YSU/WILLIAMSON COLLEGE OF BUSINESS MASTER STUDENTS, AHP IN DECISION MAKING

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SESSION ABSTRACT

In this session Youngstown State University, Williamson College of Business master students will present Application of AHP into three managerial decision making situations involving multiple quantitative and qualitative criteria.

First paper is about plant location. Copwire, a company from an emerging market, is seeking location to establish manufacturing site in the United States, serving New England market. The company is looking for locations within New York, Ohio, or Pennsylvania. This study identifies and compares relevant factors to support manufacturing site selection. Authors collected data from company executives, from sources such as the Bureau of Labor Statistics, the Energy Information Administration, state government websites, and Google Maps. Ohio was found to be the most favorable of the three states.

In the second paper the authors utilized the Analytical Hierarchy Process to determine the most valuable Emerging Market (EM) among China, India, Turkey, and Russia. They found out that China is the most promising market yet Russia is the least.

Third paper is again on Emerging markets. The emerging markets of Brazil, India and China were compared utilizing the Analytic Hierarchy Process (AHP) to determine which country was the most favorable to expand into for business. The robustness of the results was also tested using the sensitivity analysis. Results were sensitive to the importance of market size and robust with the rest of the criteria. China was the best emerging market among the three compared.

BEST PLANT LOCATION FOR A MANUFACTURING COMPANY: AN ANALYTIC HIERARCHY PROCESS APPROACH

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ABSTRACT

Copwire, a company from an emerging market, is seeking location to establish manufacturing site in the United States, serving New England market. The company is looking for locations within New York, Ohio, or Pennsylvania. This study identifies and compares relevant factors to support manufacturing site selection. The identified criteria were classified as primary and secondary. Factors were analyzed using Expert Choice software, decision support system uses the Analytical Hierarchy Process (AHP) as a methodology. As most parameters in choosing a location are qualitative, quantitative or both, AHP model allows managers to successfully evaluate all considerations. This model structures the decision making process so that importance of criteria and sub-criteria as well as preference of each alternative over another are obtained as a result of expert pairwise comparisons. This paper emphasizes the reasons for assorting existing criteria, consisting of specific location analysis within each state, and performs/applies sensitivity analysis demonstrating the influence of selected parameter on the outcome via which tests the robustness of the alternative location selections.

Keywords: Plant Location, Analytical Hierarchy Process, AHP, Multi-criteria Decision Making

1. Introduction

The creation and distribution of products are the most fundamental and critical functions of a manufacturing company. The location of the plant must be efficient in order to minimize costs associated with operations and the supply chain. Selecting a location for a plant can be a daunting task for decision makers due to the amount of factors that must be

realized. This study proposes the use of Analytical hierarchy processing (AHP) to aid in selecting a prime location in the United States for a plant, given a set of qualitative and quantitative criteria. The AHP allows the user to setup a complex problem in a simple hierarchy and analyze often conflicting factors from general to more detailed, thus increasing understanding of the problem and exploring all aspects. Our Location decision model includes seven criteria under two categories. Three states were selected under which locales were determined based on statistical data congregate. From these three a prime location was carefully chosen determinant of the model created.

The goal of this study is to exhibit systems decision makers can utilize the AHP model to determine locations for a manufacturing plant. The idea is to achieve a result in an efficient and effective manner while considering all qualitative and quantitative factors. It is crucial to find a promising location in order to meet demand and influence the bottom line as compared to a poor location and related consequences leading to lost opportunities and cost. Some factors will weigh inversely to others depending on which criteria an organization considers significant. The decision on where to locate is a strategic decision.

2. Literature Review

There is a substantial amount of research performed to find the best location using AHP for a firm. M Alakin et al. (2013) determined the relative importance or weight of multiple criteria and its attributes in the decision problem of location selection using AHP method. The evaluation weights provided by AHP were applied as a way to select important evaluation factors as required by the decision maker. In addition, they set priority weights for every location alternative and selected the location with the highest potential among alternatives for clothing retailers.

AHP model if often combined with various analysis actors to substantiate the results. E.H Ibrahim et al. (2011) integrated fuzzy AHP and Geographical Information System (GIS) functionality to select the best location for a wastewater lift station. They designed an online application using fuzzy AHP to calculate weights of the criteria and the GIS were used to extract suitability map with the weights calculated. The use of fuzzy set theory instead of dealing with crisp numbers to imitate the real life situations proved to be practical and effective identifying suitable sites with respect to multiple criteria. Jasuk Ko et al. (2005) illustrated how multiple decision factors can be combined with the AHP approach to permit a more flexible and inclusive use of available information about alternative locations in a facility location decision and concluded that integrated decision model offers a systematic approach to the distribution facility location problem.

3. Objectives

This study aims to identify the most favorable location for Copwire's expansion goals through accessing the relative effectiveness of the criteria's and their attributes, affecting the decision for location selection. The Analytical Hierarchy Process was applied, followed by sensitivity analysis to test the robustness of the results.

4. Research Design

The location of any facility for a company has a significant impact on its operating costs, pricing, services, and ability to compete in its market, and attract new customers. Criteria are used to consider a new location should be sensitive to location as well as having a greater impact on the company's ability to meet its goals. In the case of Copwire, eight factors affecting the location were analyzed using Expert Choice software. These factors were split into primary and secondary factors, with primary factors having a superior impact on the location analysis. Copwire's greatest costs are projected to stem from labor, energy, and taxes making them the primary factors. Secondary factors include proximity to markets, incentives, quality of life for employees, proximity to suppliers and resources, and proximity to parent company facilities. Each of these areas was evaluated using both financial and nonfinancial metrics in the Expert Choice software.

5. Data/model analysis

The data considered for selecting the location of Copwire's new plant was based on information given from the Copwire executives. This data was gathered from sources such as the Bureau of Labor Statistics, the Energy Information Administration, state government websites, and Google Maps.

The criteria were weighted against one another using Expert Choice software, which allowed us to compare factors that are both quantitative and qualitative. Each parameter was weighted against all other factors, and the outcome is presented in Figure 1.

