

SYSTEMS THINKING APPROACH AS A UNIQUE TOOL FOR SUSTAINABLE TOURISM DEVELOPMENT: A CASE STUDY IN THE CAT BA BIOSPHERE RESERVE OF VIETNAM

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ABSTRACT

Tourism is not simply an industry, but is an open, dynamic and complex system. The system consists of many interacting components and involves many different stakeholders. The development of tourism in a sustainable way impinges on and is subject to many factors. The limitation of traditional approaches to tourism research has become evidently in many cases. These approaches have usually looked at a particular issue or issues of the whole tourism picture. As a result, it has become difficult to manage tourism toward sustainability. This paper provides an overview of the systems thinking approach and its application in the study of the tourism system in the Cat Ba Biosphere Reserve of Vietnam. This study shows that systems thinking has proved to be an effective and powerful tool to explain the complexities of the tourism system. It has helped to simplify, clarify and integrate isolated problems associated with the industry, and provided a mechanism for group learning and decision making to achieve desirable outcomes. The paper proposes systems thinking be used as an appropriate tool for sustainable tourism development.

Key words: complexity, dynamics, sustainability, systems thinking, sustainable tourism development

1. INTRODUCTION

In recent years, systems thinking (Jackson, 2003; K. Maani, E. & Cavana, 2007) has been widely applied in the development planning process by academics, scholars, managers, planners, and policy makers (Andrew & Petkov, 2003; Macadam, Vanasch, Hedley, & Pitt, 1995; Schianetz, et al., 2009; Winch, 1993). Systems thinking is a scientific methodology or an approach that consists of a set of principles and tools to deal

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with complexity, ambiguity and mental models underlying our most present social, economic, ecological, and political challenges (Bosch, Maani, & Smith, 2007). 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, and 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). This system includes many interacting components and involves diverse stakeholders, each of whom holds different management objectives. Hence, it becomes difficult to manage the the system towards sustainability. In order to achieve sustainable development of tourism, the system cannot be studied based on each of its separate components. This paper presents the use of systems thinking as a unique methodology in dealing with the dynamic and complex nature of the tourism system with special reference to a case study in the Cat Ba Biosphere Reserve (CBBR) of Vietnam.

2. TOURISM SYSTEM MODELS

The development of tourism in the late 20th century has led to the creation of a number of models of tourism development. Most of them have focussed on the tourist destination region. These models help to understand past experiences and how various factors interact to generate the models. In this section, several tourism system models and the destination life cycle model are explored.

2.1. Tourism System

Tourism is not simply defined as an “industry” but also as a “system” (Gunn, 1994; Leiper, 1990; Mill & Morrison, 1998). Generally, a system has a structure and the

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environments (Bertalanffy, 1971). The structure of the tourism system has been conceptualised from different perspectives.

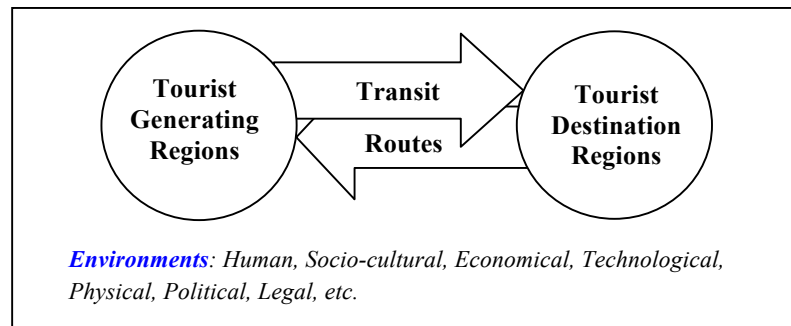


Figure 1: The geographical components of tourism
Source: Leiper (1979)

Taking a geographical point of view, Leiper's model (1979) looks at a whole tourist journey from the homes of tourists to the attractions they are going to visit. This system incorporates three intimate components (**Figure 1**): (i) tourist generating regions where tourists originate, (ii) tourist destinations which may have certain services with distinct attractive features that attract tourists, and (iii) transit routes which allow tourists to 'flow' through the system.

In the light of tourism as a product, the system is structured as to distinguish between the supply and demand sides (**Figure 2**). The model shows how demand and supply interact to increase regional tourism development. The supply side is represented by the five interdependent components of attractions, transportation, information, promotion, and services (Gunn, 1994). A change in one component will have an effect on other components of the system.

