectivist society (low IDV index) members' identities are based in the social network to which they belong.

According to Hofstede, the *Masculinity/Femininity* dimension deals with the roles that the genders have in the culture. In masculine societies (high MAS index) the gender roles are distinct; men are tough and assertive whereas women are more tender and modest. However, in a feminine culture (low MAS index) the gender roles overlap with both men and women being tender and modest. In a masculine culture the dominant values in society are success, money and things, while a feminine society values caring for others and the quality of life.

The use of all four of Hofstede's dimensions simultaneously gives an overall measure of cultural similarity and difference among the markets that are being screened. Culture, specifically, failure to plan and account for cultural differences, is often mentioned in international marketing texts as a reason for failed marketing efforts. Additionally, it is mentioned as a screening variable in Kumar, Stam and Joachimsthaler (1994), Andersen and Strandkov (1998) and Douglas, Craig and Keegan (1982).

The variables selected for this example may or may not be the same variables that an actual dialysis firm would choose. They are used here for illustrative purposes only. Screening variables are selected based on management objectives in regards to international market operations and are usually adapted to particular industry and product lines concerned (Douglas, Craig and Keegan 1982).

RESULTS

The Kohonon SOM program used in this study is found in SAS's *Enterprise Miner* release 4.1. The 4 X 4 SOM is included as Table 1. Recall from discussion of the SOM algorithm, countries that are placed in the same cell on the map are deemed most similar when considering all seven variables. Countries that are in neighboring cells are deemed slightly less similar across the variables and, the farther apart on the map, the more dissimilar the countries are considered to be. Examination of Table 1 reveals results that are for the most part not surprising, however, there are a few exceptions.

Table 1: SOM for IMS Screening Process

Chile (1:1) Guatemala Panama Peru El Salvador Thailand	Costa Rica (1:2) Portugal Korea Uruguay	(1:3)	Denmark (1:4) Netherlands Norway Sweden
Brazil (2:1) Turkey Yugoslavia	Argentina (2:2) Greece Spain	France (2:3) Israel	Finland (2:4)
Colombia (3:1) Ecuador Indonesia Mexico Pakistan Venezuela	Iran (3:2) South Africa	Italy (3:3)	Australia (3:4) Canada

India (4:1) Malaysia Philippines	Hong Kong (4:2) Jamaica Singapore	Ireland (4:3) New Zealand United Kingdom	Austria (4:4) Japan Switzerland United States
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The first interesting result is the placement of Japan, Austria, Switzerland and the US in the same cell. Of all forty-seven countries across economic, health expenditure, political risk, and culture; these four countries are deemed very similar. These markets are placed in the same cell because they are comparable across the GDP per capita, health expenditure per capita, as well as, political risk variables and, are somewhat similar culturally. They all tend to be masculine cultures, with medium to high uncertainty avoidance, medium to high individualism and medium to low acceptance of power being unequally distributed.

Table 2: Cell Averages/Results for SOM

SOM Cell	GDP/capita	HE\$/capita	Risk Index	PDI	IDV	UAI	MAS	Nearest Cell	Distance to Nearest Cell
1:1	2,853	127	71	75	16	86	38	1:2	1.22
1:2	8,971	449	76	55	24	94	32	1:1	1.22
1:3
1:4	34,662	2,174	85	30	74	39	11	2:4	1.41
2:1	2,999	118	51	70	34	83	38	3:1	1.52
2:2	12,945	857	74	55	44	95	52	1:2	1.38
2:3	23,439	1,687	72	41	63	84	45	3:3	1.56
2:4	32,024	1,525	87	33	63	59	26	1:4	1.41
3:1	2,057	115	56	73	15	71	61	2:1	1.52
3:2	2,817	153	68	54	53	54	53	4:1	1.92
3:3	20,885	1,488	76	50	76	75	70	3:4	1.50
3:4	23,189	1,711	81	38	85	50	57	4:3	.92
4:1	2,141	44	67	92	35	40	57	3:2	1.93
4:2	18,078	556	78	62	28	17	58	4:1	2.25
4:3	22,318	1,151	82	28	79	40	64	3:4	.93
4:4	39,081	2,902	84	35	65	67	77	3:4	2.24

To analyze the other potential markets on the map and their similarity to Japan, Austria, Switzerland and the US (cell 4:4), it is helpful to look at cell averages; these are found in Table 2. The cell closest (Euclidian distance) to 4:4 is 3:4 containing Australia and Canada. These economies are not nearly as large yet on a per capita basis they are well developed. Their health expenditure per capita is well below cell 4:4, while their political risk is similar. Culturally the countries of cell 3:4 do not differ greatly from those of 4:4 on PDI, but there are differences in IDV, UAI and MAS. The 3:4 countries are more individualistic, more feminine and are more tolerant of uncertainty.