	Favorable	Proximity t	Quality of L	Proximity t	Proximity t	Utility Cost	Taxes	Incentives
Favorable Labor Climate		6.0	6.0	4.0	6.0	1.0	3.0	3.0
Proximity to Markets			3.0	4.0	4.0	4.0	2.0	1.0
Quality of Life				2.0	5.0	4.0	4.0	1.0
Proximity to Suppliers and Resources					2.0	4.0	3.0	3.0
Proximity to Parent Company's Facilities						5.0	3.0	3.0
Utility Costs							2.0	6.0
Taxes								4.0
Incentives	Incon: 0.07							

Figure 1 - Pairwise Comparison Matrix of Main Criteria

Inconsistency checked throughout pairwise comparison process. If exceeded .10 reasons were explored with the assistance of software. Overall inconsistency turned out 0.07 which is acceptable for such analysis. Similar analysis was carried out for sub factors within each criterion. This procedure was then applied to the three states under consideration. Ohio was found to be the most favorable of the three states (Figure 2).
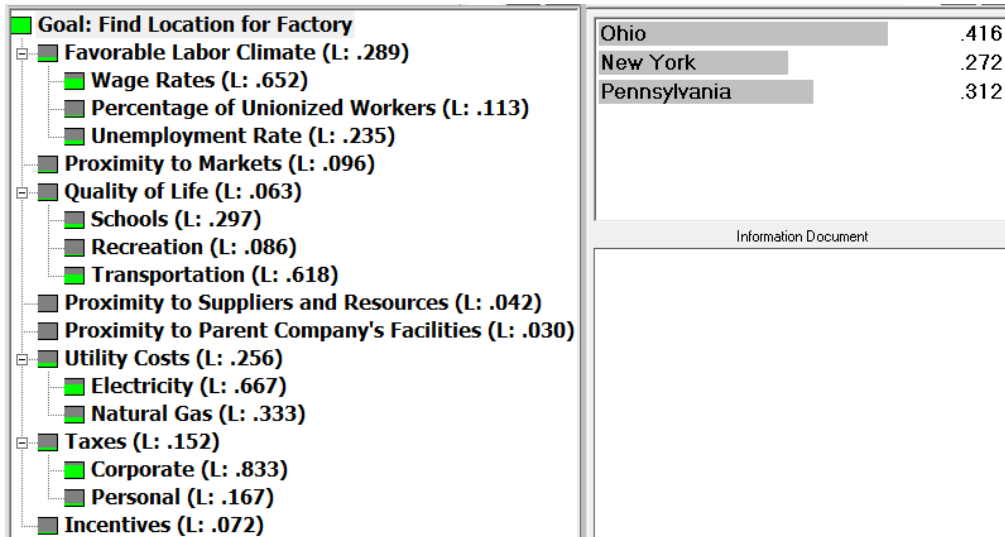
Figure 2 - AHP Model with Decision Alternatives

Furthermore, Youngstown was observed to be the most favorable city in Ohio to build this factory. The cities in Ohio were evaluated using the same parameters as established for the comparison of states. Additionally various cities were also identified within New York and Pennsylvania and ranked using Expert Choice. These cities were determined to be less attractive compared to Youngstown, Ohio.

Expert Choice also allowed us to consider the sensitivity of the factors considered (Figure 3). We were able to use the sensitivity analysis to see how the recommendation would change if the factors were weighted differently. For example, we considered what would happen if proximity factors were more important.
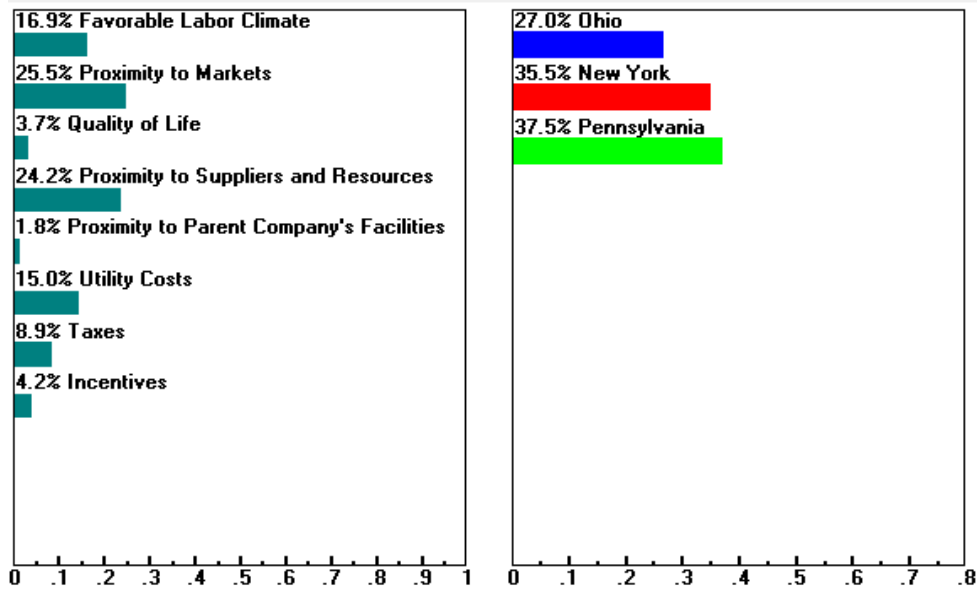
Figure 3 - Sensitivity Analysis

6. Limitations

Similar to various other studies, inadequacy of specific information makes it difficult to complete an analysis to its entirety. In light of the wide variation of environmental protection laws, there is potential for one state to be much more appealing than the other. Furthermore, the AHP analysis assumes that the factors considered are independent factors and do not depend on one another. If the factors were to be dependent on each other, we would need to use Analytic Network Process (ANP). However for practical decisions sometimes AHP can be used instead of ANP since ANP requires quite a few pairwise comparison much more than AHP. Executives may not have time and/or patience to do necessary pairwise comparisons of ANP.

7. Conclusions

The plant location decision is a complex decision requiring the analysis of qualitative and quantitative criteria. The Analytical Hierarchy Process allows the decision maker to factor in sensitive criteria such as proximity to markets, labor climates, and proximity to suppliers and resources to make a concrete decision regarding a final location without overruling judgmental data. This paper depicts our alternative location options that have been successfully evaluated using the weighing and ranking methodology of the AHP process. Every company utilizing this process with have its own way of weighing primary and secondary factors based on their industry and necessities. In the case of Copwire, the utilization of expert choice showed us that Ohio was the best location to construct a plant based on our selected criteria and data analysis. Expert Choice also allowed us to see the differences in locations if the weight of primary and secondary factors changed. The combined review of AHP literature, the gathering of necessary

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statistical data, and the utilization of the AHP weighing and ranking system provides the best probable location based on the assumed criteria even if all data is not available.

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SELECTION OF THE MOST ATTRACTIVE EMERGING MARKET FOR A BUSINESS TO ENTER AMONG THE COUNTRIES TURKEY, RUSSIA, INDIA, AND CHINA: AN ANALYTICAL HIERARCHY APPROACH

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ABSTRACT

In today's growing global economy, Emerging Market's (EM) in developing countries contain a lucrative opportunity to investors in a range of businesses. If considered appropriately, specific contributing dimensions composed of economic, political, and social factors can theorize growth or potential problems for a business in one of these EM's. Dimensions are composed of 16 measurable variables from each EM. The authors' objective in this study was to determine the best potential EM among the countries, Russia, China, India, and Turkey. To determine the most valuable EM, the authors utilized the Analytical Hierarchy Process, a multicriteria comparison approach. Results of testing ranked the EM's in the following order, China, India, Turkey, and Russia. It is the authors' opinion that the assigned weight of 44% to the importance of Market Size, specifically to China and India's advantage, is a flawed representation of EM's. Running a sensitivity analysis assigning Market Size a more congruent weight of 20 percent results in the new ranking of Turkey, China, Russia, and India, which is more fitting to the authors' analysis.
Key words : AHP, Emerging Markets, Turkey, China, Russia, India

1. Introduction
In today's business landscape, with the technology resources at hand and maturing of once undeveloped countries, there is a growing trend of utilizing foreign markets to grow businesses. Realizing the potential of these markets, many foreign countries have become prime targets to investors. While many emerging markets (EM's) have lower GDP's, they are experiencing growth due to increasing population size, purchasing power, and better expectations. EM's are also experiencing rapid household income growth, modernization, and industrialization of major cities. Other characteristics these countries share are: economic enhancement though reform programs, dependence shift from agriculture to manufacturing, and stock and bond markets with less functionality and liquidity. When compared to mature markets, the growth EM's are experiencing is outstandingly positive.

