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Quantitative Decision Approach in Optimizing Resource Allocation: Evidence from Domestic Tourism in Egypt

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Abstract: Optimizing the returns of various economic activities and their sustainability, identifying weaknesses and addressing them, identifying strengths, enhancing them and giving them more impetus are among the most important objectives of management. This paper introduces an approach that combines both qualitative and quantitative analysis techniques to re-demonstrate the collected data, then select a suitable quantitative decision-making model(s) to determine the best allocation of the resources. The paper offers an application of the introduced approach in tourism which is one of the economic activities that can contribute in increasing the national income, especially in a country like Egypt, which has many tourism potentials, including traces of different historical civilizations and great environmental and geographical diversity. first by examining the opinions of representatives of various categories of domestic visitors about different Egyptian tourism destinations and then analyzes the data quantitatively using Monte-Carlo simulation technique. The paper also uses a transportation model to explore the strengths and weaknesses of each of those destinations and makes recommendations on the optimal effort and budget allocation at each destination that will maximize and sustain the total return.

Keywords: Tourism, Optimization, Monte-Carlo Simulation, Data-Analysis, Transportation

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Introduction

In various economic sectors and activities there is an urgent and increasing need to make the best possible decisions and actions that can be judged based on their expected outcomes. This is because the expansion of these activities and the greatness of the resources spent on their development magnifies the difference between the returns of the optimal decision and other choices (Anderson et al., 2012). The management of tourism and tourist destinations is considered "especially in countries that it has large and diverse potentials for tourist attraction, such as Egypt" is one of the sectors that, if carefully utilized, it can maximize financial returns, see (Hegazy, 2023). Researchers have noted the scarcity of using scientific methods for decision-making in this sector. The current research presents a quantitative approach to decision-making regarding the optimal allocation of efforts and resources in the domestic tourism sector in Egypt, with the aim of identifying criteria of strengths and weakness in various tourist destinations, hence determining which of these criteria resources should be allocated to, either overcome their weakness or to maintain their excellence. First let's give some words about each of "Decision-Making" and "Tourism" in the following subsection

While making decision, there are many techniques that can be used either separately or combined to reach the optimal possible decision subjected some specific circumstances. These techniques can be divided into two main categories:

- Qualitative decision-making techniques that rely on descriptive data and are basically counting on the point of view and experience of the decision maker.
- Quantitative decision-making techniques, in which the decision is made and the optimal alternative(s) are chosen in light of quantitative (numerical) data and relies on mathematical theorems to compare different potential alternatives.

Reliance on quantitative methods for decision-making has become prevalent in various institutions due to the large volume of available data and the constant changes that occur to it, and on the other hand because quantitative methods for decision-making provide the decision-maker the mathematical and statistical methods to test and compare the selected decisions.

The quantitative Decision-making is characterized by the following properties:

- Scientifically based, that every selection of an alternative is mathematically proved or at least statistically justified.
- Objectivity, that the Judgment on the various alternatives doesn't depends on any personal perspective.
- Comprehensive, that the same mathematical model can be employed to formulate and solve different managerial case on different areas.
- Comparative, which means the comparison between results can compared and arranged without ambiguity.

In addition, one of the most important supports that quantitative decision-making provides to decision makers is to show the optimal allocation of resources (budgets, efforts, human resources...) to obtain the best possible returns from the sector.

The use of quantitative decision-making techniques with regard to evaluating and analyzing any economic activity can give a good idea of this activity and highlight the obstacles to success, weaknesses and difficulties, and how to overcome them. It also shows the success factors and areas of competition that need to be improved to drive the sector to higher levels of success.

On the other hand, over the last few decades, tourism has represented one of the fastest growing global economic sectors (Sharpley, 2011). As reported by the World Tourism Organization (UNWTO, 2018), the tourism sector produced US$1.7 trillion in 2020. The number of tourist comers is anticipated to continue to enhance and finally will totaling 1.488 billion in 2030. This forming an additional $1,00 billion in revenue compared with the prior year's (McKercher, 2020).

