Benefits and Impacts of Tourism: A Systems Thinking Approach

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Abstract

From a systems analysis viewpoint, tourism is a complex system involving simultaneous and time-dependent relationships to economic, social, environmental and policy factors operating at various spatial levels In collaboration with the tourism industry, CSIRO has established the Tourism Futures Project which aims to develop an innovative framework for evaluating the benefits and impacts of nature-based tourism and the factors influencing tourism development. The case study area centres on Douglas Shire and the Cairns section of the Great Barrier Reef in Queensland, Australia. This paper describes progress in developing the methodological framework for setting up and analysing the spatially-explicit dynamic modelling system. The objective is to provide a framework for mapping, summarising and investigating key social, economic and environmental outcomes of various development scenarios in annual steps to the year 2020. The modelling system allows various interrelationships to be examined with a view to simplifying the underlying casual linkages. We refer to the modelling system as the Tourism Futures Simulator (TFS) as the system can be customised to allow simulations of factors of interest to various industry operators or management agencies. In this way, the system can be used as a learning tool, as opposed to a predictive system, to examine the impacts and benefits of control actions or external factors.

1. INTRODUCTION

Understanding the forces that shape the future of tourism in a holistic manner is essential for sustainably managing tourism development in Douglas Shire and the Great Barrier Reef . The last couple of decades have seen remarkable growth in tourism activity in the region and there is concern within the industry that continued growth cannot continue without some form of economic, social and environmental backlash. For some in the industry, the natural attractions of the region represent an unlimited resource to be exploited to maximise their returns. Others see the continued growth of visitors numbers and tourism-related infrastructure as prejudicing the core attractions of the region and the lifestyle of its residents.

Tourism activity is subject to sudden and sever fluctuations because of its high dependency on external forces. Dramatic declines in visitor numbers have been experienced due to natural factors such cyclones or human-induces influences such as a pilot strike.

It is a belief of the industry that marketing holds the key to success of regional tourism. However, if we view tourism as a complex system it seems more likely that a large range of activities and factors have to be managed simultaneously for regional tourism to be successful and sustainable in the long-term. The CSIRO project was designed to assist the industry by providing a tool which can be used by operators and managers to learn how such complex systems might operate.

2. TOURISM FUTURES PROJECT

CSIRO Wildlife and Ecology has been developing GIS-based resource accounting and evaluation systems for a number of years, especially those which integrate economic and ecological approaches to agriculture-related land-use questions. The Tourism Futures Project applies these skills to another industry and a different set of natural resource management activities.

The Tourism Futures Project is a joint project between CSIRO and the tourism industry. It is aimed at developing an innovative framework for evaluating the benefits and impacts of nature-based tourism in a region, for assessing a range of policy and management activities for guiding tourism development, and for making the causal relationships explicit in a manner that is conducive to improving the knowledge of stakeholders. The study area is Douglas Shire in Tropical North Queensland and the Cairns section of the Great Barrier Reef.

The simulator is intended to pave the way for development of a capability to evaluate a wide range of

economic, social, environmental and land-use variables that could affect tourism development and/or be affected by tourism in the region.

Using concepts from *Systems Thinking*, as exemplified by Senge et al [1994] and *Learning Organisations* and taking advantage of recent developments in low-cost simulation languages and macro-languages, the idea is to develop a systems analytical tool that has the potential of being widely adopted by stakeholders in tourism development. Systems Thinking is a powerful tool to help explore the complexities of the tourism industry and its interactions with the economy, the environment and local communities. Systems thinking also helps to simplify and clarify problems associated with the industry and provides a mechanism to probe potential solutions. In the long term, it is envisaged that continued development work will produce something similar to a flight simulator that lets people explore the future implications of management and policy options. We call the system the Tourism Futures Simulator (TFS).

The client base for such a system is broad and includes people from both the private and public sector. The TFS could allow exploration of a range of commonly cited economic indicators of tourism, for instance total visitor spending, occupancy rates, and employment, but it might also help managers and planners to explore more complex and systemic implications including environmental implications for land and water resources, and social impacts on the local resident community.

