

# **Towards a shared systems model of stakeholders in tourism development in the Cat Ba biosphere reserve of Vietnam**

**Thanh Van Mai Bosch O.J.H, and Maani E.Kambiz**

School of Agriculture and Food Sciences  
The University of Queensland, QLD 4343, Australia  
Tel: +61 7 5460 1693; email address: [thanh.mai@uqconnect.edu.au](mailto:thanh.mai@uqconnect.edu.au)

## ***Abstract***

Tourism is a dynamic and complex system which involves various stakeholders, each with different understandings of a system and holding different management objectives. These different expectations result in unforeseen conflicts among stakeholders that could negatively affect the development of tourism. This paper describes a participatory systems approach to develop a shared understanding amongst stakeholders of the tourism system in the UNESCO designated Cat Ba Biosphere Reserve in Vietnam.

The process includes the development of a systems model that represents a holistic understanding of the interconnectedness and relationships between the various components that impact on sustainable development of tourism in the biosphere. The model is intended for use as a framework for decision making and capacity development by government and private stakeholders who share the responsibility of developing, managing and sustaining the system.

***Key words:*** sustainable tourism, systems thinking, complexity, system dynamics, biosphere reserve

## **1. Introduction**

In recent years, tourism has become the largest and fastest growing sector of the world economy . It is therefore seen as one of the main instruments for enhancing regional development in many countries as it generates opportunities for employment, gross income and also stimulates the demand for local products and industries .

Despite the many obvious advantages, tourism can also have negative impacts on the environment and society that may pose threats to the sustainability of the region . Therefore, sustainable tourism development has become a critically important topic and has been receiving increasing attention from the world community. This is especially true for Islands which are often perceived to mean “paradise” to many people and therefore attract and motivate them to seek an “island experience” during their travels . This study has been conducted in the Cat Ba Biosphere Reserve (CBBR) in Vietnam, which is a highly preferred tourist destination, but also has significant environmental and social problems. The study is part of a Pilot Project to establish biosphere reserves as ‘Learning Laboratories for Sustainable Development’ .

A tourism destination is a highly dynamic and complex system, comprising many interdependent components and involving a diverse array of stakeholders , each of whom holds different management objectives that could result in unforeseen conflicts among stakeholders. These differences in the perceptions of different stakeholders of the tourism system and how they should be managed are of significant importance. Stakeholders all have different mental models of the components of the system as a whole and how these components interact. Capturing these can significantly help to develop a better understanding of the system as a whole. More importantly, such a process should result in a shared understanding, which will only be possible if all stakeholders are involved in the process . Developing a systems model that incorporates and reflects the different mental models of stakeholders will not only develop a shared understanding of the system, but also assist in defining the root causes of complex problems, rather than merely treating the symptoms.

This paper focuses on the integration of the different mental models of stakeholders on tourism development through the structuring of these models into a conceptual model of the tourism system on Cat Ba island. It illustrates how this conceptual model can be analysed and used for the identification of leverage points for systemic interventions that are required to develop a sustainable tourism industry on the CBBR.

## **2. Background of tourism development in the Cat Ba Biosphere Reserve**

Cat Ba is the largest Island of the Cat Ba Archipelago, which belongs to Hai Phong City, situated in the north of Vietnam. The Island is identified as one of the areas of highest biodiversity importance in the country. It has great historical and cultural advantages and is recognized as having a high priority for global conservation .

In 2004 UNESCO designated Cat Ba as one of the world’s biosphere reserves which covers most of the Ca Ba Archipelago . The unique features of the Island have made it become a much sought after tourist destination. The number of tourists to the Island has dramatically increased over the years (Table 1), and the tourism sector has become the largest contributor to the local economy .

**Table 1:** Tourism Development in the Cat Ba Biosphere Reserve (1,000 tourists)

<b>Number of Tourists</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
International Tourists	60.5	118	122	171	224	250	286.2	303.5
Domestic Tourists	189.5	210	313	329	505	510	718.8	823
Total	250	328	435	500	729	760	1,005	1,126.5

Source: Department of Tourism, Culture and Sport of Cat Hai District, 2010

The management of tourism in the CBBR involves a diverse range of public and private stakeholders, such as tourism operators, local communities, local authorities, and the Cat Ba National Park, each of which have varying sets of needs and expectations towards tourism development in the region.

Tourism operators depend on the natural and cultural heritage resources of the region and therefore put emphasis on the availability of tourism facilities and services. Their main concerns are long-term growth, profitability and new business opportunities, while the local authorities desires to optimise utilization of the resources where jobs are created and the resources protected. Local residents who pay the costs associated with tourism development are more interested in employment opportunities, security or improvement of their lifestyle and the cost of living in the region. Management of the Cat Ba National Park emphasises a reduction of the impact of tourism on the natural environment.

The different needs and expectations between stakeholders increase the challenges of achieving the sustainable management of tourism in the Cat Ba region. The complexity involved in the development of a sustainable tourism industry under these conditions justifies the use of a systems approach to develop a shared understanding and to minimise conflicts of interest amongst various stakeholders in the system.

### **3. Conceptual model of the tourism system in the CBBR**

#### **3.1. Model development process**

The development of a conceptual model was mainly based on qualitative descriptions of the mental models of different stakeholders. The process included two main stages. In the first stage, a preliminary conceptual model was developed from an extensive review of literature and integrating and structuring the mental models of different stakeholders on how they perceive the different components and interactions between the different variables in the system. In this stage, in-depth interviews and focus group discussions (FGDs) were conducted with a wide range of relevant stakeholders to explore their mental models. In the second stage, a stakeholder workshop was conducted to refine and validate the preliminary systems model.

One week prior to the workshop, the preliminary systems model, a questionnaire and a summary of how the model was constructed were sent to twenty-five participants, who had been involved in the FGDs and in-depth interviews. The questionnaire had three questions aiming to seek participants' expert knowledge to:

- amend the links between variables in the model based on their own opinion;
- add variables, which were not included in the preliminary model, as well as to indicate the reason why they added these variables to the model, and
- prioritize the three most important variables according to their opinion.

Nineteen questionnaires were returned, a response rate exceeding the 75 percent which has been regarded as acceptable for a mail questionnaire. The answers to these questions assisted in determining which factors were to be incorporated into the final model.

