

# System Dynamics in Development and Management of Traveling Resources

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## 1. Flourishing of tourism

With the continuous progress of society, the tertiary industry has been developing quite rapidly, and in particular, tourism as a new force rising suddenly, is becoming daily more important in the economic development of all cities.

Nanjing is the capital of Jiangsu Province and also a famous ancient capital of six dynasties. In recent years, energetic efforts have been made in the development of tourism, which has speeded up the economic development. The scenic spots such as the Confucian Temple, Xuanwu Lake Park and Dr. Sun Yat-sen's Mausoleum have gradually become the pillars for the tourism in Nanjing. However, expensive tickets make people flinch. Not many citizens and tourists would come except in weekends and holidays, mainly because of the high ticket prices.

Now people are happy to see that this condition is being gradually improved. For example, the Xuanwu Lake Park opened freely to tourism for the first time during the Spring Festival this year. This not only attracted a large number of tourists and increased visitors to the park, but also made an experiment for the permanent elimination of admission tickets in the future. The effect is quite good. Although the admission ticket at the entrance of the park was eliminated, charge was still demanded for the Children's Paradise and rowing in the park, therefore, the total income was not affected, and on the contrary, it increased by a big margin.

In the school where the author is now studying, experiment on spreading the education with systems thinking and system dynamics are being made. In the study, I got some preliminary ideas about the methods and tools to solve dynamic and complicated questions, and I also came to know that it should be more effective to study with this method on how to improve the policies and strategies in tourism management. I therefore wrote this article as an exercise of my study of systems thinking.

## 2. Application of systems thinking in tourism

### 2.1 Important factors and their interrelationship

In the operation of tourism, four factors playing important roles: **quantities and quality of scenic spots** (hereinafter referred to as QQS), **number of tourists**, **ticket price** and **Accumulative gains** of operation and management departments. The interrelationship of these four factors are as shown in Fig. 1.

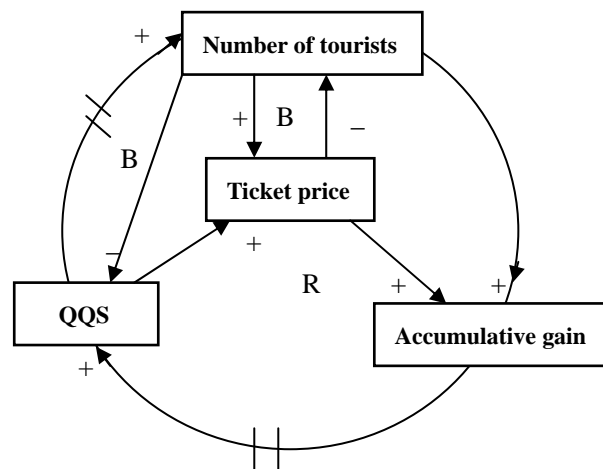


Fig. 1 Causal Loops of No. of tourists ,Ticket price, QQS and Accumulative gains

### 1. Accumulative gains

The total gains of tourism depends on one hand on the **number of tourists** and **ticket price**, as they determine the income of tourism. The more **number of tourists** and higher **ticket price**, the more total gains, and vice versa. On the other hand, they are restricted by the cost required to manage and maintain the touring environment. Therefore, the **accumulative gains** is the difference between income and cost. The **accumulative gains** will not surely increase when the **ticket price** and **number of tourists** increase. To increase the **accumulative gains** from tourism, the relations of these three factors must be properly handled. It cannot do by solely increasing the ticket price with no regard to maintenance of resources, nor by solely improving the environment with investment with no regard to the industrial gains. It is necessary to find a balance point between increasing gain and protecting the environment according to their relations and relevant data.

## 2. Quantity and quality of scenic spots (QQS)

The **QQS** is determined by both **accumulative gains** and **number of tourists**, of which the **accumulative gains** plays a positive role, while the **number of tourists** a negative role. When the **accumulative gains** increases, there will be sufficient capital available to improve the existing quality of scenic spots and add new spots; but when the **accumulative gains** decreases, there will be fewer opportunities to improve the scenic spot quality. However, increased number of tourists tends to increase the damage to the quality of scenic spots.

