ABSTRACT

The objective of this research is to prioritize important spectator needs in relation to soccer stadiums in Oman, a country in the gulf cooperation council. The prioritization of needs is often conducted using multiattribute weight assessment methods. The entropy method is selected and implemented in order to determine the relative importance of spectator needs. The house of quality approach is then employed to determine the relative importance of stadium technical attributes. This research fills the gap in the research of infrastructural facilities in the game of soccer from a spectator’s perspective.

KEYWORDS: Entropy, HOQ, Soccer stadium, Multiattribute, and Weights

INTRODUCTION

Soccer is one of the most popular games in the world in terms of the number of people who play and watch the game. The sport of soccer has attracted substantial investments from entrepreneurs, sponsors and governments and the revenues have grown manifold subsequent to the growth of league soccer. Although, the majority of the population watches soccer on television and internet, at home or a café, a number of people might actually prefer to go to the stadium and watch the real game. The design of stadiums greatly influences the quality of in-stadium experience and can attract more loyal spectators at soccer tournaments at the stadium.

The soccer or football stadium is an important infrastructural element of soccer both for the spectators and the players who participate in the game. The requirements of players can be quite technical in nature and are not discussed in this paper. The paper deals with needs to be satisfied by a stadium from the spectator’s perspective. The study presented is an attempt to understand the customer preferences with respect to soccer stadiums in Oman. For the purpose of this study, we apply the house of quality (HOQ) (Hauser & Clausing, 1996) and entropy method (Hwang & Yoon, 1981) to determine the relative importance of spectator needs and integrate the same into an HOQ to compute the relative importance scores of stadium attributes. The latter can be used for the purpose of evaluating football stadiums in Oman. This may a one-of-its-kind study focusing on the needs of the spectator and their preference structure and the relationship between these needs and the stadium attributes. The study can provide important inputs to design and development of stadiums which are instrumental in enhanced participation and facilitating better revenues on and off the field.

Overview of Oman

The sultanate of Oman is located in the southeastern region of Arabian Peninsula, adjacent to Saudi Arabia, Republic of Yemen, and the United Arab Emirates. The country had a
population of 2.77 million according to the latest 2008 census (Omani Ministry of National Economy, 2010). The country is divided in three governorates and five regions and the capital city is Muscat. Subsequent to 2000, the improvement in oil prices resulted in a tremendous improvement in economic growth. Currently, the country’s GDP stands at 27.95 billion Rials (US $72.6 billions) (Reuters, 2012) and Oman maintains a significant trade surplus owing to its oil and gas exports.

The national football team of Oman started competing in global competitions in the late seventies and the official football association was formed in 2005, in order to manage the national Omani team and the football league. As a result of the increased popularity of both sports and football, Sultan Qaboos Sports Complex was built in the District of Bousher around 1996. It is the largest stadium in Oman and the home of the Oman national team. The stadium can host over 34,000 spectators after the renovations done on it in 2009. Several smaller stadiums were later built in several districts of the country. Moreover none of these stadiums, except the Seeb stadium, are built solely for the purpose of hosting football games; these host other non-soccer sporting events. The Seeb stadium is also the head quarter of Oman football Association.

LITERATURE REVIEW

The research conducted on different aspects of soccer has been prolific over the years. For example, one can find a number of research works on the efficiency of soccer teams in league soccer (Haas, 2003, Haas et al., 2004, Mavi et al, 2012). At the same time, there has been considerable work on the performance of individual players in soccer (Rampinini et al, 2009, Tiedeman et al, 2011). Despite the sizeable investments in physical infrastructure in sports, the research on sports infrastructure in sports in general, and soccer in particular, has been scarce. Previous studies elaborated on the management side of stadiums as a facility used by the public and how managers should deal with the safety issues and risk management (Bowley et al, 2004, Ngai et al, 2009, Liu et al, 2010).