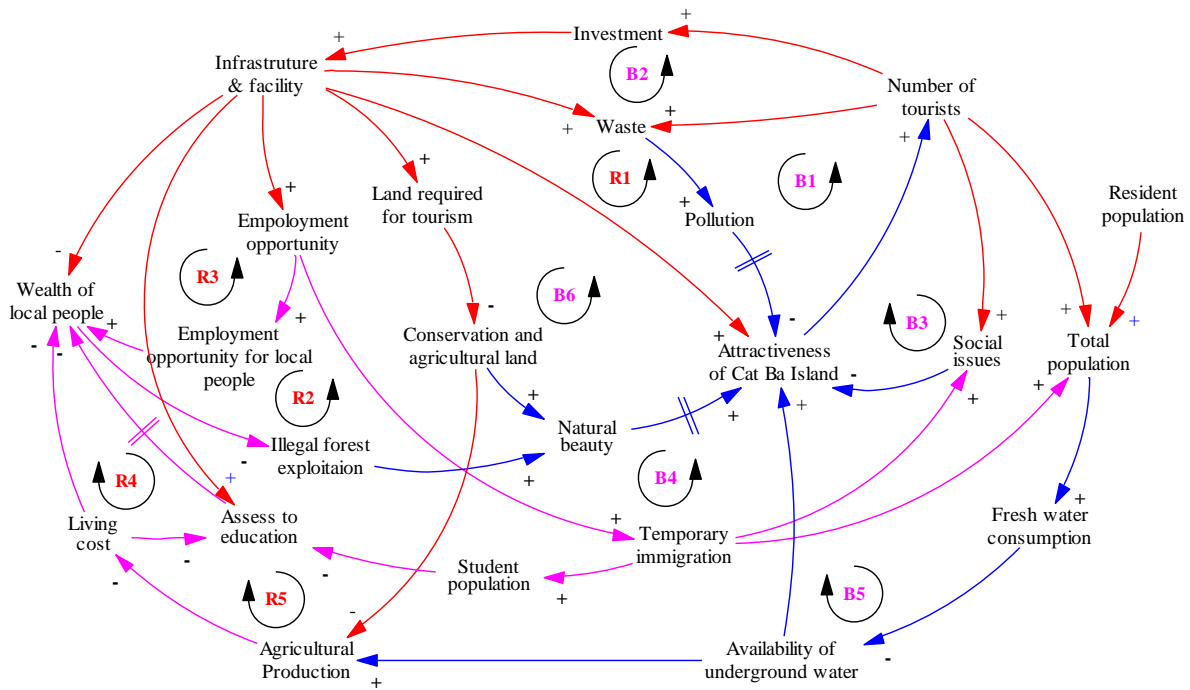
The twenty five selected participants were then formally invited to attend the stakeholder workshop. The participants represented local government agencies, tourism operators, commune leaders, and local residents, who were all actively engaged in tourism activities.

The workshop was used to develop a better understanding of the concept of systems thinking and to discuss the development of the conceptual model of the tourism system. To facilitate this session, the preliminary model was copied onto a large sheet of paper and posted on the wall where the workshop took place. The preliminary model was relatively simple and did not reflect a comprehensive picture of tourism in the region at this stage. However, it served as an important starting point for brainstorming by the workshop participants.

The participants were encouraged to make changes to the model based on their discussions by removing or adding variables on a piece of paper. The participants were also asked to identify relationships between the variables by drawing an arrow between each pair of related variables. To generate a direct arrow, they were guided to place at the head of the arrow a positive (+) sign for an increase and a negative (-) for a decrease. This process resulted in a first draft causal loop diagram (CLD). In addition, with the assistance of the research team, several feedback loops were initially identified. At the end of the group model-building exercise, there was a general consensus that this model was a fair representation of the shared views of the various stakeholders. The first draft CLD was developed further by adding new variables and links as well identifying the feedback loops.

### **3.2. *Conceptual Model of the tourism system of the CBBR***

The final conceptual model presented in Figure 1 provides a fair idea of the integration of the mental models that were shared and integrated by the relevant stakeholders on tourism development in the CBBR. The model building process was a significant exercise for the participants who considered the discussion groups, individual interviews and workshop as a forum for them to present their ideas. There was a clear feeling amongst the stakeholders that their experiences and knowledge were regarded as valuable. They could directly experience the addition of many variables and removal of others from the model they have helped to create, and the stakeholders took strong ownership of the model.



**Figure 1: Conceptual Model of the Tourism System in the CBBR**

*Legend: + (same direction), - (opposite direction), // (delay), R (reinforcing loop), B (balancing loop)*

The model explains the sources of dynamism and complexity that have given rise to Cat Ba’s predicament. This dynamic and complex systems model shows that relationships between the key variables are not linear, but have cause-effect relationships. The model comprises many components, which concern many different tourism-related aspects, such as pollution, immigration, wealth of the local people, and the limitation of natural resources (particularly fresh water and land). These aspects can be grouped into three major categories, including the economics of tourism; natural resources and environment; and socio-demographical issues. These are illustrated in different colours in Figure 1. The red arrows link the economic variables, forming the economic component of tourism; the blue arrows connect environment variables, while the pink arrows link socio-demographical variables, representing the socio-demographical component of the tourism model.

The systems model and especially the process of its development have helped the stakeholders to better understand each other’s mental models, as well as the long term effects and complexities involved in the sustainable development of tourism in the biosphere reserve. The systems model is particularly useful to illustrate and understand the ‘bigger picture’ of tourism in the CBBR and how the factors affecting the system are not isolated and independent, but are dynamically linked. It illustrates how the different factors cause growth or decline in each other as well as in other key areas of the system.

The model can therefore be used as a platform for dialogue, communication, collaboration and decision making between relevant stakeholders in the region. This makes the model a potentially powerful tool for policy makers and practitioners, who are sharing the responsibility of managing and sustaining the system. This is of particular importance in the current tourism context of the CBBR, where a lack of a shared vision and coordination between stakeholders has been identified as key obstacles in sustainable tourism management.

The model also enables the identification of feedback loops, which could either be reinforcing (R) or balancing loops (B). Reinforcing loops are positive feedbacks that represent actions that are repeatedly affecting each other so as to continuously grow or decline, while balancing loops (negative feedbacks) seek stability and help in controlling the system to return to normal or working against a reinforcing loop . These loops play a significant role in the systems analysis by helping to identify driver or growing engines and inhibitors or barriers to the tourism system. In addition, they are particularly important for the identification of leverage points (see section 5) in the system that can help managers to address the root causes of problems. This will enable them to devise appropriate intervention strategies that can help in achieving sustainable tourism in the CBBR.

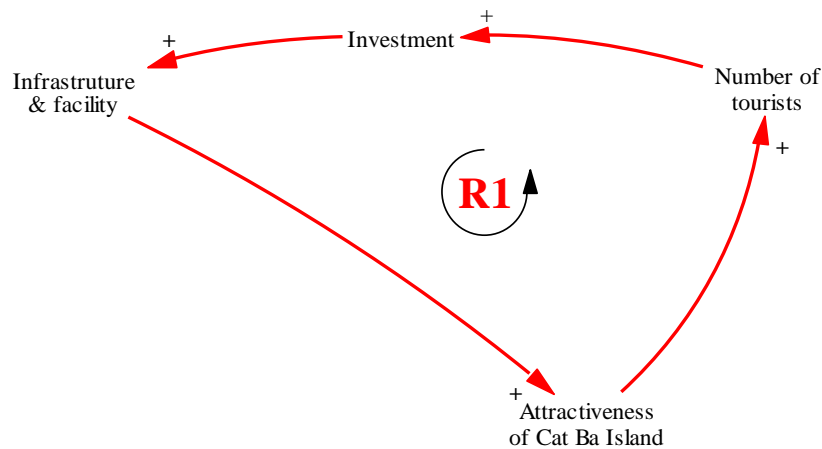
#### **4. Analysis of the conceptual tourism model**

Identification of feedback loops provided a valuable basis for analysing the links in the conceptual model of tourism . Eleven feedback loops were identified from the model, including five reinforcing loops (R1-R5) and six balancing loops (B1-B6) as shown in Figure 1. The following sections discuss each of these loops in details.