3. METHODOLOGICAL ASPECTS OF DEVELOPING A TOURISM FUTURES SIMULATOR

The core concern of the TFS is to explore how tourism in a region can grow in such a manner that the limit to the growth of tourism is not the adverse effects of the growth itself, but something of the region's choosing.

3.1 Process of building the TFS

The process of building TFS involves

- developing a geographic information base and tourism database for the region,
- identifying "mental models" of the range of stakeholder groups in the tourism industry about influences on and of tourism,
- conceptualising a holistic view of tourism and identifying key factors of economic, environmental, social and policy nature,
- translating the factors and relationships into a process-based simulation model in a manner that reflects the dynamic and spatial character of the processes and captures systems characteristics such as lag times and threshold behaviour,
- building a system interface which allows users to manipulate input data and develop scenarios,
- providing means whereby the causalities leading to an outcome can be explored, and
- showing stakeholders how the TFS may be used as an exploratory learning tool to examine how the tourism system might operate.

The following sections describe selected aspects of this development path, in particular how the project is incorporating stakeholder involvement and learning and how different mental models are built into the TFS.

3.2 Accounting for the concerns of tourism planners and managers

With an ever increasing emphasis on community consultation and ownership of the policy-development process, many community groups are actively seeking involvement in the research and policy development agenda for their regions.

Before building the TFS, it is essential to identify the potential users of the tool and to identify the key questions that these stakeholder groups have. Understanding how these groups view the future of tourism in the region, and what they see as the critical driving forces affecting change is critical to setting up the TFS. Here are some examples:

- Marine tourism operators want to know the effect on their economic viability of limits on the number of visitations to specific locations. How do commercial fishing in or near the reef and ongoing water pollution impact on the diversity and abundance of fish and coral, and hence the reef's attractiveness for visitors?
- Service providers in the industry want to know what are the implications of a significant down-turn in the numbers of international visitors to the region?
- The resident community is concerned with employment opportunities and security, their lifestyle and the cost of living in the region.
- From a local government perspective it is essential that the relationship between tertiary sewage treatment and oceans water quality can be shown and that the benefits and costs associated with the measure are explicit. It is important to show the implications of zoning and the number of building approvals on occupancy rates and employment.
- The State Government sets general land-use guidelines and regulations which invariably affect the scenic value of the region and its attractiveness to visitors.

The TFS encapsulates the system dynamics and perceptions by the community and industry and by policy makers at different levels and thereby provides a learning

tool that stakeholders can use to evaluate the consequences of activities and compare alternative developments. Proponents of change need to understand how their recommendations will affect, or be perceived to effect, other stakeholders and the resources upon which they are dependent. The TFS provides such a facility for a holistic evaluation of activities and development scenarios.

Resource management in Australia is moving away from sector-specific policy alternatives to a focus on developing programs that seek to exploit synergies and efficiencies from integrating related issues. There are, for example, significant advantages in pursuing catchment management, sugar-cane production and remnant vegetation policies simultaneously with tourism initiatives. The conceptual and modelling structure inherent in the TFS is flexible enough to allow these other related considerations to be taken into account.

3.3 Process-based modelling

The complexity of inter-relationships and inter-dependencies which constitute a holistic view of tourism has been emphasised earlier in this paper. Often, analyses focus on the influence of single factors, such as the monetary exchange rate, on tourism. It is equally important, however, to emphasise the implications of tourism on the environment, infrastructure and social structure of a destination area as such factors may for example provide feedback controls on the attractiveness of an area.

Influences can be cumulative, such as the ongoing loss of agricultural land for tourism development and decreasing capacity of land fills to absorb waste produced by the tourism industry. Often, processes are characterised by lag times where the effects of activities are noticeable many years after the event. For example, the accumulation of sediments along the coast from soil erosion turns into a pollution problem for the reef only when currants associated with severe storms translocate the material. In the past, each of these issues has been analysed and reported separately. The result can often be conflicting advice. The TFS sets out to provide a simultaneous assessment of such processes which reveals common causes and chances for improvement.