However, EM's in this analysis will be measured against one another through quantitative measurements of each country in search of the most potential as an EM.

For this analysis, the authors gathered information on the emerging market status of country will be presented. Next, a detailed methodology section will outline Expert Choice Desktop Software, which was used for the comparison of the countries. The authors then outline the dimensions used to determine market potential, and lastly present their results of testing.

2. Literature Review
Russia
Russia is an enormous country that lays hold to many natural resources, a growing and skilled workforce, and support of foreign investors to continue their recent growth. Since the former Soviet Union fall in 1989, Russia has shown a strong initiative to rebuild its government, economy, and legal system (Alas, Messemer, & Knapik, 2011). To successfully expand in Russia, investors need to give due diligence to its complex business environment and the jurisdictional authorities. Partnering with the right people will help investors to understand and comply with sometimes ambiguous and inconsistent laws. Despite the aforementioned, Russia has one of fastest growing economies of the researched countries and has displayed sustainable growth with projections to continue. Key factors to Russia's growth are correlated to its strong infrastructure, abundant energy supply, healthcare, and a strategy with economic diversity (Alas et al., 2011).

India
Companies seeking to enter the market in India will have opportunity due to its size, and market consumption capacity. One of the leading factors of the potential to sell in India is the rising household income of its rural and urban population. India's middle class is growing, and with that, they are gaining purchasing power of commodities such as automobiles. Additionally, income rates continue to rise in a large percentage of India's population. However, due to India's poor transportation and building infrastructure, its rural market remains an unexplored customer base for many investors (Stovsky, Pontius, & O'Brien, 2011).

Nonetheless, a strong communication sector exists in India. Like Russia, businesses in

India face corruption problems and outdated unclear laws placed on business owners. Furthermore, while the political system is stable, the legal system is extremely slow (Stovsky et al., 2011). Key barriers to overcome in India will be establishing and maintaining a relationship with government officials, speed-up processes, and a long term strategy including a plan to reach India's rural market by other means than a car. Domestic demand in India will continue to grow as better paying jobs increasingly become available to India's people. Foreign investors certainly stand a chance to profit from India's growing economy.

China
Another massive land area country researched was China. While China's economy seems to be slowing down due to experiencing growth much earlier than the other countries, it continues to see robust growth driven by investment. Like India, China's middle class is experiencing a rising income and is able to afford more goods that were once made purely for export, a big contributor to its market growth. Additionally, China's extensive manufacturing opportunities for foreign investors continue to be its most attractive quality (Stovsky et al., 2011).

At inland areas of China, a vast amount of low-cost property and labor still exist. With many natural resources, such as iron ore, these properties have become ideal sites for steel manufacturers and other heavy industries. China maintains a good infrastructure with continued improvements to it. The challenge foreign companies face entering China is recognizing and respecting the cultural differences not only between nations, but also throughout China itself (Stovsky et al., 2011). Practices vary greatly between neighboring local governments, and China has a complex legal system and tax policy. Like Russia and India, understanding and complying with government regulations is key to success. This can also be achieved in China through initial research of laws and more importantly creating a strong, trusting partnership with local businesses and government agencies. Investor's need to understand these relationships take time and a great deal of effort on their part (Stovsky et al., 2011).

Turkey
A key factor in Turkey's recent success is location. Considered a bridge between Europe and Asia, Turkey acts as an energy corridor between the two major continents ("Doing Business In," 2012). Turkey's skilled, cost-effective, and accessible workforce provides the country with the fourth largest labor force in the European Union (EU). Another key attraction of Turkey is the various tax and non-tax incentives the government offers to foreign investors. These include customs exemptions on various imported goods, free land and energy support, and R&D support to encourage exporting. With flexible exchange rates and assistance from the Turkish banks, the legal sector offers a level playing field and support for foreign investors unlike many other countries with complex legal systems ("Doing Business In," 2012). While Turkey's legal structure is stable, they are currently in the process of adopting the International Financial Reporting Standards (IFRS); currently accounting practices vary from company to company which can impede on business-to-business transactions.

Despite Turkey's excellent location, it contains little natural resources, and imports 90 percent of its oil, and 97 percent of its gas resources from Russia and the Middle East,

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causing high energy prices. There is also a split between the east and west in Turkey with the majority of skilled labor and stable infrastructure in the west. Turkey also suffers from corruption issues within its government. However, Turkey is a large producer of buses and has a strong presence in the car industry. Other profitable industries in Turkey include: textiles, clothing, tourism, and construction ("Doing Business In," 2012).

Turkey's economy is growing, and expected to continue. With less obstacles of entrance to overcome in Turkey, many foreign investors are looking to make their way in. Investors need to act quickly to experience the same growth. It is cautioned, however, that rising energy expenses may become issues to some industries, and due to a large account deficit, inflation, and currency instability may become long-term issues. A long-term strategy plan including the ability to weather these potential financial storms will prove valuable to any foreign investor.

Emerging Markets are attractive to businesses because of the economic growth they are experiencing. Businesses that enter these emerging markets have the same growing ability as these countries. This is ultimately reflected as a bottom line profit, increasing corporate revenues faster in growing economies compared to leveled-off economies. One of the largest challenges businesses will face when entering an EM is gaining growth quickly to offset the major expenses with expanding distribution. Businesses need to ensure the expenses and capital required to ensure these projects do not outpace the profits to be gained. To ensure any EM will provide an opportunity of growth, business must put together a focused strategy demonstrating strengths and likeliness for success. By studying trends of EM and compiling the data into a systematic analysis of aggregate market potential, businesses will be able to make strategic, smart decisions on where and what market to enter. Verifying the potential of a business entering a foreign market will be essential to the businesses success or determine that the risk is not worthwhile (Cavusgil, 1997).

3. Hypotheses/Objective
The researchers were tasked in this study to demonstrate how utilizing the Analytical Hierarchy Process can prioritize the attractiveness of an EM based on given importance levels of economic, political and social criteria.