Multiattribute weight assessment and the entropy Method

Since the entropy method is used for determining the relative importance of customer needs, the literature related to multiattribute assessment is reviewed in this section. The weight assessment methods suggested in the literature include the based eigenvector method, the weighted least squares method, the entropy method, and a linear programming technique for multidimensional analysis of preferences (see Shannon and Weaver 1949, Srinivasan and Shocker 1973, Chu et al, 1979, Saaty 1980, Hwang and Yoon 1981, and Sen and Yang 1998). The eigenvector and weighted least squares methods are rather subjective approaches, because the decision-maker performs pairwise comparisons of CNs and assigns a preference ratio to each pair based on his/her subjective judgment associated with the relative importance of one CN to another. In the case of n CNs, the ratios are arranged in a symmetrical pairwise comparison matrix of size nxn and weights are determined by scaling preference ratios using the principal eigenvector of the matrix. However, eigenvector method requires an excessive number of pairwise judgments even for a small number of CNs. This might affect the quality of pairwise comparisons, resulting in inconsistent customers’ judgments. The entropy method (Hwang and Yoon, 1981) requires a group of customers to evaluate n CNs of m competitor products. The individual evaluations can be aggregated using a weighted average and presented in a customer decision matrix of size mxn. The procedure for determining weights from the decision matrix is presented in section 3. When customer evaluations are expressed on a linguistic scale, fuzzy concepts (Zadeh, 1975) can be integrated into the entropy method for converting linguistic qualifiers into crisp scores (Kao, et al, 1994, Sopadang, et al, 2003). Govindaluri and Cho (2007) incorporate a periodic markov chain into fuzzy entropy method.
THEORETICAL DEVELOPMENT/MODEL

A questionnaire survey was administered to 100 people for collecting primary data regarding important spectator or customer needs with respect to soccer stadiums. A total of 65 responses were received from university students, staff, and spectators at soccer stadiums. Once the needs were determined, the entropy method was selected to determine the relative importance of spectator needs, CN₁, CN₂, ..., CNᵢ, ..., CNᵥ of η selected stadiums. The decision matrix of customer ratings of customer needs for different alternatives Aᵦ are structured as shown below.

\[
\begin{bmatrix}
CN₁ & CN₂ & \cdots & CNᵥ \\
A₁ & r(CN₁, A₁) & r(CN₂, A₁) & \cdots & r(CNᵥ, A₁) \\
A₂ & r(CN₁, A₂) & r(CN₂, A₂) & \cdots & r(CNᵥ, A₂) \\
\vdots & \vdots & \ddots & \vdots & \vdots \\
Aᵦ & r(CN₁, Aᵦ) & r(CN₂, Aᵦ) & \cdots & r(CNᵥ, Aᵦ)
\end{bmatrix}
\]

(1)

In order to get the weights of the needs we will be using the following formulas:

\[
O(CNᵢ, Aⱼ) = \frac{r(CNᵢ, Aⱼ)}{\sum_{f=1}^{v} r(Nᵢ, Aⱼ)}, \text{ for } i = 1, 2, \ldots, v.
\]

(2)

A measure of the relative importance of the CNs is then computed as

\[
Eᵢ = -c \sum_{j=1}^{n} O(CNᵢ, Aⱼ) \ln(O(CNᵢ, Aⱼ)),
\]

(3)

The weights \(w_cᵢ\) for the CNs in terms of the degree of diversification are then calculated as

\[
w_cᵢ = \frac{dᵢ}{\sum_{i=1}^{v} dᵢ},
\]

(4)

The relative importance weights of spectator needs CNs can be converted into the relative importance of stadium attribute (SA) by establishing the relationship coefficients \(aᵢⱼ\) between the \(k^{th}\) spectator need and the \(k^{th}\) SA. The \(aᵢⱼ\) may be measured on a 1-3-9 scale to represent a weak, medium, and strong relationship, respectively. The relative importance weight of the \(k^{th}\) SA, \(wₛ_k\), where \(k = 1, 2, \ldots, m\), can then be calculated as follows (Wasserman, 1993):

\[
wₛ_k = \frac{\sum_{i=1}^{v} w_cᵢaᵢⱼ}{\sum_{i=1}^{v} \sum_{k=1}^{m} w_cᵢaᵢⱼ}
\]

(5)
RESULTS AND CONCLUSIONS
The methodology in section 3 was applied to find customer needs and determine weights as shown in Table 1.

Table 1. Decision matrix of customer ratings

<table>
<thead>
<tr>
<th></th>
<th>Boushar Stadium</th>
<th>Aseeb Stadium</th>
<th>Sur Stadium</th>
<th>Sohar Stadium</th>
<th>Row Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanness</td>
<td>3.49</td>
<td>4.48</td>
<td>2.42</td>
<td>1.62</td>
<td>12.00</td>
</tr>
<tr>
<td>Accessibility</td>
<td>3.45</td>
<td>4.59</td>
<td>1.50</td>
<td>2.46</td>
<td>11.99</td>
</tr>
<tr>
<td>Safety</td>
<td>4.52</td>
<td>2.64</td>
<td>3.51</td>
<td>4.47</td>
<td>15.14</td>
</tr>
<tr>
<td>Services</td>
<td>2.56</td>
<td>3.37</td>
<td>1.63</td>
<td>1.46</td>
<td>9.02</td>
</tr>
<tr>
<td>Technology</td>
<td>2.32</td>
<td>2.36</td>
<td>1.51</td>
<td>1.57</td>
<td>7.76</td>
</tr>
</tbody>
</table>

The outcomes shown below in Table 2 were calculated using formula $O(CN_i, A_j)$ given in equation (2).