Also, as reported by the (UNWTO, 2018) distinctive tourism destinations, such as China, Turkey, and Malaysia have started to play a more essential role in the tourism sector (Nisha & Chung, 2022). Particularly, in some tourism destinations where tourism had once failed, tourism has come to be a profitable industry. Besides, other destinations, although strong potential, have failed to acquire the advantages from the tourism industry. One good example of this situation may be shown in the Middle East. However, there are many components that would make the region an optimal tourism destination, it accounts for just 5.4% of international tourist comers; it is regarded as one of the worlds developing region (Hegazy, 2023, Nazmfar et al., 2019 and Nisha & Chung, 2022). In accordance with (Gorji et al., 2023), the Middle East has the ability to be a huge tourism destination; it has distinctive historical locations, nice landscape, delicious food, and hospitable resorts—hospitality is

a unique Middle Eastern lifestyle. Despite, statistics referred to this region has failed to appeal potential tourists [Cohen & Cohen, 2015 and Morakabati, 2011). Thus, it is reasonable to conclude that stimuli (attractive resources) alone are not adequate for improving the tourism industry. But, this region has lately started to deal with the challenges they encounter in tourism improvement—it now exhibits an upward trend (UNWTO, 2018). Although, it should be observed that this rate is relatively small and that it is implemented to small tourism bases (McKercher, 2020).

But, it should be noted that tourism improvement varies among the Middle East nations. To catch the attention on the rate of tourism, some nations in this area, like Saudi Arabia, the UAE, and Egypt, have exerted much effort to improve their tourism industry (specifically international tourism), involving promoting techniques as well as tourism expenditures (Dutt et al., 2023). The tourism industry has progressively become a prospering industry in their economy of these nations; indeed, Saudi Arabia has become today a top religious tourism destination (Naseem, 2021).

There is an ignoring of domestic tourism research. Even the researches that studied the domestic tourism mainly focused on the role of the specific factors play on travelling to the destinations only (Liu et al., 2020), not focus on how to build strong brand for these tourism destinations.

- The previous studies applied destination branding topic on only the developed economies like Portugal & Spain and growing economies like Vietnam & Taiwan but not applied on the developing countries.

- It is noted that brand love in the prior studies had many positive consequences like loyalty, word of mouth, repurchase intention, and brand attachment but there are very limited researches that addressed overall brand equity as a consequence.

- Self-congruence, for the first time, as a mediator on the relationship between destination brand experience and overall destination brand equity.

- Most of previous studies that were applied on tourism and hospitality sectors were used pure quantitative or qualitative methods, but there is a shortage of research that used mixed methods (Hegazy, 2023).

In this current research, however we adopt region-level analysis. A structured questionnaire is designed and administered to collect the required data about the favorite tourist destinations of domestic visitors in Egypt. The collect data was used as a seed to generate series of Monte Carlo simulations to provide a feel and other hierarchy of these destinations in relation to some specific criteria and hence the transportation model will be used to determine the optimal allocation of resources in each destination to enhance the strengths and overcome the weaknesses of each of the tourist destinations under study.

Literature Review:

Quantitative decision-making is a scientific approach to decision-making based on mathematical and statistical theories and based on quantitative analysis. Quantitative decision-making can provide support to decision-makers that complements a subjective approach to decision-making that draws on expert expertise, talents, and perspectives see (Anderson et al., 2012, Taylor, B., 2016).

"Quantitative data analysis is the science of using computational and statistical methods that focus on statistical, mathematical, or numerical analysis of data sets" (Anderson et al., 2012), With quantitative data analysis, analysts can formulate complete tables of data points to make informed optimum decisions.

Generally Quantitative Decision-making involves the following stages (Anderson et al., 2012, Taylor, B., 2016):

- Observation.
- Problem definition.
- Criteria determining
- Model Building.
- Solution which includes
  - — Alternatives evaluation
  - — Alternative selection
- Implementation and feedback.