3.4 Data structure

The primary purpose of the TFS is to be a tool that supports learning about the complexities of tourism. Although applied to a case study area, a secondary requirement is that the model design supports a transfer of the methodology to other regions with minimal re-development.

A key component of the system would be a spatially coherent data base available to all modellers. Integration of existing data sets would be given a high priority over establishing new data sets. The system would include information on external factors affecting tourism demand (including exchange rates, income growth), types and quantity of accommodation provided (eg. backpacker to five-star resorts), destinations and infrastructure to support land and marine tour operations, environmental attributes, as well as a set of economic and social indicators. We envisage that the integrated database would be made available to a range of government and research agencies trying to implement and formulate local development, conservation and sustainable management strategies.

A high degree of stakeholder involvement is anticipated as work proceeds. If the model is to be used by a range of agencies and users, then the model must be seen to include factors that are deemed to be significant by these groups. The modelling process and assumptions need to be transparent to users. The system must present sufficient information on the underlying assumptions and documentation about model structure to allow users to understand the parts of the model where detailed knowledge is weak or where there is disagreement among users about the nature of the impacts.

3.5 Software Shell

The development of software for developing models in an explicit manner has been rapid. Therefore, rather than spending time on developing yet another software framework, VENSIM was chosen as a software shell that allows the modeller to meet all the requirements that have been placed on the TFS (section 3.1).

VENSIM provides some key features:

- Simulation development language,
- Graphical interface,
- High level macro-language for front-end development,
- Integrated windows-based help system,
- Graphical tracking of causes and impacts,
- Low cost mapping of results - integrated into a commercial platform, and
- Real time tutorial - sound and graphics using Lotus Screen-Cam.

4. CURRENT STATUS OF THE TFS

4.1 Tourism life cycle

A prototype TFS which addresses the question of tourism life-cycle for a small set of regions has been developed. The tourism life cycle is characterised by increasing growth in tourism numbers, eventually reaching a turning point at which the numbers of visitors asymptotes or declines (Figure 1).

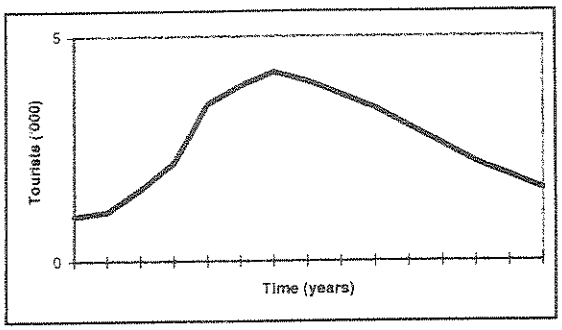

Figure 1: Tourism life cycle

A remote area of great scenic beauty is 'discovered' by adventurers. Gradually it becomes well known, leading to more visitors arriving at the destination. In time, the growth in the numbers of visitors can increase to the point of crowding and/or destruction of the natural beauty, hence diminishing the very features which the region is famous for.

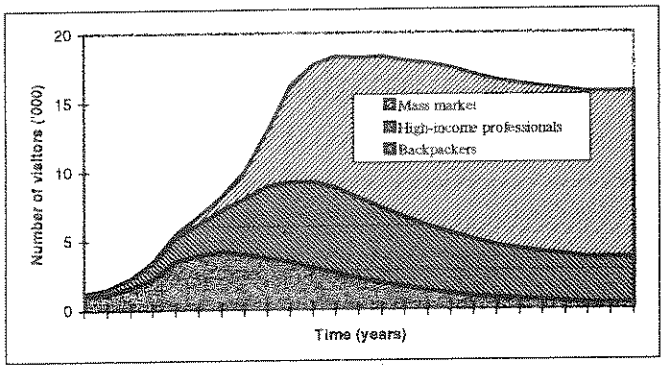

Figure 2: Composite tourism life cycle

This overall tourism life cycle function can be the combined result of developments in different visitor segments. Backpackers are attracted to the region as long as it is 'off the beaten track' and void of tourism infrastructure. As tourism development occurs, less backpackers visit. Now, high-income professionals take over the scene who stay in the new accommodation facilities and enjoy the exclusivity of the place. Eventually, an airport and new roads increase accessibility and large-scale development opens up the region to mass tourism. The region has largely lost its attractiveness to backpackers and up-market visitors. This process is conceptualised in Figure 2.

