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Applications of Analytic Network Process in Entertainment[1]

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In this paper we present a real application of ANP in entertainment business, the expansion of Disney amusing parks by establishing a new theme park in greater China. The Analytic Network Process (ANP) is an efficient approach for this critical decision making. ANP is a generalization of the Analytic Hierarchy Process (AHP). The basic structure is an influence network of clusters and nodes contained within the clusters. Priorities are established in the same way they are in the AHP using pairwise comparisons and judgment.

Key Words: *ANP; AHP; Entertainment; Network; Feedback structure.*

1. Introduction

In order to enhance operations in foreign market, Disney is constantly searching for areas where it can expand into new markets. According to the projected number of foreign visitors, Walt Disney World expects to increase the current level from 20 percent foreign visitors in domestic parks to 50 percent as well as to expand its theme park business outside the U.S. To achieve these projected numbers Disney needs to make an aggressive attempt to expand its presence in foreign markets, especially Greater China. However, considering the diverse social and economic backgrounds within this area, Disney needs to carefully evaluate the possible benefits as well as the costs and potential risks. In this model, we narrow down the alternatives to Hong Kong, Shanghai, Taiwan and no investment in Greater China. In fact, an awakening and growing middle class in these three areas is exactly the prime target audience for a Disney theme park.

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Due to the importance of this project and its various aspects such as social, economical and political, it is vital to make a proper decision. The Analytic Network Process (ANP) can be applied to reach this goal.

The paper is organized as follows. In section 2, we review the concepts and basic elements of ANP. The model is presented in section 3. The sensitivity analysis of the model is discussed in section 4.

2. The Analytic Network Process (ANP)

In this section, we review ANP briefly. For more information the reader is referred to [1, 2, 3, 4].

The Analytic Network Process (ANP) is a generalization of the Analytic Hierarchy Process (AHP) by considering the dependence between the elements of the hierarchy. This makes ANP more realistic compared with AHP. In fact, many real world decision problems cannot be structured hierarchically because they involve the interaction and dependence of higher-level elements in a hierarchy on lower-level elements. Therefore, ANP is represented by a network, rather than a hierarchy.

A hierarchy is comprised of a goal, levels of elements and connections between the elements. These connections are oriented only to elements in lower levels. A network has clusters of elements, with the elements in one cluster being connected to elements in another cluster (outer dependence) or the same cluster (inner dependence). A hierarchy is a special case of a network with connections going only in one direction. The view of a hierarchy, such as that shown in [1], the levels correspond to clusters in a network.

There are two kinds of influence: outer and inner. In the first one compares the influence of elements in a cluster on elements in another cluster with respect to a control criterion. In inner influence one compares the influence of elements in a group on each one. For example if one takes a family of father mother and child, and then take them one at a time say the child first, one asks who contributes more to the child's survival, its father or its mother, itself or its father, itself or its mother. In this case the child is not so important in contributing to its survival as its parents are. But if we take the mother and ask the same question on who contributes to her survival more, herself or her husband, herself would be higher, or herself and the child, again herself. Another example of inner dependence is making electricity. To make electricity you need steel to make turbines, and you need fuel. So we have the electric industry, the steel industry and the fuel industry. What does the electric industry depend on more to make electricity, itself or the steel industry, steel is more important, itself or fuel, fuel industry is much more important, steel or fuel, fuel is more important. The electric industry does not need its own electricity to make electricity. It needs fuel. Its electricity is only used to light the rooms, which it may not even need.

Paired comparisons

To make tradeoffs among the many objectives and many criteria, the judgments that are usually made in qualitative terms are expressed numerically.

In the judgment matrix A, instead of assigning two numbers w_i and w_j and forming the ratio w_i/w_j we assign a single number drawn from a fundamental scale of absolute numbers to represent the ratio $(w_i/w_j)/1$. It is a nearest integer approximation to the ratio w_i/w_j. The derived scale will reveal what w_i and w_j are. This is a central fact about the relative measurement approach. It needs a fundamental scale to express numerically the relative dominance relationship. The general eigenvalue formulation is obtained by perturbation of the following consistent formulation:

$$Aw = \begin{array}{c} \\ A_1 \\ \vdots \\ A_n \end{array} \overset{\begin{array}{ccc} A_1 & \cdots & A_n \end{array}}{\begin{bmatrix} \frac{w_1}{w_1} & \cdots & \frac{w_1}{w_n} \\ \vdots & & \vdots \\ \frac{w_n}{w_1} & \cdots & \frac{w_n}{w_n} \end{bmatrix}} \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix} = n \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix} = nw.$$

where A has been multiplied on the right by the transpose of the vector of weights $w = (w_1, ..., w_n)$. The result of this multiplication is nw. Thus, to recover the scale from the matrix of ratios, one must solve the problem $Aw = nw$ or $(A - nI)w = 0$. This is a system of homogeneous linear equations. It has a nontrivial solution if and only if the determinant of $A - nI$ vanishes, that is, n is an eigenvalue of A. Now A has unit rank since every row is a constant multiple of the first row. Thus all its eigenvalues except one are zero. The sum of the eigenvalues of a matrix is equal to its trace, that is, the sum of its diagonal elements. In this case the trace of A is equal to n. Thus n is an eigenvalue of A, and one has a nontrivial solution. The solution consists of positive entries and is unique to within a multiplicative constant.

Benefits, Opportunities, Costs and Risks

The process of decision-making requires us to analyze a decision according to Benefits (B), the good things that would result from taking the decision; Opportunities (O), the potentially good things that can result in the future from taking the decision; Costs (C), the pains and disappointments that would result from taking the decision; and Risks (R), the potential pains and disappointments that can result from taking the decision. We then create control criteria and subcriteria or even a network of criteria under each and develop a subnet and its connection for each control criterion. Next, we determine the best outcome for each control criterion and combine the alternatives in what is known as the ideal form for all the control criteria under each of the BOCR merits. Then we take the best alternative under B and use it to think of benefits and the best one under O, which may be different than the one under C, and use it to think of opportunities and so on for costs and risks. Finally we must rate these four with respect to the strategic criteria (criteria that underlie the evaluations of the merits all the decisions we make) using the ratings mode of the AHP to obtain priority ratings for B, O, C, and R. We then normalize (not mandatory but recommended) and use these weights to combine the four vectors of outcomes for each alternative under BOCR to obtain the overall priorities. We can form the ratio BO/CR which does not need the BOCR ratings to obtain marginal overall outcomes. Alternatively and better, 1) we can use the ratings to weight and subtract the costs and risks from the sum of the weighted benefits and opportunities.

Outline of Steps of the ANP

1. Describe the decision problem in detail including its objectives, criteria and subcriteria, actors and their objectives and the possible outcomes of that decision. Give details of influences that determine how that decision may come out.
2. Determine the control criteria and subcriteria in the four control hierarchies one each for the benefits, opportunities, costs and risks of that decision and obtain their priorities from paired comparisons matrices. If a control criterion or subcriterion has a global priority of 3% or less, you may consider carefully eliminating it from further consideration. The software automatically deals only with those criteria or subcriteria that have subnets under them. For benefits and opportunities, ask what gives the most benefits or presents the greatest opportunity to influence fulfillment of that control criterion. For costs and risks, ask what incurs the most cost or faces the greatest risk. Sometimes (very rarely), the comparisons are made simply in terms of benefits, opportunities, costs, and risks in the aggregate without using control criteria and subcriteria.
3. Determine the most general network of clusters (or components) and their elements that apply to all the control criteria. To better organize the development of the model as well as you can, number and arrange the clusters and their elements in a convenient way (perhaps in a column). Use the identical label to represent the same cluster and the same elements for all the control criteria.
4. For each control criterion or subcriterion, determine the clusters of the general feedback system with their elements and connect them according to their outer and inner dependence influences. An arrow is drawn from a cluster to any cluster whose elements influence it.
5. Determine the approach you want to follow in the analysis of each cluster or element, influencing (the preferred approach) other clusters and elements with respect to a criterion, or being influenced by other clusters and elements. The sense (being influenced or influencing) must apply to all the criteria for the four control hierarchies for the entire decision.
6. For each control criterion, construct the supermatrix by laying out the clusters in the order they are numbered and all the elements in each cluster both vertically on the left and horizontally at the top. Enter in the appropriate position the priorities derived from the paired comparisons as subcolumns of the corresponding column of the supermatrix.
7. Perform paired comparisons on the elements within the clusters themselves according to their influence on each element in another cluster they are connected to (outer dependence) or on elements in their own cluster (inner dependence). In making comparisons, you must always have a criterion in mind. Comparisons of elements according to which element influences a given element more and how

strongly more than another element it is compared with are made with a control criterion or subcriterion of the control hierarchy in mind.

