MICRO-FACTORS INFLUENCING SITE SELECTION FOR SMALL AND MEDIUM ENTERPRISES (SMES) IN SAUDI ARABIA: AL-HASSA AREA USING ANALYTICAL HIERARCHY PROCESS (AHP) ANALYSIS

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Abstract

Site selection is a complex task for decision makers. However, this task becomes more complicated with small and medium enterprises. Location selection decision involves selected octal-factors which influence the decision. This paper proposed micro-factors that influence site selection decision with a quantitative tool (AHP analysis) to rank which factor is most significant and vice versa. Outcome of this paper considerably matches perspectives of experts and owners of small businesses in Al- Hassa area who gave an accurate estimation of factors prioritization due to their experience in the region as well as the businesses.

Keywords: Site selection, Analytical Hierarchy Process (AHP) analysis, Al-Hassa, Small and Medium Enterprises **(**SMEs)

Introduction

Site selection is one of the ten operation management decisions which can be considered as important as the other decisions in strategic management. This paper aims at highlighting an optimal method to rank factors affecting site decision for small and medium businesses. Location can play a major role and a key success factor which should be in a high priority of the business start ups. Several factors influence a decision of site selection, such as goals, industry, strategy, environment, size of business. In market penetration strategy, site can be totally different from product generation strategy. Also, small businesses select their affordable sites based on their budget unlike big companies sometimes rent a site for the sake of competition existence rather than for profit generating.

Arentze, Aloys and Harry (1996) define a more efficient site-selection procedure by a larger set of sites that can be considered and a smaller probability of removing suitable sites from the choice set. Due to this mechanism, improving the efficiency of the selection strategy may lead to better outcomes and profitability.

This research is carried out with AHP techniques to test micro-factors that affecting site selection for SMEs in Al-Hassa for opening new site for service sector. These micro-factors below are listed randomly and they include:

1. Parking: Parking lot for customers in front of the site.

2. Residents' income: the income of the people who live in the same area of the business site.

3. Street width: How wide the street matters in Saudi Arabia in which the street width determines the rank of commerciality it is.

4. Rent cost: The regular fixed cost which is paid for using the physical facility.

5. Shop area: How many square meters is the shop or the site.

6. Floors: Is the site in the ground or upper floors?

7. Infrastructure: Telecommunication, water, internet, electricity, sidewalk and the rout to the shop.

8. Population size: what population size whom are served by this business site.

As per European Commission (EC),"Small and medium-sized enterprises (SMEs) represent 90% of all businesses in the EU.Small and medium-sized enterprises (SMEs) are defined in European Commission the main factors determining whether a company is an SME are:

1.Number of employees and

2.Ether turnover or balance sheet total

Company category	**Employees**	**Turnover**	or	**Balance sheet total**
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

Table 2: Campany Catagory

Small businesses are defined and categorized by Ministry of Labor as those businesses operated by 9 workers or fewer (Nitaqat Guide 2010). However, CDSI defines small businesses as those which are operated by 5 or fewer employees (CDSI 2010). Because the Ministry of Labor is directly involved in employment and it announces influential laws to small businesses, the definition by the Ministry of Labor is applied in this study (Albaqshi and Alhajhoj 2015).

Literature review

Arentae, Borgers, and Timmermans (1996) described an algorithm for spatial search, which is used in an expert system for site selection. The algorithm, named Prof Mat, is able to find the best site in the area of interest even when the number of possible sites is large and many decision criteria are involved. The Prof Mat procedure is illustrated by analyzing the problem of retail site selection. A comparison with alternative search procedures shows that Prof Mat considerably reduces the evaluation costs needed to find the best site.The efficiency of the procedure allows considering large sets of optional sites, so that it may improve the quality of the outcome.

Regarding large corporation, Rongen (1997) conducted a conceptual framework that explains two types of location selection which are: minimizing cost based location and multi-criteria location selection. In a developing a new distribution structure, Rongen focuses on supply chain and summarizes seven steps to select a location in a minimized cost strategy. Large companies usually plan their strategies to reduce costs unlike small businesses that care about differentiation and depend on flow of sales.