When the life-cycle model is generalised into a composite or multi-market-segment model, the net effect is one of continual growth in visitor numbers associated with a change in market composition.

The TFS prototype includes the capability for displaying different stakeholder mental models about the future of tourism within one system. The mental model associated with the accommodation providers, for instance, is quite different to that developed in association with tour operators. An example of part of one such mental model that can be accessed using TFS is given in Figure 3. The value of these mental models is that each stakeholder group is able to express their concerns about the inter-relationships between , for example, economic and environmental aspects of tourism in a non-confrontational framework, and yet still be able to see the same problem from the viewpoint of other stakeholders.

Extracting meaning from such mental models can be difficult for people with little exposure to systems thinking. One technique of exploring these complexities is through the use of influence diagrams. These diagrams show how one factor can have an impact on others and vice versa.

Since its commencement in November 1996, the project assembled a representative network of stakeholders in the Shire and used cross-impact analyses to identify the mental models of different stakeholder groups. The workshop also provided a mechanism to encourage stakeholder involvement in the project. During the workshop, the mental models of three stakeholder groups were elicited. They represented (a) accommodation, gastronomy and retails, (b) land-based and marine tour operators, and (c) planning agencies and representatives from other industries (agriculture). The models were drawn for three geographically separated regions within the shire and described the attractions that bring visitors to the region, the market segmentation of visitors, and the potential developments which the region might see in the future (10-20 years) and their effect on the attractiveness of the region.

These changes can, but do not necessarily, occur in each region. Just as the market composition for one region could change under this simple model, equally a transfer of market segments can occur from one region to another.

4.2 Accounting for mental models

One important feature of the TFS is that it accounts for 'mental models'. These capture the perceptions of different stakeholder groups and their beliefs as to which relationships drive tourism and its development.

Using graphical facilitation techniques, the groups were able to clearly see the different mental models and the complexity of the cause-effect relationships. The resulting mental models were incorporated into the TFS which provides a means of displaying the causalities within the mental models (Figure 3).

4.3 User interface

The following figures show the current user interface for the TFS. This interface typically involves the use of slide-bars and explicit trade-off and response functions.

Graphics show the simulated response of tourism in the region to changes in policy levers, for instance, the economic growth rate. The overview menu (Figure 4) shows a selection of controls and overview graphs and links to other functions. The simulator can be re-run directly from this menu.