8. Perform paired comparisons on the clusters as they influence each cluster to which they are connected with respect to the given control criterion. The derived weights are used to weight the elements of the corresponding column blocks of the supermatrix. Assign a zero when there is no influence. Thus obtain the weighted column stochastic supermatrix.
9. Compute the limit priorities of the stochastic supermatrix according to whether it is irreducible (primitive or imprimitive [cyclic]) or it is reducible with one being a simple or a multiple root and whether the system is cyclic or not. Two kinds of outcomes are possible. In the first all the columns of the matrix are identical and each gives the relative priorities of the elements from which the priorities of the elements in each cluster are normalized to one. In the second the limit cycles in blocks and the different limits are summed and averaged and again normalized to one for each cluster. Although the priority vectors are entered in the supermatrix in normalized form, the limit priorities are put in idealized form because the control criteria do not depend on the alternatives.
10. Synthesize the limiting priorities by weighting each idealized limit vector by the weight of its control criterion and adding the resulting vectors for each of the four merits: Benefits (B), Opportunities (O), Costs (C) and Risks (R). There are now four vectors, one for each of the four merits. An answer involving marginal values of the merits is obtained by forming the ratio BO/CR for each alternative from the four vectors. The alternative with the largest ratio is chosen for some decisions. Companies and individuals with limited resources often prefer this type of synthesis.
11. Governments prefer this type of outcome. Determine strategic criteria and their priorities to rate the four merits one at a time. Normalize the four ratings thus obtained and use them to calculate the overall synthesis of the four vectors. For each alternative, subtract the costs and risks from the sum of the benefits and opportunities. At other times one may subtract the costs from one and risks from one and then weight and add them to the weighted benefits and opportunities. This is useful for predicting numerical outcomes like how many people voted for an alternative and how many voted against it. In all, we have three different formulas for synthesis.
12. Perform sensitivity analysis on the final outcome and interpret the results of sensitivity observing how large or small these ratios are. Can another outcome that is close also serve as a best outcome? Why? By noting how stable this outcome is. Compare it with the other outcomes by taking ratios. Can another outcome that is close also serve as a best outcome? Why?

3. DISNEY EXPANSION MODEL

Disney’s intention is to make a minimal equity investment in any operating entity and generate most of its returns through royalty, licensing, and fee income streams.

BOCR Networks and Cluster Definitions

Under the benefits, opportunities, costs, and risks (BOCR) models, different clusters define interactions with respect to the control hierarchy established, Figure 1. The benefits networks indicate the alternatives that yield the most benefit and the opportunities networks indicate the alternative that offers the most opportunities, whereas the costs and risks networks indicate the alternatives that are the most costly or pose the most risk on each alternative.

The flow of the decision process is to first build the networks and sub-networks for each of the BOCR models, make the judgments and evaluate which is the best alternative in each case for this particular decision. The importance of the BOCR must then be determined by rating them with respect to the strategic criteria of the organization or decision maker.

