DISAGGREGATING NATIONAL TOURISM DATA TO REGIONAL AREAS

Paul A Whitelaw and Leo K Jago
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DISAGGREGATING NATIONAL TOURISM DATA TO REGIONAL AREAS

ABSTRACT

This paper reports on the development and application of a methodology to convert large scale data such as the International Visitor Survey (IVS) and the National Visitor Survey (NVS) into a format that can be used at the local level.

A technique was developed whereby the large regional data such as Statistical Local Area (SLA) from Tourism Research Australia (TRA) (IVS and NVS) can be disaggregated to smaller local areas within the region such as an Urban Centre (UC). Whilst the mathematics are relatively straightforward, the process is somewhat complex because it requires detailed local area data (Census) from the ABS as well as the larger area data (IVS and NVS) from the TRA. This data can be enriched by incorporating other local area data such as road traffic counts, retail and accommodation statistics and other local area data that is reliable. The data can also be used to create ‘new’ tourism geographies, such as a string of townships along a highway or coastline.

The most significant contribution of this disaggregation technique is that it can bring a wide body of data including all that which is incorporated in the IVS and NVS as well as Census and other geographically based data into a highly focused analysis of a small, local area; an activity which has not been feasible with existing public datasets.

Acknowledgements

The Sustainable Tourism Cooperative Research Centre, an Australian Government initiative, funded this research.

We would also like to acknowledge the assistance of Tourism Tropical North Queensland (TTNQ) staff, especially Mr John McIntyre and Ms Melinda Connolly. Similarly, we would like to acknowledge the assistance of Townsville Enterprise Limited (TEL) staff, especially Ms Shannon McDonagh. The contribution of Dino Zanon from Parks Victoria cannot be overstated. Dino played a key role in conceptualising and resolving many of the mathematical challenges involved in the disaggregation process.
SUMMARY

Objectives of Study
The aim of this project was to develop and apply a method that allows for the disaggregation of large area (such as local government and regional area) tourism data into smaller areas (small towns and hamlets within large local government areas).

Methodology
The work was undertaken by identifying the distribution of visitors in small areas as recorded in the ABS Census. These distributions were then used to apportion the distribution of tourists from the IVS and NVS as produced by the TRA. Further, the resultant data was mapped to present the data in a more visually appealing manner. Finally, if appropriate, other geographically based data, such as road traffic counts and ABS accommodation statistics, can be integrated into the databases to enhance the richness of the analysis.

Key Findings
The resultant datasets, analysis and GIS maps have been evaluated by a panel. This panel has endorsed the approach as a meaningful and novel way to better understand tourism patterns in small, local areas.

Future Action
This paper reports on a prototype project in the TTNQ-TEL (Tourism Tropical North Queensland – Townsville Enterprise Limited) area of North Queensland. The workshop was conducted in Cairns in late August 2006 with representatives from TTNQ and TEL. That workshop involved a three-hour presentation on the background, underlying theory, methodology and outcomes of the project.

Knowledge transfer sessions took place in Cairns and Townsville in late September 2006 at which TTNQ and TEL staff received a comprehensive one day introduction to the process as well as elementary training in SPSS and MapInfo.

The results indicate that there is significant merit in scoping the feasibility of extending this methodology to the entire country. The tabling of this report marks the end of this project.
Chapter 1

BACKGROUND TO PROJECT

This project was initiated in mid-late 2005 and commenced in mid-April 2006. The project was brought about by TTNQ-TEL’s need for greater insight into data that is either readily accessible (such as the IVS and NVS and Census) or somewhat inaccessible (such as localised, geographic based data).

By way of technical background, this project sought to achieve a number of critical goals:

• Producing ratio level record data that can be used for advanced statistical analysis.
• Disaggregating the IVS/NVS data from its smallest reported geography, the SLA (statistical local area) to even smaller geographies (the urban centre and remaining rural balance, and even micro settlements) using advanced allocation algorithms that have been developed using the ABS Census data to enable local area analysis of tourism performance.
• Using these smaller geographies, new tourism precincts such as a touring route or coastal node were created to enhance understanding of tourism performance within the wider region.
• Creating a common, geographic based, unique key to enable the incorporation of other data sources such as the population statistics, tourist accommodation statistics and road traffic counts; basically, any measures that can be tied to a particular geographic area into the existing datasets.
• Geocoding the geographic based data and using mapping software to produce maps to display the data.