##### **4.2. *The Tourism Growth Feedback Loop (R1)***

The starting point for analysis of the tourism system of the CBBR is the central tourism growth loop R1 (included in Figure 1 and separated as in Figure 2 for ease of observation). This loop links the following variables of Number of tourists, investment, infrastructure and facility, and attractiveness of Cat Ba Island. This is a simple reinforcing loop that portrays the drivers behind the exponential tourism growth on the Island in the last few decades.

The important role of loop R1 is illustrating the attractiveness of the Island through the provision of tourism-related facilities and infrastructures. A possible starting point for this loop is the ‘number of tourists’. As the rapid tourism growth in the biosphere in the last decade has resulted in a large amount of tourism revenue, government and private sectors have been encouraged to invest in developing tourism related-facilities and infrastructures on the island to accommodate the growing demand. Part of this is the roads network, including the main road that goes through the island that has been built to connect different communes and tourist attractions.



**Figure 2:** Tourism Growth Loop (R1)

Furthermore, many tourist resorts and recreational facilities have been constructed and transport facilities have been improved in both quantity and quality. The improvement of facilities and infrastructures has created a more comfortable environment leading to attracting more tourists to the island.

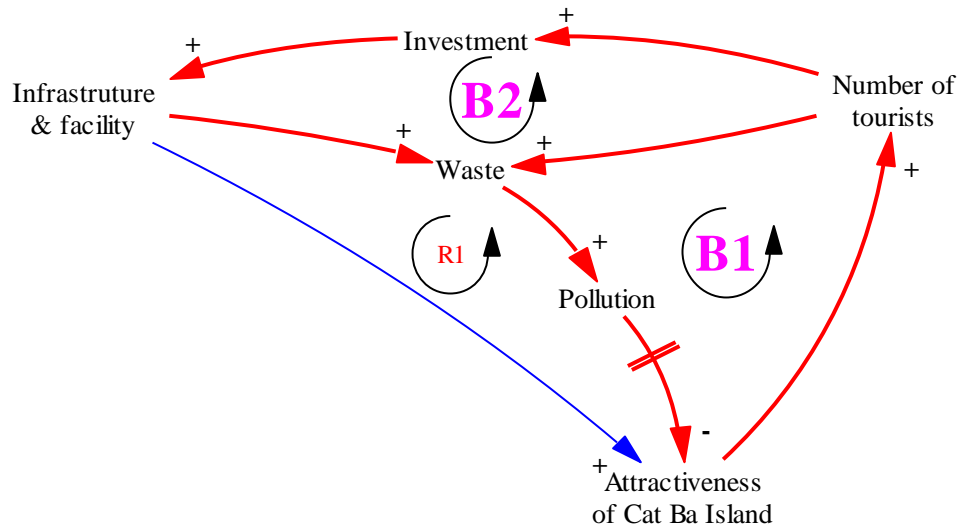
It is clear that in the R1 loop, the attractiveness of Cat Ba Island acts as the most important driver for tourism growth that encourages people to visit and spend time at the island . Vengesayi also pointed out that the more a destination is able to meet the needs of tourists, the more attractive it is perceived to be. The result is that such a destination is more likely to be considered and chosen in making a decision on where to travel .

If only the R1 loop existed in the system, the tourism industry would rapidly reach its objective of increasing the number of tourists. However, there are many loops in the system that would limit the growth of the R1. It is therefore important to investigate the role of the other (balancing) feedback loops in order to obtain insights into the dynamics of the tourism system.

#### **4.3. Pollution Feedback Loops (B1 & B2)**

There are two important balancing loops highlighted in Figure 3 that explain the long term effects of tourism development on the environment and attractiveness of a tourist destination. These loops include B1 (number of tourists, investment, tourism infrastructure and facility, waste, population, and attractiveness of Cat Ba Island); and B2 (number of tourists, waste, pollution, and attractiveness of Cat Ba Island).

Starting with ‘number of tourists’, it is clear that the increased number of facilities will lead to an increase in the amount of waste (solid and liquid) being generated by hotels and restaurants to be discharged into the environment. In addition, the increased numbers of tourists also generate more litter from their recreational activities.



**Figure 3: Pollution Loops (B1 & B2)**

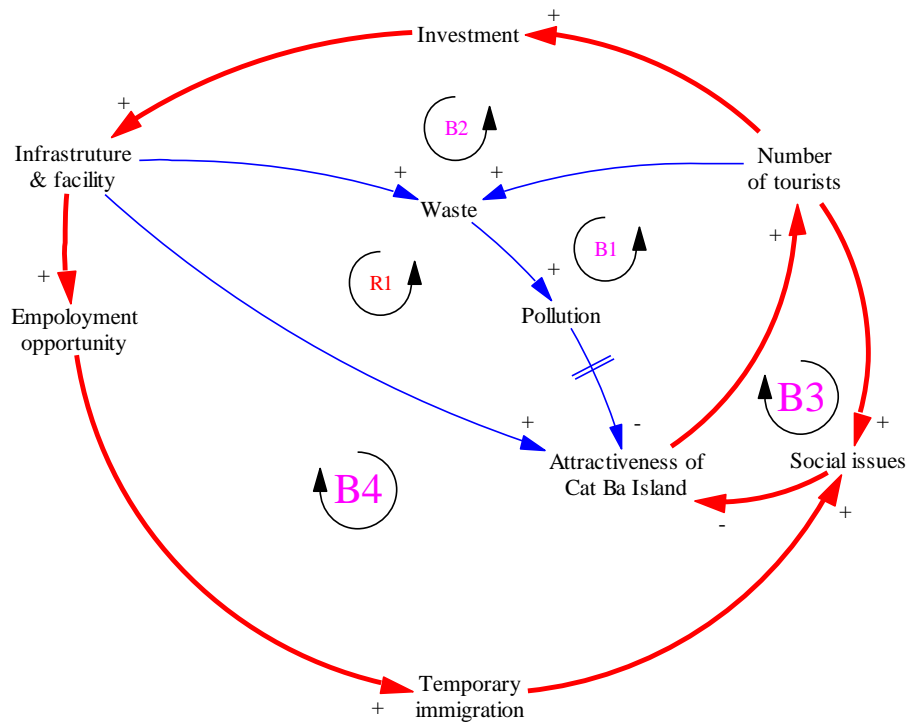
Another indirect source of pollution is due to the concentration of tourist numbers in the peak season (summer), which will lead to an over exploitation of the limited underground water resources. A lack of a fresh water supply has already led to many hotels having had to drill their own bore wells, leading to salt-water intrusions along the coast of Cat Ba bay. Other pollution factors include traffic pollution and congestion, and sanitation problems. The increasing number of vehicles, both in marine and terrestrial areas, does not only generate more waste, but also increase oil leaks and CO2 emissions on the island.