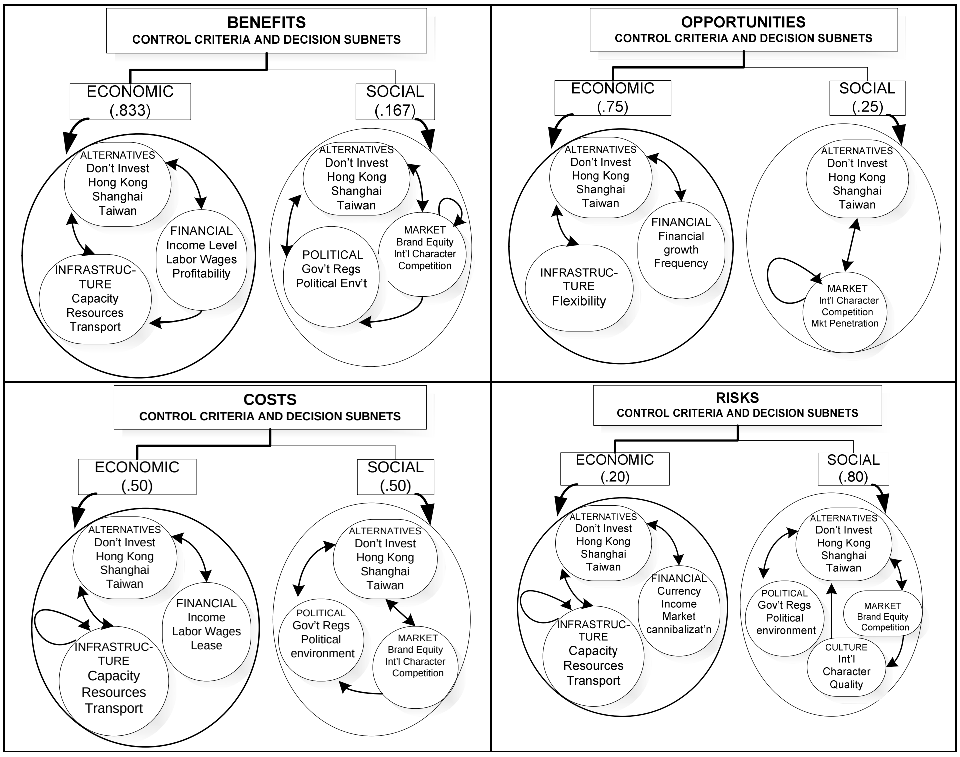


Figure 1. Decision Sub-networks with Clusters and Nodes for each of the BOCR

Control Criteria and Subnets of the BOCR

Each of the BOCR has control criteria whose priorities are established through pairwise comparison. The control criteria in turn have associated network sub-models that contain the alternatives of the decision and clusters of elements. Thus priorities for the alternatives are determined in each of the subnets. These are weighted by their control criterion, and these results are multiplied by the BOCR weights from the rating model and combined to give the final results. The alternatives appear in a cluster in every decision subnet, so we define them only once here. There are three locations being considered for the first Disney theme park in Greater China plus the alternative of not building at all, Figure 1.

Alternatives (in every subnet)

- Don't invest in Greater China
- Hong Kong
- Shanghai
- Taiwan

Moving on to the first subnet, under the Social control criterion for Benefits we show the clusters in that network below:

Clusters in Benefits/Social Subnet

- **Alternatives**
- **Market** (Brand Equity, International Character, Market Competition)
- **Political Factors** (*Government Regulation,* Political Environment)

Brand Equity: For the brand equity, we consider it as an intangible asset to Walt Disney. Brand equity represents Disney's reputation and image in the market. Within this subnet, we will examine how much benefit each alternative can bring to Disney in terms of increasing their brand equity.

International Character: International character refers to having a diversified visitor base. The higher the diversification of the visitor base, the more it benefits Disney.

Market Competition: Market competition refers to the number of competitors with *comparable scale* in one market. Within the benefit cluster, we will discuss the level that Disney can benefit from the competition in the market under each alternative.

Government Regulation: We believe a favorable local government regulation on the theme park business will definitely benefit Disney's operation in that area and vise versa.

Political Environment: We believe a stable political environment will create a promising investment environment. Thus, the benefits will be measured base on the current political stability and potential political instability of each alternative.

Interactions between Clusters in the Benefits/Social subnet

In this subnet, we can see the interactions among clusters as well as interactions within clusters.

Market Factors: First of all, since the government regulations and political environment will affect the international character and the market competition in a market, we can see an interaction between market cluster and political factors cluster. Besides, different choices that Disney makes will affect the company itself in terms of brand equity, international character and competition in the market. Finally, the competitive ability of the company and the international character of the market may also affect Disney's brand equity at the end. Thus, we can see another interaction within the market cluster itself.

Political Factors: Besides the interaction with the market cluster, the political factors cluster also interacts with the alternative cluster because the political factors are also affected by different alternatives.

Alternatives: While each alternative affects factors in the market and political clusters, those factors also have effect on Disney's decision among alternatives in return. Thus, there are also backward interactions between the alternatives cluster and the other two clusters.