This research approach achieves a number of key goals:

• Confirms existing understanding of the market and its performance and dynamic.
• Knits seemingly disparate datasets together to provide background context to reliable, but sparse data.
• Creates completely new insights into the market and the relative performance of the region’s urban locations.
• Creates a ‘backbone’ upon which new research can be undertaken.

Therefore:

• TTNQ-TEL can develop new visitor surveys with smaller samples less (i.e. with fewer respondents) but which can be more in-depth for greater insight into visitors’ values, attitudes and opinions.
• Provided sufficient socio-demographic data is obtained, particularly residential location, the results can be extrapolated to the ‘same’ residents of that location.
• Alternatively, you can assess how representative the visitor is of that residential location and whether there is a viable market segment there for further marketing and promotion.
• This scaffolding will ensure that TTNQ-TEL attains greater yield for its future research dollar.
Chapter 2

METHODOLOGY

The project involved several key data management steps:

- the reconfiguration of the TRA CDMota data
- compilation of ABS Census Statistics
- applying the ‘apportionment methodology’ to the TRA data
- compilation of ABS accommodation statistics
- compilation of DMR traffic counts on the major roads in the region
- geocoding and mapping the TRA CDMota data and the ABS accommodation statistics and DMR traffic counts.

In preparing the data for this project, the record level data was obtained from TRA who extracted the relevant data records and transformed them from nominal level data to ratio level data.

Next, the ABS Census data which provides a measure of how many visitors were in an Urban Centre and SLA on Census night and what type of visitors these people were (from the local neighbourhood, elsewhere in Queensland, elsewhere in Australia or from overseas) were obtained.

Using the ABS Census data and the ‘apportionment methodology’, the SLA data from TRA was apportioned into the UC locations within the SLA—thus distributing the one single SLA wide statistic into several UCs within the SLA. This activity is the ‘engine room’ of the developed approach and provides the small local area statistics used in the subsequent processes.

As part of the process of enhancing the quality and reliability of the data, the ABS accommodation data was compiled and incorporated into the larger statistical dataset for subsequent analysis and mapping. In essence, this incorporation of the geography based accommodation statistics with other statistics such as the visitation and population greatly enhances the quality of the output because it aligns sample based data (IVS and NVS) with Census level data (accommodation statistics) thus providing a ‘third party corroboration’ of the data. Further, these data can also be used for subsequent analysis such as assessing the penetration of the local accommodation sector into the various visitor markets. The same process was undertaken for the Department of Main Roads (DMR) traffic counts for the major roads in the region.

All of these data were then standardised using a unique geographic coding key which was then geocoded into MapInfo which enabled the display of data and statistical results in maps.
Data Sources

The project used a variety of data sources.

**IVS-NVS visitor statistics**

Firstly, the record level raw data from TRA were drawn down from the main TRA database for the years 1999–2005. Next, the data were transformed. This process involved converting the existing file structure wherein the variables (visitors and nights) were converted from a nominal response category (which indicated which was the first, second, third and so on to 100 destinations that the respondent visited) to a ratio response category in which a new variable was created for visitors and visitor nights for each of the twenty-eight Statistical Local Areas (SLAs) in TTNQ-TEL Region. These new variables, one for visitors and one for visitor nights for each of the twenty-eight SLAs in the TTNQ-TEL area, were then packed back into the database so that other respondent characteristics such as age, gender, family status and so on, could be used in further analysing the visitors and visitor nights data. As a result of this, it is feasible to calculate the average length of stay in a particular SLA. Using the apportionment technique, the twenty-eight SLAs were decomposed into approximately 100 Urban Centres, including the major centres of Townsville and Cairns.

**ABS Census 2001**

The ABS Census for 2001 was used to identify the distribution of visitors on Census night. The Census records visitors in five categories:
- resident from the local collection district
- resident from the local Statistical Local Area
- resident from elsewhere in that State
- resident from elsewhere in Australia
- resident from overseas.

This information facilitates the apportionment from the SLA level to the UC level.

**ABS accommodation statistics**

The ABS accommodation statistics for the period January 2003 to December 2005 were compiled. Unlike the TRA CDMota statistics, which are based on surveying people after the fact, the accommodation statistics are based on an actual census of accommodation properties. However, owing to confidentiality requirements, the statistics are not published for locations that are so small that individual businesses could be identified. To this end, these data were presented in graphical and tabular format to show the relative performance of the SLAs throughout the region.

