

The Important Aspects Of Theme Parks Using Fuzzy Logic

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ABSTRACT

Tourism is one of the fastest growing service industries in the global economy. It is an important activity and is rapidly becoming the second most important sector for the Malaysian economy. The growth of the tourism industry impacts several important economic areas such as employment, income, foreign exchange earnings, and generation of value added. Realising that tourism sector is becoming a key component of the economic sources, the Malaysian government is now focusing in this sector. Many tourism packages are being promoted such as eco and agro tourism, festivals and entertainment, such as amusement parks and theme parks. Theme parks are one form of leisure activity designed to suit individuals of all ages and is gaining popularity in Malaysia. The growth of the theme park industry increased the number of theme park operators, which creates intense competition both in products and services they provide to customers. As a result, this situation is developing the implementation of new management techniques such as Knowledge Management (KM) to increase competitive advantage. KM is a new management approach that makes theme parks more competitive by improving the decision-making and the productivity. KM solutions are expected to improve the performance of the theme parks to gain competitive advantage. By measuring the achievement of this competitive advantage, this will enable the operators to monitor the required services being provided to the patrons. In this paper, we implement the LOWA operator to perform linguistic assessments instead of numerical values to express the preferences of theme park patrons. Comparisons are then made between the age group, sex, ethnic of patrons, frequency of visiting theme parks, and also between selected theme parks. This is to identify the key aspects of theme parks services preferred by patrons.

Keywords

Knowledge management (KM), Theme park, Linguistic assessment, LOWA operator

1.0 INTRODUCTION

Over the years, tourism has made remarkable impact on the Malaysian economy with steady growth. Tourism is described as the ‘activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited’. Tourism effects employment, income, foreign exchange earnings, generation of value added, etc. It can help drive economic growth and offer opportunities of employment in a wide range of industries throughout the economy. It earns foreign exchange through increased export earnings and attracts foreign investment. Through domestic tourism, it reduces foreign exchange outflows.

The growth of the tourism industry is driven by several factors including political and economic stability to attract foreign investment, infrastructure improvements, diversify tourism products and improve the domestic air and surface connections. Rising standard of living of Malaysian citizens has made leisure a necessity. The declaration of holidays for the public sector service for the first Saturday of the month with effect from 1 January 1999 and third Saturday of the month effective 1 February 2000 has increased domestic tourism. The development and improvement of surface transportation has made easy access to tourist destinations.

Despite the scare of September 11, 2001 attack on the United States and the global economic downturn, over 12.7 million tourists visited Malaysia in 2001, generating more than RM2.4 billion revenue to the economy, a RM7 billion jump compared to the figure of 2000. Therefore, Malaysian tourism enjoyed quite an impressive average growth of 9.26% between 1981 and 2000 (Badaruddin, 2002). As indicated in Table 1, after taking a dip in 1997 and 1998, Malaysian tourism sector recovers with a 53% increase in international tourist arrivals. Malaysia can expect further annual growth of 8.5% until 2005 from the projection by the Economic Intelligence Unit.

Table 1: Tourists arrivals in Malaysia 1990-2001

Year	Tourist Arrivals	% Growth
1990	7445908	
1991	5847213	-21.4708
1992	6016209	2.890197
1993	6503860	8.105619
1994	7197229	10.66088
1995	7468749	3.772563
1996	7138452	-4.42239
1997	6210821	-12.9948
1998	5200000	-16.2752
1999	7931149	52.5221
2000	10221582	28.87896
2001	12775073	24.98137

Source: Tourism Malaysia, 2002

Tourism in Malaysia, especially after 1990, continues to be popular. The wave of alternative tourism like eco, agro tourism, festivals, and entertainment: amusement and theme parks, etc. is spreading into the hearts of Malaysians.

Malaysian government has allocated RM1 billion for development expenditure over the next five years under the Eighth Malaysia Plan, 2001-2005. This will go into the preservation of national and historical heritage, accommodation, beautification, cleanliness and environmental protection, facilities and infrastructure, with the objective of maximising the returns to the tourism industry and the economy as a whole.

Theme parks have become one of the recreational and tourism development trend throughout the world. The first real theme park was Disneyland in California, USA that opened in 1955. Since then, the theme park industry in the United States has grown dramatically such that it contributes USD4 billion per year based on annual attendance of about 130 million visitors at 42 parks. The growth has been followed by development of the industry elsewhere, generating a total of nearly USD1.8 billion in revenue in Asia alone (Braun, 1998). In Malaysia, theme parks such as Genting, Sunway Lagoon, Desa Water Park, Bukit Merah do not only serve as recreational and entertainment places but are also part of tourism industry that continue to generate economic value to the country.