Inappropriate landfill and the unavailability of a sewage treatment plant to accommodate a large amount of solid and liquid waste that are generated daily by hotels, restaurants and other tourism facilities, are critical issues for the environment. It is expected that more pollutants will continue to be discharged into the biosphere while environmental degradation will continue to increase due to lack of appropriate waste treatment plants and waste disposal facilities. Furthermore, this accumulation of waste will reduce the attractiveness of the island and subsequently reducing the number of tourist to the island. Therefore, the B1 and B2 balancing loops are critical feedback loops that will counteract the growth of tourism on the island.

#### **4.4. Immigration and Employment (B3 & B4)**

Two other balancing loops (B3 and B4) are presented in Figure 4. Loop B3 is indicated by the number of tourists, social issues, and attractiveness of the Cat Ba Island while B4 shows that an increase in the number of tourists and infrastructures and facilities, will impact on employment opportunities, which in turn increases temporary immigration that could lead to negative social issues that will be detrimental to the attractiveness of Cat Ba Island. Similar to the B1 and B2 loops, the B3 and B4 balancing loops also play an important role in controlling tourism growth on the island.





**Figure 4:** Immigration and Employment Loop (B3 & B4)

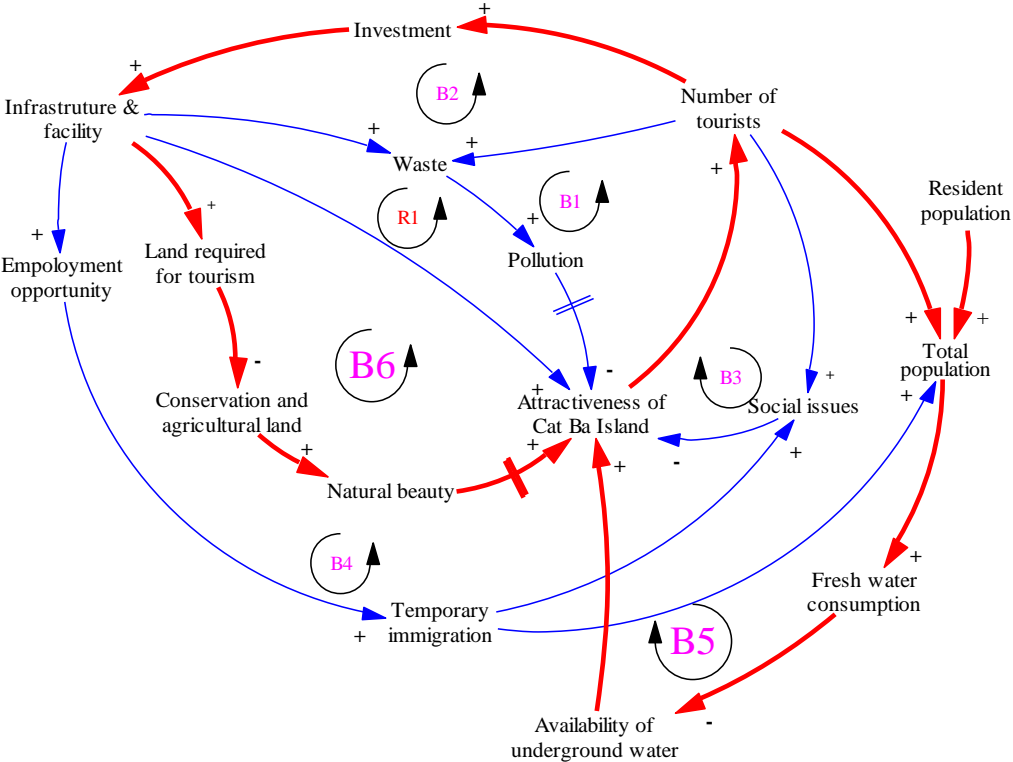
The rapid tourism development has brought more development to Cat Ba town as well as increasing the disparity between the town and other areas on the island. A wide range of employment opportunities has been generated through the various tourism related services, which attract a large number of people from rural areas to migrate temporarily to Cat Ba town seeking better livelihoods.

There is no doubt that temporary migration has improved the living standards of the very many poor families in the Cat Hai District and other adjacent areas. In the case of unskilled labourers, migration has helped to improve their food security, access to finance for agricultural activities and accumulation of minimal assets, which help them to offset the high costs of their children’s education and living expenses. On the other hand, the existence of migrants and tourists has created many social issues on the island such as drugs, crime and prostitution. These factors could ultimately affect the image and reputation of Cat Ba negatively and start reducing the number of tourists to the island.

**4.5. Limitation of Natural Resources Feedback Loops (B5& B6)**

Both B5 and B5 are balancing loops. B6 describes how the number of tourists affects infrastructure and facilities, which in turn will put a demand on available land for tourism to the detriment of the natural beauty of the island and its attractiveness to tourists (Figure 5). The fresh water loop B6 depicts how the number of tourists, the island’s population and immigration to the Island are interlinked with fresh water consumption and availability of

underground water. These loops describe the effects of scarce resources, particularly land and fresh water, on tourism development on the island.



**Figure 5:** Fresh Water and Land Use Balancing Loops (B5 & B6)

The rapid development of tourism in the CBBR over the last few decades has required more land for expansion of tourism-related facilities and infrastructures. The physical development of these facilities has created negative impacts on the environment. The most prominent of these are large areas of agricultural and conservation land that have been cleared to build the main road that runs through the island and the construction of other recreation facilities such as tourist resorts and resettling areas for local people.

It is expected that a large area of land will be required to build golf courses and recreational resorts which can only be constructed on former agricultural and conservation lands. These developments will result in a further reduction of the natural beauty of the island. In addition, it will have long term effects on the availability of underground water, because of the change in land covers. This all makes the availability of land a critical factor that could limit the growth of tourism growth on Cat Ba Island.

A shortage of fresh water has been identified as an important factor that will limit the growth of tourism on the island. As previously mentioned Cat Ba Island relies almost entirely on underground water (about 95%). The water consumption varies and depends on

the number of tourists that visit the Island. The water source only meets about 35-40% of the needs of the tourism industry during the peak season. This freshwater constraint has already been demonstrated by several incidences where tours to the Island had to be cancelled due to this issue.