Ertuğrul and Karakaşoğlu (2007) used a fuzzy multi-criteria decision-making methods are proposed. The aim of this study is to use fuzzy analytic hierarchy process (AHP) and the fuzzy technique for order preference by similarity to ideal solution (TOPSIS) methods for the selection of facility location. The proposed methods have been applied to a facility location selection problem of a textile company in Turkey.

Tabari, Kaboli, Aryanezhad, Shahanaghi, and Siadat (2008) present a new method for location selection which they called a hybrid analysis. This hybrid method of multi criteria decision making (MCDM) that make it possible to select the optimal location that satisfies the decision maker.

Chou, Chang and Shen (2008) present a new fuzzy attributes decision-making (FMADM) approach in which fuzzy simple additive weighting system (FSAWS), for solving facility location selection problems by using objective/subjective attributes under group decision-making (GDM) conditions. The proposed system integrates fuzzy set theory (FST), the factor rating system (FRS) and simple additive weighting (SAW) to evaluate facility locations alternatives. It depends on subjective decision-making with intuitive perspectives while quantitative and rating approach is applied.

Heizer and Render (2011) address country, region and cite decisions in a chapter that contains the influential factors of each, methods of evaluating location alternatives and geographic information systems. They highlight three methods which are: the factor-rating method, center of gravity, locational break-even analysis and transportation model. Methods discussed rely on pure quantitative techniques rather than intuitive and qualitative approaches.

According to BizReport 2010 reported by Foster Jones (2013), "There is up to 85 percent of a store's customers come from a five-mile radius" (p .25). This is in the United States. However, when it is applied to Saudi Arabia, social circumstances are close in which population intensity is considered an important factor to be considered in cite location for service or retailing services.

Background about Al-Hassa

Al-Hassa is an oasis rich with green spaces and water springs. It is a land of welfare, beauty, and good people. Also, it is the biggest governorate in the Eastern Province and a place of multiple historical civilizations and archeological sites. Al Hassa is an oasis of dates and water springs, and it is the greenest place in the whole of eastern province in the Kingdom. It has more than a million and a half palm trees which is the largest palm oasis in the world, placing it in the edge for the Seven Wonders in the World contest strongly. (sauditourism website)

According to statistics issued by central department of statistics and information (CDSI) in 2010, the population of Al-Hassa is approximately 1,220,655 people which (983,305 citizen) and (237,350resident). The total area of Al-Hassa is 530,000 Km^2 which 68% of total area of eastern region and 24% of total area of Saudi Arabia. The geography location of Al-Hassa is very important since it is boundaries with UAE, Qatar and Oman.

Methodology

The methodology implemented in this study is using a quantitative method using AHP analysis to rank the factors of site selection. Rating the tables of AHP analysis came as results of survey filled out by 24 experts and owners of small businesses in Al- Hassa area who gave an accurate estimation of factors prioritization due to their experience in the region as well as the businesses.

The Analytical Hierarchy Process – AHP

"AHP is one of most popular decision analysis the multiple criteria for problem solving and decision-making method and process that was originally developed by Thomas L. Saaty (1977). AHP provides measures of judgment consistency, derives priorities among criteria and alternatives, and simplifies preference ratings among decision criteria using pair wise comparisons. The basic procedure is as follows:

1. Develop the ratings for each decision alternative for each criterion by:

• developing a pair wise comparison matrix for each criterion
• normalizing the resulting matrix

• averaging the values in each row to get the corresponding rating
• calculating and checking the consistency ratio

2. Develop the weights for the criteria by:

• developing a pair wise comparison matrix for each criterion
• normalizing the resulting matrix
• averaging the values in each row to get the corresponding rating
• calculating and checking the consistency ratio

3. Calculate the weighted average rating for each decision alternative. Choose the one with the highest score. "

AHP Analysis Steps:

• The first step in the AHP procedure is to make pair wise comparisons between each criterion.

Scale	Degree of preference
1	Equal importance
3	Moderate importance of one factor over another
5	Strong or essential importance
7	Very strong importance
9	Extreme importance
2,4,6,8	Values for inverse comparison

Table 2. The example scale for comparison (Saaty& Vargas, 1991)

Results of the comparison (for each factors pair) were described in term of integer values from 1 (equal value) to 9 (extreme different) where higher number means the chosen factor is considered more important in greater degree than other factor being compared with."