These stages can be summarized as (figure 1):

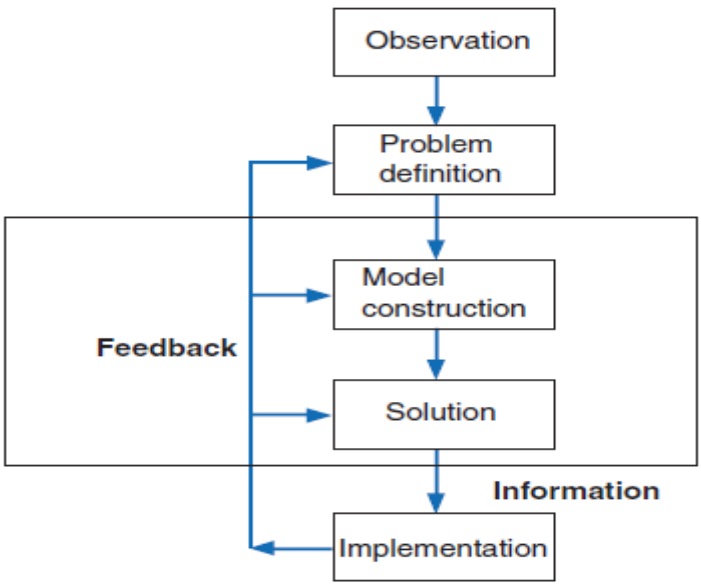

Figure 1 (Diagram of decision-making process) (Taylor, B., 2016)

Both "Quantitative Decision-making" and "Data Analysis" involve a large (and constantly growing) set of techniques, models, methods, as well as algorithms. Most of these tools were initially designed for a specific purpose and to solve a specific type of problem, but over time many of them have been used to solve a wider range of problems that can be formulated in the same mathematical form.

In this research a Monte-Carlo simulation will be used to generate data hence, the transportation model will be employed as a decision-making technique.

Monte-Carlo Simulation:

A simulation model is a descriptive data analysis and decision-making model rather than an optimization model, which means that simulation models provide scenarios and answers to what-if Questions (Ebiedy, 2000).

Monte-Carlo simulation technique has multiple definitions but lead to one goal and can be defined as a statistical technique that deal with complexities in decision-making problems that involves certain types of necessary mathematical and logical relationships to describe the behavior and system of the complex Real world and for long intervals of time (Ebiedy, 2000).

The major components of the Monte-Carlo algorithm are defined as follows:

- Probability distribution functions: each uncertain component of the real-life system must be assigned to suitable probability distribution.
- Random number generator: a source of random (or pseudo-random) numbers uniformly distributed on the unit interval [0, 1] must be available.
- Sampling rule: a description for sampling from the specified probability distribution function assuming the existence of random numbers in the interval [0, 1].
- Scoring: the outcomes must be accumulated into overall tallies or scores for the quantities of interest.

The main objective of the Monte-Carlo technique is to imitate the real-life system by random sampling from the pre-assigned probability distribution functions and then performing the necessary supplementary computations needed to describe the system behavior replacing real actions by random sampling of states from probability distribution functions that can describe the system actively, if the pre-assigned probability distribution functions are

suitable to represent the actual behavior of the physical or mathematical model. Monte-Carlo can be viewed as a statistical technique, for more details see (Aaref et al., 2017, Alex, 2001, Christor, 1993, Taha, 2019 and Tharwat et al. 2022).

Steps of Simulation process:

1) Defining problems and plan for the study. There must be a problem that requires actually to be studied by simulation techniques, also, the objective of the problem studied should be clear, precise, specific and tangible. It is then necessary to estimate the work and time plans required for completion of the study, with the plan to control the progress of the work and prevent the study from falling into error by focusing on one side of the problem on the rest of the other sides (Christor, 1993).