4. Methodology
To determine the most valuable EM, authors utilized a multidimensional comparison approach, the Analytical Hierarchy Process. This process allowed the authors to solve this complex multidimensional problem, which was determining the best EM country in our study. This approach utilizes importance levels, or weights, for each measurement being compared and allowed the authors to both qualify and quantify their results. Users of the AHP formulate a problem and then break the problem down into hierarchy sub-problems, each of which can be evaluated individually. The authors were able to evaluate their criteria systematically by comparing them against one another with respect to the hierarchy level they are being evaluated on. This step allows qualitative data to be numerically compared and quantified. Lastly, numerical preferences are determined for each decision alternative. Synthesization in this study was used to determine priorities

based on a pairwise comparison through the software program Expert Choice.

Expert Choice Software. Expert Choice utilizes a "pairwise comparison" approach to elicit needs, essentially, creating a "trade off" between requirements of each author. This paired comparison approach is then utilized with customizable screening surveys to segment marketing groups, giving deep insight into market segments (Expert Choice, 2014). Priority levels of importance are multiplied by priority levels of measured units per each country and compared. A hierarchy model is generated to display the overall goal to select the best potential emerging market country. The next level down includes individual dimensions and alternatives of the four countries: China, Russia, India, and Turkey, follow.

Table 1
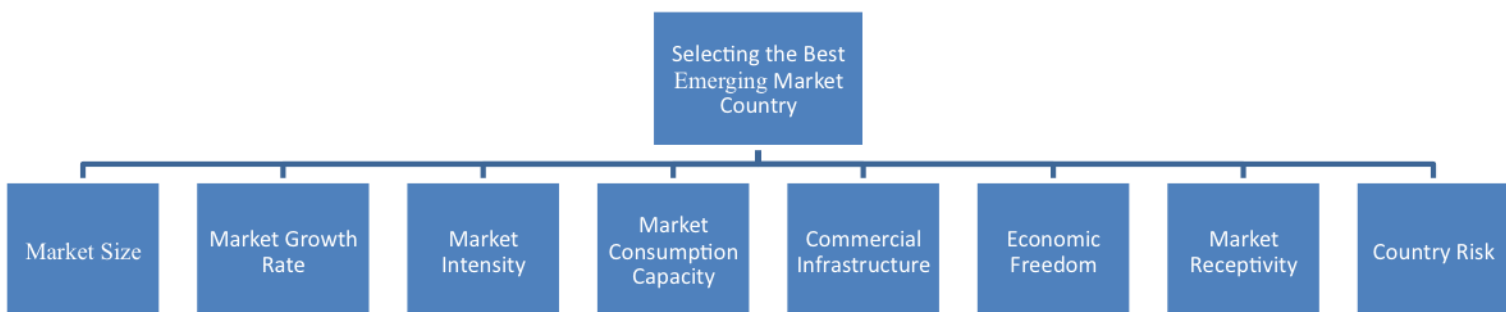
As shown, in the pairwise comparison between measurements, measurements are assigned a given weight according to the dimensions that lie within. The alternatives or countries are then compared to one another by assigning a preference to each, utilizing the data for each measurement collected. By synthesizing pairwise comparisons of each country's' measured units, the authors were able to quantifiably rank each country against the others. At this point, the software program Expert Choice calculated an overall ranking for each alternative in regards to the measurement examining while taking into account the weight of the criteria previously determined by the pairwise comparison. After all the preferences had been made, Expert Choice then compared all the data and determined the overall final ranking between the alternatives, which had taken into consideration all the measurements and the amount of weight each carried.

5. Dimensions Used to Determine Market Potential
Measurements used in each dimension to compile the priority levels for each country are briefly explained below.

Market Size
Market size carries a rough estimate of the market potential using the country's' urban

population and electricity consumption measured in billions of kilowatts in this study. Market size uses the urban population because reaching the entire population of a country will not be the goal of any one company (Cavusgil, 1997). High electricity consumption implies a country is improving social development and has faster economic growth. Growing electricity consumption is a positive identifier of enhanced standards of living and economic development (Leung & Meisen, 2005).

Market Growth Rate
Market growth rate observes the increase in average annual energy growth rate as a percentage between specific periods of time. For this study, the years between 2006 and 2011 were examined. Additionally, market growth rate observes Real GDP Growth Rate as a percentage. Increase in GDP accounts for all final sales in the market value of goods and services.

Market Intensity
Market Intensity utilizes two variables: GNI per capita using PPP in US Dollars and Private consumption as a percentage of GDP. The first variable, GNI per capita in PPP, is the Gross National Income divided by the mid-year population, converted into PPP. This is based on Purchasing Power Parity, which measures the purchasing power of other country's' currencies for the same goods. This allows for a more accurate comparison of standards of living (GNI Per Capita, 2014). Private consumption as a percentage of GDP observes the value of household and non-profit institution purchases divided by the total population. This is a variable to measure private purchases and negates business transactions (Cavusgil, 1997).

Market Consumption Capacity
Market Consumption Capacity observes one variable, Percentage share of middle-class in consumption/income. While not in poverty or rich, the middle class has a good amount of purchasing capacity, and makes up between 20 to 80 percent of the country's income (Cavusgil, 1997). Businesses looking to enter into a country's market need to consider purchasing power of the middle class and goods and services popular to them. Raising household income of the low to middle class in EM is the force driving much of the economic growth.

Commercial Infrastructure
Commercial Infrastructure looks at the most variables: main telephone lines per 100 habitants, cellular subscribers per 100 habitants, paved road density as a percentage, and internet users per 100 habitants. Commercial Infrastructure measurements define the overall accessibility of distribution and communication abilities of the country using the dimensions: telephone, cellular phones, paved roads, and internet connectivity. Because the costs associated with overcoming issues from infrastructure and connectivity can quickly become overwhelming to an expanding business, Commercial Infrastructure is an important dimension to pay attention to when looking at a potential EM to enter.

Economic Freedom
Economic Freedom uses the Economic Freedom Index developed by Johnson and Sheehy in 1995 for the Heritage Foundation and the Political Freedom Index. The Economic Freedom Index ranks countries based on the number of and intensity of government

regulations on wealth creating activities. It considers factors such as private property rights, minimum wage, international trade restrictions, and other metrics affecting what people keep from earnings that are controlled by governments ("Index of Economic," 2014). Political Rights Rating score is from the 2014 *Freedom in the World* global report. This score is derived from measures such as election process, functioning of government, freedom of expression and belief, and organizational rights. The *Freedom in the World* global report assesses real-world rights and civil liberties experienced by individuals not government reports. Countries are given a rating of Free, Partly Free, or Not Free and a numerical rating of 1 to 7 with 1 being very free with a range of civil liberties and 7 being few to no civil liberties ("Freedom In The," 2014).

Market Receptivity
Market Receptivity utilizes the variables of per capita imports from the US and Trade as a percentage of GDP. These two variables measure the openness of the country to trade with the United States of America (US) and other foreign countries as well. A country's imports alone are not a clear indicator of its receptivity to other markets. Therefore, it is important to measure its total trade as a percentage of GDP, as well as how open to trade they are with the US.