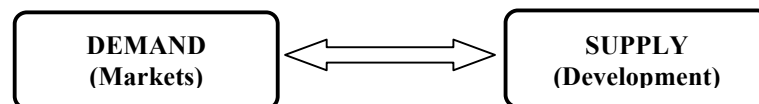


Figure 2: Demand and supply balance
Source: Gunn (1994)

The functioning level of each component largely depends on many external factors including natural and cultural resources, organization, leadership, finance, labour, entrepreneurship, the community, competition, and government policies (Gunn, 1994).

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Developers and managers within each component come from commercial enterprises, non-profits organizations and the government sector.

Another way of conceptualizing the tourism system is based on an economical or commercial view. Mill & Morrison's model (1998) shows the system as consisting of the demand (market), travel, destination and marketing (*Figure 3*).

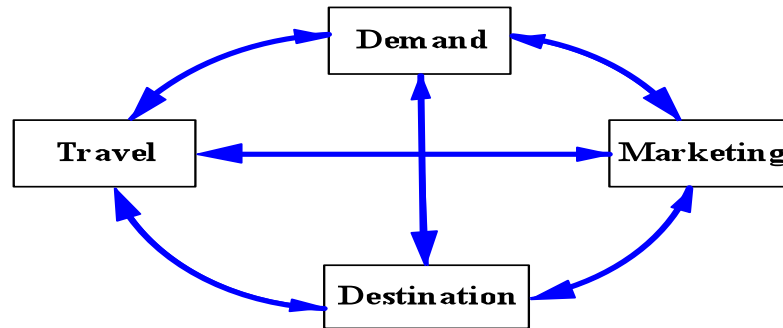


Figure 3: The Economical Components of Tourism
Source: Mill & Morrison (1998)

Essentially, marketing sells the destination to the market through promotion and/or direct contact programs, while travel allows the market to get to the destination through transportation means (Mill & Morrison, 1998).

Furthermore, the environments of the tourism system include political and legal, social-culture, economic, environment, institution and cooperation, infrastructure, and physical and ecological factors (Leiper, 1979; Weichard, 1992).

In order to manage the development of tourism at a certain destination toward sustainability, it is necessary to understand its structure and the environments in which it operates, as well as the associated operational mechanisms. Figure 4 illustrates a combination of the above models. This could serve as a framework for the analysis of tourism at any specific destination.

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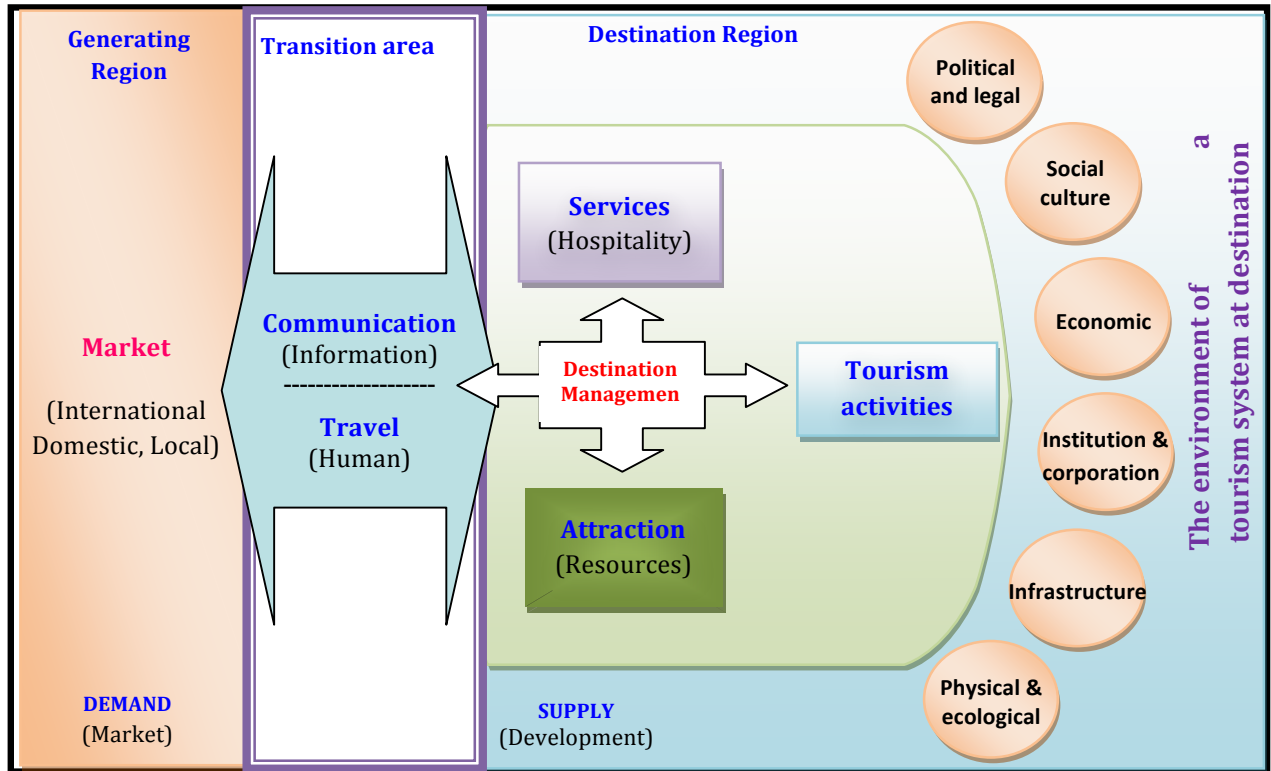