2) Building the Simulation Model. It is one the most important steps of simulation process, that all the following stages will depend on it. This step contains sub-steps like defining the variables that describe the system being simulated and its outputs. The system variables can be classified into (Ebeidy, 2000):

- Exogenous Variables: Can be defined as all the variables that are independent and external for the model, it can be called also, input variables.
- Internal Variables: are all the variables that are in the inner environment for the Model, that are functions for the external variables and model structure, also it can be called as output variables.

3) Efficiency Standards of the Model. These standards confirm the main points and milestones of the system, which can be analyzed to get the recommendations that can improve the current state of the system.

Transportation Model:

Transportation model is a special case of linear programming technique which had been developed by Dantzig (Anderson et al., 2012 and Taha, 2019). the transportation model was originally designed to solve the problem of finding the optimal distribution of any resource, of which there are specific quantities in specific places, and it is required to send predetermined quantities of it to each of several specific destinations, with the aim of obtaining the largest possible return from this distribution or paying the smallest possible cost for it. It consists usually of *"m"* suppliers each of has a predetermined

capacity *(S_i, $1< i < m$)* of some product and *"n"* destinations each of them is demanding a fixed quantity *(D_j, $1 < j < n$)*, also the transportation cost (or return) from each supplier to each demander "c_{ij}" are known, the objective of the problem is to determine the quantities that has to be addressed from each supplier to each demander "x_{ij}" in order to minimize the total cost or maximize the total

return (see figure 2),

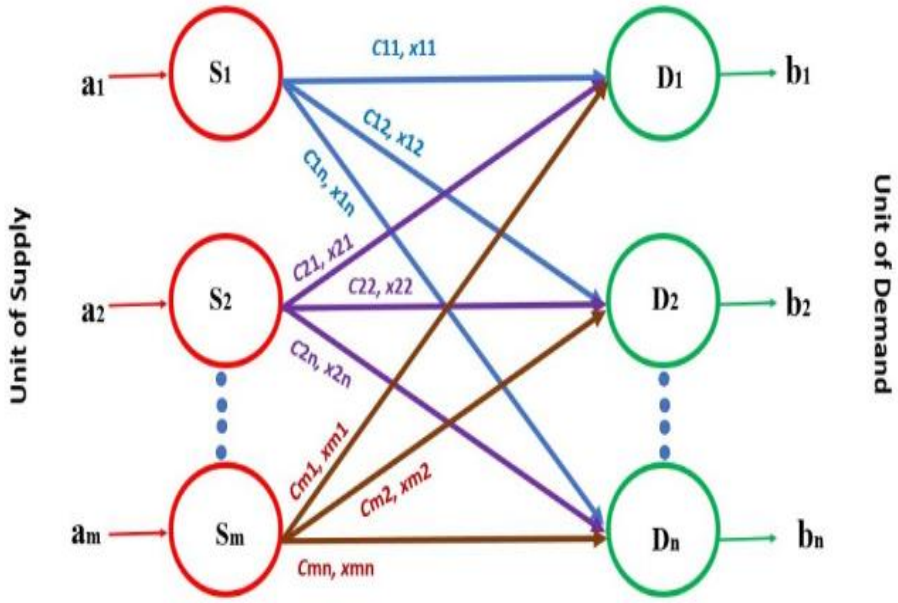

Figure 2 (Transportation problem)

The problem can be formulated as linear programming problem like:

"***Minimize (maximize):*** $Z = (c_{11}x_{11} + c_{12}x_{12} + c_{13}x_{13} + \ldots\ldots + c_{1n}x_{1n}) + (c_{21}x_{21} + c_{22}x_{22} + c_{23}x_{23} + \ldots\ldots + c_{2n}x_{2n}) + \ldots\ldots + (c_{m1}x_{m1} + c_{m2}x_{m2} + c_{m3}x_{m3} + \ldots\ldots + c_{mn}x_{mn})$

Subject to:

$x_{i1} + xi2 + \ldots\ldots + x_{in} < S_i$
$x_{1j} + x_{2j} + \ldots\ldots + x_{mn} > D_j$
$x_{ij} > 0,$
$i = 1, 2, 3, \ldots\ldots, m, j = 1, 2, 3, \ldots\ldots, n$"

The common formulation of the transportation model is tabular format (figure 3) and there are several effective algorithms and software solve it (Anderson et al., 2012 and Taha, 2019).