Country Risk
The Country Risk rating is a rate given to the country determined by the associated risk of investing in the foreign country. These ratings were found using Standard & Poor's Banking Industry Country Risk Assessment (BICRA) rating. These scores reflect the country's' economic strength and creditworthiness of its financial institutions. BICRA scores examine rated and unrated financial institutions and their relationship to the country's banking industry as a whole (Williams, 2011). Main elements include economic risk and industry risk and are scored on a scale of 1 to 10, 1 being the lowest risk banking and 10 being the highest-risk banking.

6. Research Results
Using Expert Choice, market potential between Turkey, Russia, India, and China was determined. Before results the results had been calculated, preferences of each dimension had to be determined to provide valid pairwise comparisons. The relative importance of each criterion was made and can be seen in Figure 1. In order to determine if the judgments for each criterion was correct, there had to be less than a 10% inconstancy. An inconstancy of 0.02 (2%) can also be seen in Figure 1. The sub-criteria are equally weighted under each criterion.

In Figure 2 the relative importance can be seen collectively for all of the criterion and sub-criteria. Notice that Market Size has a relative importance of 44.1%. This has a relative importance 3 times higher than the next highest criteria which is Market Intensity and Infrastructure (both equally weighted) at 13.4%. Given how highly weighted the Market Size is, this is a good indication that the countries with the largest Market Size will be the best emerging markets. Figure 3 shows the relative sizes of Market Size for the four countries with China at 39.7%, India at 37.4%, Turkey at 13.3%, and Russia at 9.6%. This means that for the overall market size between these countries, China consumes 39.7 of the total Market size.

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The comparison of each criterion, with respect to every country and the overall results are graphed and presented in Figure 4. This shows in a quick view the highs and lows for each country with respect to all of the criteria. The best emerging markets are ranked as follows: China with 29.7%, India with 27.0%, Turkey with 23.7%, and Russia with 19.5%. Since the Market Size had a very high weight compared to all of the other criteria, a sensitivity analysis was performed. The weight of Market Size was drastically cut by almost 50% to put it at the same weight as Market Receptivity and Infrastructure. Figure 5 shows the new overall graph with the reduced weight of Market Size. This sensitivity analysis now shows a new order for the best emerging markets. The order has changed to Turkey, China, Russia, and India. When looking at Figure 5, Turkey has a better rating in 5/8 criteria compared to China. This would be a good indication as to why Turkey would be considered a better emerging market give a smaller Market Size weight. Figure 6 illustrates data used in the analysis.

7. Conclusion

In 2001 Jim O'Neill referenced Brazil, Russia, India, and China as the potential powerhouses of world economy "BRIC." He has since identified Mexico, Indonesia, Nigeria, and Turkey as emerging giants also known as "MINT" (BBC News, 2014). BBC concludes that Turkey as well as other MINT countries may be "fresher" than Russia, India, and China and has good "inner demographics" which means there will be a rise in number of people eligible to work. As stated by BBC (2014), if Mexico, Indonesia, Nigeria and Turkey get their act together, some of them could match Chinese-style double-digit rates between 2003 and 2008.

While the authors only conducted analysis on four of these countries, analysis supports BBC's statements. As shown in Figure 4, the best emerging markets are China and India. Turkey and Russia were ranked lowest, but still have potential. As noted previously, outcome of Market Size truly did foreshadow the final results of the emerging market calculations. Market Size dimensions held a majority of the weight compared to all of the other dimensions leading the authors to believe that countries with significant higher ratings in this category are more likely to be a better EM compared to a country with a smaller Market Size. While China and India were noted to be the leading emerging markets in this analysis, Turkey was third. With some changes, Turkey could make head way against other EM's.

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Appendix
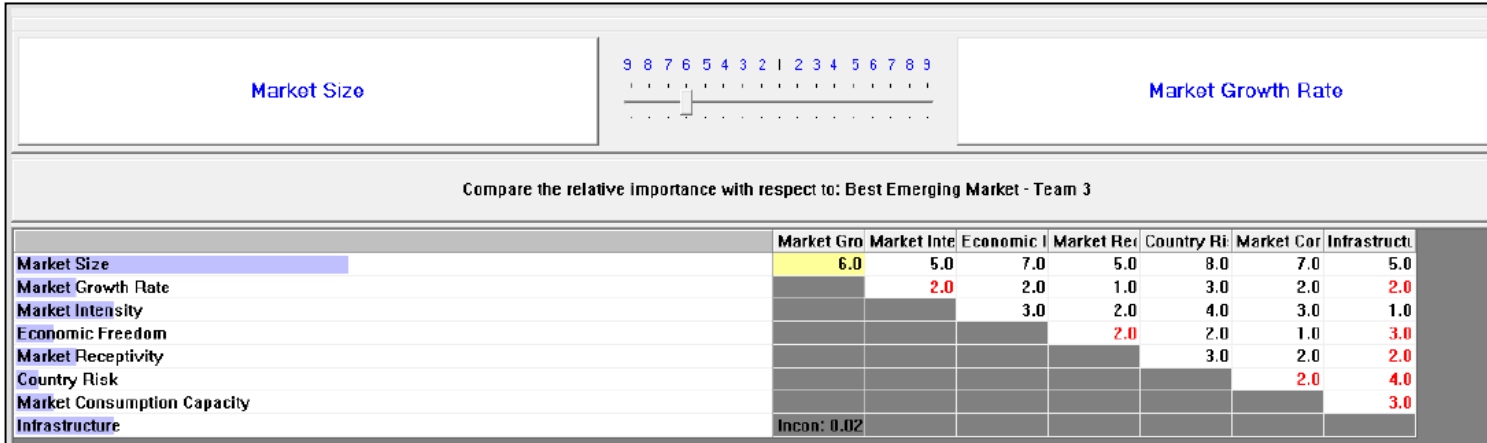
Figure 1

Relative Importance Analysis for Each Dimension

	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	
Market Size		Market Growth Rate

Compare the relative importance with respect to: Best Emerging Market - Team 3

	Market Gro	Market Inte	Economic I	Market Rec	Country Ri	Market Cor	Infrastructu
Market Size	6.0	5.0	7.0	5.0	8.0	7.0	5.0
Market Growth Rate		2.0	2.0	1.0	3.0	2.0	2.0
Market Intensity			3.0	2.0	4.0	3.0	1.0
Economic Freedom				2.0	2.0	1.0	3.0
Market Receptivity					3.0	2.0	2.0
Country Risk						2.0	4.0
Market Consumption Capacity							3.0
Infrastructure	Incon: 0.02						