**DMR traffic counts**

The state traffic counts provided by the Department of Main Roads, Queensland were also secured. Again, these data were entered into the database and geocoded for subsequent analysis.

Data Format and Structure

The IVs and NVS data were formatted and analysed using SPSS, which is capable of reading and outputting data in Excel format. All other data, Census, traffic counts, and accommodation statistics were recorded in Excel and then imported into SPSS. MapInfo imports data in Excel but not SPSS format. Therefore, it was necessary to output the SPSS results into Excel and then read into MapInfo.

Given the role of Excel in this process, it was possible to incorporate other datasets into the database model, provided that the captured data are geocoded. For example, TTNQ-TEL could conduct its own visitor surveys at various locations throughout the region. Provided that the location of the survey is recorded, it can be geocoded and thus integrated into the dataset for subsequent analysis, comparison to other data, and mapping.

Data Reconciliation and Verification

A workshop was conducted in May 2006 with representatives from Tourism Australia, TRA and the ABS to discuss and evaluate the legitimacy of the approach to using the ABS Census data to apportion the IVS and NVS data from the SLA to the UC. The workshop endorsed this approach.
Furthermore, as part of the quality control processes, meetings were held with TRA in July 2006 to present the reconfigured dataset which was reconciled to the original data. The reformatted data were successfully reconciled with the original data confirming the accuracy of the data transformation and apportionment techniques.

Therefore, because they were drawn from the TRA-CDMota databases (IVS and NVS), and transformed in an approved manner, the results were reconciled directly to the published statistics and/or those available from CDMota.

**Caveats, Warnings and Limitations**

Despite the precautions undertaken, considerable care and caution must still be exercised when using the IVS and NVS data that are presented at the urban centre level. Firstly, they are based on resident sampling (NVS) and international airport lounge exit sampling (IVS) methods. That is, people are asked at home for the NVS and at the airport exit lounge for the IVS about their holiday behaviours. As such, these samples are based upon a residence or intercept at the international airport departure lounge, rather than surveying people as they leave the region. Therefore, the data are subject to considerable volatility. This volatility is known as sampling error which is considered and measured in terms of the ‘confidence interval’. In essence, the ‘confidence interval’ is the range around the given figure wherein one can be confident that a value within that range is accurate.

At large geographic levels, such as for the nation or state, the IVS and NVS are highly reliable with relatively small confidence intervals, thus making them relatively accurate. Similarly, the broad traveller profiles, such as age and gender, are also highly reliable and accurate. However, as one ‘drills down’ into the data the confidence interval can grow to a size wherein the results are meaningless. For example, in some instances, the number of visitors to a locality could be 15 000 with a confidence interval of +/-5000, meaning that one can be 66% confident that the answer is somewhere between 10 000 and 20 000 visitors or 95% confident that it is between 5000 and 25 000 or 99% confident that it is between 0 and 30 000 visitors. Repeated sampling helps to overcome problems with sampling error. It is for this reason that the visitation statistics have been aggregated over the six year period 1999 to 2005.

A comprehensive discussion of the IVS and NVS and schedule of sample errors and confidence intervals for both the IVS and NVS is provided in Appendix A.

**Replicating Existing Data Analysis**

Whilst it is in its SPSS format, the data can be analysed using the traditional methods such as frequencies and means and standard deviations. However, this is essentially the same as undertaking analysis in CDMota. To some extent, simple frequencies of large, simply defined geographies are probably best done within CDMota. However, when it comes to analysis at the ratio rather than nominal level or for more sophisticated analysis, such as cluster analysis or complex or novel geographies, it is most appropriate to use the transformed data in SPSS as pioneered in this project.

**Novel Data Analysis with IVS and NVS data in SPSS**

The SPSS format allows for detailed analysis using several techniques.

**Calculating means and standard deviations**

Given the aforementioned caveats, means and standard deviations should only be undertaken for the larger localities such as Cairns and Townsville on an annual basis. However, in terms of calculating a broad comparison amongst the new geographies, aggregated means and standard deviations for the six year period can be calculated to give a flavour of their comparative performance over that timeframe.

**Creating natural clusters of visitors**

One approach that can be pursued with the data in SPSS is the identification of natural market segments. For example, over the six year period a typical profile of visitors to Cairns, Townsville and other major localities can be prepared to gain a greater insight into the market.
In particular; age, gender, family status, age of children and so on can be incorporated into identifying these market segments. In a similar fashion, it is possible to form naturally occurring market segments based upon the respondent’s visitation to the major and smaller towns in the region.

