

Systems Thinking for Sustainable Tourism in the Cat Ba Biosphere Reserve of Viet Nam

Thanh Van Mai and Kambiz E. Maani

School of Integrative Systems
The University of Queensland, Australia

Abstract

Cat Ba Archipelago in Viet Nam has been recognized as a world biosphere reserve. This biosphere is identified as the highest biodiversity in the country and a priority for global conservation. Cat Ba, the largest Island in the archipelago, features diverse topography, remarkable historical heritage and archaeological value. Because of these unique features, the Island has become a popular tourist destination. Cat Ba is experiencing a strong growth in tourism. However, a number of challenges pose threats to sustainable tourism development in Cat Ba including environmental degradation, high poverty level, overuse of underground water, lack of fresh water and electricity, lack of skilled labours, and poor infrastructure and recreational facilities. This paper seeks to explain how a complex and dynamic tourism systems model can be developed and used as framework for decision making and capacity development for local government and private stakeholders who share the responsibility of sustaining the system. The causal loop diagrams and stock and flow models have been developed with participation of diverse stakeholders. Alternative scenarios will be analysed to explain how tourism in the biosphere may change in the next 10-20 years as a result of both multiple investment strategies and changes in the external environments.

Introduction

In recent years, systems thinking approach in the development planning process has been widely applied by academics, scholars, managers, planners, and policy makers (Andrew & Petkov 2003; Macadam et al. 1995; Schianetz et al. 2009; Winch 1993). This approach derives from the theory and practice of Systems Thinking and the Learning Laboratory (Senge, 1991, Kim, 1992, Maani & Cavana 2007). It is a scientific methodology that consists of a set of tools to deal with complexity, ambiguity and mental models underlying our most present social, economic, ecological, and political challenges. The main objectives of the approach are (i) to focus on the whole system and the constituent parts as well as their interactions, (ii) to provide a framework for managing change and complexity through the understanding of dynamic feedback embedded in complex systems, (iii) to allow decision makers to anticipate the long-term consequences of their decisions and actions, as well as the unintended consequences of policies and strategies, and (iv) to provide a common language for diverse stakeholders for deep dialogue and consensus building.

In the field of tourism, the literature agrees that tourism is an open, dynamic, and complex system (Butler 1991; Gunn 1994; Leiper 1990; Mill & Morrison 1998). The system includes many interacting components, and involves diverse stakeholders each of whom holds different management objectives. Hence, it becomes difficult to manage it towards sustainability. In order to achieve sustainable development of tourism, the system can not be tackled as an individual dimension. This paper presents the use of Systems Thinking as a unique methodology in dealing with the dynamic and complex nature of the tourism systems with a special focus on the Cat Ba Biosphere Reserve (CBBR).

The Learning Lab approach commonly includes identifying key stakeholders from relevant sectors at different levels, defining initial issues, building consensus, and group model building. In the case of the CBBR, the key stakeholders included local community representatives, management board of the Cat Ba National Park, local authorities, tour operators and international aid agencies. The stakeholders participated in key informant interviews or focus group discussions to identify drivers and inhibitors that assist or impede sustainable development of tourism in Cat Ba Island. These stakeholders also participated in the consensus building stage to develop a conceptual tourism system model of the Island. In this stage, diverse and sometimes conflicting views about the important system parameters were discussed in a one-day intensive workshop. The outcome of the workshop was a road

map for the development of a system dynamic model which is the conceptual framework outlined in this paper.

Backgrounds

Cat Ba is the largest of 366 islands in the Cat Ba Archipelago, and also the second largest limestone island (200 km²) in the coastal zone of Vietnam (Tran 2008). It is located in the north – east of Vietnam in the northern section of the Tonkin Gulf, and adjacent to Ha Long Bay (the world natural heritage site). The Island has a similar geology as the spectacular and romantic flooded karst landscape of Ha Long bay, and is situated at the gateway of an important line of sea transportation for the area, and within the triangular zone of the economic growth in northern Vietnam (Hanoi – Hai Phong – Quang Ninh).