Nodes in the Benefits/Economic Subnet Clusters

- **Alternatives**
- **Financial Factors** (Gross and disposable income level, Labor Wage, Profitability)
- **Infrastructure** (Accommodation Capacity, Resources, Transportation)

Gross and disposable income level: Under this factor, only the current gross and disposable income level of the area's citizens will be considered. We assume that a higher income level in the local area will bring more business to the Disney facility and further increase Disney's revenue.
Labor Wage: Labor refers to the current level of local labor wage. A lower labor wage will benefit Disney from reducing operating overheads.
Profitability: Profitability refers to the forecasted profits based on the current market situation.

Accommodation Capacity: This refers to the current hotel accommodation capacity of that area.
Resources: The resources factor refers to the current construction quality and efficiency of the area.
Transportation: Transportation here means the current development of local railroads, airports, tunnels, etc. If the area is already well developed, Disney can benefit from an instant resource of transportation system for customers.

Table 1. Alternative Rankings from the Benefits/Economic Subnet					
Graphic	Alternatives	Total	Normal	Ideal	Ranking
	Don't invest in Greater China	0.0273	0.0579	0.1242	4
	Hong Kong	0.2201	0.4662	1.0000	1
	Shanghai	0.1379	0.2922	0.6267	2
	Taiwan	0.0867	0.1837	0.3940	3

Table 2. Alternative Rankings from the Benefits/Social Subnet					
Graphic	Alternatives	Total	Normal	Ideal	Ranking
	Don't invest in Greater China	0.0045	0.0099	0.0219	4
	Hong Kong	0.2059	0.4521	1.0000	1
	Shanghai	0.1556	0.3417	0.7558	2
	Taiwan	0.0894	0.1963	0.4342	3

Combining the outcomes from the social and economic decision subnets (Tables 1and 2) for the benefits model produces the results shown in Table 3. The normalized values (in bold) show that Hong Kong offers the most benefits, and by a significant amount, at 46.4%.

Table 3. Synthesized Result for the Benefits Model					
Graphic	Alternatives	Total	Normal	Ideal	Ranking
	Don't invest in Greater China	0.107	**0.050**	0.107	4
	Hong Kong	1.0000	**0.464**	1.000	1
	Shanghai	0.648	**0.301**	0.648	2
	Taiwan	0.401	**0.186**	0.401	3

In the opportunities, costs and risks models, the decision subnets are built based on the same logic as that of the benefits subnets. The details of their clusters and nodes are similar to that of benefits and will not be shown here. A general idea of what they are can be obtained from the figure above showing the decision sub-networks. The results for each of the control criteria for opportunities, costs and risks are given below. We show only the final synthesized results for opportunities, costs, and risks, Tables 4, 5 and 6.

Table 4. Synthesized Results for the Opportunities Model					
Graphic	Alternatives	Total	Normal	Ideal	Ranking
	Don't invest in Greater China	0.019	**0.010**	0.019	4
	Hong Kong	0.428	**0.224**	0.428	3
	Shanghai	1.000	**0.524**	1.000	1
	Taiwan	0.462	**0.242**	0.462	2

Table 5. Synthesized Results for the Costs Model					
Graphic	Alternatives	Total	Normal	Ideal	Ranking
	Don't invest in Greater China	0.104	**0.040**	0.105	4
	Hong Kong	0.610	**0.233**	0.617	3
	Shanghai	0.989	**0.378**	1.000	1
	Taiwan	0.912	**0.349**	0.922	2

Table 6. Synthesized Results for the Risks Model					
Graphic	Alternatives	Total	Normal	Ideal	Ranking
	Don't invest in Greater China	0.116	**0.051**	0.118	4
	Hong Kong	0.425	**0.188**	0.434	3
	Shanghai	0.981	**0.434**	1.000	1
	Taiwan	0.736	**0.326**	0.751	2

Decision Model for Rating Strategic Criteria

The final step in the decision is to determine the strategic criteria that are more or less the same for the organization or individual in making any decision and use them to rate the BOCR with respect to competition, income level, infrastructure, international character and political support as shown in the table below. We thought the five strategic criteria below pretty well captured Disney’s main corporate concerns about their theme parks.