Creating novel tourism precincts
In a similar fashion, this approach enables the identification of the relative performance of the various Urban Centres within the region with a view to comparing their visitation patterns and types of visitors. It is feasible from this position to create novel tourism precincts or touring routes to meet the needs of different market segments.

Micro settlements
Whilst the focus of this work has been on the development of statistics for explicitly identified Urban Centres (UCs), it is possible to identify settlements that are even smaller than the formally designated UCs (which typically have more than 100 permanent residents). This activity is particularly time consuming and should not be seen as part of the ‘standard product’ which had UCs as its focus. However, there may be instances where there is a settlement that is not yet large enough to be considered a UC, but which functions as a significant tourism entity. In this particular project two activities were undertaken to highlight this phenomena.

In the Cook SLA, the Daintree ‘settlement’ does not qualify as an Urban Centre and so was not identified under the standard approach. However, after consultation with TTNQ staff, this area was investigated and the Daintree settlement was identified as an area with significant levels of international and interstate visitation. This information can be used to better understand tourism performance in the far northern areas of Tropical North Queensland.

In a similar fashion, but with different results, the TEL staff identified the LGA of Dalrymple which is a large and sparsely populated area west of Townsville. What makes Dalrymple unique is the combination of its sparse population, the presence of two major roads, one running north south and the other east west and, most importantly, the location of Charters Towers as an SLA in its own right, at the intersection of these roads, in the middle of the Dalrymple SLA. Normally, the project methodology would suggest that the bulk of the visitation to the Dalrymple SLA would be fairly evenly shared between Ravenswood (the one UC in the SLA) and the remainder of the SLA. However, closer analysis of the sub UC data suggested that the vast majority of the visitors to Dalrymple stayed along the main roads on the edges of Charters Towers—most likely the strip of motels and caravan parks that are typically found at the entrance to a rural centre. Whilst these areas are officially in Dalrymple Shire, they are likely to function as integral components of the Charters Towers’ tourism industry. This information is important to understanding the nature of tourism in the broader Charters Towers region.

Both of these examples highlight the need for ‘on the ground’ knowledge to maximise the benefit of the data and this advanced analytical method.

Further Analysis Options
The datasets and databases were developed in such a fashion as to enable an individual with moderate computer and statistics skills to develop their own analytical approaches. However, the aforementioned caveats about pushing the IVS and NVS data at the urban centre level too hard and drawing inappropriate conclusions must be carefully considered at all times.
Chapter 3

ENABLING THEORIES AND DATABASES

This project has been informed by a number of key theories and practices:

- normalising databases
- concordance
- apportionment
- number theory
- sampling.

Each shall be dealt with in turn.

Normalising Databases

This approach is driven by some elementary database theories relating to the use of unique, but common keys across different databases. That is, if two different databases have a common variable (such as postcode, or similar geography), then they can be linked and certain assumptions from each database can then be made about aspects of the other database. As Table 1 shows, provided that ‘location’ uses the same metric, the two databases can inform each other and ‘extend’ their value with this extra information.

<table>
<thead>
<tr>
<th>Database A</th>
<th>Database B</th>
<th>New Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident Survey</td>
<td>Visitor Survey</td>
<td>Resident &amp; Visitor Survey</td>
</tr>
<tr>
<td>Location</td>
<td>Location</td>
<td>Location</td>
</tr>
<tr>
<td>Age</td>
<td>Length of Stay</td>
<td>Age</td>
</tr>
<tr>
<td>Gender</td>
<td>Type of Accommodation</td>
<td>Gender</td>
</tr>
<tr>
<td>Level of Education</td>
<td>Purpose of Holiday</td>
<td>Level of Education</td>
</tr>
<tr>
<td>Family Status</td>
<td>Mode of Transport</td>
<td>Family Status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length of Stay</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Type of Accommodation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purpose of Holiday</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mode of Transport</td>
</tr>
</tbody>
</table>
Concordance
Within the ABS Census profiles are a multitude of geographic references, including: State; Federal and State Seat; Local Government Area; Urban Localities and Postcodes. Many of these geographies sit within larger geographies and thus make it possible to derive relationships from one geography to another. Generally, within each Statistical Local Area (SLA) reside several Urban Centres (UC). These Urban Centres can be small townships and hamlets. However, there are other situations where several SLAs are combined to form an Urban Centre. The SLA is typically the smallest geography used by CDVota and the ABS published statistics.