Cat Ba island has a significant biodiversity value as it is home to a number of rare and endangered species of plants and animals, with the world's rarest primates – the Golden-headed Langur (FFI. 2003). It is identified as one of the areas of highest biodiversity importance in Vietnam and is recognized as a high priority for global conservation (Brooks 2006; WB 2005; Zingerli 2005). In 1986, 15,200 ha (approximately half of the island's total land mass) of terrestrial and marine area was allocated to the National Park (VNMAB 2003). The Park was declared as the Vietnam's first national park that included both land and marine ecosystems. It also differs from others because of the unique variety of landscapes and ecosystems, including sandy beaches, mangrove, freshwater swamp forest, tropical evergreen forests, small freshwater lakes and streams, and many coral reefs and seagrass beds (Viet & Lin 2001). Beside biological and geological values, the island also has remarkable cultural and historical values. Therefore, it is considered as one of Vietnam's most favour and beautiful places (Nguyen et al. 2002). In 2004, most of the Cat Ba Archipelago was designated as an UNESCO Biosphere Reserve with a total area of 26,241 ha (HPPC 2005). The National Park now covers a majority of the Biosphere's Core Zone.

Tourism Development on Cat Ba Island

Prior to 1979, the human population in Cat Ba Island was relatively low. However, since then a large number of migrants from the mainland have settled on the island for fishing (Hien 2009). Tourism has developed significantly over past 10-15 years and is expected to grow in the future. The industry has created employment opportunities and economic development of the region. As a result, the island has attracted migrants from other regions of Vietnam. In 2009, the island was inhabited by about 15,500 people, of which 96.17% is Kinh people (the

majority population in Vietnam) and the remaining is Chinese borned Vietnamese, who live in six communes and the Cat Ba town. Before the 1990s, the Island's economy was basically based on agriculture and fishery sector. Tourism has then developed, the agriculture and fishery sector's share has been gradually decreased. Tourism has become the leading sector of the Island's economy.

Presently, approximately 40% of Cat Ba's population lives in rural areas engaging in agriculture., Most of them live in poverty according to the UN poverty indicator which sets the level at under US\$1 per day (World Bank 2001), especially, in some ecological sensitive areas in the core zone of the biosphere reserve, such as Viet Hai (US\$ 0.56) and Hien Hao (US\$0.64). Due to poverty, local people have illegally over-exploited the resources of the National Park (Nadler & Ha 2000; Viet & Lin 2001). In addition, a shortage of arable land has led to illegal land clearing and fragmentation of the island's natural areas including encroachment into the National Park. The island communities have limited education and receive poor health care services. The livelihoods of local villagers are built mainly upon subsistence agriculture and aquaculture, including unsustainable and often illegal practices, such as trading coral for cement and sale to tourists, destructive fishing and gathering of shellfish.

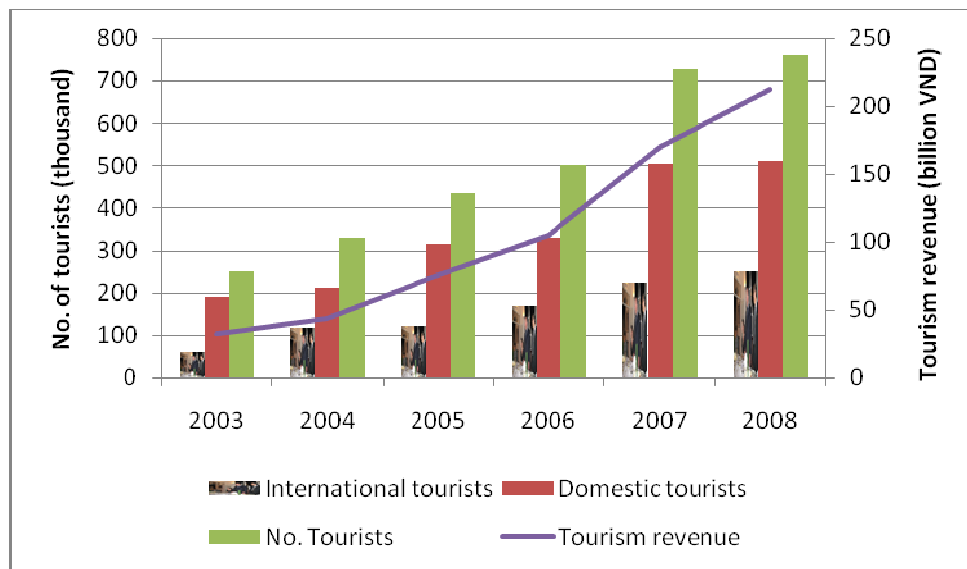


Figure 1 - Tourism Growth in the Cat Ba Island

Because of the spectacular scenery and a high diversity of landscapes, Cat Ba Island is a special place and has become an outstanding destination for national and international tourists. The remarkable cultural and historical values on the Island provide other attractions to tourists. The number of tourists has increased dramatically in recently years with an annual

growth rate of 22.16% particularly since the island was recognized as a world Biosphere Reserve.