## 3. Number of tourists

The **number of tourists** depends on **QQS** and **ticket price**. When there are more scenic spots with high quality, the attraction rate of the spots will increase, bringing in more tourists; when there are few scenic spots with poor quality, the scenic spots will become less attractive, resulting in reduced number of tourists. Meanwhile, the number of tourists is also linked with ticket price. If the price of admission tickets has exceeded the acceptable range of people, there will be less people to visit the spot; on the contrary, a proper ticket price level will attract more tourists.

## 4. Ticket price

**Ticket price** is determined by **QQS** and **number of tourists**. Tourism operators usually set the ticket price according to the quantities and quality of the scenic spot. A scenic spot with beautiful views, meandering and winning attractions, or with natural wonder and magnificent style will surely deserve a decent price; however, if the scenery is not quite to the expectations of tourists, a high price will never be set. In addition, the price level is also influenced by the number of tourists. During the peak season of tourism with more tourists, the operators would certainly seize the business opportunity to increase the ticket price. On the other hand, to protect the quality of the scenic spots, when the **number of tourists** has increased to the extent that it will seriously damage the environmental quality, operators will also try to control the increase of **number of tourists** by setting a high **ticket price** level. However, in the slack season, operators usually decrease the **ticket price** to attract more tourists.

## 2.2 Operation of feedback loop

The structure shown in Fig. 1 is a complicated dynamic system, consisting of feedback loops and delays. How many feedback loops are there in it? How do they operate?

1. When the **QQS** increases, the **number of tourists** will increase. But the increase of **number of tourists** will unavoidably result in damage and pollution to the environment, then the **quality of scenic spots** will decrease. On the other hand, decrease in **quality of scenic spots** will reduce the **number of tourists**, which will lessen the pollution to the scenic spots. This forms a simple negative feedback loop.

2. When the **QQS** increases, both the **number of tourists** and **ticket price** will increase. The increase of these two factors will increase the **accumulative gains**, which in turn will optimize the resources, improve the **quality of scenic spots**, and finally increase the **QQS**. This is a positive feedback loop.

3. The increase of **number of tourists** will drive the **ticket price** up. Increase of **ticket price** will decrease the **number of tourists**. This is another simple negative feedback loop.

The combined action of these three rings determines the management of the four major factors and their interrelationship.

## 2.3 System dynamic model

The prosperity of tourism is also closely linked with the quality of operators. The purpose of operators is to achieve benefits from tourism and also improve the **quality of scenic spots**, ensure good leisure-making quality for tourists. To realize this purpose, they should first of all get sufficient finance to develop the resources, to make the scenic spots more attractive to get more tourists; then, they may slowly increase the ticket price to get more income from tourism; after a period of time, they must face the reality that the

scenic spots is more or less damaged, so they should spend part of the tourist income on restoring and improving the quality of scenic spots, or employing people to manage the scenic spots. It can be said that before the real start of tourism, there is no **accumulative gains** at all, as it is necessary to obtain loans, instruct new scenic spots, pay the interest, salaries for workers and overheads, etc. It is possible to gain rapid development of tourism and to get net profit only when everything has been brought to the track. Therefore, a tourist operator must have a global vision, courage and patience, to make intelligent analyses of the relations of all the above-mentioned factors. He must never seek the short-term interest only, to get high profit by solely increasing the ticket price or by other means.

To implement proper control by people to realize the purpose as described above in such a complicated system, it is not sufficient to determine its qualitative relations, nor is it possible to predict such complicated and dynamic correlations with visual estimation. An overall consideration can be taken only by establishing a systematic numerical model and providing it with quantitative relations and data.

A system dynamic model was established on the basis of the above thinking. The model consists of three sub-model, respectively tourist resources, number of tourists and finance.

### 1. Sub-model of tourist resources and number of tourists.

These two sub-model are comparatively simple in structure, and it can be clearly seen in the overall structure diagram as shown in Fig. 2.