Source	**Destination**				**Supply**
	1	2	….	N	
1	C11	C12	….	C1n	**S1**
2	C21	C22	….	C2n	**S2**
….	….	….	….	….	**….**
m	Cm1	Cm2	….	Cmn	**Sm**
Demand	**D1**	**D2**	**….**	**Dn**	

Figure 3 (Tabular format of transportation model)

Methodology:

The pivotal proposal of this work can be stated as:

- Quantitative decision-making models can provide the decision maker with important recommendations and support for improving performance even in areas that appear to be completely descriptive and cannot be quantified (the example presented here is a survey of tourists at different tourist destinations).
- It is possible to repurpose quantitative models for decision-making and apply them in areas that initially seem far from the basic function of these models (here we repurpose the transportation model to determine the optimal use of resources in developing tourism destinations).

To verify this proposal the work will achieved the following stages:

1) Investigate the opinions of domestic visitors about the different Egyptian tourism destinations using a questionnaire that is described next section.
2) Analyze the results quantitatively using The Monte-Carlo simulation technique.
3) Employ the Transportation model to give a recommendation about the criteria that the decision makers have to bay attention and allocate efforts and resources for each destination either to sustain its strengths or overcome its weaknesses.

Case description

In this section we are going to demonstrate the questionnaire and analyze the data extracted from it reaching to the recommended actions and conclusions that must be taken.

Data collection

The population of this research consists of tourists residing inside Egypt who are accustomed to traveling to or visiting domestic Egyptian tourist destinations (Hegazy, 2023).

The sampling process began with building a list of types of individuals and also compiling a list of relevant people who had a personal relationship with one of the researchers. Next, the researcher started reaching out to the people on this list, either through an email or a phone call. These initial communications are largely designed to give a general idea of the planned research and its aims, and to invite an interview in an environment most suitable to the topic, in fact, the response was positive and satisfactory from the majority of those contacted, showing a willingness to make interviews to complete discussing the questionnaire points (Hegazy, 2023).

The following restrictions had been imposed on the interviewees to select the targeted sample elements (Hegazy, 2023):

- Interviewees visited several Egyptian tourism destinations to have more enough experiences about these destinations, to be able to compare the different Egyptian destinations.
- Interviewees visited destinations outside Egypt (more than one) to be able to make a comparison among inside and outside Egypt destinations.
- The most recent visit to the outside or domestic destination at most one year ago to be able to remember and express their experiences.
- The ages of the interviewees are more than or equal 18 years. To be able to decide visiting any destination independently.
- The selected sample has the following Characteristics:

Table 1 (sample Characteristics)

Factors	Items	Frequency	percent
Gender	Male	361	70.2
	Female	153	29.8
Age Category (years)	Less than 20	43	8.4
	20 less than 30	173	33.7
	30 less than 40	105	20.4
	40 less than 50	77	15
	50 less than 60	75	14.6
	60 or above	41	8
Educational Level	High school	41	8
	Undergraduate	177	34.4
	Bachelor degree	154	30
	Postgraduate	142	27.6
Employment Status	Student	89	17.3
	Employed	262	51
	Self-employed	115	52.4
	Retired	48	9.3
Income per Month (EGP)	Less than 5000	74	14.4
	5000 less than 10000	78	15.2
	10000 less than 20000	269	52.3
	20000 less than 30000	57	11.1
	30000 less than 40000	32	6.2
	40000 or more	4	8
I Usually Travel	Alone	45	8.8
	With family	300	58
	With friends	154	30
	With colleagues	15	2.9

Questionnaire Design:

The questionnaire was designed to assess the various factors that influence the decision that Egyptians may take to revisit different regions (destinations) in Egypt. The questionnaire contains a list of questions that measure the reasons that prompt Egyptians to re-visit areas they have visited before, the answer of each question (for each region separately) is a score from 1 to 5 to evaluate the impact of this reason on the decision of revisiting the

region (5 means high impact and 1 means low impact), the questions are classified into four class each of them assess the effect of one criterion of the following:

Environment, that measured by the following questions:

1) Viewing this destination pleases me
2) The smell of the sea and pure air of this destination affects me positively
3) The sounds in this destination affect my sense of hearing positively
4) This destination is an exciting city
5) This destination induces my emotions positively
6) This destination generates positive emotional vibes
7) I could form positive feelings towards this destination
8) This destination attracts me emotionally
9) I performed a variety of bodily activities in this destination (like swimming, diving, visiting famous places, etc.)
10) This destination is appropriate for practicing bodily activities
11) I could practice my daily exercises in this destination
12) I did memorable bodily activities in this destination
13) There is shortage of activities to do, so I have more time to think
14) I engaged in a lot of thinking in this destination
15) This destination encourages me for thinking
16) deeply
17) This destination stimulates my curiosity (The desire to know more about it)

Impact of destination on the visitor personality, that measured by the following questions:

1) The personality of this destination matches with my personality
2) The personality of this destination is a mirror image of me
3) The image of this destination reflects how I see my self
4) The personality of this destination represents the person I wish to be
5) The personality of this destination matches with my best personality
6) The image of this destination reflects how I would like to be
7) The image of this destination matches with my actual image in the mind of others
8) The image of this destination reflects the image others see me
9) The personality of this destination expresses how others think of me

10) The image of this destination matches with my best image in the mind of others
11) The personality of this destination represents the person I wish to know the others
12) The image of this destination reflects the image I wish others to see me

Mood improvement, that measured by the following questions:

1) This destination makes me feel good
2) I could not determine my feelings toward this destination
3) This destination makes me happy
4) I love this destination
5) I have special feelings toward this destination
6) I have passion toward this destination
7) I'm very attached to this destination

Memories, that measured by the following questions:

1) I would prefer to visit this destination, even if other destinations have similar features
2) It is favorable for me visiting this destination rather than other similar destinations
3) I would desire to visit this destination, even if there are other destinations as good as it
4) It is favorite for me visiting this destination, even if all other destinations are alike
5) I would prioritize to visit this destination, even if other destinations are better than it.

The regions were divided into eight main regions (which received the highest number of answers) as follows (alphabetically ordered):

Alexandria, Aswan, Fayoum, Matrouh, North Coast, Red Sea, Sharm El-Sheikh and Siwa.

The respondents in the questionnaire were asked to answer these questions only for the areas they had already visited before, and this explains why the number of answers varies from one area to another. For respondent in the questionnaire the average score for each criterion with each region were found, and then we calculated the maximum score, minimum score and also the most likely score for each region with each criterion, the results where be summarized in table (2).

Table 2 (scores of regions with criteria)

	Environment			Impact on personality			Mood Improvement			Memory		
	Maximum score	Most probable score	Minimum score	Maximum score	Most probable score	Minimum score	Maximum score	Most probable score	Minimum score	Maximum score	Most probable score	Minimum score
Alexandri	5	4	1.875	5	5	2.08	5	4.289	2.289	5	5	1.2
Aswan	5	4	3.125	5	5	1.5	5	4.429	3	5	5	1.2
Fayoum	4.75	4	3.438	5	5	2.5	5	4.429	3.571	5	5	1.8
Matrouh	4.875	4.25	3.625	5	4	2.5	4.714	4.429	3.714	5	5	3
North	5	4	3.5	5	5	4	5	4.429	3.571	5	5	4
Red Sea	5	4	3.5	5	5	2.167	5	4.429	3.571	5	5	1.4
Sharm	5	4	3.25	5	5	2.25	5	4.429	2.714	5	5	1
Siwa	4.3125	2.71875	1.125	5	5	1.417	4.571	4.429	1.571	5	5	1.2

Results

This section includes the results that were gained by running the Mont-Carlo Simulation and Transportation models and the interpretations of these of these results.