Despite the recent global financial crisis, according to *figure 1*, 0.76 million tourists visited Cat Ba Island in 2008; 1.0 millions in 2009, and 1.5 millions expected in 2015 and 2.0 millions in 2020. As the number of tourists increased, many related services such as hotels, restaurants, and transportation have developed. In 2003, there were 74 hotels with 1,300 rooms. After five years, the number rose to 107 with nearly 2,000 rooms offering a large range of services from basic to high end quality, and these rooms can accommodate about 5,000 visitors per day. As a result, tourism revenue has rapidly increased and become the largest contributor to the local economy. Total revenue from the tourism sector was 170.1 billion VND in 2007 (equivalent \$ 11 million), and 212.5 billion VND (equivalent \$ 13 million), and is expected to be 1,100 billion VND (equivalent \$ 69 million) in 2015, and 1,700 billion VND (equivalent \$ 106 million) in 2020.

However, the Island is facing a number of severe and urgent environmental problems. These include biodiversity degradation and environmental pollution, high levels of poverty in several communes (Bosch et al. 2007), overuse of underground water, lack of fresh water and electricity (especially in the summer – tourist season), lack of skilled labours for the tourism industry, as well as poor infrastructure and recreational facilities. These problems pose serious threats to sustainable tourism development in the Cat Ba region

System Thinking Methodology: Process and Results

Maani & Cavana (2007) propose a five-phases process of Systems Thinking and Modeling, including problem structuring, causal loop modelling, dynamic modelling, scenario planning and modelling, and implementation and organization learning. This paper focuses on the first three phases, involving knowledge elicitation processes for developing a mental model obtained from relevant stakeholders and tourism experts.

Problem structuring

In this stage, 76 participants from 8 groups of stakeholders (*Table 1*) participated in focus group discussion (FG) or key informant interview (KI) during the period of May to July 2009 to identify key issues, potentials as well as challenges for sustainable tourism development in the Island.

Table 1 - Stakeholders' participation in the interview

No.	Stakeholder Groups	No. of interviews	No. of people involved	Interview mode	Gender	
					Male	Female
1	Local community representative	4	34	FG	27	7
2	Cat Ba National Park	2	14	FG & KI	14	0
3	Local authority	12	12	KI	10	2
4	Transport supplier	3	3	KI	3	0
5	Travel agent	2	2	KI	2	0
6	Hotel/restaurant manager	1	7	FG	5	2
7	NGOs	1	2	KI	1	1
8	Tourism advisor	2	2	KI	2	0
Total		26	76		64	12

According to **Table 2**, respondents reflected differently on the issues which are subjected to stakeholders' backgrounds. The main issues identified were: (i) an increasing impact of tourism development on the environment in terms of marine pollution, sewage, waste disposal, and biodiversity degradation; (ii) limitations of natural resources, particularly domestic water and land; (iii) poor infrastructure and tourism facilities, and lack of recreational activities; and (v) temporary immigration.

Table 2 - Key Identified Issues for Sustainable Development of Tourism in Cat Ba Island

Tourism economy	Natural resources	Social-demography
Poor infrastructure	Lack of land for recreation facilities	Low education quality
Poor and insufficient tourism facilities	Lack of domestic water	Lack of skilled labour
Solid waste disposal systems		Islander's welfare
High number floating farms, boats		Temporary migrant
Pollution (marine and area near by rubbish dump)		Social evils (drugs and prostitution)
Pollution of underground water		High living cost

Failure of crops (lack of fresh water and wild birds)		Illegal forest exploitation (hunting/poaching)
---	--	--

These main issues are grouped into three broad categories: Tourism economy, social-demography, and natural resources as summarised in **Table 2**.