Theme parks are a unique entertainment concept that strives to create a fantasy atmosphere of another place or time using high technology (Milman, 2001). They offer a trip into a world of fantasy, excitement and adventure. This is where senses are stimulated as thrill-seekers are jolted into electrifying entertainment hour after hour and for a moment, they are in a world of make-believe. Most theme parks have been designed exclusively, each having their own themes such as 'Sea World', 'Underwater World', 'Dream World', 'Fantasy Island' and 'Neverland'. In

Malaysia, theme parks are generally a combination of water activities, adventure, futuristic experiences, games, rides and sometimes just a place for relaxation and sightseeing.

As rapid changes are taking place in the business environment, many operators in the tourism are facing challenges such as improved in-home technology, employees, economic and political forces, demographic changes and competition among the operators. Theme park operators is being asked to deliver more services, at a faster pace and with higher quality, with fewer and fewer seasonal employees to satisfy the increasing level of customer expectation for excitement and quality of experience. Therefore, as a result, this current situation is encouraging the implementation of new management techniques such as knowledge management (KM) to increase competitive advantage.

Knowledge Management could be seen as understanding the knowledge of an organisation and the ability to allow others to improve their own work by learning from this knowledge. This is a description that any organisation can conceptualise and understand how it can lead to competitive advantage or substantial process improvement. This concept is not restricted to the large organisations that are currently leading the knowledge management uptake. KM solutions are expected to improve the performance of theme parks businesses to gain competitive advantage. By measuring the achievement of this competitive advantage, this will enable the operators to monitor key aspects for their success. KM is a management tool that makes companies more competitive by improving the decision-making and the productivity (Schreiber *et al.*, 1998). Decision-making normally portrays a decision as clear-cut acts of choice in an environment in which the goals, constraints, information and consequences of possible actions are supposed to be precisely known (Chiclana, 1996). However, when the uncertainty is of a qualitative

nature, the use of other techniques such as Fuzzy Sets Theory is necessary.

Fuzzy sets theory might provide the flexibility needed to represent the uncertainty resulting from lack of knowledge. There are many opportunities to apply the theory of fuzzy sets as in decision-making. Fuzzy tools and methodologies can be used either to translate imprecise and vague information in the problem specification into fuzzy relationships. Suppose that the variables in the problems are assessed by linguistic terms. Then, a realistic approach is to use linguistic assessments instead of numerical values to provide individuals' preference through linguistic preference relations (used to express their degrees of certainty in a preference). Linguistic Ordered Weighted Averaging (LOWA) operator carries out the operation of linguistic information aggregation. In this paper, LOWA operator is used to analyse the key aspects of services preferred by patrons from the theme park data.

2.0 ATTRACTION OF THE RESEARCH

This study is focused on three most popular theme parks in Malaysia that are Genting Theme Park, Sunway Lagoon and Desa Water Park. Data were obtained from questionnaires distributed to a sample of 150 respondents, which were selected randomly from those who had visited at least one of the three theme parks. In order to analyse the main aspects of the theme park services preferred by patrons, the respondents were divided into several categories according to their sex, ethnic, age group and frequency of visiting theme parks. They were asked to evaluate the main aspects of the services provided by the theme parks that they have visited. The evaluation was on quality of accessibility, facilities, safety, staff services and products (i.e. the games at the theme parks).

The criteria analysed for accessibility are the transport facilities to the theme parks and inside the theme parks (i.e. from one game to another game), whereas for comfortability, cleanliness and public facilities are considered. The public facilities are toilets, café, informative signboards, comfortable rest places, car parking places, visitors' lockers to place patrons' belongings and public telephones. For safety, the focus is on the product safety, safety facilities and insurance coverage. Besides that, staffs' services are also considered in terms of their efficiency, friendliness and helpfulness. Other criteria considered is the product provided by the theme parks, i.e. whether the games are entertaining, adventurous or variant. The purposes of this paper are to interpret the outcomes from the criteria and to compare services among the theme parks using LOWA operators.

3.0 METHODOLOGY

Fuzzy preference relation is a useful tool in modelling decision processes in decision-making situations. In this paper, it is used to analyse the main aspects of the theme park services to express preference according to the criteria and the respondents' sex, ethnic, age group and frequency of visiting theme parks. Each decision-making for the criteria comes from a different background and the respondents have their own ideas, attitudes, motivation and personality. And the decision-making is based on linguistic information aggregation operation carried out by LOWA operator. It is used to solve group decision-making problems from individual linguistic preference relation. To facilitate this, we shall use the properties and preference aggregations axiomatic of LOWA operator (Herrera *et al*, 1996).