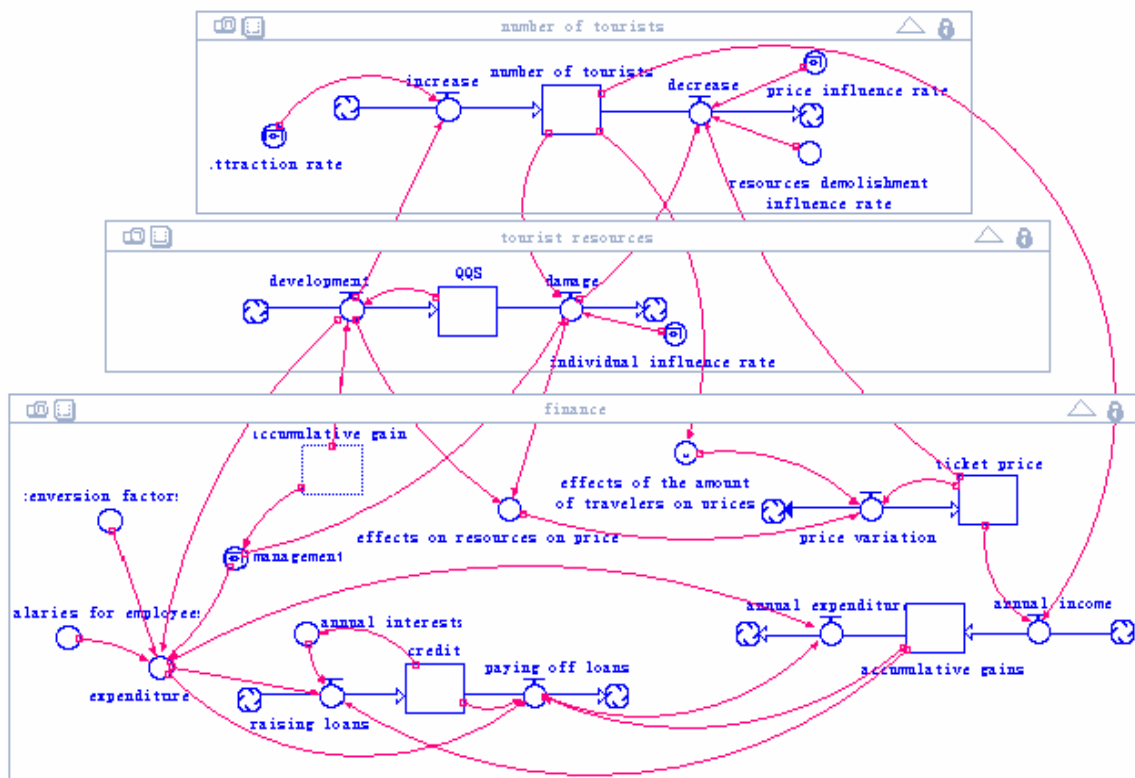


Fig. 2

### 2. Sub-model of finance

Now here is an analysis of the complicated finance model. Capital is required to tap natural resources. In the initial status, there is no tourist **income**, and **expenditures** have to be paid with bank loan. Only after the resources have been developed as tourist resources and play their role – attracting tourists, the tourist **income** will begin to increase. Only after tourist income has been obtained, can the **expenditures** be paid jointly by the bank and the self-obtained income, or be fully paid with tourist **income**. However, when the **number of tourists** increases, pollution will become unavoidable, resulting in damage to the resources. Therefore, people must be employed to perform **management** and repair the resources. So part of the income will be taken out as the **management** expenses and **salaries for employees**. Furthermore, when there is sufficient **income** to pay these, loan and its interest must be repaid, or re-investment should be made to expand the development. If the income is not sufficient to pay the management expenses and salaries for employees, more loans have to be obtained from the bank, and there is no opportunity of expansive development. This is the mechanism of the financial model.

### 3. Interactive relations

It can be seen from Fig. 2 that these three sub-model are correlated in operation.

In the model, three feedback loops as analyzed above are reflected. Now they are correspondingly described as follows.

1). When the **damage** flow of resources increases, the **decrease** flow of number of tourists increases, or the decrease of **number of tourists** stack. With the decrease of number of tourists, the **damage** flow to resources decreases. This will result in decrease of the **decrease** flow of the number of tourists, or increase of the **number of tourists** stack. This is the first negative feedback loop. Of course, the same result can be obtained by considering in terms of the development flow of resources.

2). When the **development** flow of resources increases, the **increase** flow of number of tourists increases, or the increase of **number of tourists** stack. This increase will bring increase in the **annual income** flow, or increase in the **accumulative gains** stack, and therefore it increases the **development** flow of resources, completing a positive feedback loop.