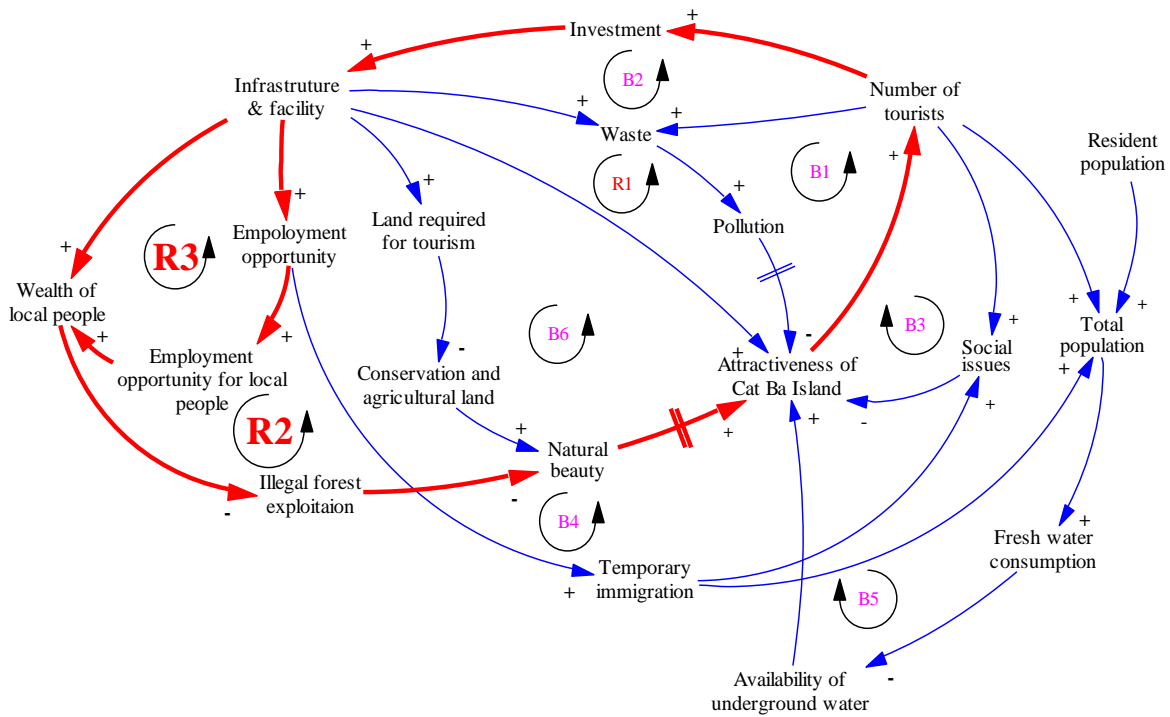
The effects of the balancing loops in Figure 5 will finally reduce the attractiveness of Cat Ba Island due to a decrease in the number of tourists to the island. Thus these loops will control the reinforcing loop R1.

#### ***4.6. Poverty Reduction Feedback Loops (R2 & R3)***

Two further reinforcing loops are operating in the system namely R2 and R3, which describe the effects of tourist numbers that are increasing the need for infrastructure and tourism facilities and therefore increase employment opportunities for the local people (e.g. construction of hotels, various tourism-related activities, small businesses and home stays). These could contribute to poverty reduction of the local people (Figure 6).

The improvement of infrastructure and tourism facilities, such as road systems and public facilities lead to increases in value of local products, as they enabled the local people to sell their products. This could contribute to alleviate the poverty of local people. In addition, the improvement of infrastructure and tourism facilities stimulates other social, cultural and educational activities, which will in turn increase awareness of the local people. As a result, the wealth of the local people is improved, and this will lead to a reduction in illegal forest exploitation activities, thereby maintaining or restoring the natural beauty of the island.

Loops R2 and R3 also indicate that tourism development and poverty reduction are opposite linked. In order to ensure a sustainable tourism system on the island, local poverty will need to be reduced. Therefore, in loop R2 and R3, the poverty variable plays a critical important role for sustainable tourism development on the Island.

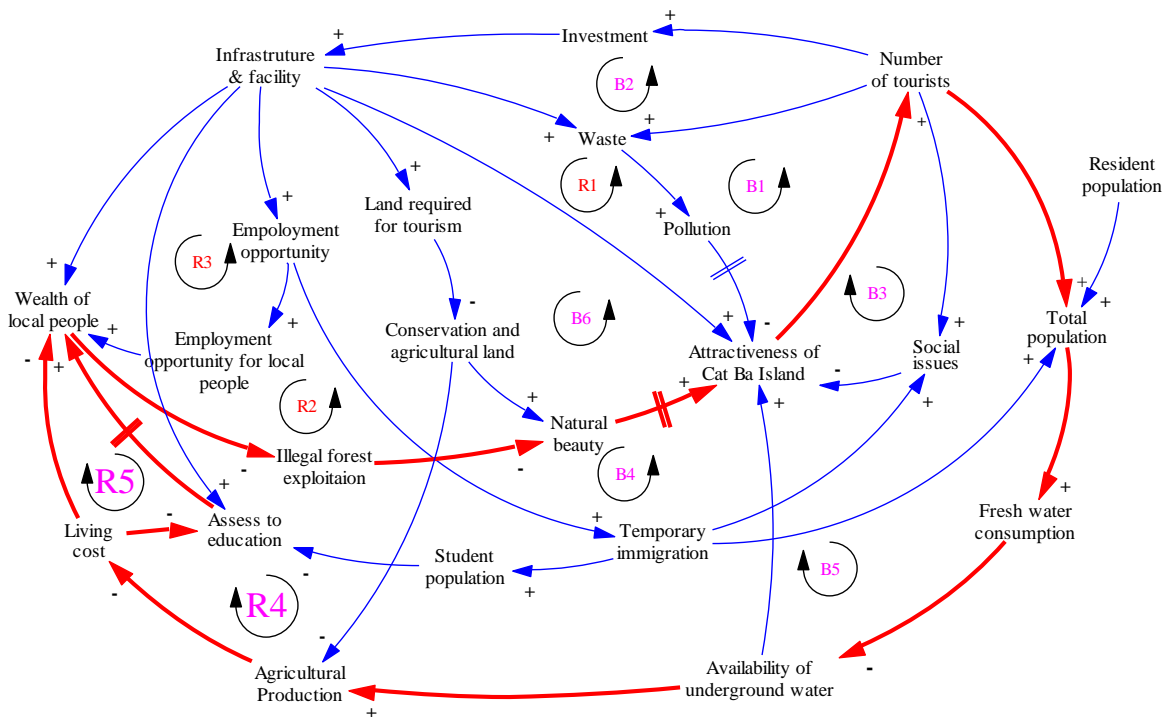


**Figure 6:** Employment and Poverty Loop (R2 and R3)

#### 4.7. Population and Poverty Feedback Loops (R4 and R5)

Finally, the remaining two reinforcing loops, namely R4 and R5 (highlighted in Figure 7), are concerned with the effects of tourism development on social demography, and environmental attractiveness of the Island. Since the availability of underground water primarily relies on the number of tourists, increasing tourist numbers to the Island would lead to less water availability for agriculture. Reducing agricultural land is another factor that contributes in reducing agricultural production that poses a negative effect on the wealth levels of local people. As a result, it pushes local residents to exploit forests illegally in order to make a living. These activities include illegal hunting (even threatened species), cutting timber, collecting non-timber forest products and illegal fishing inside and around the Cat Ba National Park, an increase in the number of deliberate fires (used in the collection of natural honey) and the extent of deforestation. When the livelihood of local people improves, there will be a reduction in these illegal activities. This will undoubtedly contribute to healthier and conserved ecosystems and a more attractive Island.