Table 3. The example scale for importance (Saaty& Vargas, 1991)

Factor	Factor weighting score			Factor
	More importance than	Equal	Less importance than	
F1	9 8 7 6 5 4 3 2	1	2 3 4 5 6 7 8 9	**F2**
F2	9 8 7 6 5 4 3 2	1	2 3 4 5 6 7 8 9	**F3**
F3	9 8 7 6 5 4 3 2	1	2 3 4 5 6 7 8 9	**F4**
F4	9 8 7 6 5 4 3 2	1	2 3 4 5 6 7 8 9	**F5**
F5	9 8 7 6 5 4 3 2	1	2 3 4 5 6 7 8 9	**F6**
F6	9 8 7 6 5 4 3 2	1	2 3 4 5 6 7 8 9	**F7**
F7	9 8 7 6 5 4 3 2	1	2 3 4 5 6 7 8 9	**F8**
F8	**.....**			

where :

1. Parking (F1)
2. Residents' income (F2)
3. Street width (F3)
4. Rent cost (F4)
5. Shop area size (F5)
6. Floors (F6)
7. Infrastructure (F7)
8. Population size (F8)

Results and Discussion

Step 1: Pair wise comparison

The first step in the AHP procedure is to make pair wise comparisons between each criterion.

Table 4. Pair wise comparison matrix which holds the preference values

#	A	B	C	D	E	F	G	H	I
1	Factor	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**
2	**F1**	1	6	3	7	8	0.2	0.17	0.5
3	**F2**	0.17	1	0.5	2	5	0.125	0.14	0.17
4	**F3**	0.33	2	1	5	6	0.25	0.2	0.17
5	**F4**	0.14	0.5	0.2	1	2	0.125	0.14	0.17
6	**F5**	0.125	0.2	0.17	0.5	1	0.11	0.125	0.14
7	**F6**	5	8	4	8	9	1	2	3
8	**F7**	6	7	5	7	8	0. 5	1	2
9	**F8**	2	5	5	5	7	0.33	0.5	1
Total		14.765	29.7	18.87	35.5	46	2.64	4.275	7.15

Step 2: Normalization

This step is to normalize the matrix by totaling the numbers in each column.

Each entry in the column is then divided by the column sum to yield its normalized score. The sum of each column is 1.

#	A	B	C	D	E	F	G	H	I	Total	Average
1	Factor	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**		
2	**F1**	0.07	0.2	016	0.2	0.17	0.08	0.04	0.07	0.99	0.12
3	**F2**	0.01	0.03	0.03	0.06	0.11	0.05	0.03	0.02	0.34	0.04
4	**F3**	0.02	0.07	0.05	0.14	0.13	0.09	0.05	0.02	0.57	0.07
5	**F4**	0.01	0.02	0.01	0.03	0.04	0.05	0.03	0.02	0.21	0.03
6	**F5**	0.01	0.01	0.01	0.01	0.02	0.04	0.03	0.02	0.15	0.02
7	**F6**	0.34	0.27	0.21	0.23	0.2	0.38	0.47	0.02	2.52	0.28
8	**F7**	0.41	0.24	0.26	0.2	0.17	0.01	0.23	0.28	1.8	0.22
9	**F8**	0.14	0.17	0.26	0.14	0.15	0.125	0.12	0.14	1.245	0.16

Table 5. Normalization

Step 3: Consistency analysis

Now, calculate the consistency ratio and check its value.

The purpose for doing this is to make sure that the original preference ratings were consistent.

* There are 3 steps to arrive at the consistency ratio:

1.Calculate the consistency measure.

2.Calculate the consistency index (CI).

3.Calculate the consistency ratio (CI/RI where RI is a random index).