LOWA operator is based on the ordered weighted averaging (OWA) operator (Yager, 1988) and on convex combination of linguistic labels (Delgado *et al*, 1993). Consider a finite and totally ordered label set $S = \{s_i\}, i \in H = \{0, \dots, 6\}$, each label s_i represents a possible value for a linguistic real variable, i.e. a vague property or constraint on $[0,1]$. If $\{s_1, \dots, s_m\}$ is a label set to aggregate, then LOWA operator ϕ is defined as

$$\begin{aligned}\phi(s_1, \dots, s_m) &= W \cdot B^T \\ &= C^m \{w_k, b_k, k = 1, \dots, m\} \\ &= w_1 \odot b_1 \oplus (1 - w_1) \odot \\ &\quad C^{m-1} \{\beta_h, b_h, h = 2, \dots, m\}\end{aligned}$$

where $W = [w_1, \dots, w_m]$ is a weighting vector such that

$$w_i \in [0,1] \text{ and } \sum_i w_i = 1. B \text{ is the ordered label vector,}$$

each element $b_i \in B$ is the i th largest label in $\{s_1, \dots, s_m\}$. Determine the weight

using $\beta_h = w_h / \sum_2^m w_k$ and C^m is the convex

combination of m labels. If $m = 2$,

$$\begin{aligned}\phi &= C^2 \{w_i, b_i, i = 1, 2\} \\ &= w_1 \odot s_j \oplus (1 - w_1) \odot s_j \\ &= s_k, s_j, s_i \in S \quad (j \geq i)\end{aligned}$$

such that $k = \min \{T, i + \text{round}(w_1 \cdot (j - i))\}$ and

$$b_1 = s_j, b_2 = s_i.$$

If $w_i = 1$ and $w_j = 0$ with $i \neq j \forall i$, then the convex combination is defined as $C^m \{w_i, b_i, i = 1, \dots, m\} = b_j$.

As an alternative, S-PLUS built-in fitting function could also be used to fit this model. An example of S-PLUS built-in fitting function for this model is shown in **Appendix 1**.

4.0 RESULTS

Data used for this study are secondary data, obtained from a postgraduate student's thesis, Kurniawan Yusof Ali (2003). The results of key aspects of theme parks services as shown in Table 2 and **Appendix 2** are obtained using S-PLUS program.

Table 2: LOWA's result of key aspects of theme parks services.

Respondents	Facilities	Accessibility	Security	Service	Product
Overall	QI	QI	QI	I	QI
Sex					
Male	QI	QI	QI	QI	QI
Female	QI	QI	QI	QI	QI
Ethnic					
Malay	QI	MI	QI	QI	QI
Chinese	QI	QI	QI	I	QI
Indian	QI	I	QI	QI	I
Age Group					
< 20 years old	QI	MI	QI	MI	QI
≥ 20 years old	QI	QI	QI	I	QI
Visit					
First time	QI	QI	QI	I	QI
Second time or more	QI	MI	I	I	QI
Theme Park					
Genting	QI	MI	QI	QI	MI
Sunway Lagoon	QI	QI	QI	I	QI
Desa Waterpark	QI	QI	QI	I	QI

Notes:

- NVI – Not Very Important
- NI – Not Important
- NQI – Not Quite Important
- MI – Moderate Important
- QI – Quite Important
- I – Important
- VI – Very Important

From Table 2, both male and female respondents believe that all key aspects, i.e. facilities, accessibility, security, service and product are quite important. However, when the data is analysed according to ethnic, Indians are more concern on product and accessibility to theme parks as compared to the Chinese and Malays. This may due to most Indians do not own private transports. For Chinese, staff service in terms of helpfulness, friendliness and efficiency is important among other key aspects.

For respondents above 20 years old, accessibility and service are important to them when visiting theme parks. However, respondents below 20 years old feel that those

two aspects are only moderately important. This may due to the reason that they go to the theme parks with their parents, therefore transportation is not a problem.

Respondents who went to the theme parks for the first time feel that accessibility and security are quite important. But, it is different for those who had been there several times. They are familiar to the surroundings and therefore have high expectation on security. On the other hand, they feel that accessibility to the theme park is moderately important, possibly because they can gauge suitable mode of transport.