Running Monte-Carlo Simulation:

The next step was to make simulation containing 500 trials for the score of each region with respect to each criterion, the question here is; why we used simulation? The reasons to use simulation can be summarized as: The collected data were not big enough to represent the community of Egypt's residents which is very huge. The number of answers for some regions were very small. The number of answers for different regions are not the same, the highest number of answers was For Sharm El-Sheikh (63 answers) and the smallest number of answers was for Siwa Oasis (7 answers only) which make the comparison has no sense.

To perform the simulation process, the researcher found it is appropriate to assign the score of each region with respect to each of the triangular probability distribution criteria which can be expressed by the three parameters, the maximum score, the most likely outcome and the minimum score that have already been computed.Simulations were run using the package (MINITAB) for 500 experiments. Then, for each criterion separately, the scores for the regions for each trial were compared and the region with the highest score in each trial was identified.The results of these comparisons can be compiled into the following matrix (Table 3), which contains the number of times each region received the highest score with each criterion, for example, in the environment criterion, Matrouh region received the highest score 121 times (out of 500 trials) but the Siwa region did not receive the highest score at any time.

Table 3 (the summary of comparison results)

	Environment	Matching with personality	Mood improvement	Memories
Alex	37	55	48	42
Aswan	55	63	53	43
Fayoum	38	59	98	53
Matrouh	121	11	42	88
North Cost	94	180	91	168
Red Sea	79	51	96	34
Sharm	76	42	69	31
Siwa	0	39	3	41

From the above table we can conclude the following:

- The visitor who wants to enjoy healthy and clean environment should spent his/her vacancies in places like Matrouh, North Coast, Red Sea or Sharm El-Sheikh respectively (column one).
- North Coast is the suitable destination to different visitors with different characteristics and needs (Column two).
- Fayoum, Red Sea, North Coast and Sharm El-Sheikh are respectively the destinations that can re-mood and relax persons to be able to return to their work and regular life (column three).
- North Coast is the distinguished destination in making good memories for the persons (column four).

Applying Transportation Model:

Our new goal now is to assist the authorities entrusted with the revitalization and improvement of tourist destinations in maximizing the return from their efforts by defining two criteria for each tourist destination, one of which will be a criterion in which that destination is distinguished in order to take the necessary measures for the continuation, continuation and development of this discrimination, and the other represents a weakness for this destination In order to do what is necessary to get rid of this weakness and turn it into a point of strength and competition.

To achieve this goal, we suggest to use the transportation model twice for the above matrix once as maximization and the as minimization assuming that the destinations are the suppliers (with total supply one unit for each) and the criteria are the demanders (with total demand two units for each), the formulation of the problem will be as (table 3):

Table 4 (transportation formulation)

	Criteria				
Destinations	1	2	3	4	**Supply**
Alex	37	55	48	42	1
Aswan	55	63	53	43	1
Fayoum	38	59	98	53	1
Matrouh	121	11	42	88	1
North Coast	94	180	91	168	1
Red Sea	79	51	96	34	1
Sharm	76	42	96	31	1
Siwa	0	39	3	41	1
Demand	2	2	2	2	

The solution of this problem had been run using the software (Management Scientist II) and the result of maximization run was found to be (table 4):

Table 5 (solution of maximization problem)

	Criteria			
Destinations	1	2	3	4
Alex	0	1	0	0
Aswan	0	1	0	0
Fayoum	0	0	1	0
Matrouh	1	0	0	0
North Coast	0	0	0	1
Red Sea	1	0	0	0
Sharm	0	0	1	0
Siwa	0	0	0	1

This solution can be interpreted as:

- Each of Matrouh and Red Sea are distinguished by the environment criterion and we should make efforts to sustain this situation.
- Both Alexandria and Aswan are distinguished in their compatibility with different personalities, and the authority must make efforts to preserve this characteristic.
- Both Fayoum and Sharm El-Sheikh can restore relaxation and the general mood of visitors, so we must preserve these features
- Both the North Coast and Siwa leave distinct memories for their visitors, and the authorities must develop this property.The result of minimization run was found to be (table 5):