The map below highlights several urban centres (UCs) located within a larger statistical local area (SLA); this is the SLA of Atherton.

Map 1: Atherton SLA and Constituent UCs

In contrast, the map below shows several SLAs comprising one Urban Centre; this is the UC of Cairns.

Map 2: Cairns UC and Constituent SLAs

These two formats create a challenge in the way SLAs and UCs are analysed. In larger metropolitan areas such as Cairns and Townsville, the analytical approach aggregates the SLAs into one large UC. However, in remote areas such as the Atherton Tablelands, the analytical approach disaggregates the SLAs into several smaller UCs.
Apportionment

Within the ABS Census, each household is required to declare the number of visitors on the night of the Census by: Visitors from the same Local Government Area; Visitors from elsewhere in the State; Visitors from elsewhere in Australia and; Visitors from Overseas.

- Within the ABS Census, each household is required to declare the number of visitors on the night of the Census by:
  - visitors from the same Local Government Area
  - visitors from elsewhere in the State
  - visitors from elsewhere in Australia
  - visitors from Overseas.

- Because each SLA is made up of several UCs (and a remainder) and it is possible to know the number of ABS Census visitors in each UC and the remainder, and the overall SLA, it is then possible to calculate the percentage share of ABS Census visitors in the SLA into each UC and remainder.

- The general visitation patterns from the IVs and NVS are apportioned ‘WITHIN’ each SLA to the respective UCs and remainder within that SLA.

- In practice, the process:
  - uses the portions for each UC within each SLA
  - uses the SLA visitation patterns from TRA
  - identifies the geographic source of each visitor
  - obtains the individual SLA visitation activity for each respondent of the IVS and apportions that value to each UC and/or remainder within the SLA
  - arrives at a measure of visitation activity for each UC.
For example, according to CDMota, Atherton SLA has:

- 540,000 domestic visitors, and
- 73,500 international visitors
- However, how are these people ‘distributed’ through the SLA?

Firstly, the population from the Census is obtained.

**Table 2: Atherton Population from Census 2001**

<table>
<thead>
<tr>
<th>UCL_NAME</th>
<th>AT HOME</th>
<th>SAME SLA</th>
<th>QLD</th>
<th>AUSTRALIA</th>
<th>OVERSEAS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Balance</td>
<td>3,210</td>
<td>37</td>
<td>130</td>
<td>92</td>
<td>44</td>
<td>3,513</td>
</tr>
<tr>
<td>Atherton</td>
<td>5,360</td>
<td>74</td>
<td>279</td>
<td>156</td>
<td>46</td>
<td>5,915</td>
</tr>
<tr>
<td>Tinaroo (L)</td>
<td>245</td>
<td>3</td>
<td>158</td>
<td>15</td>
<td>21</td>
<td>442</td>
</tr>
<tr>
<td>Tolga (L)</td>
<td>764</td>
<td>0</td>
<td>18</td>
<td>6</td>
<td>6</td>
<td>794</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>9,579</td>
<td>114</td>
<td>585</td>
<td>269</td>
<td>117</td>
<td>10,664</td>
</tr>
</tbody>
</table>

This is then apportioned.

**Table 3: Apportionment Values for Atherton Population from Census 2001**

<table>
<thead>
<tr>
<th>UCL_NAME</th>
<th>AT HOME</th>
<th>SAME SLA</th>
<th>QLD</th>
<th>AUSTRALIA</th>
<th>OVERSEAS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Balance</td>
<td>0.3351</td>
<td>0.3246</td>
<td>0.2222</td>
<td>0.3420</td>
<td>0.3761</td>
<td>0.3294</td>
</tr>
<tr>
<td>Atherton</td>
<td>0.5596</td>
<td>0.6491</td>
<td>0.4769</td>
<td>0.5799</td>
<td>0.3932</td>
<td>0.5547</td>
</tr>
<tr>
<td>Tinaroo (L)</td>
<td>0.0256</td>
<td>0.0263</td>
<td>0.2701</td>
<td>0.0558</td>
<td>0.1795</td>
<td>0.0414</td>
</tr>
<tr>
<td>Tolga (L)</td>
<td>0.0798</td>
<td>0.0000</td>
<td>0.0308</td>
<td>0.0223</td>
<td>0.0513</td>
<td>0.0745</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1.0000</td>
<td>1.0000</td>
<td>1.0000</td>
<td>1.0000</td>
<td>1.0000</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

These apportions are applied to the IVS and NVS statistics to arrive at the UC level visitations.