Other cells that contain potential markets for the US firm appear to be 3:3 and 4:3. Cell 4:3 contains countries that have experienced a British influence. Although these economies are not as large as cell 4:4, like 3:4 their per capita GDP is respectable. Their health expenditures are also closer to 3:4, being considerably lower than 4:4 and, their cultures are more similar to the US than most others (see also Table 2). The political risk average for this cell indicates low risk at 82.

Cell 3:3 consists solely of Italy and it appears to be a long shot for further consideration. Its per capita GDP is roughly half of 4:4 and so is its health expenditure per capita. Italy's political risk is slightly higher as well. Further consideration of this market would be questionable.

The other countries on the SOM are dissimilar to the US in either terms of economic development, health expenditures, political risk, and culture or, a combination thereof. As one moves away from the lower right to the upper right part of the map one encounters cells 2:4 and 1:4 containing Scandinavian countries. The markets possess good economic, health expenditure and political risk indicators but their cultures are dissimilar enough to place them in separate segments. The salient cultural factor is the femininity of these cultures compared to the cultures of 4:4.

The left one-half of the map contains markets with weak per capita GDP, weak healthcare expenditure per capita, higher political risk and greater degrees of cultural differences than the markets of 4:4. These countries are eliminated from further consideration.

CONCLUSION

This paper demonstrates the application of SOM's as a DSS tool for foreign market screening. The SOM considered forty-seven potential markets and grouped these markets in an organized fashion that facilitates elimination of a number of the markets, as well as, selection of others for further review in the IMS process.

The results indicate that the countries found in cells 4:4, 3:4 and 4:3 should be subjected to further, more involved, study. The countries found in the remainder of the cells, should be disregarded for the time being. Thus SOM has assisted in screening out thirty-eight of the forty-seven markets under consideration.

The results of a K-means clustering approach to the problem are shown in Table 3. The clustering algorithm placed Australia, Canada, Switzerland and the United Kingdom in the same cluster as the US. The nearest cluster contains Austria and Ireland. The difference in the K-means and SOM algorithms appear to be the SOM's inclusion of the Japanese and New Zealand markets for further study.

Table 3: Results of K-means Clustering of Markets with Variable Averages

Cluster	Markets	Near/clust	GDP/cap	HE/cap	Risk	PDI	IDV	UAI	MAS
1	Israel New Zealand	3	17,308	1,098	71	18	67	65	53
2	Brazil Colombia Ecuador Mexico Venezuela	5	3,092	179	59	75	20	76	64
3	Austria Ireland	4	30,252	1,572	85	20	63	53	74
4	Australia Canada Switzerland USA U. Kingdom	3	29,356	2,344	83	37	84	48	62
5	Indonesia Pakistan	7	755	18	50	67	14	59	48
6	Jamaica South Africa	16	2,885	162	69	47	52	31	66
7	Turkey Yugoslavia	5	2,187	55	48	71	32	87	33
8	Chile Costa Rica	13	3,430	150	71	55	25	74	32

	Iran Thailand								
9	Denmark Norway Sweden	11	35,894	2,226	85	27	71	34	10
10	Japan	12	44,830	2,585	82	54	46	92	95
11	Finland Netherlands	9	31,495	1,771	86	36	72	56	20
12	France Italy	4	25,348	1,850	78	59	74	81	56
13	Argentina Greece Portugal Korea Spain Uruguay	8	11,801	694	75	58	36	96	44
14	Guatemala Panama Peru El Salvador	8	2,239	107	71	80	13	92	41
15	Hong Kong Singapore	16	26,224	794	81	71	23	19	53
16	India Malaysia Philippines	2	2,141	44	67	92	35	40	57

SOMs appear well-suited as a DSS for the IMS screening process because they can consider a number of screening variables such as the macro economic, macro-proxy (*i.e.*, health expenditures as a proxy for the hospital supply industry), political risk and cultural variables and, display the results on a two dimensional map that is easily visualized and understood. Further research involving manifold screening variables should be conducted to ascertain new advantages and limitations of the approach.

This type of DSS is readily tailorable to firms' changing needs, an important attribute for a service based IT system (Sotiropoulou and Theotokis 2005). Furthermore its implementation is inexpensive and is available to assist firms in small or developing countries that are at an IT disadvantage. Such an IT shortcoming impedes their ability to compete globally (Rosson and Davis 2004, Osterwalder 2004). This type DSS addresses that IT inadequacy.

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