Figure 4: Synthesis Model of a Tourism System at Destination

Source: Adaption from various sources (Gunn, 1994; Leiper, 1979; Mill & Morrison, 1998; Weichard, 1992)

2.2. The Destination Life Cycle Model

In the light of tourism as a product and a product life cycle, several models have been developed to depict evolution of tourism at a destination through a life cycle. Basically, those models emphasise the changing nature of the tourism market and the motivation of the traveller, rather than the economic, social and physical impacts of these latter changes at tourist destinations. One of these models, Butler's model (1980), has become one of the best known theories of tourism evolution at destinations (Weaver & Lawton, 2002). This model represents the relationship between an increasing number of tourists and the development of a tourist destination over time, as a life cycle. The cycle includes six stages: exploration, involvement, development, consolidation, stagnation and post-

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stagnation (*Figure 5*). This model also explains the involvement processes of the local community in those stages.

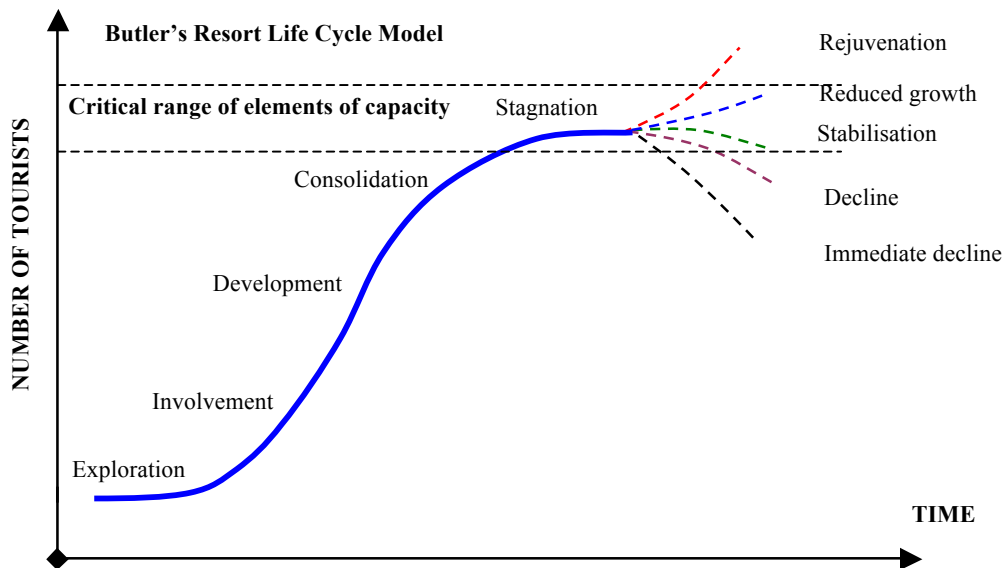


Figure 5: Destination Life Cycle Model
Source: Butler (1980)