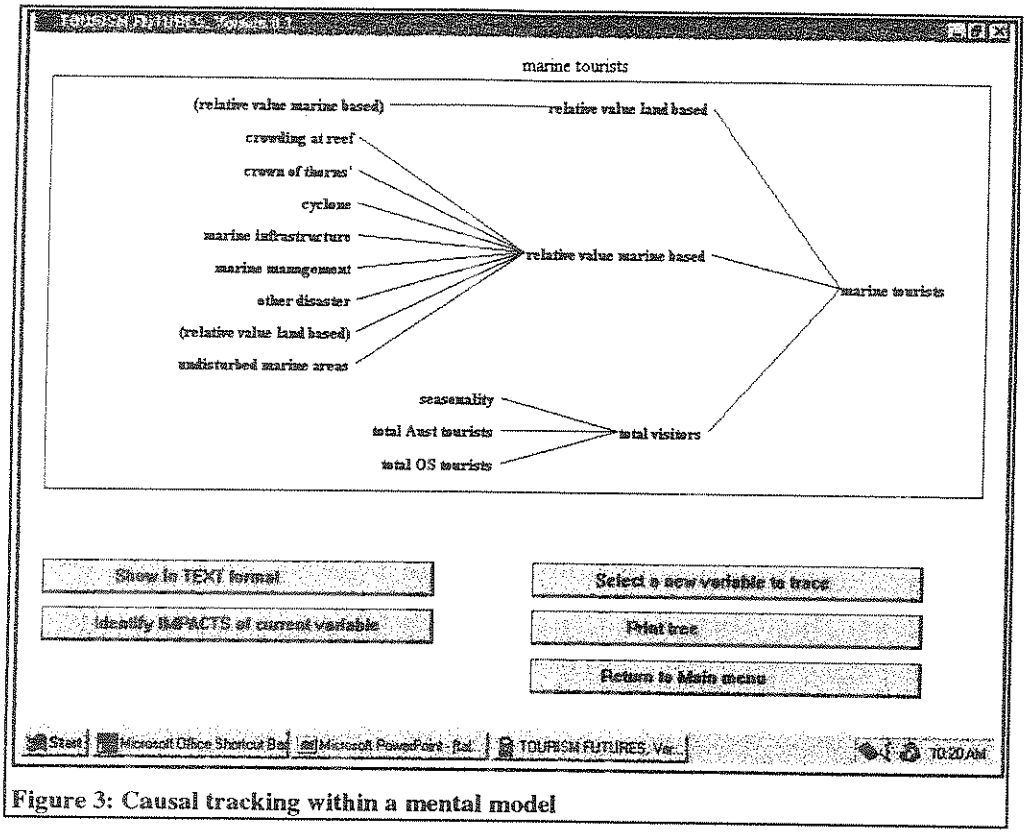

Figure 3: Causal tracking within a mental model

More detailed region-specific responses can then be explored by examining the summary graphs. Here the user can select some or all of the regions in the simulator and compare these regions on a number of pre-specified graphs.

Causal tracking mechanisms allow the user to explore the factors driving the model, and hence lead to the patterns observed in the graphs. The causal tracking technique (see Figure 3), when combined with simulation results, allows the user of the simulator to explore the relationships, seeking variables of high leverage for intervention.

The TFS links directly to a mapping package and also to both Arc/Info and SPANS geographic information systems. The TFS also imports and exports data directly to Excel spreadsheets.

The tourism simulator is being developed to help the industry, management agencies and planners understand complex relationships (especially those linking environment, social and economic processes) and also to develop and test alternative management policies.

Accordingly, the simulator will have sets of policy options specifically oriented to the problems of the marine tourism operators, the accommodation providers and the land-based tour operators. It will also allow these groups to modify many of the underlying input data and response functions to reflect their understanding of the baseline data. However modifications are mainly those related to perceptions such as the benefits or impacts on social, behavioural, and possibly issues for which there is no hard-core information other than the experience of operators. Processes for which objective research results are available, for example the environmental impacts of cyclones, or that of resuspended sediment on corals, would not be modified. But the perception of the relative impacts may be modified.

5. CONCLUSION

CSIRO has established the Tourism Futures Project which aims to develop an innovative framework for evaluating the benefits and impacts of nature-based tourism and the factors influencing tourism development. The framework is based on the tools and procedures from Systems Thinking and Learning Organisation.

The application of Systems Thinking to evaluate the benefits and impacts of tourism has allowed us to build a flexible simulation modelling framework which takes into account the objectives and information base of operators and policy makers within the context of a complex interrelationship with social, economic and environmental factors.

Mental models are an especially important part of the process of developing the TFS. By helping industry to explore the differences (and commonality) between mental models of stakeholders, the project seeks to increase stakeholder understanding of the complexities of the problem and the inter-dependency between the marine and terrestrial aspects of the tourism industry.

The TFS system provides a platform for operators and policy makers to learn about the consequences of control actions or external factors by exploring the interacting linkages within the system.