The quality of and access to education are also affected by temporary immigration, living costs, and infrastructures with long-term effects on local poverty levels. This loop is thus a reinforcing, which shows the interrelationships between the population, poverty and tourism development.



**Figure 7: Population and Poverty Loops (R4 and R5)**

## 5. Leverage Points and Intervention Strategies

The concept of “leverage points” was first mentioned by Archimedes (287-212 BC) in his famous quote: *“Give me a place to stand, and I shall move the earth with a lever”*. This statement demonstrates the power of a leverage point that exists in any complex system, such as a living body, an ecosystem or a socio-economic system. Meadows pointed out that *“the leverage points are places within a complex system where a small shift in one item can produce big changes in everything”*. She further stated that *“the leverage points are points of power and are the right places to intervene in a system”*.

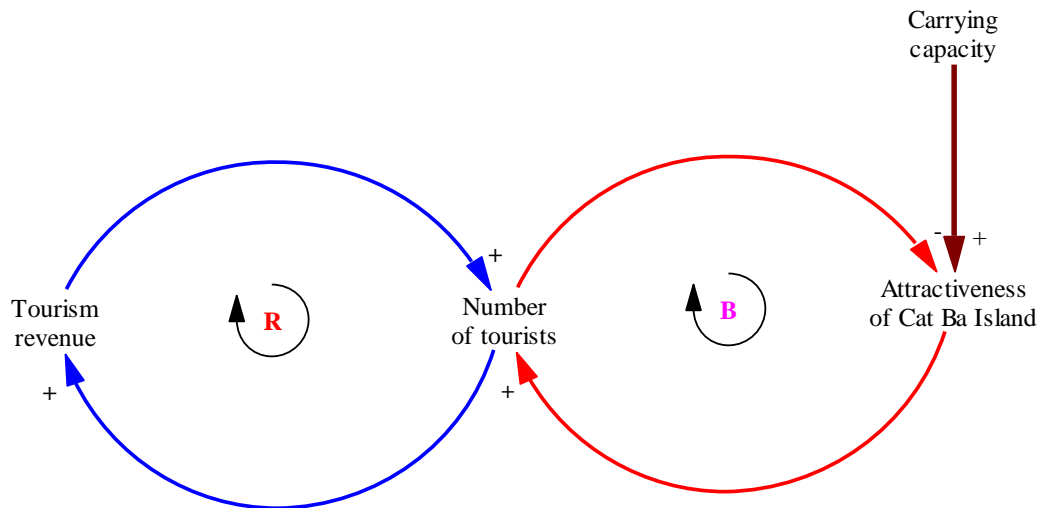
Although the importance of leverage points to system analysis has been alluded to, they are not easy to identify, because *“leverage points are not intuitive”*. However, they can be identified by using systems thinking and modelling. Once a conceptual model or causal loop diagram of a system is developed and validated, it would normally reveal the causal relationships between issues, and then enable the identification of common patterns in the system, known as “system archetypes”.

System archetypes are generic systems models or templates that represent a wide range of situations. They provide high-level maps of dynamic processes and are highly effective tools for gaining insight into patterns of behaviour of the system being studied. The archetypes also provide good indications of where the potential leverage points in the system are. The identification of leverage points can therefore be facilitated in conjunction with the identification of system archetypes.

In the case of tourism in the CBBR, there are three major system archetypes that were identified including the “Limits to Growth”, “Fixes that Fail”, and “Tragedy of the Commons”. These archetypes provide a high level ‘story’ which capture the key dynamics of the tourism system and help to understand the interconnectedness and relationships within and between the components of the tourism system. The following sections will analyse these archetypes and their implication in formulating interventions for tourism development in the biosphere reserve.

### 5.1. *Limit to Growth Archetype*

“Limit to growth” was first introduced by Meadows who stated that a reinforcing process of accelerating growth (or expansion) will always be counteracted (or pushed back) by a balancing process. This is known as a limiting (or constraining) force in the system. The generic structure of the limit to growth archetype consists of one reinforcing and one balancing loop as illustrated in Figure 8.



**Figure 8:** Limit to Growth

The lesson learned from this archetype is that some element always pushes the system back, so that if we do not plan for limits, we are planning for failure. In order to anticipate future problems and eliminate them before they become a threat, the growth engines and potential limiting or constraining forces need to be identified and mapped out. This implies that in the limit to growth archetype, the leverage point is not only placed in reinforcing loop, but also in the balancing one. This reminds managers that they should not only focus on the growth engine factors, but also take time to examine what might be limits or constraints that could push back against their efforts.

In the tourism context of the CBBR, most of the tourism policies and planning programs have so far been focused on the growth engine to attract more tourists to the island, rather than the constraints or negative impacts of tourism. In other words, the reinforcing process of growth through massive building programs of tourism infrastructure and facilities (e.g.

roads, luxury hotels, and recreational facilities) has received a lot of attention, without recognising the constraints, such as pollution, environmental degradation and poor service quality. These constraints are a significant threat to the sustainability of tourism in the CBBR.

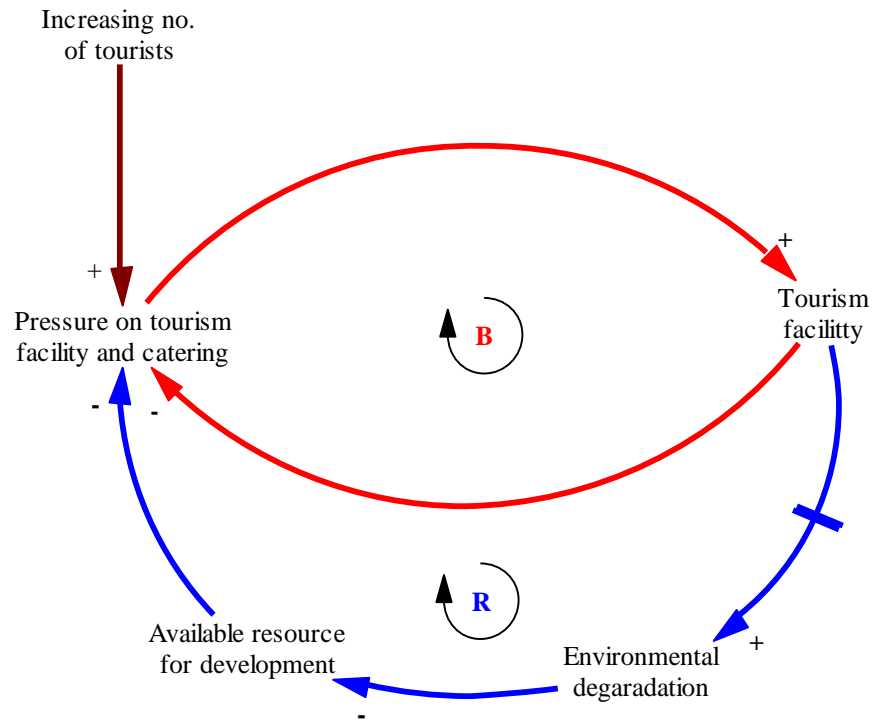
## **5.2. *Fixes that Fail Archetype***

This archetype represents a situation in which unintended and often harmful consequences follow well-intended actions. Similar to the 'limit to growth' archetype, 'fixes that fail' is also composed of one reinforcing loop and a balancing loop (Figure 9).