In the first stage, an area is discovered by those persons who cherish its 'raw' beauty or culture. The second stage experiences a small but growing stream of visitors; and in this stage tourism acts as a catalyst for local initiative to cater for visitors. During the first two stages the local community has the opportunity to control tourism. In the third stage, a large number of new visitors continue to arrive in the region. These require more facilities, thus bringing in outside investment. At this stage, the control of tourism is passed from local communities to regional and national authorities for policy making, planning and standardizing facilities. In the fourth stage, the rate of increase of development starts to decline, but the number of visitors still increases. During this stage, marketing and promotion efforts are increased to extend tourism reason and attract more potential tourists. In the fifth stage, the number of visitors is stabilized and reaches the capacity level, resulting in economic, social and environmental problems. Consequently, development of tourism has affected negatively on the qualities that attracted people to the region. In the final stage, there are five possibilities reflecting a range of options that tourism development at destinations may arrive at (see figure 5). How well tourism

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develops at this stage depends on intervention policies of the local and national governments.

The above models of tourism demonstrate that tourism is an open, dynamic, and complex system. The scale and dominance of tourism development is strongly dependant on many factors. The evolution of tourism at destinations over time is another critically important factor that contributes to the increasing complexity of the tourism system.

3. A SYSTEMS THINKING APPROACH

The conventional approaches have viewed the world as a machine and tended to focus on parts rather than wholes (Ackoff, Magidson, & Addiso, 2006; Vennix, 1996). This way of thinking tends to over- simplify situations, and disregard the existing relationships between parts (A. Wilson, 1974). Therefore, the conventional approaches have become ineffective in addressing many complex problems that we are facing today. In contrast, systems thinking is a new way of seeking to understand reality that emphasizes the relationships between a system's parts, rather than the parts themselves (Bosch, et al., 2007). This approach has been described as an emerging discipline for understanding complexity and change (K. Maani, E. & Cavana, 2007). In addition, it offers a powerful new paradigm, a specialized language and methodology. Bosch et al., (2007, p. 58) summarized these as follows:

- *Paradigm: Systems thinking is a way of thinking about the world and relationships. This paradigm relates to the dynamic relationships that influence the behaviour of complex systems. It is the ability to see the tree and forest.*
- *Language: Systems thinking provides a tool for understanding complexity and dynamic change. Systems thinking language unravels the underlying cause and effect, relationships and makes divergent mental models transparent.*
- *Methodology: Systems thinking provides a sophisticated computer modelling technology and associated learning environments for group interactions and learning.*

Maani and Cavana (2007) simplified the approach by using the analogy of an iceberg to visualize four levels of thinking (**Figure 6**). The *events* level represents the tip of the iceberg which describes symptoms of reality. However, most of the decisions and

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interventions take place at this level. This is because events are the most visible part and often require immediate attention and action (Maani and Cavana 2007). Therefore, it often receives quick fixes and leads to “fire fighting” or “band aid” behaviour (Bosch, et al., 2007). The next level of thinking is *patterns* where a larger set of data points are linked together to create the trends or patterns behaviour of events. The following level of thinking is *systemic structures* which presents the causal relationship within different parts of the system.

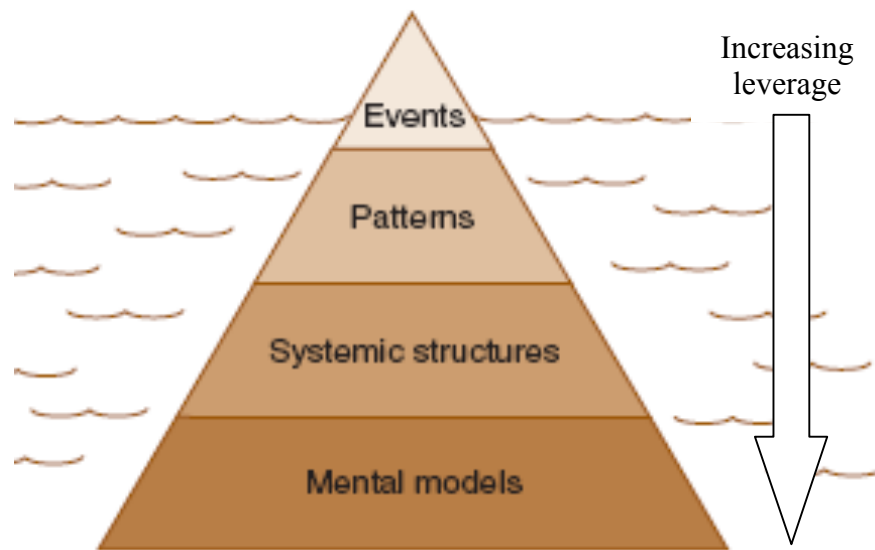


Figure 6: Four Levels of Thinking
Source: Adapted from Maani & Cavana (2007)