Table 2. Outcomes $O_i$

<table>
<thead>
<tr>
<th></th>
<th>$A_1$</th>
<th>$A_2$</th>
<th>$A_3$</th>
<th>$A_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$CN_1$</td>
<td>0.29</td>
<td>0.37</td>
<td>0.20</td>
<td>0.13</td>
</tr>
<tr>
<td>$CN_2$</td>
<td>0.29</td>
<td>0.38</td>
<td>0.13</td>
<td>0.20</td>
</tr>
<tr>
<td>$CN_3$</td>
<td>0.30</td>
<td>0.17</td>
<td>0.23</td>
<td>0.30</td>
</tr>
<tr>
<td>$CN_4$</td>
<td>0.28</td>
<td>0.37</td>
<td>0.18</td>
<td>0.16</td>
</tr>
<tr>
<td>$CN_5$</td>
<td>0.30</td>
<td>0.30</td>
<td>0.19</td>
<td>0.20</td>
</tr>
</tbody>
</table>

The natural logarithms $\ln O(CN_i, A_j)$ were computed as shown in Table 3 since these are needed to compute $E_i$s.

Table 3. Natural logarithms

<table>
<thead>
<tr>
<th></th>
<th>$A_1$</th>
<th>$A_2$</th>
<th>$A_3$</th>
<th>$A_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$CN_1$</td>
<td>-1.24</td>
<td>-0.99</td>
<td>-1.60</td>
<td>-2.00</td>
</tr>
<tr>
<td>$CN_2$</td>
<td>-1.25</td>
<td>-0.96</td>
<td>-2.08</td>
<td>-1.59</td>
</tr>
<tr>
<td>$CN_3$</td>
<td>-1.21</td>
<td>-1.75</td>
<td>-1.46</td>
<td>-1.22</td>
</tr>
<tr>
<td>$CN_4$</td>
<td>-1.26</td>
<td>-0.98</td>
<td>-1.71</td>
<td>-1.82</td>
</tr>
<tr>
<td>$CN_5$</td>
<td>-1.21</td>
<td>-1.19</td>
<td>-1.64</td>
<td>-1.60</td>
</tr>
</tbody>
</table>

Finally, using equations (3) and (4) from methodology the $E_i$, $d_i$ and $w_c_i$ were calculated and listed in Table 4. The sum of weights $w_c_i$ should be equal to 1.

Table 4. Diversification measures and weights

<table>
<thead>
<tr>
<th></th>
<th>$E_i$</th>
<th>$d_i$</th>
<th>$w_c_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$CN_1$</td>
<td>0.82</td>
<td>0.18</td>
<td>0.21</td>
</tr>
<tr>
<td>$CN_2$</td>
<td>0.81</td>
<td>0.19</td>
<td>0.22</td>
</tr>
<tr>
<td>$CN_3$</td>
<td>0.85</td>
<td>0.15</td>
<td>0.18</td>
</tr>
<tr>
<td>$CN_4$</td>
<td>0.83</td>
<td>0.17</td>
<td>0.21</td>
</tr>
<tr>
<td>$CN_5$</td>
<td>0.85</td>
<td>0.15</td>
<td>0.18</td>
</tr>
</tbody>
</table>

The house of quality approach represented by equation (5) was implemented and the relative importance weights $w_s_i$ of stadium attributes $SA_i$ were determined as follows in Table 5.
Stadium personnel and location were the top two stadium attributes for satisfying the five spectator needs. Among the spectator needs, $CN_1$, $CN_2$ and $CN_3$ were equally important. The relative importance scores $w_k$ can be utilized to evaluate stadiums if data regarding the ratings of stadiums with respect to the technical attributes is collected. This research fills the gap in the research of infrastructural facilities in the game of soccer from a spectator’s perspective. A similar study can be conducted from the players’ and coaches’ perspectives.

**REFERENCES**