**Table 4: Apportioned Visitation to Atherton 1999–2005**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Balance</td>
<td>131 352</td>
<td>27 667</td>
<td>159 019</td>
</tr>
<tr>
<td>Atherton</td>
<td>267 497</td>
<td>28 918</td>
<td>296 415</td>
</tr>
<tr>
<td>Tinaroo</td>
<td>125 503</td>
<td>13 171</td>
<td>138 674</td>
</tr>
<tr>
<td>Tolga</td>
<td>15 891</td>
<td>3753</td>
<td>19 644</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>540 243</td>
<td>73 509</td>
<td>613 752</td>
</tr>
</tbody>
</table>

This logic is at the heart of the methodology and it may be appropriate to discuss this more explicitly, because the Census is taken only on one night in the year.
There may be some concern that there is a potential sampling bias. What happens if that one night is an unusually busy night due to an extraordinary event? The Census is scheduled to take place in the first week of August every five years. This time of year is selected because it is a very ‘normal’ time; it is during the school term, there are few major events or festivals on at that time and the weather tends to be fairly normal; neither too hot nor too cold relative to the rest of the year. Therefore, it can be regarded as typically a ‘business as usual’ night and thus unlikely to be affected by unusual events.

There may also be some concern about seasonality. Whilst that may appear to be a problem, it is not relevant nor of any consequence. SLAs are small and within the one SLA there is the one local government authority and usually the one tourism promotion entity and largely the same weather pattern. Therefore there is no problem with intra-SLA seasonality. That is, there is no evidence of a locality within an SLA being busy in one time of year whilst another locality within that SLA is quiet and then vice versa at another time of year.

For example, referring back to the Atherton SLA. There is no reason to suggest that the township of Atherton is busier in the summer than Tolga whilst during the winter months Tolga is busier than Atherton. Whilst each may have a festival or some other special event scheduled at different times of the year, such events are unlikely to significantly change the balance between these two towns over the course of a year. Furthermore, it is unlikely that one is better to visit in the winter than the summer and vice versa. Finally, the marketing and promotion of these two towns are unlikely to be done at the expense of the other, that is, the tourism promotion entity is unlikely to encourage visitation to one town and not the other. Therefore, any differences between the towns will be due to factors inherent in the nature of the towns (typically their size, provision of tourist infrastructure and location). These factors are unlikely to vary due to seasonality.

By way of contrast, this approach would not work if a larger regional geography is used, for example the broader TTNQ region. That is because there is evidence to suggest that within the broader TTNQ region, there are areas which are preferred during the dry season at the expense of other areas which are preferred during the wet. For example, visitation up into the north (Cook SLA) is likely to be significantly curtailed during the wet period because of road access problems. Therefore, when looking at the total TTNQ area on Census night, there is a risk that one SLA (as opposed to the UCs within that SLA) may be under-represented compared to other SLAs. However, as explained, the methodology is focused only on the distribution amongst UCs within an SLA. The problems of seasonality between the SLAs within the larger region is dealt with directly by the TRA data, the IVS and NVS which tracks visitation patterns and thus accounts for seasonality.

Because each SLA is made up of several UCs (and a remainder) and the number of ABS Census visitors in each UC and the remainder, and the overall SLA, is known, it is possible to calculate the percentage share of ABS Census visitors in the SLA into each UC and remainder. Knowing these proportions, it is possible to apportion general visitation patterns from CDMota ‘WITHIN’ each SLA to the respective UCs and remainder within that SLA.
**Number Theory**

There are four number scales, each with its own set of characteristics which directly impact on the statistical analysis that can be undertaken.

- Nominal (numbers as names, yes, no etc.)—nominal data can only be used for frequency distributions
- Ordinal (numbers as ranks, first, second etc.)—Ordinal data can only be used for frequency distributions
- Interval (numbers in an artificial scale, temperature F)—Interval data can be averaged
- Ratio (numbers with a natural 0)—Ratio data can be subjected to any mathematical manipulation

CDMota records data in nominal format. People are asked where they took their first holiday, second holiday, third holiday and so on. As a result, the TRA database (and thus CDMota) lists lots of destination names in each holiday column. Unfortunately, in this format, this is nominal data and can only be counted, thus, precluding opportunities to do more insightful statistical analysis (inferential statistics).