For the three theme parks, i.e. Genting, Sunway Lagoon and Desa Waterpark, facilities and security are equally quite important. Accessibility to Genting is placed as moderately important because service of public transport directly to Genting is available, unlike the other two theme parks. Sunway Lagoon and Desa Waterpark offer variety of games, hence product is quite important to the patrons. On the contrary, Genting provides not only games but also place for relaxing and sightseeing. Carved out of the Ulu

Kali Mountain range at 2000 metres above sea level, it is a hill resort. This is one of the reasons respondents place product as moderately important for Genting.

On overall, all key aspects are quite important, except for service, which is placed as important. This shows that service is a vital aspect for patrons while visiting theme parks.

5.0 CONCLUSION

Linguistic preference relation, as one of fuzzy techniques has proven to be useful in improving key aspects' performance of the theme parks. The findings revealed that all key aspects are important. Therefore, theme park operators need to improve the quality of their theme parks besides offering better services. Linguistic preference relation also incorporated human preference as part of decision-making in linguistic environment. Respondents' opinions help the operators to plan strategic decisions in facing stiff competition with other operators.

6.0 ACKNOWLEDGEMENT

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APPENDICES

APPENDIX 1

```
qgd <- function(mt,a=0.3,b=0.8)
{ n <- dim(mt)[1]
  qd.i <- rep(0,n)
  for(i in 1:n) qd.i[i] <- sum(-sort(-
mt[i,][-i])*owa(n-1,a,b))
  qd.i
}
```

```
qgn <- function(mt,a=0.3,b=0.8)
{ n <- dim(mt)[1]
  qnd.i <- rep(0,n)
  mtc <- matrix(rep(0,n*n), n)
  for(j in 1:n){for(i in 1:n)mtc[j,i] <-
max(0,mt[i,j]-mt[j,i])}
  for(i in 1:n)qnd.i[i] <- sum(-sort(-
1+mtc[i,][-i])*owa(n-1,a,b))
  qnd.i
}
```

```
utpre <- function(x)
{n <- length(x)
pr <- matrix(rep(0,n*n),n)
for(i in 1:n-1)
  for(j in (i+1):n)
    {pr[i,j] <- x[i]^2/(x[i]^2+x[j]^2)
pr[j,i] <- 1- pr[i,j]}
pr
}
```

```
orpre <- function(x)
{n <- length(x)
pr <- matrix(rep(0,n*n),n)
for(i in 1:n-1)
  for(j in (i+1):n)
    {pr[i,j] <- (1 + x[j]/(n-1)-x[i]/(n-
1))/2
pr[j,i] <- 1- pr[i,j]}
pr
}
```

```

ccpre <- function(x,a=0.3,b=0.8)
{m <- dim(x)[3]
  n <- dim(x)[1]
  ccpr <- matrix(rep(0,n*n),n)
  ctm <- rep(0,m)
  for(i in 1:n)
    for(j in 1:n)
      {for(k in 1:m) ctm[k] <- x[i,j,k]
        ccpr[i,j] <- sum(-sort(-
          ctm)*owa(m,a,b))
      }
  ccpr
}

decis <- function(x,a=0.3,b=0.8)
{cmt <- ccpre(x,a,b)
  qgdd <- qgd(cmt,a,b)
  qgnd <- qgn(cmt,a,b)
  list(COLPRE=cmt, QGDD = qgdd, QGND = qgnd)}

quan <- function(x)
{x <- as.matrix(x)
  n1 <- dim(x)[[1]]
  n2 <- dim(x)[[2]]
  jw <- matrix(rep(0,n2*10), ncol=10)
  for (i in 1:n2) jw[i,] <-
    quantile(x[,i],seq(.1,1,.1))
  dimnames(jw) <-
    list(NULL,c("p10%","p20%","p30%","p40%",
      "p50%","p60%","p70%","p80%","p90%","p100
      %"))
  jw }

```

APPENDIX 2

Key Aspects:

Public Facilities

- V1 – clean toilets
- V2 – clean food at the café and food stalls
- V3 – adequate number of toilets
- V4 - variety of café and food stalls

- V5 - comfortable rest places
- V6 - public telephones
- V7 - informative signboards

Accessibility

- V8 – accessibility inside the theme parks, i.e. from one game to another game
- V9 - transport facilities to the theme parks

Security

- V10 – safe products
- V11 – insurance coverage
- V12 – emergency room
- V13 – effective emergency alarm
- V14 – fire extinguisher
- V15 – safety car parking spaces

Service

- V16 – efficient staffs
- V17 – helpful staffs
- V18 – friendly staffs
- V19 – efficient ticket services

Product

- V20 – entertaining games
- V21 – variant games
- V22 – adventurous games

Notes:

- NVI – Not Very Important
- NI – Not Important
- NQI – Not Quite Important
- MI – Moderate Important
- QI – Quite Important
- I – Important
- VI – Very Important

Table A: LOWA's result of public facilities.