There is yet another deeper level of thinking located at the bottom of the iceberg which hardly ever comes to the surface. This is the mental model of individuals and organisations that influence *why* things work the way they do. Mental models reflect the beliefs, values and assumptions that we personally hold, and how they underlie our reasons for doing things the way we do (K. Maani, E. & Cavana, 2007).

The events represent the shallowest and most visible level of reality while mental models reflect the deepest and most profound assumptions, norms and motivation. Leverage from events to mental models is increasing. Hence, the deeper the level we apply, the stronger is the leverage that can be perceived. The tools of systems thinking focus on the four levels of thinking, thus they provide a systemic framework to deal with the most complex or stubborn problems that we are facing in everyday life and work. Those tools include

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causal loop diagram, stock and flow diagram, computer simulation, learning laboratory and group modelling (K. Maani, E. & Cavana, 2007).

The application of systems thinking has grown extensively and encompassed work in many diverse fields such as business (Sterman, 2000), health (Cavana, Davies, Robson, & Wilson, 1999), commodity systems (Sawin, et al., 2003), agricultural production systems (J. Wilson, 2004), natural resource management (Allison & Hobbs, 2006), environmental conflict management (Elias, 2008), decision making and consensus building (Kambiz E Maani, 2002; Kambiz E Maani & Maharaj, 2004), and human resource management (Quatro, Waldman, & Galvin, 2007)

Nevertheless, this is the first study using a systems thinking approach to apply in the sustainable development of tourism in a biosphere reserve context. It would therefore have high potential to be applied globally, considering the importance of tourism in many economies and a comprehensive network of biosphere reserves (UNESCO, 2009)

4. SYSTEMS THINKING FOR SUSTAINABLE TOURISM DEVELOPMENT IN THE CAT BA BIOPHERE RESERVE

4.1. Backgrounds

Cat Ba Island is located in northern Vietnam, and is an area that has high potential for tourism development. The Island is adjacent to and has a similar geology as the spectacular and romantic flooded karst landscape of Ha Long bay--the World Natural Heritage site. It is identified as one of the areas of highest biodiversity importance in the country and is recognized as a high priority for global conservation (Brooks, 2006; WB, 2005; Zingerli, 2005). Cat Ba National Park was declared as Vietnam's first national park which included both land and marine ecosystems. The park also differs from others because of its unique ecosystems and abundance of species. Many of them are listed as rare and endemic in the Red Books of Vietnam and in the World (Viet & Lin, 2001). One extremely important objective of the Park is to conserve a population of a threatened primate - *the Golden-headed langur, or Cat Ba Langur*. This species is now one of the world's rarest primate species, listed in the world's top 25 most endangered primates and is only found in Cat Ba Island (Cat Ba Biosphere Reserve Management Unit, 2007; Nadler & Ha, 2000). Besides biological and geological values, the island also has

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remarkable cultural and historical values. In 2004, Cat Ba Island was designated as an UNESCO Biosphere Reserve.

Because of its geographical, biological and cultural advantages, the biosphere reserve is considered as one of Vietnam's most favoured and beautiful places (S. T. Nguyen, Pigram, & Rugendyke, 2002). It has also become an outstanding destination for tourists from all parts of Vietnam and around the World. The CBBR is currently experiencing strong growth in tourism (and revenue). However, the biosphere is facing a number of severe and urgent environmental problems that pose serious threats to sustainable tourism development in the Cat Ba region.