To prepare to rate the strategic criteria one first pairwise compares them for importance in a hierarchy resulting in the priorities shown underneath their names in Table 20. Then one establishes intensities to indicate the degree of fulfillment (in the case of benefits and opportunities) or impact (in the case of costs and risks). The intensities and their priorities (in the ideal form) are Very Strong (1.000), Strong (.627), Medium(.382), Moderate(.232) and Weak(.148). Priorities are determined for them by pairwise comparing. In this case the same intensities and priorities are used for each strategic criterion, although they could be different.

Strategic Criteria Definitions

The strategic criteria are defined below and pairwise compared for importance with respect to Disney’s goal. Ratings are then established for each of these criteria and pairwise compared to establish their priorities in turn. These ratings are then used to determine the priority or importance of Benefits, Opportunities, Costs and Risks and these values are used to weight the results in the submodels attached to them.

Competition – Successful theme parks in the area of the Disney Facility may be viewed both positively and negatively. Other theme parks already in the areas represent competition for Disney; however, competitors may also bring more people to the area to visit both facilities at the same time.

Income Level– Gross and disposable income levels of the area's citizens may also affect the success of the park. Consider Tokyo Disney Land for example. Approximately 95% of its visitors are local Japanese; thus, the high average income level of Japanese does appear to contribute to the tremendous success of Disney in Japan.

Infrastructure– Infrastructure in the area of the park and the regional support are also important. Visitors should be able to access the park easily. The transportation system should be well established or enhanced while the park is being constructed. A good area should have the infrastructure to support a park efficiently. Besides, the region should also contribute to extending the time visitors are able to spend at the Disney facilities. For example, a stock of hotel rooms to support park visitors is important and rooms at a variety of price levels, from economy all the way to luxury, should be available when the park opens.

International Character – Disney is looking for "international character" for any theme park it builds in Greater China. A diversified visitor base will reduce the risks of problems in one country having an adverse effect on the flow of international visitors.

Political Support – In all Disney's international operations, support from local government is critical to the Disney Company. This support ranges from providing a good location to build the theme park to insuring sufficient capital flow.

Rate Benefits, Opportunities, Costs and Risks

To select the ratings in Table 7 for Benefits, for example, one must keep in mind the alternative in the synthesized results for the benefits model given in Table 16 that has the highest priority, Hong Kong. For example, Hong Kong's benefits to fulfill the Competition strategic criterion or objective is thought to be strong. For fulfilling benefits for Income Level, Hong Kong would be very strong as people there have high disposable income, and so on for all the Strategic Criteria.

When making ratings for Costs and Risks, keep in mind that the highest priority alternative is the most costly or most risky. To select the ratings for Risks keep in mind Shanghai. Shanghai has very strong risks so far as Competition is concerned, and strong risks for Income Level as people have less disposable income there, and medium risks for Political Support which means the risk is not too great for Disney in Shanghai as they believe they would have the support of the Chinese Government.

The overall priorities for the BOCR are computed by multiplying and adding across each row and normalizing the final result shown in the last column of Table 7. The priorities show that the most important merit is Benefits at 31.9% followed by Opportunities at 26.4%. This means that the priorities of the alternatives under benefits are weighted more heavily. Benefits at 31.9% drive the decision more than the Risks at 19.3%.

Table 7. BOCR Ratings and Priorities Very Strong(1.000), Strong(.627), Medium(.382), Moderate(.232) and Weak(.148)						
	Competi-tion (0.127)	Income Level (0.190)	Infrastructure (0.147)	Internat'l Character (0.323)	Political Support (0.214)	Prior-ities
Benefits	strong	very strong	strong	very strong	very strong	**0.319**
Opportunities	very strong	strong	strong	very strong	medium	**0.264**
Costs	very strong	medium	strong	strong	strong	**0.223**
Risks	very strong	strong	strong	medium	medium	**0.193**

The final results shown in Table 8 are obtained by using the formula bB + oO – cC – rR where b, o, c and r are the priorities for Benefits, Opportunities, Costs and Risks obtained from rating the strategic criteria in Table 7. This formula is applied for the alternatives using the priority vectors from the synthesized results (the B, O, C, and R of the formula) in Tables 3-6. Since this formula involves negatives, the overall synthesized results in Table 8 may be negative, meaning that the alternative is undesirable. Sometimes all results are negative, and one is forced to take the least undesirable one. In Table 8 positive results are labeled blue and negative red. Here Hong Kong is best with the highest positive value and Taiwan is worst with the highest negative value.