Developing Causal Loop Model

The relationship amongst those issues was elicited through an intensive one-day stakeholder workshop which was held in Cat Ba Island. Twenty six representatives from eight groups of stakeholders, and key institutions in charge of development planning policy for the Cat Ba Island were selected. The participants consist of local governmental planning committee (including tourism, agriculture and forestry, industry, natural resources, education, transportation, national park and the Cat Ba biosphere reserve office), practitioners (hotel manager, travel agent, and tourist information center), community leaders, and NGOs. About 30% of workshop participants was aware of systems thinking and system dynamic knowledge as they had attended an intensive one-day workshop on “System Thinking” held in Hai Phong city by the University of Queensland’s experts. The remaining has not had any knowledge and experience in this respect. Therefore, these stakeholders were introduced to acquire the knowledge of System Thinking at the beginning of the workshop. The workshop was critical in developing a mental model, identifying important components of the system, and establishing general inter-relations between these components. The outcome was validated by various tourism experts. The causal loop diagrams of the Island’s tourism system, presented below, were then refined based on the outcome of the workshop and validations of tourism experts.

(1) – Economy and Natural Resources Diagram

Growth in the number of tourists usually requires the expansion of infrastructure (roads, waterways, electricity, water supply, schools, hospitals, sewage treatment, and solid waste disposal), and tourism facilities (hotels, restaurants, recreation facilities, transport systems), which leads to increasing land transformation for development, and competes for natural resources, particularly water and land. These are also reflected in the Cat Ba Island where water and land resources are the most limiting factors. The **Figure 2** indicates that requirement of land area affects conservation area, and then it impacts on the attractiveness of Island through natural amenity. On the other hand, development of infrastructure and tourism facilities bring an impressive image of the region that attract tourists. The main water

supply source for Cat Ba town, wherethe most tourism activities are' is from underground water, but its availability level is dependent on the number of tourists to the Island. These inter-relations are illustrated on **Figure 2**.

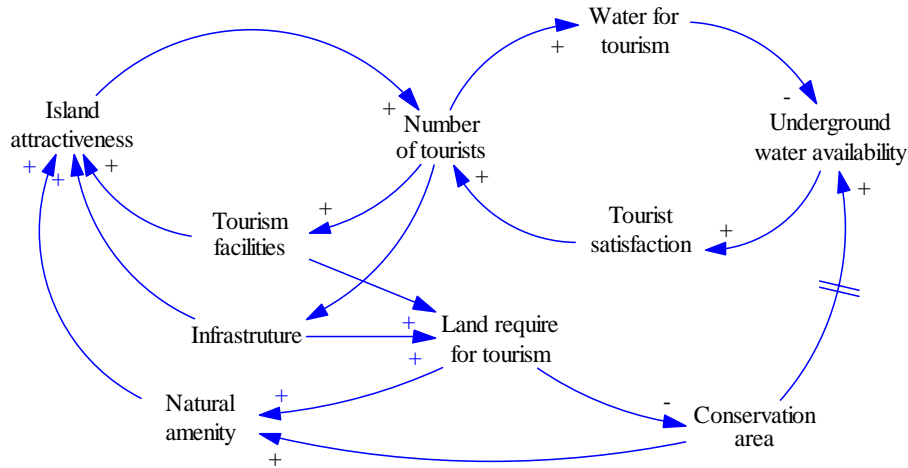


Figure 2 - Inter-relations Between Economy and Natural Resources

(2) – Socio-demography and Nature Resources Diagram

Development of tourism in the Island creates employment opportunities through a variety of tourism related services such as hotels, restaurants, and transportation, which then attract in-migrants to the Island. As a result, the population of Island increases. As the more populated it is, the more production of waste and pollution are, thus affects on underground water and on islanders' welfare. Increasing food demand is another factor that also affects to Islanders' welfare because of increasing living cost.