Figure 2

Criterion Measurements with sub-criteria

Best Emerging Market - Team 3
- Market Size (L: .441)
  - Urban Population (L: .500)
  - Electricity Consumption (L: .500)
- Market Growth Rate (L: .080)
  - Average Annual Growth Rate of Primary Energy Use (%) (L: .500)
  - Real GDP Growth Rate (L: .500)
- Market Intensity (L: .134)
  - Private Consumption as % of GDP (L: .500)
  - GNI Per Capita using PPP (L: .500)
- Economic Freedom (L: .048)
  - Economic Freedom Index (L: .500)
  - Political Freedom Index (L: .500)
- Market Receptivity (L: .082)
  - Per capita imports from US ($) (L: .500)
  - Trade as % of GDP (L: .500)
- Country Risk (L: .031)
  - Country Risk Rating (L: 1.000)
- Market Consumption Capacity (L: .048)
  - % of Middle-Class (L: 1.000)
- Infrastructure (L: .134)
  - Main Telephone Lines (L: .250)
  - Paved roads (%) (L: .250)
  - Internet Users (L: .250)
  - Cell Phones (L: .250)

Figure 3

Pairwise Comparison for Market Size
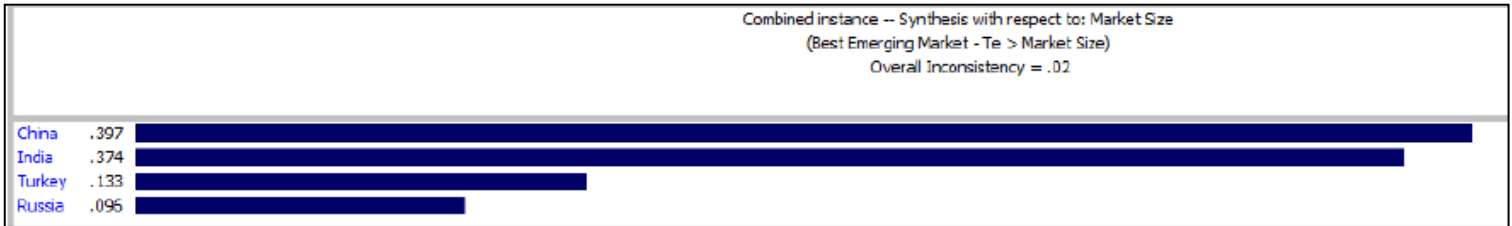
Figure 4

Emerging Markets Graph Performance for Every Dimension Including Overall Rating
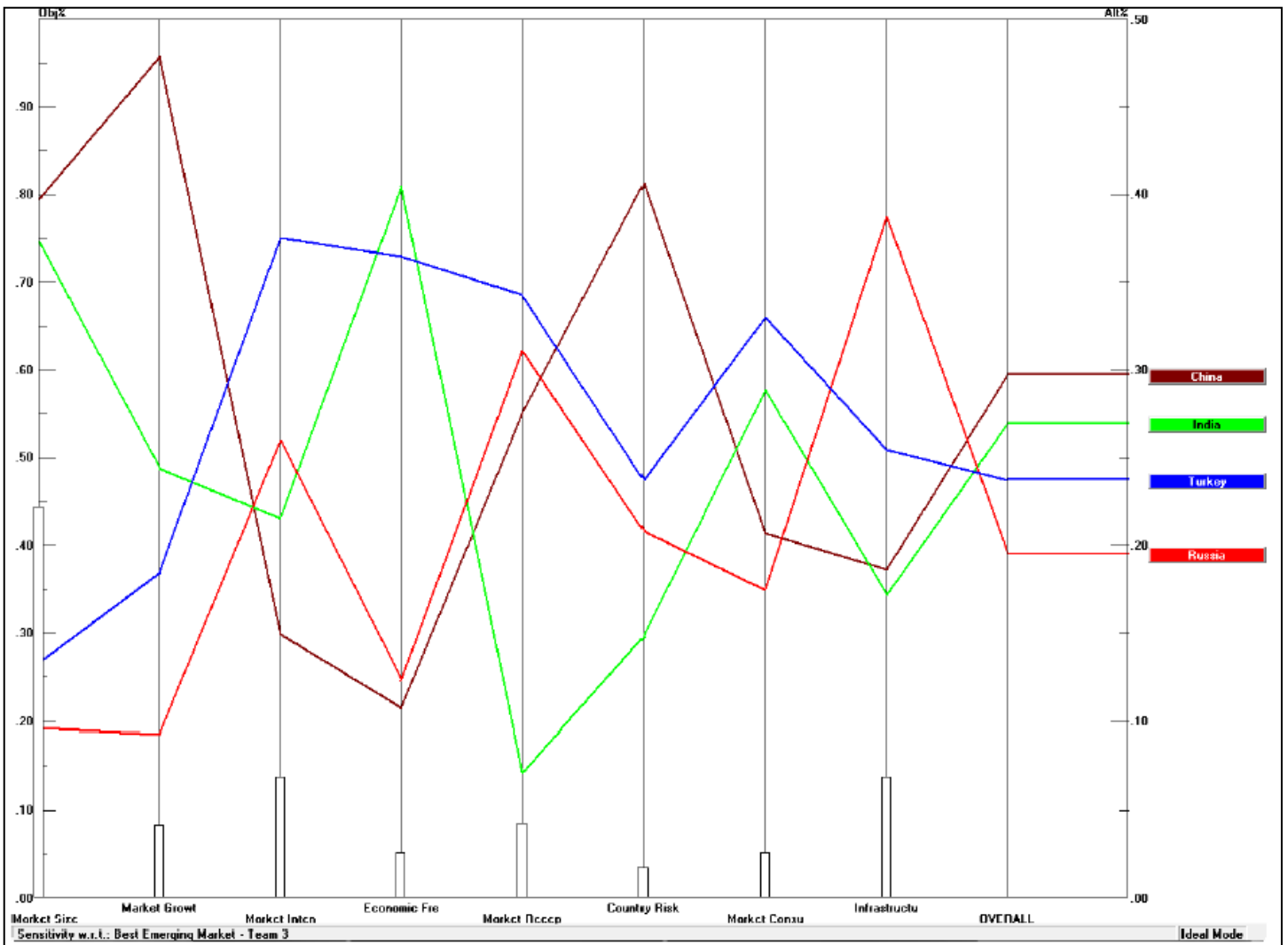