The archetype is a good reflection of reductionist thinking that leads to a continuing worsening scenario. The initial problem becomes exposed as a symptom, which through reductionist thinking will only require a quick-fix or short-term solution from managers. Results will be achieved faster and initially appear to cost less to achieve. As a result, the problem symptom is temporarily diminished or removed in the short term but the quick fix solution can have unintended consequences that in the long-term may return to the previous level or even exacerbate the problems.

The "fix that fail" archetype exists in the tourism system of the CBBR where the increasing tourist numbers have created a high pressure on tourism services. Much of the tourism infrastructure and facilities, such as hotels, restaurants and means of transportation have been established as a response to the pressure. However, these quick-response solutions have created unintended consequences that would increase environmental degradation, less resources becoming available for development and resulting in an acceleration of the pressure on demands.

This approach will ultimately create negative effects on the tourism industry such as pollution and social issues, which will make Cat Ba Island less attractive and will result in reduced number of tourists. Obviously, such decisions carry long and short-term consequences, and the two are often diametrically opposed, since they focus on identifying and removing the fundamental cause of the symptom problem. If a temporary, short-term solution is needed, developing a two tier approach simultaneously would be useful. That is, while a short-term fix is applied, planning should be continuing to find a fundamental long-term solution.



**Figure 9: Fixes that Fail**

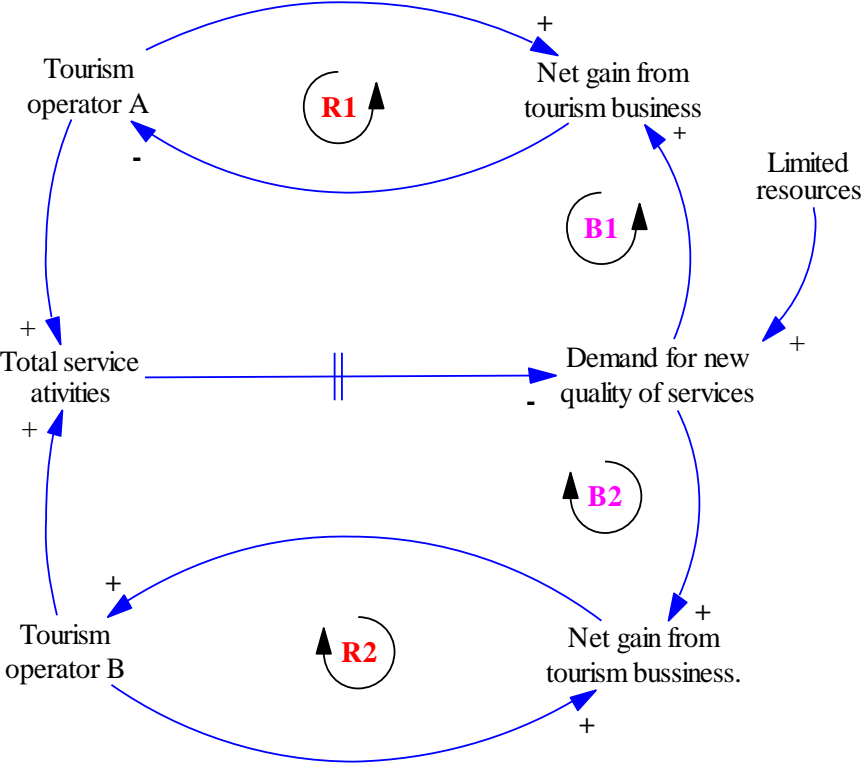
### 5.3. *Tragedy of the Commons Archetype*

The tragedy of the commons archetype is very common in our daily lives. Hardin describes tragedy of the commons as what happens to common resources as a result of human greed. The core intention of this term is to demonstrate a situation where a single player gains the benefits, while the consequences of actions are shared among a larger group of people. The root cause that creates this tragedy is typically economies of scale. Everyone wants to maximise returns from the common resources, and people will tend to take actions that in the long term damages interests of the whole group. Therefore, the “tragedy of the commons” archetype is truly a tragedy.

In the Cat Ba biosphere reserve, the tragedy commons archetype is happening in many beautiful places where most of the attractions for tourists on the Island are found, such as Cat Ba, Ben Beo, and Lan Ha bay. These areas receive thousands of tourist everyday that require a large amount of services to accommodate their demands. Each tourism operator tries to consume more of the common resources on the island to gain maximum returns as shown by the two reinforcing loop R1 and R2 in figure 10. However, as there is insufficient space, these tourism sites are unable to accommodate the increase in demand for tourism facilities (e.g tourism boats, floating restaurants), and local interest such as floating farms. This makes it inconvenient for everyone and their income starts to fall as shown by the two



balancing loops B1 and B2. The environment will also start to further degrade due to increased pollution, and the negative effect on biodiversity.



**Figure 10:** Tragedy of the Commons Archetype

The ‘tragedy of the common’ archetype can be addressed in many ways. While the tourism operators on the island continue to think and behave as if there are limited connections between the systems they are operating in that will affect their ability to meet their respective goals and objectives, the problems will remain. Public education is needed to raise an awareness of the “bigger picture” amongst all stakeholders on the island who share common resources for their businesses. At the same time, policies and regulations that will enable people to create a form of self-regulation need to be introduced. This could only be achieved if an integrated master plan and operational strategy for tourism sectors are introduced.

**6. Conclusions**

Tourism in the CBBR represents a dynamic and complex system. The process of developing the tourism conceptual model has significantly helped the relevant stakeholders within the region, who share the responsibility of sustaining the system. A better understanding of the dynamic and complex relationships in the system has been achieved

especially through the participatory process of sharing and aligning divergent mental models of the different stakeholders.

The systems model presents the ‘bigger picture’ of tourism in the CBBR and illustrates how the factors affecting the system are not isolated and independent, but are dynamically linked. It shows how the different factors cause growth or decline in each other as well as in other key areas of the system. The model can therefore be used as a platform for dialogue, communication, collaboration and decision making between relevant stakeholders in the region. This makes the model potentially a powerful tool for policy makers and practitioners, who have to manage and sustain the system as a whole.

Development of the causal loop model of the tourism system in the CBBR has served as a solid foundation to enable the identification of key leverage points in the system. These leverage points are valuable in allowing the formulation effective and timely systemic intervention strategies which will permit the important tourism industry of the CBBR to move forward in a sustainable way.