4.2. Systems Thinking Approach: Process and Results

Systems thinking approach commonly includes identifying key stakeholders from relevant sectors at different levels, defining initial issues, building consensus, and group model building (K. Maani, E. & Cavana, 2007). In this case study of the CBBR, the key stakeholders included local community representatives, the management board of the Cat Ba National Park, local authorities, tour operators and international aid agencies. The stakeholders participated in a series of key information interviews and focus group discussions, to identify drivers and inhibitors that assist or impede sustainable development of tourism on the Island. These stakeholders also participated in the consensus building stage to develop a conceptual tourism system model for the Island. In this stage, diverse and sometimes conflicting views about the important factors to be included in the system model were discussed in a stakeholder workshop. The outcome of the workshop was a road map for the development of a systems dynamic model which is the conceptual framework outlined in this paper.

4.2.1. Problem structuring

In this stage, 76 participants from 8 different groups of relevant stakeholders (Table 1) participated in focus group discussion (FG) or key information interviews (KI) during the period of May to July 2009 to identify key issues, potential, and challenges for sustainable tourism development in the biosphere.

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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

The identification of key issues is slightly different amongst groups based on their different backgrounds (see table 2). 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. These main issues are grouped into three broad categories namely tourism economy, social-demography, and natural resources as summarised in Table 2.

Table 2 - Key Identified Issues for Sustainable Development of Tourism in the CBBR

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

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Hight 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 fesh water and wild birds)		Illegal forest exploitation (hunting/poaching)

4.2.1. Developing Causal Loop Model

The relationship amongst those issues was elicited through another stakeholder workshop conducted in Cat Ba Island. Twenty six representatives from eight groups of relevant stakeholders, and key institutions responsible for policy planning 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 concepts as they had attended a workshop on “System Thinking” held in Hai Phong city by the University of Queensland’s experts. The remaining of workshop paprticipants has not had any knowlege and experience in this respect. Therefore, these stakeholders were given a general introduction on System Thinking at the beginning of the workshop. The workshop was critical in identifying important components of the system and establishing general inter-relations between these components. The causal loop diagrams of the Island’s tourism system, presented below, were then refined based on the outcome of the workshop and validations from tourism experts.

- 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). This leads to increasing land transformation for development and competitions

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for natural resources, particularly water and land. These are critical issues for Cat Ba Island where water and land resources are the most limiting factors. Figure 7 indicates that requirement of land area affects the conservation area, and then impacts on the attractiveness of the Island through affecting natural amenity. On the other hand, development of infrastructure and tourism facilities bring an impressive image of the region that attracts tourists. The main water supply source for Cat Ba town, where the majority of tourism activities are undertaken, is from underground water, but its availability level is dependent on the number of tourists to the Island. These inter-relations are illustrated in Figure 7.

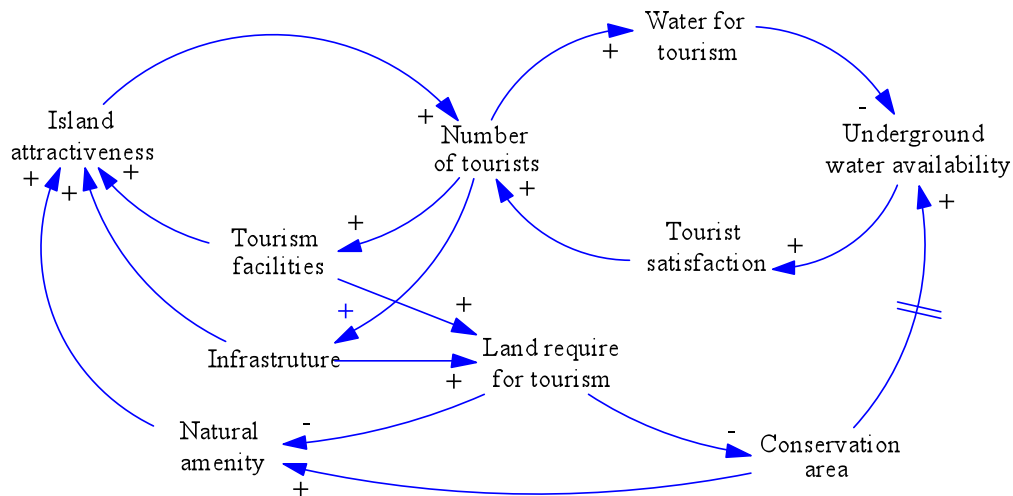


Figure 7 - Inter-relations Between Economy and Natural Resources¹

- Socio-demography and Natural Resources Diagram

Development of tourism on 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 the Island increases. This leads to an increase in the level of waste and pollution, which in turn has a negative impact on the quality of underground water and the welfare of local people.