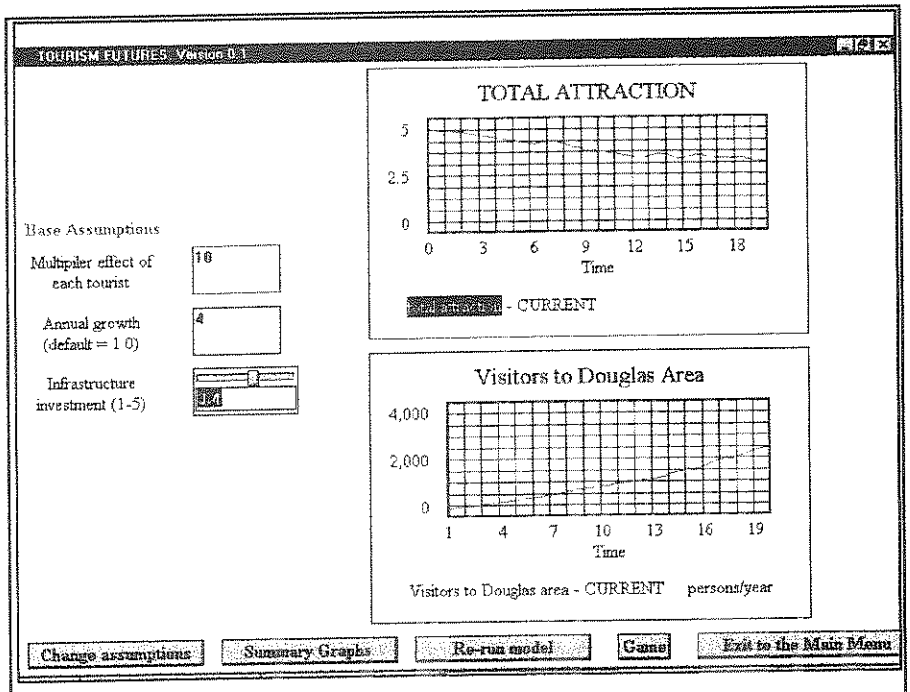

Figure 4: Tracking visitor numbers and attractiveness of the region depending on chosen input factors

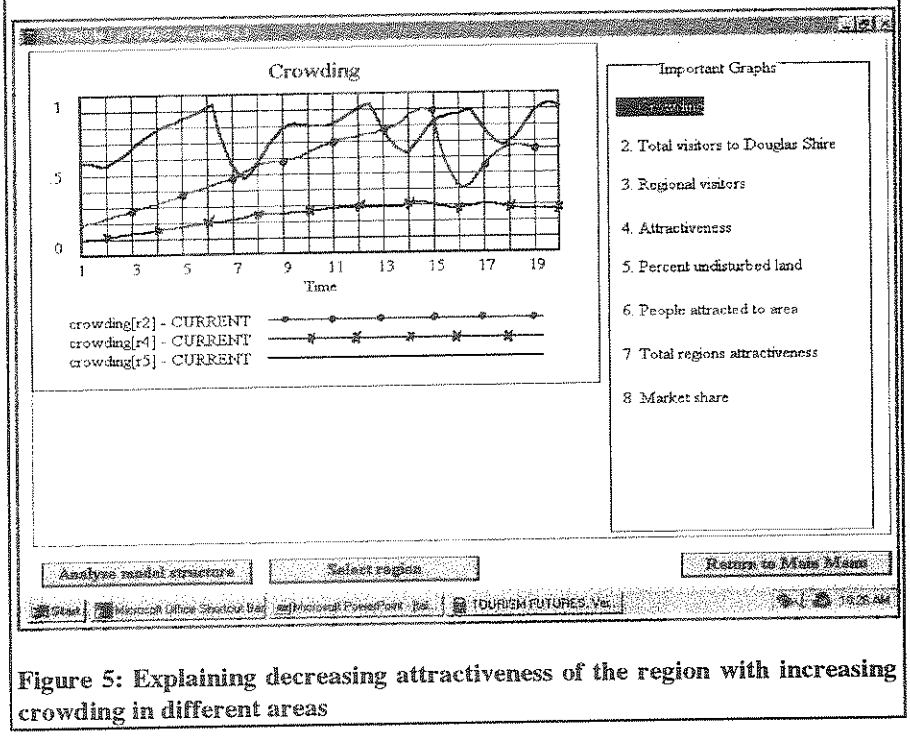

Figure 5: Explaining decreasing attractiveness of the region with increasing crowding in different areas

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