This study has demonstrated the use of a radical approach (systems thinking) to investigate and explore the complexity of tourism development. The study is an on-going research. The causal loop model has been used to develop a systems dynamic model allowing policy makers and relevant stakeholders to test different scenarios related to the development of tourism in the CBBR. This will be the content of a forthcoming paper.

### **Acknowledgements**

The authors would like to express their deep gratitude to the International Foundation Science (IFS) for financial support to conduct field work of this study. We also highly appreciate the invaluable assistance and collaboration of various bodies in Hai Phong City, Vietnam, especially the Provincial People’s Committee, Cat Hai District People’s Committee, and Cat Ba Biosphere Reserve Office.

## References

- Akis, Sevgin, Nicos Peristianis, and Jonathan Warne. "Residents' Attitudes to Tourism Development: The Case of Cyprus." *Tourism Management* 17, no. 7 (1996): 481-94.
- Baggio, R. "Symptoms of Complexity in a Tourism System." *Tourism Analysis* 13, no. 1 (2008): 1-20.
- Bramwell, Bill, and Bernard Lane. "Collaboration and Partnerships in Tourism Planning." In *Tourism, Collaboration, and Partnerships : Politics, Practice, and Sustainability*, edited by Bill Bramwell and Bernard Lane. Buffalo, NY: Channel View Publications, 2000.
- Cat Ba Biosphere Reserve Management Unit. "Information on the Biosphere Reserve 'Cat Ba Archipelago' for the Hon Tom Burns-Queensland Government Special Representative to Vietnam." Hai Phong, Vietnam: Cat Ba Biosphere Reserve Management Unit, 2007.
- Cat Hai People's Committee. "Master Plan for Social Economic Development of Cat Hai District (2006-2010) and Vision 2020." Hai Phong, 2005.
- Cavana, R. Y., P. K. Davies, R. M. Robson, and K. J. Wilson. "Drivers of Quality in Health Services: Different Worldviews of Clinicians and Policy Managers Revealed." *System Dynamics Review* 15, no. 3 (1999): 331-40.
- Dang, Quang Thuyen. "Socio-Economic Survey for the Cat Ba National Parks Master Plan." Hano, Vietnam: Forest Inventory Planning Institute, 2006.
- Elias, Arun Abraham. "Towards a Shared Systems Model of Stakeholders in Environmental Conflict." *International Transactions in Operational Research* 15 (2008): 239-53.
- Goodrich, J.N. "The Relationship between Preferences for and Perceptions of Vacation Destinations: Application of a Choice Model " *Journal of Travel Research* Fall, no. 8-13 (1978).
- Gunn, Clare A. *Tourism Planning: Basics, Concepts, Cases*. 3 ed. Washington, D.C: Taylor & Francis, 1994.
- Hai Phong People's Committee. *The Master Plan for Cat Ba National Park (2006-2010) and Vision 2020*. Hai Phong: Hai Phong People's Committee, 2006.
- Hardin, Garrett. "The Tragedy of the Commons." *Science* 162 (1968): 1243-48.
- Hoang, Viet, and C.Kwei Lin. "Cat Ba National Park." Bangkok, Thailand: Asian Institute of Technology, 2001.
- Le, Manh Tuan. "Current Status of Vegetation in Cat Ba National Park." Hai Phong: Vietnam Forest Inventory and Planning Institute, 2006.
- Lim, Charles C, and Chris Cooper. "Beyond Sustainability: Optimising Island Tourism Development." *Tourism research* 11, no. 1 (2009): 89-103.
- Maani, Kambiz E. "Consensus Building through Systems Thinking - the Case of Policy and Planning in Healthcare." *Australian Journal of Information Systems* 9, no. 2 (2002): 84-93.
- Maani, Kambiz E., and Robert Y. Cavana. *Systems Thinking, System Dynamic: Managing Change and Complexity*. 2 ed. Auckland: Prentice Hall, 2007.
- Mackay, and Lindsay Alan. "Archimedes Ca 287-212." In *A Dictionary of Scientific Quotation*, 11. London: Taylor & Francis, 1991.

- Mason, Peter *Tourism Impacts, Planning and Management* 2ed. Oxford: Elsevier Butterworth-Heinemann, 2008.
- Meadows, Donella. "Leverage Points: Places to Intervene in a System." the sustainability institute, 1999.
- Meadows, Donella H, Jorgen Randers, and Dennis L Meadows. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*: Universe Books: London, 1972.
- Nadler, Tilo , and Thang Long Ha. "The Cat Ba Langur: Past, Present and Future, the Definitive Report on Trachypithecus Poliocephalus, the World's Rarest Primate ". Hanoi, Vietnam: Endangered Primate Rescue Centre, 2000.
- Neto, F. "A New Approach to Sustainable Tourism Development: Moving Beyond Environmental Protection." *Natural Resources Forum* 27, no. 3 (2003): 212-22.
- Nguyen, N. C., O. J. Bosch, and K. E. Maani. "Creating 'Learning Laboratories' for Sustainable Development in Biospheres: A Systems Thinking Approach." *Systems Research and Behavioral Science* 28, no. 1 (2011): 51-62.
- Nguyen, Thanh Van, Tuan Trong Bui, and Duong Duc Tung. *Catba Archipelago Biosphere Reserve, Hai Phong City Vietnam*. HaiPhong, Vietnam: Management Unit for Cat Ba Archipelago, 2007.
- Seddighi, H. R., and A. L. Theocharous. "A Model of Tourism Destination Choice: A Theoretical and Empirical Analysis." *Tourism Management* 23, no. 5 (2002): 475-87.
- Senge, Peter. *The Fifth Discipline: The Art and Practice of the Learning Organization*: Random House, 1991.
- Sherwood, D. *Seeing the Forest for the Trees: A Manager's Guide to Applying Systems Thinking*. London, UK: Nicholas Brealey Publishing, 2002.
- Son, Thi Nguyen., J. J. Pigram, and B. A. Rugendyke. "Tourism Development and National Parks in the Developing World: Cat Ba Island National Park, Vietnam." *Contemporary issues in tourism development*. (1999): 211-31.
- Sterman, John D. *Business Dynamics: Systems Thinking and Modeling for a Complex World*. Boston: Irwin/McGraw-Hill, 2000.
- Swarbrooke, John. *Sustainable Tourism Management*. New York: CABI, 1998.
- Vengesai, S. "A Conceptual Model of Tourism Destination Competitiveness and Attractiveness." Paper presented at the Australian and New Zealand Marketing Academy Conference (ANZMAC), Adelaide, Australia, 2003.
- Vennix, J. A. M., and J. W. Gubbels. "Knowledge Elicitation in Conceptual Model Building: A Case Study in Modeling a Regional Dutch Health Care System." *European Journal of Operational Research* 59, no. 1 (1992): 85-101.
- Yoon, Yooshik, Dongan Gursoy, and Joseph S Chen. "Validating a Tourism Development Theory with Structural Equation." *Tourism Management* 22, no. 4 (2001): 363-72.