¹ (+) denote the same way relationship between two variables, while (-) denote an opposite relationship

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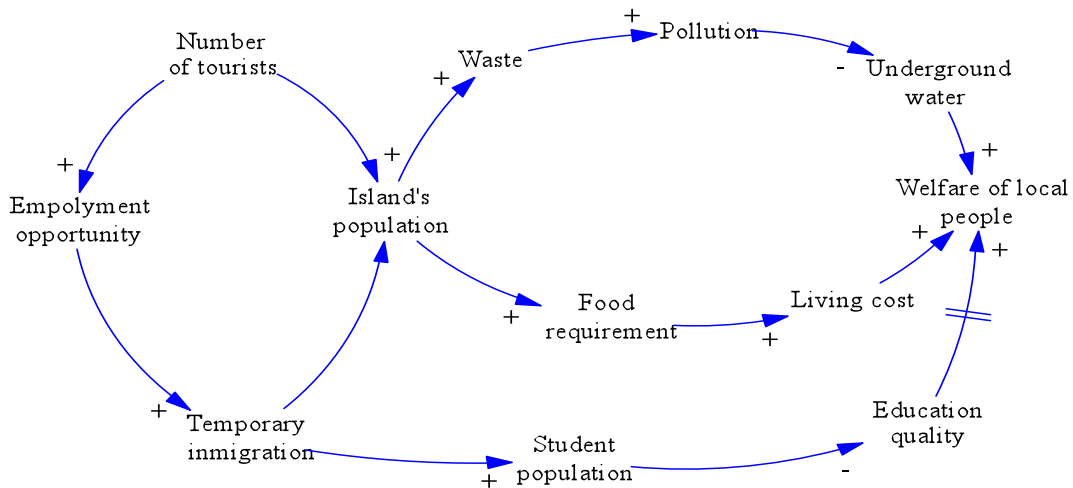


Figure 8 - Inter-relations Between Socio-demography and Natural Resources

Increasing food demand is another factor that also affects the welfare of local people because of increasing living costs. In addition, the quality of education is also affected by the increase of temporary students. Consequently, the welfare of local people is also affected. These inter-relations are illustrated in Figure 8.

- Socio-demography and Economy Diagram

Figure 9 illustrates that increasing tourist numbers will demand more of natural products that encourages local islanders to exploit forest products illegally, such as hunting and 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 and which attracts temporary migrants. The existence of tourists and migrants influences social evils on the Island, such as drug taking and prostitution. This negatively affects the Islanders' welfare. These inter-relations are illustrated on Figure 9.

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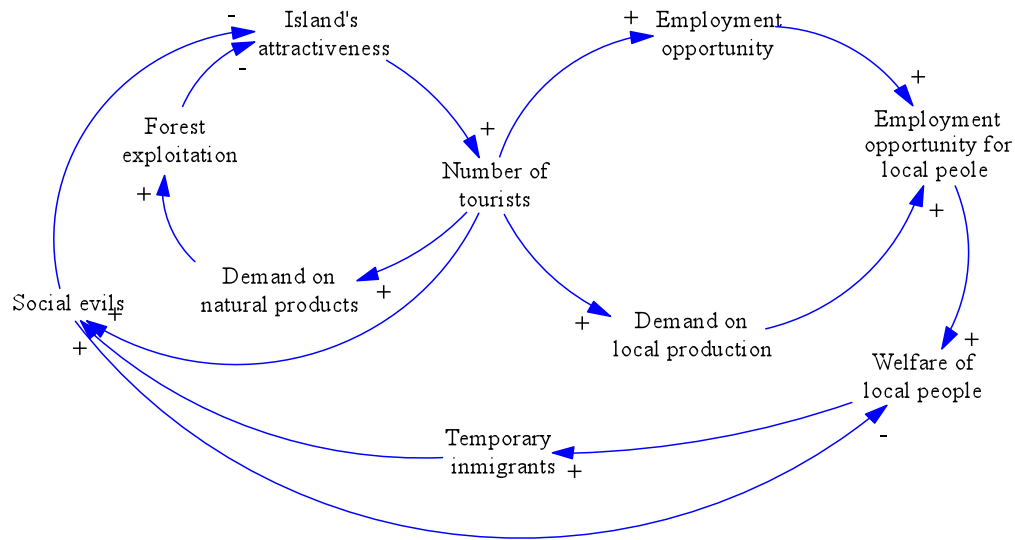


Figure 9 - Inter-relationships Between Socio-demography and Economy

- Casual Loop Diagram of the Tourism System of Cat Ba Biosphere Reserve

The inter-relationships between sub-systems of tourism on 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 10).