CI =(λ *max – n)/ (* n- 1)
CR = CI / RI

To calculate the consistency measure, we can take advantage of Excel's
Matrix multiplication function =MMULT ().
Approximation of the Consistency Index(CI)
1. Multiply each column of the pair wise comparison matrix by the corresponding weight.
2. Divide of sum of the row entries by the corresponding weight.
3. Compute the average of the values from step 2, denote it by λ *max* .
4. The approximate CI =(λ *max – n)/ (* n- 1)
Consistency Index (CI)
Reflects the consistency of one's judgment CI =(λ *max – n)/ (* n- 1)
Random Index (RI)

n	1	2	3	4	5	6	7	8
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41
n	9	10	11	12	13	14	15	
RI	1.46	1.49	1.52	1.54	1.56	1.58	1.59	

Table 6. The CI of a randomly-generated pair wise comparison matrix

Consistency Ratio (CR)
CR = CI / RI

#	A	B	C	D	E	F	G	H	I	Total	Avg	Consistency
1	Factor	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**		.	Measure
2	**F1**	0.07	0.2	0.16	0.2	0.17	0.08	0.04	0.07	0.99	0.12	0.66
3	**F2**	0.01	0.03	0.03	0.06	0.11	0.05	0.03	0.02	0.34	0.04	0.81
4	**F3**	0.02	0.07	0.05	0.14	0.13	0.09	0.05	0.02	0.57	0.07	0.78
5	**F4**	0.01	0.02	0.01	0.03	0.04	0.05	0.03	0.02	0.21	0.03	0.94
6	**F5**	0.01	0.01	0.01	0.01	0.02	0.04	0.03	0.02	0.15	0.02	1.2
7	**F6**	0.34	0.27	0.21	0.23	0.2	0.38	0.47	0.02	2.52	0.28	1.04
8	**F7**	0.41	0.24	0.26	0.2	0.17	0.01	0.23	0.28	1.8	0.22	0.84
9	**F8**	0.14	0.17	0.26	0.14	0.15	0.125	0.12	0.14	1.245	0.16	0.83
Total		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	CI =		-1.13
										RI=		1.41
										CR =		-0.8

Table 7. Consistency ratio

After implementing AHP analysis technique and results from tables above, researchers found that priorities are as this order:

Average	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**
	0.12	0.04	0.07	0.03	0.02	0.28	0.22	0.16

Table 8. Consistency ratio

1. **Floor (F6)** is the first most influential factor among selected in site selection.
2. **Infrastructure (F7)** is the first most influential factor among selected in site selection.
3. **Population size (F8)** is the first most influential factor among selected in site selection.
4. **Parking (F1)** is the first most influential factor among selected in site selection.
5. **Street width (F3)** is the first most influential factor among selected in site selection.
6. **Residents' income (F2)** is the first most influential factor among selected in site selection.
7. **Site rent cost (F4)** is the first most influential factor among selected in site selection.
8. **Shop area size (F5)** is the first most influential factor among selected in site selection.

Inpractice, a CR of 0.1 or below is considered acceptable.

• Any higher value at any level indicates that the judgments warrant re-examination.

So,

CR = -0.8 is acceptable since it is below 0.1

Conclusion

The AHP enables the decision maker to structure a complex problem in the form of a simple hierarchy and to evaluate a large number of quantitative and qualitative factors in a systematic manner with the conflicting multiple criteria (M.A. Badri, 1999). However, experience is vital to make right judgment among alternatives. Results are fit with conducted survey of experts and owners of small businesses in Al- Hassa area who can give an accurate estimation of factors prioritization due to their experience in the region as well as the businesses. The first four central factors must be considered by business owners. The floor is very important for customer in order to build customer visit frequency, such as easy access to the shop. Existence of infrastructure comes next in the ranking as it is very important to stakeholders and customers too. Then, population size of whom are served by this business site which is essential for decision makers. Frequent visits of customers make parking lot in the top four features of site selection. The other four factors which can be also partially important can contribute to the business success. Width of the street matters in Saudi Arabia in which the street width determines the rank and the extent of its commerciality. Stakeholders should know the income of the people who live in the same area of the business site to serve them with their category. Rent

cost is one of the fixed cost to be calculated for finance purposes and profitability. Finally, the shop area size comes on tail of ranking because it depends on the type of service the site provides.

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