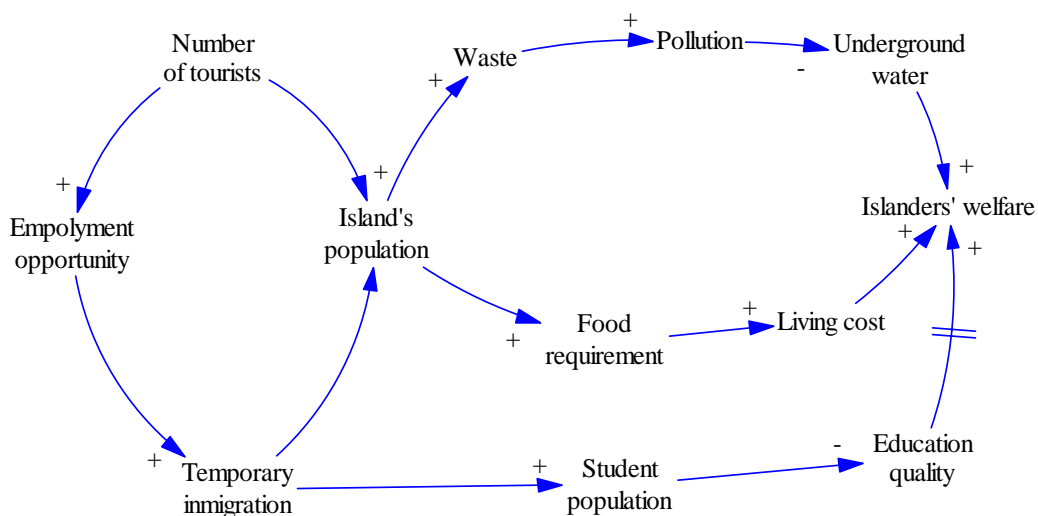


Figure 3 - Inter-relations Between Socio-demography and Natural Resources

In addition, the quality of education is also affected by temporary students due to temporary in-migrants. Consequently, welfare of the islanders is also affected. These inter-relations are illustrated on *Figure 3*.

(3) Socio-demography and Economy Diagram

Figure 4 presents that increasing tourist numbers will demand more on natural products that encourages local islanders to exploit the forest products illegally, such as hunting, poaching. Subsequently, the attractiveness of the island is degraded. On the other hand, it also creates employment opportunities for islanders that have positive impact on their welfare. This attracts temporary migrants. The existence of tourists and migrants influences social evils on the Island, such as drugs and prostitutes. This negatively affects on Islanders' welfare. These inter-relations are illustrated on *Figure 4*.

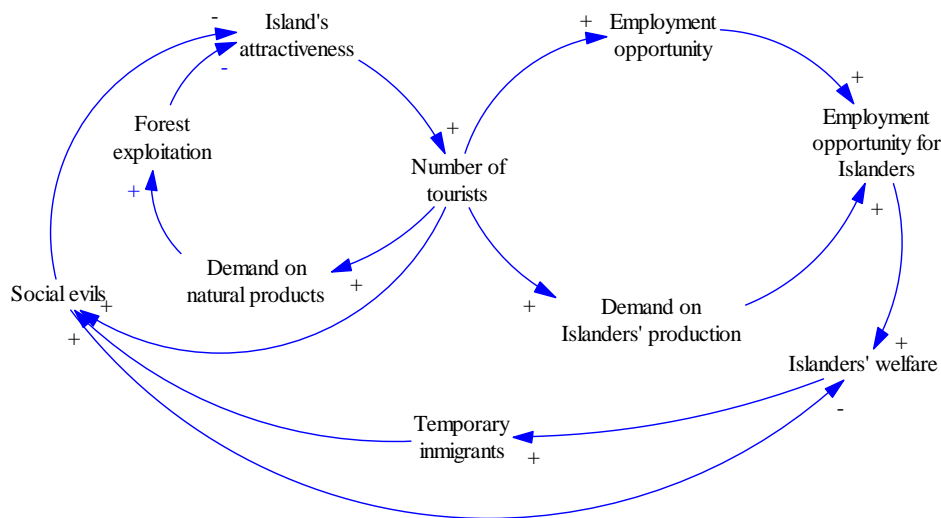


Figure 4 - Inter-relations Between Socio-demography and Economy

(4) Causal Loop Diagram of Tourism System of the Cat Ba Biosphere Reserve

The inter-relations between sub-systems of tourism in the Island were defined during the stakeholder workshop held in Cat Ba Island in July 2009. Among a number of variables within the sub-systems, only main variables are included in this model (*Figure 5*). A number of “leverage points” for systemic interventions were also identified by the workshop. The outcomes were then consulted with tourism experts from the MAB office, the Sustainable Development Institute in Vietnam and School of Tourism, the University of Queensland, Australia. In addition, the model was also presented and received feedback from the Conference of The International Society for the Systems Sciences (ISSS) held at the

University of Queensland, Australia in July 2009. The final model and its key leverage points (*Figure 5*) were refined through discussions with the advisory teams at Queensland University.