Table 8. BOCR Model: Overall Synthesized Results					
Graphic	Alternatives	Total	Normal	Ideal	Ranking
	Don't invest in Greater China	-0.006	-0.017	-0.030	3
	Hong Kong	0.214	0.567	1.000	1
	Shanghai	0.061	0.161	0.284	2
	Taiwan	-0.096	-0.255	-0.449	4

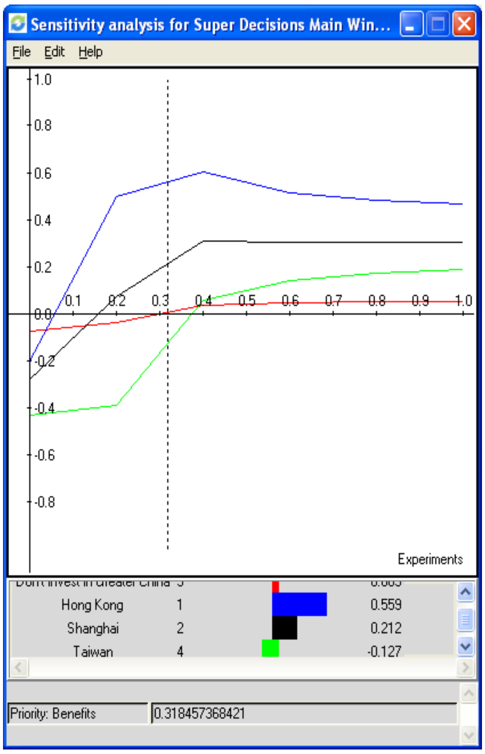
As we can see, from the overall synthesized results in Table 8, Disney's best option is to build their new theme park in ***Hong Kong***.

4. Sensitivity Analysis Graphs

Sensitivity analysis in Figure 2 shows that when the importance of benefits is greater than 0.05, investing in Hong Kong is the best choice. The dotted vertical line indicates the priority of Benefits, for example. At a priority of less than about 0.35 for opportunities, Hong Kong is the best choice, but above that the choice shifts to Shanghai. One might interpret this as meaning that there are great opportunities in Shanghai, but it is also risky as can be seen from the risks sensitivity graph. As the priority of costs increases beyond about 0.38, the best choice shifts from investing in Hong Kong to not investing at all. As the importance of risk increases the preferred alternative is to not to invest as all in Greater China, but since the priority is negative, below the x-axis, this is not a particularly good alternative, though it is the least negative. When risk is less than about 0.50, the preferred alternative is to invest in Hong Kong.

BENEFITS

At Benefits = 32.9%, Hong Kong (top line) is best; Shanghai second and Taiwan (bottom line) is worst



OPPORTUNITIES

At Opportunities = 26.4%, Hong Kong (top line) is best; Shanghai is second and Taiwan (bottom line) is worst