Table 6 (solution of minimization problem)

	Criteria			
Destinations	1	2	3	4
Alex	1	0	0	0
Aswan	0	0	0	1
Fayoum	1	0	0	0
Matrouh	0	1	0	0
North Coast	0	0	1	0
Red Sea	0	0	0	1
Sharm	0	1	0	0
Siwa	0	0	1	0

This solution can be interpreted as:

- Each of Alexandria and Fayoum has weakness in the environment criterion and we should make efforts to change that.
- Both Matrouh and Sharm El-Sheikh cannot match different type of visitors, so they need to create new activities and visiting places to be attractive to more types of visitors.
- Both North and Siwa cannot restore relaxation and the general mood of visitors, so we must make efforts to change this situation.
- Aswan and Red Sea needs more efforts to create activity and memorials to preserve good memories with the visitors.

About Siwa Oasis:

According to table 3, it was found that Siwa Oasis received the lowest number of ratings as a preferred tourist destination in all criteria, even though Siwa Oasis is world-famous for its unique nature, tranquility, and environment, and that it is an important destination for medical tourism. The truth is that this situation can be explained by two reasons, one qualitative and the other quantitative, as follows:

- Siwa Oasis targets a special type of visitor who wants its tranquility and unique environment or to study its distinct antiquities and Bedouin community. These visitors are naturally fewer than those who want to spend a vacation with the family in a place that suits different ages and personalities, and who represent the vast majority in domestic tourism.
- The number of people who had previously visited Siwa Oasis among those who were asked in the questionnaire on which our study was based was very small (only 7), so it was natural for it to appear as a preferred destination to revisit a small number of times.

The recommendation that we can suggest in such a case is to pay attention to quality more than quantity, meaning that any development or improvement made to tourist destinations of a special nature, where the large number of visitors represents a threat to the sustainability of that nature, must consider not to disturb the natural features of the place and not to harm or pollute the environment, but services and activities must be provided that are appropriate to the type of visitors who visit them

Conclusion:

This work presented a quantitative approach to enhance local visitor satisfaction for different tourist destinations in Egypt. This approach combined quantification of descriptive data extracted from a questionnaire through which visitors' opinion on specific criteria was revealed and then a Monte Carlo simulation was designed and run to explore the strength and weakness criteria of each destination. The transportation model was also used to give decision support and recommendations on how to allocate efforts to maximize the positive characteristics and minimize the negative characteristics of each destination to attract more local visitors. the results of the work can be concluded as:

- Implementing Quantitative data analysis techniques (here we used the Monte-Carlo simulation) gives a clearer and more detailed picture of the information that can be extracted from the descriptive data in a way that enables us to identify strengths and weaknesses and establish a clear ranking of tourist destinations according to different criteria.
- The Egyptian tourism destination has different characteristics, that each of them is distinguished in some criteria and compete the other destinations in some other criteria and also has weakness in some criteria
- Quantitative decision-making models can be re-employed in different new areas which were not the main target of this technique (in this work we employed the transportation model in resource assignment problem)
- Using quantitative decision-making models offer the decision makers a recommendation that may be different from and integrated with the intuitionistic decisions that can be reached by the experience and subjective point of view.
- Egyptian tourism destinations can improve and enhance their images and consequently their economic returns by making effective resource allocation.
- It was found that some destinations such as Siwa Oasis have a special ambiance and nature which targets a special category of visitors, so attention must be paid to improve the returns of this destination at the same time prevent destroying its ingredients and preserving its unique nature.

Recommendation for Future Works:

Based on the conclusions of this work some future works can be suggested as:

- The approach taken in this paper can be generalized in future work either using similar steps in different economic sectors.
- Using other quantitative decision-making models in different fields whenever it is found appropriate.
- Making an integrated approach that merge the qualitative and quantitative decision-making tools in tourism management or any other management fields.

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