Process

Figure 5

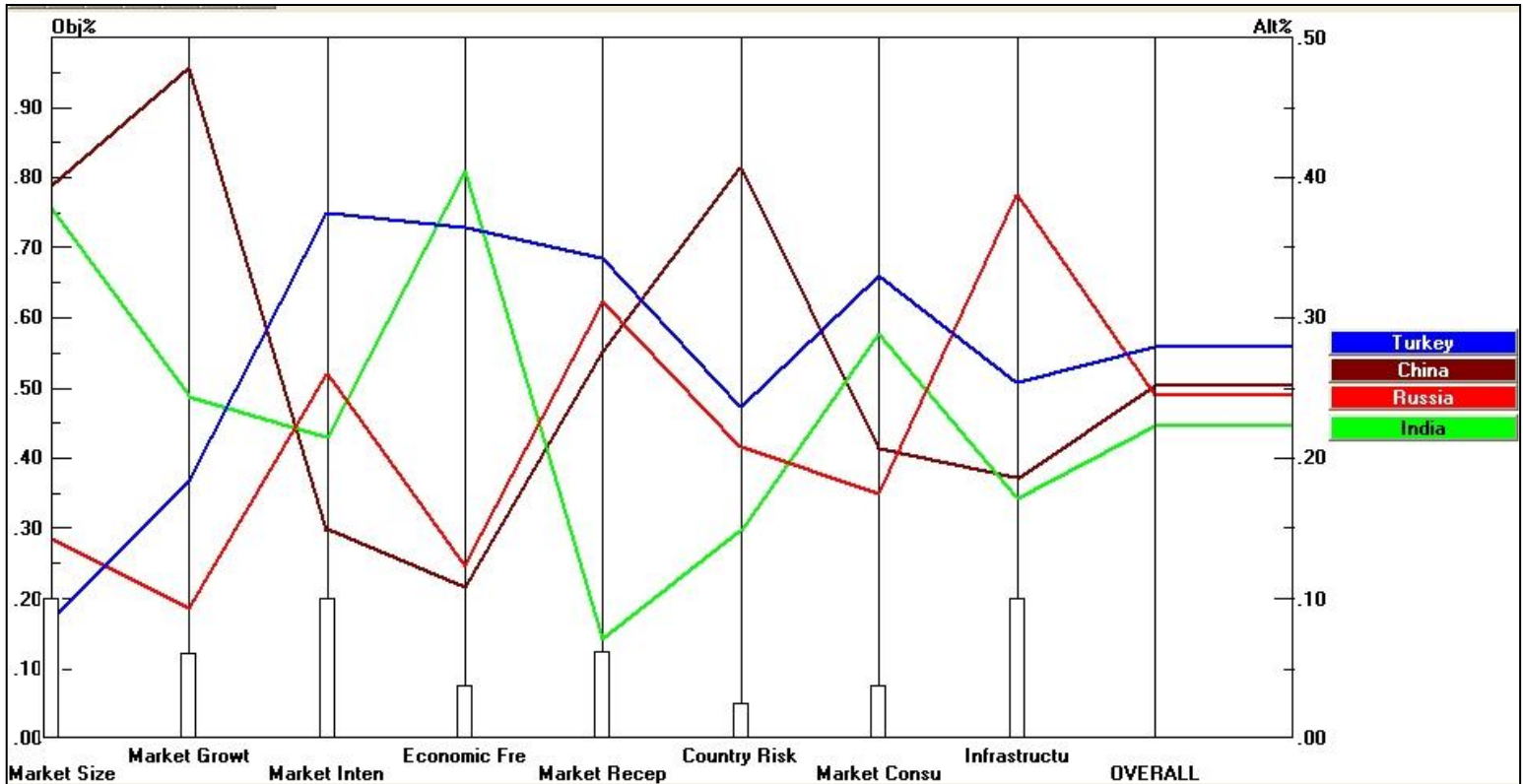Emerging Markets Graph Performance for Every Dimension Including Overall Rating with reduced Market Size weight

Figure 6

Information Utilized for Comparisons

	Russia	India	China	Turkey
Urban Population	106.2	351.2	731	53.2
Electricity Consumption	927	625.91	5320	197.9
(Overall 2006-2010% Change)	(14%)	(57%)	12.04% (44%)	(39%)
Real GDP growth rate	1.5	4.6	7.7	3.5
GNI per capita	15177 PPP	3840 PPP	9083.2M PPP	13737 PPP
Private consumption % GDP	48.1	71	35	70
Middle class size % / MC Income	72 (1)	25 (4)	25 (3)	59 (2)
Main Telephone Lines	30	2	21	19
Cell subscribers	166	69	81.26	91
Paved road density (%)	80	50	53	88
Internet users	53.3	12.6	42.3	45.1
Economic freedom Index	51.9	55.7	52.5	64.9
Political rights ratings	PR 6 (not free)	PR 1 (Free)	PR 7 (least free)	PR 3 (Partly free)
Per capita Imports from US	$1580.16	$204.01	$975.57	$2255.74
Trade as a % of GDP	51.6	42.5	2.82	50.39
Country risk rating (larger = less risk)	2 significant risk)	3 (acceptable risk)	4 (quite acceptable risk)	3 (acceptable risk)

COMPARING THE EMERGING MARKETS OF BRAZIL, INDIA AND CHINA: WHO'S THE BEST?

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ABSTRACT

The emerging markets of Brazil, India and China were compared utilizing the Analytic Hierarchy Process (AHP) to determine which country was the most favorable to expand into for business. This method enabled us to compare both qualitative and quantitative multiple criteria simultaneously. The robustness of the results were also tested using the sensitivity analysis. Through examination of economic criteria we find that even though India is currently experiencing a substantial growth in population, their emerging market ranking still remains behind both Brazil and China. Each of the three countries has areas where they stand above the other two countries showing why each of the three has strong emerging markets. But one country remained at the head of the pack regardless of the decision maker's setup, China. China is at the front of the pack when it comes to comparing emerging markets of the three by a substantial amount, over 20% greater than the next Brazil.

Keywords: AHP, Emerging Markets

1.   Introduction

We are studying emerging markets to determine which country has the best emerging market to expand a business or organization into. Emerging markets represent an enormous opportunity for entrepreneurs and investors. The

opportunity for a company to expand its market is crucial to the success of the organization in today's business world. China, Brazil and India are among the fastest growing countries in the world and making the right decision for a company is critical.

The first country, Brazil is known as the Federal Republic of Brazil and is the largest country in South America and the Latin American region. Brazil is the fifth largest country in the world both by area and by population. The economy is the world's seventh largest economy by the nominal GDP and also the seventh largest by purchasing power. It is said that Brazil has one of the world's fastest growing technologies.

The second country, India, is located in Southern Asia. It is the second most populous country in the world and is projected to overtake China as the world's most populated country by 2030. While there is great variation across India's social parameters such as income and education, the country does boast the tenth largest economy in the world. The fastest growing segment of India's economy is services.

The third country, China, is the world's most populous country with over 1.35 billion inhabitants. It is located in East Asia and is the world's Second largest country by land area. China is one of the world's few remaining socialist states openly endorsing communism. As of 2013, China has the second largest economy in terms of nominal GDP and Purchasing Power Parity. China remains a developing country and its market reforms are nowhere near completion.

In this paper we compare the emerging markets of the three countries in order to decide which the best emerging market country is. We used the AHP method which allows one to evaluate multiple criteria simultaneously and run a sensitivity analysis to see if the decisions that were made skewed the results in anyway. This is one of the most flexible methods to use and allow for different rankings of these criteria by different organizations based on their business plan.