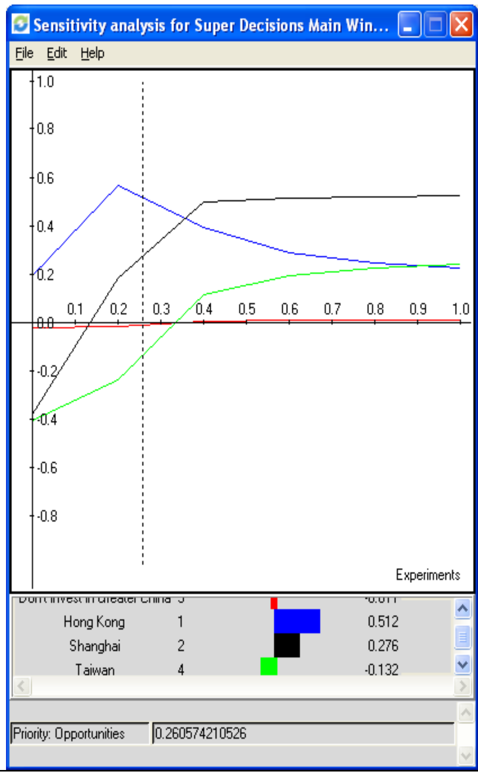


Figure 2. Sensitivity Graphs for Benefits and Opportunities

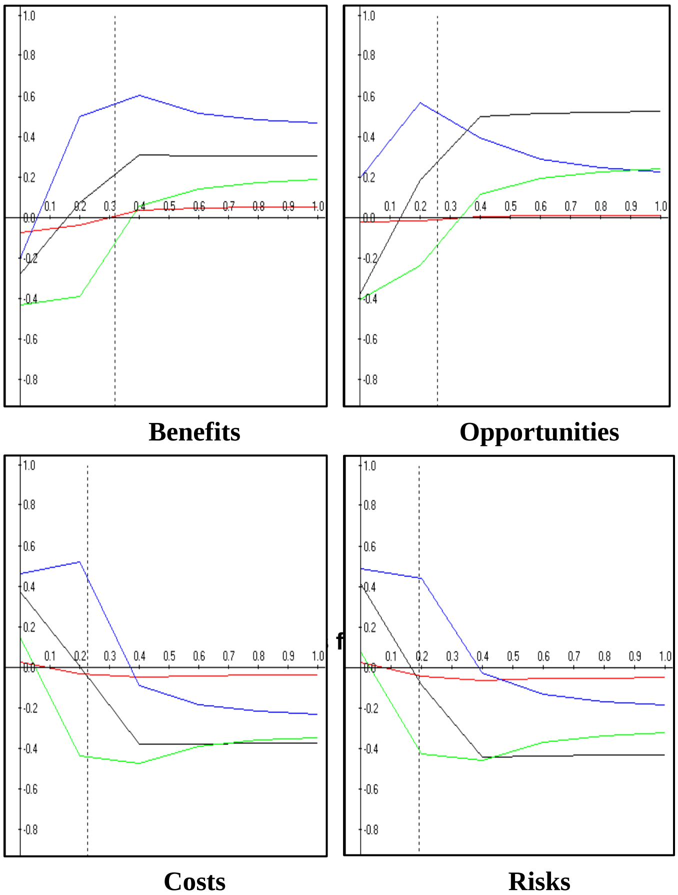


Figure 3. Sensitivity Graphs for Costs and Risks

The vertical dotted line represents the priority of Benefits and Opportunities. To see what happens as the importance of Benefits increases, move the vertical line to the right. Above a Benefits priority of about 40% the least preferred alternative changes from Taiwan to Don't Invest in Greater China. The line immediately under Hong Kong at down is Shanghai. One might interpret this as indicating that investing in China somewhere is imperative in terms of benefits.

As the importance of Opportunities increases past about 35%, the top line would be Shanghai and the bottom line Taiwan. This can be interpreted to mean that the greatest opportunities lie in ShanghaiAt an importance of 22.3% for Costs, Hong Kong (the top line) is most costly and Taiwan (the bottom line) is least costly, perhaps because of the political uncertainty and lack of supporting infrastructure in Hong Kong, and as Costs increases, not investing in China is the top line (after about 40%). So it is extremely risky to not invest in China at all.

At an importance of 19.3% for Risks the top line is Hong Kong, so it is most risky and the bottom line is Taiwan, meaning least risky.

To sum it all up, the greatest benefits and opportunities lie in mainland China, but also the greatest costs and risks, but netting it out, Hong Kong is best overall.

5. Conclusions

The ANP is a useful way to deal with complex decisions that involve dependence and feedback analyzed in the context of benefits, opportunities, costs and risks. It has been applied literally to hundreds of examples both real and hypothetical. What is important in decision making is to produce answers that are valid in practice. The ANP has also been validated in several examples. People often argue that judgment is subjective and that one should not expect the outcome to correspond to objective data. But that puts one in the framework of garbage in garbage out without the assurance of the long term validity of the outcome. In addition, most other approaches to decision making are normative. They say, “If you are rational you do as I say.” But what people imagine is best to do and what conditions their decisions face after they are made can be very far apart in the real world. That is why the framework of the ANP is descriptive as in science rather than normative and prescriptive. It produces outcomes that are best not simple according to the decision maker’s values, but also to the risks and hazards faced by the decision.

The Superdecisions software is available free on the internet along with a manual to and numerous applications to enable the reader to apply it to his/her decision. Go to www.superdecisions.com/~saaty and download the SuperDecisions software. The installation file is the .exe file in the software folder. The serial number is located in the .doc file that is in the same folder. The important thing may be not the software but the models which are in a separate folder called models.

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