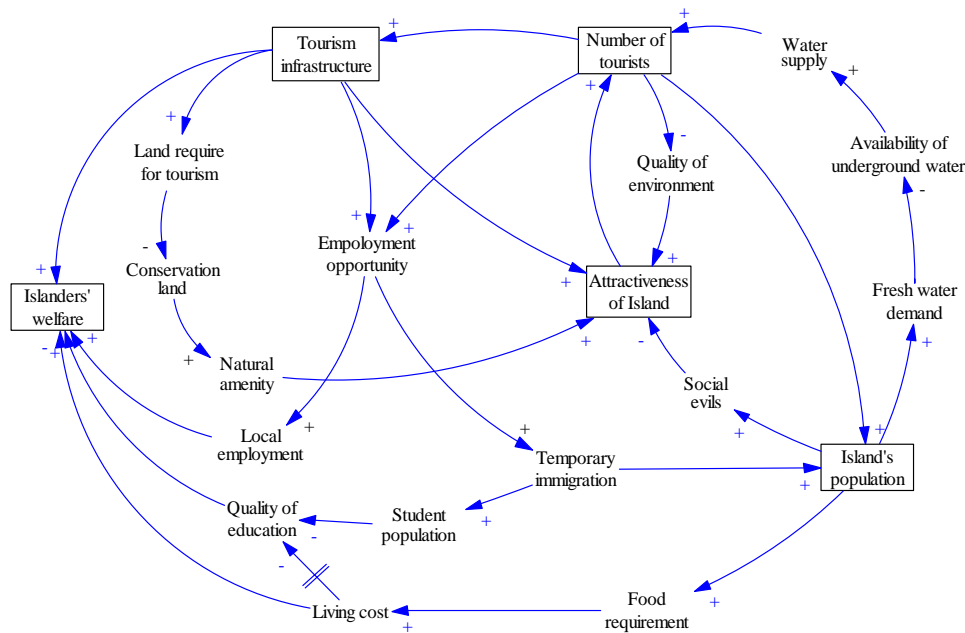


Figure 5 – Causal Loop Diagram of Island's Tourism Systems and Key Leverage Points

Dynamic Modelling

The conceptual model (*Figure 5*) was then translated into a simulation model by using the *ithink* software. The full model of the sustainability of tourism need to incorporate three key components (*Figure 6*) comprising tourism economy, the environment and social demography.

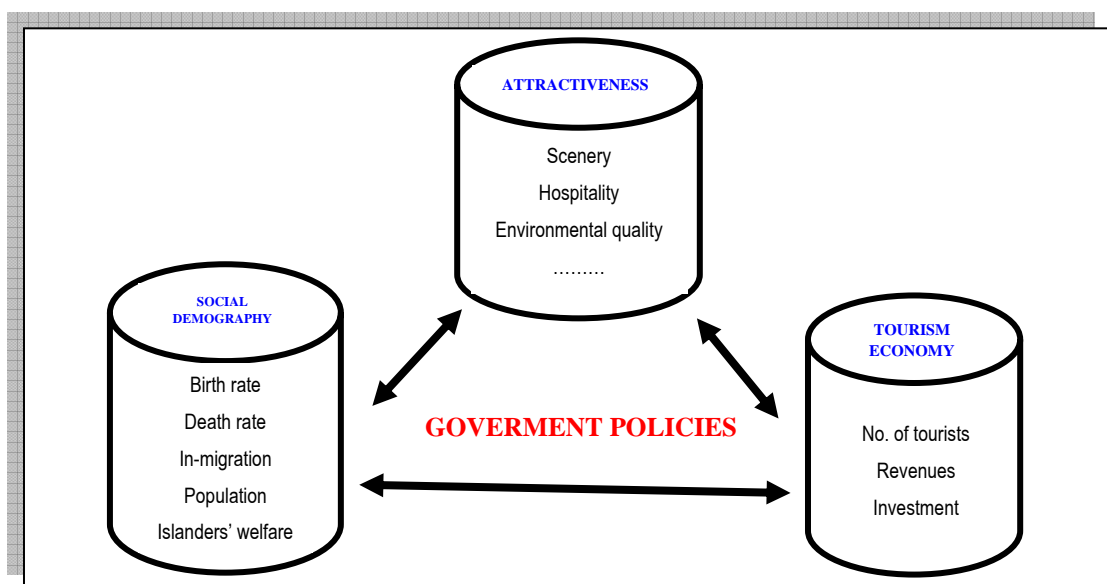


Figure 6: The Simulation Model Structure

However, due to the complexity of the social demography subsystem and lack of data availability, the model will only focus on the first two components focusing on Cat Ba attractiveness and tourism economy.

The reduced stock and flow model is conceptualized in **Figure 7** below. The main objective of the model is to gain insights into how tourism in Cat Ba may change in the next 10-20 years as a result of current investment strategies as well as changes in the external environment.