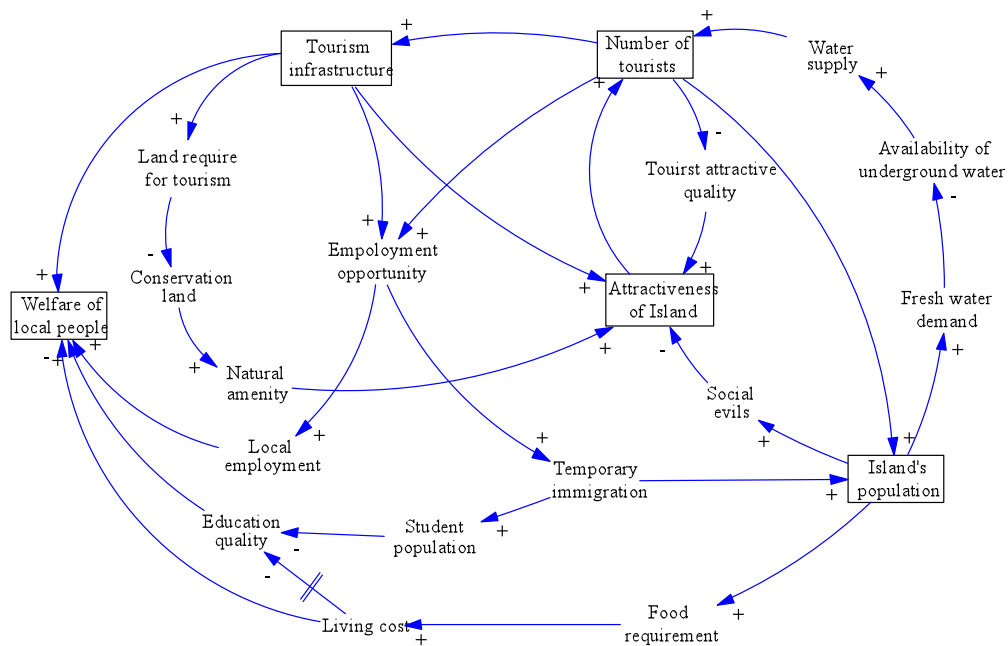


Figure 10 – Causal Loop Diagram of Island's Tourism Systems and Key Leverage Points

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A number of “leverage points” for systemic interventions were also identified by the workshop. Leverage points are places within a complex system ‘where a small shift in one item can produce big changes in everything’ (Meadows, 1999, p.1). The outcomes were then discussed with tourism experts from the Vietnam MAB office (Man and Biosphere), the Sustainable Development Institute in Vietnam and School of Tourism, the University of Queensland, Australia. In addition, the model was also presented at and received feedback from the Conference of The International Society for the Systems Sciences (ISSS) in July 2009. The final model and its key leverage points (Figure 10) were refined through discussions with the advisory team at the University of Queensland.

5. CONCLUSION

This case study is part of the Cat Ba Biosphere Reserve pilot project (N. C. Nguyen, Bosch, & Maani, 2010). 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’ (Ishwaran, Persic, & Tri, 2008; K. Maani, E. & Cavana, 2007).

This study has addressed tourism as a complex and dynamic system. The system includes many interacting components. The development of tourism in a sustainable way impinges on and is subject to many different factors. This is especially true in Cat Ba biosphere reserve context where 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 a casual loop model or qualitative modelling would help governmental agencies, managers and planners to understand complex relationships. This model has been used to identify the root cause of complex problems and the key leverage points of the tourism system in Cat Ba biosphere. The model uses as a foundation to construct a simulation model that can be used to develop and test alternative management policies. This is the content of a subsequent paper which

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has been accepted to be presented at the System Dynamic Society Conference in July 2010, in South Korea.

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