2.   Literature Review

While examining the impact of the emerging markets of India and China it is important to note that while their population growth had been a large factor in their economic growth, there are still researches out there that wonder if they two counties have reached their potential growth. Both countries continue to have an impact on the global economy however one must take into consideration additional factors when measuring their ability to maintain their emerging market status (Kalirajan, 2012). Using the AHP method allows all these other factors to

play a role in the status of their emerging markets based on factors other than market size.

Emerging markets offer long-term growth opportunities that the over developed countries, such as China, do not have (Sakarya, 2007). These markets demonstrate massive expansion capabilities and market potentials. Using the AHP method, it allows one to narrow down the list of these massive number or emerging markets into which is the appropriate to get into and also help with what the strategy may be (Cavusgil, 1997).

3.   Hypotheses/Objectives

The purpose of this report is to compare three (3) Emerging Market countries to determine which country is the best. Emerging markets are defined as countries whose development and growth represent ideal conditions for Western companies to expand into to do business.

4.   Research Design/Methodology

Our purpose is to evaluate three emerging market countries utilizing the Analytic Hierarchy Process (AHP). The analytic hierarchy process was developed by Thomas L. Saaty and provides a solution to solve multiple criteria decision problems (Anderson, Sweeney, 2006). The best emerging market can be found by analyzing and prioritizing certain criteria.

1. The very first step of AHP involves defining the criteria that are deemed necessary solve the problem.

2. Using the Market Potential Index, the main criteria used includes; market size, market growth rate, market intensity, market consumption capacity, commercial infrastructure, economic freedom, market receptivity and country risk ("Market Potential Index (MPI) for Emerging Markets", 2013*).*

3. In order to precisely give a preferred country in each of these criteria each main criterion is broken down into multiple sub criteria.

4. The next step in the AHP process is to develop a hierarchy of each main criterion to the overall goal. The decision maker starts by making a pairwise comparison of each criterion. The decision maker achieves this step by using the analyzing software, Expert Choice, scale from 1-9 with 1 being equally preferred criteria, and 9 being one criteria is extremely preferred over the other.

5. From there the Expert Choice software gathers all the values entered for each pairwise comparison in normalized pairwise comparison matrix. Expert Choice then averages the elements of each row to determine the priority of each criterion.

Figure 1 shows the resulting normalized pairwise comparison based on the information entered during the AHP process.

Priorities with respect to:
Goal: Best Country (Brazil)

Market Size	.376
Commercial Infrastructure	.125
Market Intensity	.118
Market Receptivity	.102
Market Growth Rate	.089
Economic Freedom	.070
Market Consumption Capacity	.061
County Risk	.059

Inconsistency = 0.02
 with 0 missing judgments.

Figure 1. Normalized Pairwise Comparison

5. Data/Model Analysis

Data was then collected in each sub criterion and was organized so that it may be evaluated and prioritized to ease the decision making process using the Expert Choice software. The information is listed in Table 1 below for each country ("Data | The World Bank", 2014). From this collected data, the next step is that Expert Choice constructs normalized pairwise comparison matrixes based on the information the decision maker interpreted as to what the importance of each criteria were in regards to the others.

The decision maker then goes through each sub criteria and gives a numerical rating for the pairwise comparison of each country in that sub criteria in comparison to the other countries. Each country is then compared to each other in each of the sub criteria and the decision maker uses the data collected to input the data corresponding to which country has the highest numbers and by how much. Once all data has been input, the Expert Choice software gives the results as to what country is the best and the individual results in each sub criteria.

6. Limitations

This process depends on the decision makers priority rankings but regardless of the priorities, the end results may be the same which is one of the many benefits AHP. A major limitation is mostly we only used quantitative criteria or

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Process

quantitative indicator of the qualitative criteria. Where AHP allows you to evaluate both quantitative and qualitative criteria if you have experts to make pairwise comparisons.

7.   Conclusions

After all information was gathered and entered into Expert Choice, our team concluded that China is the best country out of the countries that we compared it with coming in at 48%. Second to China was Brazil with 27% and last was India at 25% as one can see from Figure 2 below. However, China wasn't the best in each category of comparison. In fact, each of the three countries was ranked higher than the other two in different categories.
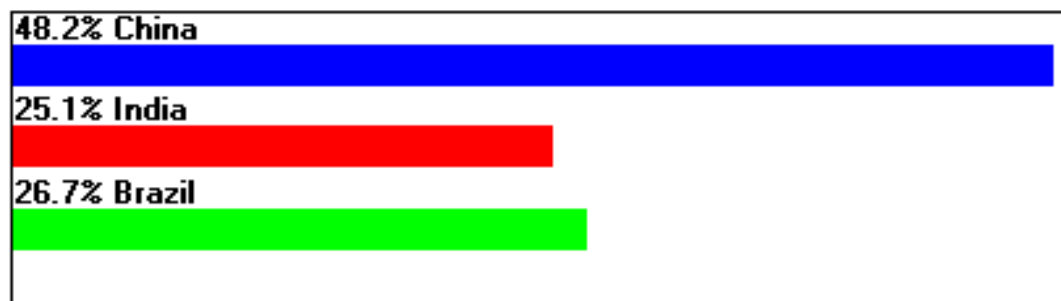

Figure 2. Dynamic Results

Figure 3 below shows the sensitivity analysis for the three countries and the weight each category held. We found that if the weight of the Market size was reduced slightly, less than 5%, India surpassed Brazil as the second best emerging market. Changing any of the other categories had no significant change in the outcome.
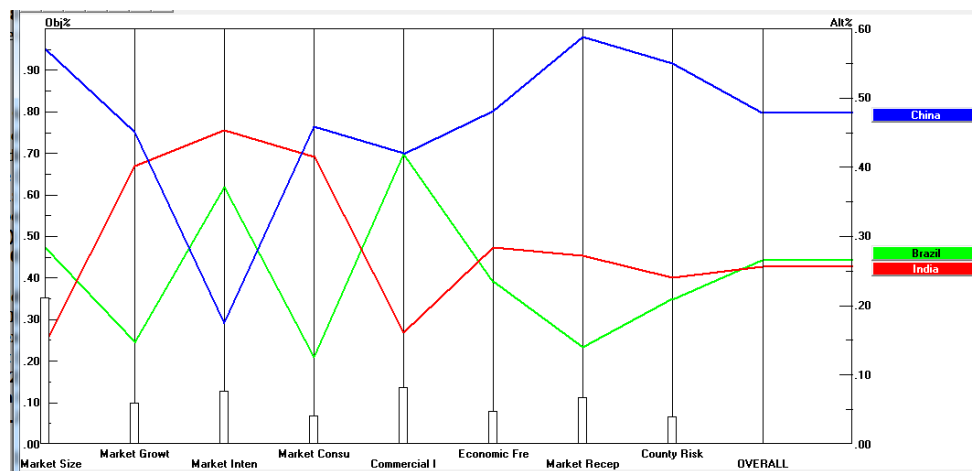

Figure 3. Sensitivity Analysis

8.   Key References

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