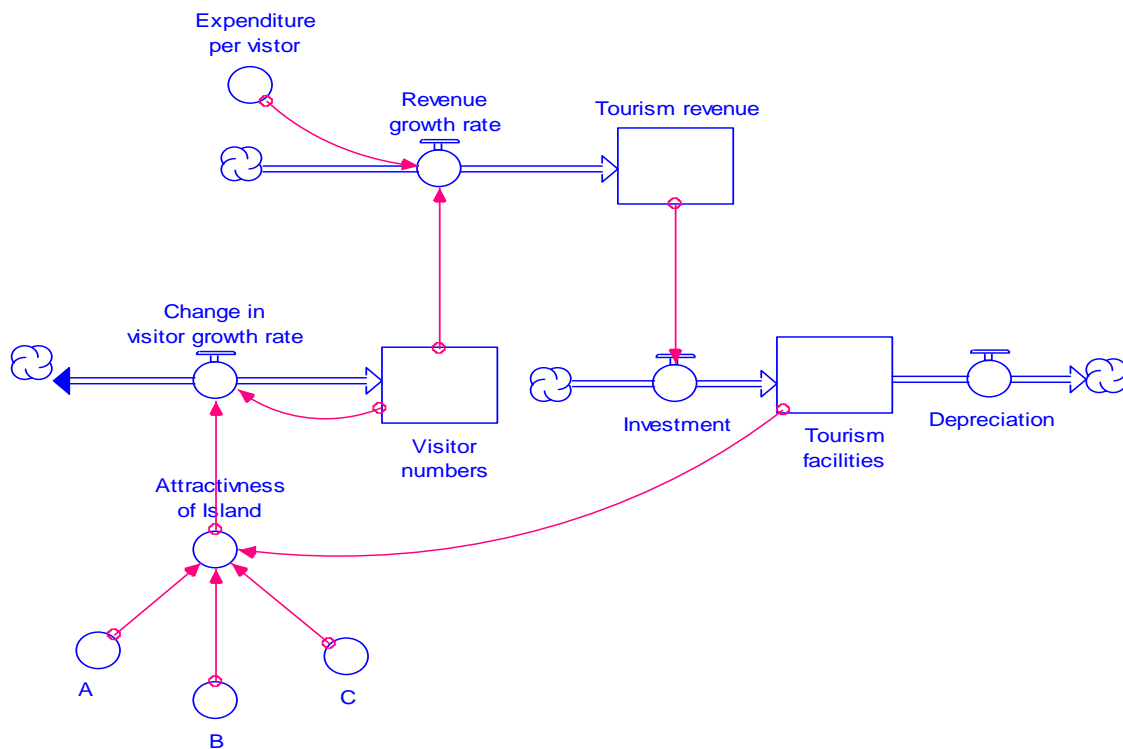


Figure 7: Stock and Flow Model of Tourism in Cat Ba Island

Currently we are in the process to parameterise the model using historical as well as primary data from field interviews. Once the model is populated and tested, it will be used with the stakeholders to test various scenarios in a Learning Lab environment. Over time this process is expected to help institutionalise group learning leading to deeper understanding of complexity, shared vision, collaborative decision making, and alignment of actions - necessary ingredients for sustainability.

Conclusion

Cat Ba Biosphere Reserve (CBBR) has a vast potential for tourism development. Tourism represents a dynamic and complex system. The system includes three interacting sub-systems of economy, environment and socio-demography, and involves diverse stakeholders each of whom holds different objectives. The process of developing and using the simulation model would help governmental agencies, managers and planner to understand complex relationships and to develop and test alternative management policies. Aligning divergent mental models is of particular importance in this regard.

Commenced in 2007, in less than 3 years, the Cat Ba Biosphere sustainability has become a notable project in Viet Nam involving senior politicians from district to central government, academics, donor organisations, field officers and managers at various levels of the government as well as villagers and commune residents. Specifically, the CBBR project addresses tourism development, cultural and ecological degradation and persistent poverty in a systemic and participatory cross-sectoral framework in the context of a 'Learning Laboratory'.

System thinking has proven an effective and powerful tool to explain the complexities of the Cat Ba Island tourism system. Systems Thinking has also helped simplify, clarify and integrate isolated problems associated with the industry and has provided a mechanism for group learning and decision making.