Respondents	V1	V2	V3	V4	V5	V6	V7	Overall
Overall	I	I	MI	QI	QI	QI	QI	QI
Sex								
Male	I	I	MI	QI	I	QI	QI	QI
Female	I	I	QI	QI	QI	QI	QI	QI
Ethnic								
Malay	I	I	QI	QI	QI	QI	QI	QI
Chinese	I	I	QI	QI	I	QI	QI	QI
Indian	I	I	MI	QI	QI	QI	QI	QI
Age Group								
< 20 years old	I	QI	NQI	QI	QI	QI	QI	QI
≥ 20 years old	I	I	QI	QI	QI	QI	QI	QI
Visit								
First time	I	I	MI	QI	I	QI	QI	QI
Second time or more	VI	I	I	MI	QI	QI	QI	QI
Theme Park								
Genting	I	QI	QI	QI	QI	QI	QI	QI
Sunway Lagoon	I	I	MI	QI	I	QI	QI	QI
Desa Waterpark	I	I	MI	QI	I	QI	QI	QI

Table B: LOWA's result of accessibility.

Respondents	V8	V9	Overall
Overall	QI	QI	QI
Sex			
Male	QI	QI	QI
Female	QI	QI	QI
Ethnic			
Malay	MI	QI	MI
Chinese	QI	I	QI
Indian	I	I	I
Age Group			
< 20 years old	MI	MI	MI
≥ 20 years old	QI	QI	QI
Visit			
First time	QI	QI	QI
Second time or more	MI	QI	MI
Theme Park			
Genting	MI	QI	MI
Sunway Lagoon	QI	QI	QI
Desa Waterpark	QI	I	QI

Table C: LOWA's result of security.

Respondents	V10	V11	V12	V13	V14	V15	Overall
Overall	I	QI	QI	QI	QI	QI	QI
Sex							
Male	I	QI	QI	QI	QI	QI	QI
Female	I	QI	QI	QI	QI	I	QI
Ethnic							
Malay	I	QI	QI	QI	QI	QI	QI
Chinese	VI	QI	QI	QI	QI	I	QI
Indian	VI	QI	QI	QI	QI	QI	QI
Age Group							
< 20 years old	I	QI	QI	QI	QI	QI	QI
≥ 20 years old	I	QI	QI	QI	QI	QI	QI
Visit							
First time	I	QI	QI	QI	QI	QI	QI
Second time or more	VI	QI	I	I	VI	I	I
Theme Park							
Genting	I	QI	QI	QI	I	QI	QI
Sunway Lagoon	I	QI	QI	QI	QI	QI	QI
Desa Waterpark	VI	QI	QI	QI	QI	I	QI

Table D: LOWA's result of service.

Respondents	V16	V17	V18	V19	Overall
Overall	QI	I	I	I	I
Sex					
Male	QI	I	QI	I	QI
Female	QI	I	I	QI	QI
Ethnic					
Malay	QI	I	I	QI	QI
Chinese	I	I	I	I	I
Indian	QI	I	QI	I	QI
Age Group					
< 20 years old	MI	QI	I	MI	MI
≥ 20 years old	QI	I	I	I	I
Visit					
First time	QI	I	I	I	I
Second time or more	I	I	I	QI	I
Theme Park					
Genting	QI	I	I	QI	QI
Sunway Lagoon	QI	I	I	I	I
Desa Waterpark	I	I	I	I	I

Table E: LOWA's result of product.

Respondents	V20	V21	V22	Overall
Overall	QI	QI	QI	QI
Sex				
Male	I	QI	QI	QI
Female	QI	QI	MI	QI
Ethnic				
Malay	QI	QI	QI	QI
Chinese	QI	QI	MI	QI
Indian	I	I	QI	I
Age Group				
< 20 years old	I	QI	QI	QI
≥ 20 years old	QI	QI	MI	QI
Visit				
First time	QI	QI	QI	QI
Second time or more	QI	QI	QI	QI
Theme Park				
Genting	QI	MI	MI	MI
Sunway Lagoon	QI	QI	QI	QI
Desa Waterpark	I	QI	QI	QI