Similarly, when the **development** flow of resources increases, the **effect of resources on price** will also increase, and **price variation** will increase accordingly. Then, the **ticket price** will increase naturally, resulting in the increase of **annual income**, and eventually promoting the increase of **accumulative gains** from tourism. When the tourism gain increase, expenses on management will surely increase, which means more **management**, then the **damage** flow of resources will decrease and the resources quality will improve, thus returning to the start point of this positive feedback loop.

3). Increase of **number of tourists** stack will deepen the **effect of number of tourists on price**, increase the **price variation** flow and drive the **ticket price** up, and this will in turn increase the **decrease** flow of **number of tourists** stack, causing decrease of **number of tourists** stack. This is a negative feedback loop.

Next, the following factors in the model also deserve attention.

1). The attraction of tourist resources. Obviously, the landscaping quality of scenic spots is quite important to tourism gain. Today in the 21st century, it is not sufficient to only expand the area of the scenic spot and add more recreational facilities. Tourists ask more for high quality landscaping views to satisfy their daily increasing demand for mental enjoyment. Therefore, the construction and development of tourism should also change from an extensive pattern to an intensive pattern.

2). Extent of management. There is no doubt that proper management contributes considerably to gain from tourism. With the increase of tourists, damage to the scenic spots is unavoidable. To deal with this problem, positive actions should be taken to repair and restore the resources, or strengthen the management of resources, instead of turning a back upon it.

3). Extent of impact by individuals. Tourists play a double role in the tourism: they pay for the tickets to contribute to the tourist income, and in the meantime they are involved in the damage to the resources to varied extents. The extent of impact by individuals on the resources may change the destination of tourism. With the daily improvement of the quality of people, the impact by individuals on resources is decreasing daily. For example, improper behavior such as littering at scenic spots and treading on lawn is getting less. This is undoubtedly positive to the management of tourism and eventual gains. The beautiful views at scenic spots are good for people to enjoy their leisure time, so each person should be conscious in protecting the resources, to keep a beautiful environment for others, and also for himself.

4). Influence from price. The influence from price is determined by the economic development level of the nation and the income of individuals. It is certain that the higher economic level of the nation, the more individual income, the less influence from price and the more accumulative gains from tourism. Therefore, energetic development of economy by the nation to improve the living standard of people will promote the development of tourism.

#### 4. Conclusions

1). The following views can be obtained through factor analysis and from the structure of causal loop: the primary tasks for tourism operators are developing new resources and improving quality of scenic spots, strengthening the timely repair and management of resources and making more people aware of the protection of resources. What the state can do to promote the development of tourism is to energetically develop economy, definitely improve the living standard of people and make initial investment in tourism. However, this will only increase the tourism gain. To enable sustainable development of tourism, importance must be attached to environmental protection, and the number of tourists should be controlled by adjusting the ticket price to protect the scenic spots from serious damage, and efforts should be made to realize steady growth of income and keeping a good tourist flow to scenic spots.

2). The model established on the basis of the above analysis can provide a simulation platform to

work out strategies for development of tourism, and enable analyze and evaluate the “status quo” of tourism management on the basis of sufficient data collected. Further, test can be made to see the “effect of changing the strategy, i.e. what result will be produced in the future ‘if ----’”, so as to finally get the “high leverage” solution on improving the management level for tourism. Moreover, this test is performed in an iterative manner. With the deepening of the work, more ideas will be introduced, and this model will be continuously improved to make it closer to the actual conditions, becoming a “quick laboratory for decision-making” by the management.

3). It has been shown in studying the development process of tourism through systems thinking to obtain practical and feasible solution strategy that, for a secondary school student, the process of systems thinking and modeling can help raise the thinking ability and innovating ability, and get better ways of thinking. This will enable people to look at issues from a systematic, dynamic and complicated point of view, for more complete and accurate results.

As far as myself is concerned, the idea of systems thinking and system dynamics has indeed brought a qualitative leap in my way of thinking. Previously, I was used to solving problems by using direct causal loop. This is certainly not sufficient nor complete, and in some cases, it may even lead to incorrect results. This problem can be avoided by systems thinking. As all related factors have been taken into consideration and their interrelationship have been clearly analyzed, the question can be taken into consideration in an all-round way, therefore more accurate results can be obtained.

**Reference:**

[1] Wu Xijun and Yuan Yonggen, *Tests on Systems Thinking and Decision-making – the Way to Success in the New Century*, Jiangsu Science and Technology Publishing House, 2001, Rev. 1.