Reference:

Andrew, TN & Petkov, D 2003, 'The need for a systems thinking approach to the planning of rural telecommunications infrastructure', *Telecommunications Policy*, vol. 27, no. 1-2, pp. 75-93.

Bosch, O, Maani, K & Smith, C 2007, 'Systems thinking - Language of complexity for scientists and managers', paper presented to Proceedings of the Conference on Improving the Triple Bottom Line Returns from Small-scale Forestry, 18-21 June, 2007, Ormoc, the Philippines.

Brooks, A 2006, *Enhancing the effectiveness of projects on Cat Ba Island - an evaluation of ten years of international support*, IUCN Vietnam Country Office, Hanoi, Vietnam.

Butler, RW 1991, 'Tourism, environment, and sustainable development', *Environmental Conservation*, vol. 18, no. 3, pp. 201-9.

FFI. 2003, *Annual Technical Report: Report on BP - Vietnam Funding, Ha Long/Cat Ba Conservation Project and Coastal Biodiversity Support Project Preparation Phase*, Fauna and Flora International (FFI), Hanoi, Vietnam.

Gunn, CA 1994, *Tourism planning: basics, concepts, cases*, 3 edn, Taylor & Francis, Washington, D.C.

Hien, TP 2009, *Immigration*, Hai Phong, Vietnam.

HPPC 2005, *Regulations on operation of Cat Ba Archipelago Biosphere Reserves Management Unit*, Decision No.1497/QD-UB dated 8/7/2005, Chairman of the People's Committee of Hai Phong (HPPC), Hai Phong City, Vietnam.

Kim, D, 1991, *Systems Thinking and Organisational Learning*, PhD Dissertation, MIT, Cambridge

Leiper, N 1990, *Tourism systems: an interdisciplinary perspective* Palmerston North, N.Z: Massey University.

Maani, K, E. & Cavana, R, Y. 2007, *Systems Thinking, System Dynamic: Managing Change and Complexity*, 2 edn, Prentice Hall, Pearson.

Macadam, R, Vanasch, R, Hedley, B & Pitt, E 1995, 'A case study in development planning using a systems learning approach - Generating a master plan for the livestock sector in Nepal', *Agricultural Systems*, vol. 49, no. 3, pp. 299-323.

Mill, RC & Morrison, AM 1998, *The tourism system: An introductory text*, 3 edn, Dubuque, Iowa: Kendall/Hunt.

Nadler, T & Ha, LT 2000, *The Cat Ba Langur: Past, present and future*, The definitive report on *Trachypithecus poliocephalus*, the world's rarest primate, Endangered Primate Rescue Centre, Hanoi, Vietnam.

Nguyen, ST, Pigram, JJ & Rugendyke, BA 2002, 'Tourism development and national parks in the developing world: Cat Ba island national park, Vietnam', in DG Pearce & R Butler (eds), *Contemporary issues in tourism development*, Routledge Advances in Tourism, New York, USA, pp. 211-31.

Schianetz, K, Jones, T, Kavanagh, L, Walker, PA, Lockington, D & Wood, D 2009, 'The Practicalities of a Learning Tourism Destination: a Case Study of the Ningaloo Coast', *International Journal of Tourism Research*, vol. 11, no. 6, pp. 567-81.

Senge, P. (1991). *The Fifth Discipline - The Art & Practice of The Learning Organization*, Random House.

Tran, VT 2008, *Cat Ba geopark proposal*, Vietnam Institute of Geosciences and Mineral Resources, Hanoi, Vietnam.

Viet, H & Lin, CK 2001, *Cat Ba National Park, Viet Nam*, ITCZM Monograph No.2, AIT, Thailand.

VNMAB 2003, *Proposed Cat Ba Archipelago Biosphere Reserve*, Vietnam Man and the Biosphere (VNMAB) National Committee, Hanoi, Vietnam.

WB 2005, *Vietnam environment monitor 2005: Biodiversity*, Vietnam World Bank (WB), Hanoi, Vietnam.

Winch, GW 1993, 'Consensus building in the planning process - Benefits from hard modelling approach', *System Dynamics Review*, vol. 9, no. 3, pp. 287-300.

World Bank 2001, *World Development Report (WDR) 2000/2001: Attacking Poverty*, Oxford University Press, New York.

Zingerli, C 2005, 'Colliding understandings of biodiversity conservation in Vietnam: Global claims, national interests and local struggles', *Society and Natural Resources*, vol. 18, no. 8, pp. 733-47.