In the approach used in this project, the 100 holiday questions are converted into several hundred holiday destinations fields in the database which are then incremented by one when the respondent (visitor) records visiting that location. Similarly, the number of nights stayed are incremented in the same fashion. This effectively turns the nominal data into ratio data which enables inferential statistics to be undertaken.
Sampling

Because CDMota is based on samples, consideration must be given to the issue of reliability which relates to the accuracy of the measures derived from the sample. That is, when a sample rather than a census is involved there is an expectation that there will be some error involved in the forecasts based upon the sample. This issue of reliability is expressed in terms of ‘sampling error’.

Sampling error is the range around which an estimated forecast is given, typically in the form of a plus or minus—to represent the range above and below the estimate. The smaller the sampling error, the better. That is, the smaller the plus or minus figure, the more confident one can be that the estimate is a close approximation to the most likely ‘real’ number. Sampling error is measured in terms of ‘confidence intervals’ which is a range given around a statistic. Confidence intervals are a plus or minus value and are used to assess how ‘confident’ one can be when working with statistics. Confidence intervals and confidence of ‘correctness’ are typically expressed at three levels:

- (plus/minus 1 x the value) = 66% confident
- (plus/minus 2 x the value) = 95% confident
- (plus/minus 3 x the value) = 99% confident

Not surprisingly, well visited, well known places, such as Sydney, Brisbane, Cairns and Townsville have progressively increasing confidence intervals. Because Sydney is so well known, and so well visited, the NVS and IVS samples for each year are likely to capture an accurate representation of people who went to Sydney. However, despite their best efforts and extensive sampling techniques, there is a fair chance that when surveying each year the IVS and NVS could well have missed surveying an appropriate representation of people who actually visited Atherton.

As a result, the confidence interval for Sydney will be small, whilst the confidence interval for Atherton will be large. One way to address large sampling error is to increase the sample. However, within the budgetary parameters of the IVS and NVS this is not feasible on an annual basis.

However, it is possible to increase the sample across time. Therefore, as part of the methodology involved in this project, the samples across the six or seven years of the IVS and NVS were aggregated respectively thus significantly improving (making smaller) the confidence intervals for these smaller SLAs. Whilst such a technique prevents making year on year comparisons within and across these SLAs, it does enable a valid, reliable, overall assessment of the relative performance of the SLAs and UC across the total timeframe. Values for the confidence interval are produced by TRA as part of the technical notes for the IVS and NVS. These tables are provided in Appendix A.
Chapter 4

THE PRODUCT

The TTNQ-TEL local area data project was based upon a data analysis technique developed by the STCRC Victorian Network partners. The technique was developed to meet the needs of stakeholders with an interest in understanding the performance of local areas that are not normally presented in the typical Tourism Research Australia (TRA) data products such as the International Visitor Survey (IVS) and National Visitor Survey (NVS). TRA, as the gatherer and manager of the data and producer of these products joined with the STCRC as a partner in the development and conduct of this project.

The current practice of the IVS and NVS is to record visitation to the ‘statistical local area’ (SLA) which is typically an area about half the size of a ‘local government area’ (LGA). Whilst this may be more than sufficient for national stakeholders (such as Tourism Australia and the Commonwealth Government) at the national level, it does not provide much information to underpin high quality decision making at the local area for key stakeholders such as Regional Tourism Associations (RTAs), local government and, in certain instances, State Government Organisations (STOs) that have a particular interest in regional and sub-regional tourism.

As such, the approach developed by the STCRC advances the power of the IVS and NVS by offering stakeholders an insight into the relative performance of local townships, settlements and villages within an SLA and ultimately across SLAs. This ability to engage in comparative performance analysis can greatly assist stakeholders and decision makers on how best to commit resources and provide support across regional areas. Furthermore, the approach gives interested parties the opportunity to create new geographies within a wider region that are based upon the natural tourism flows in that region, such as along a coastline or along a major road or touring route. Further, by using geocoding techniques, it is possible to present the tourism statistics in a map format to show the relative performance of locations within the region. Finally, by aggregating the IVS and NVS data over a six year period, problems with aspects of data reliability are lessened. Nonetheless, despite these improvements in reliability, users are strongly urged to be particularly careful when interpreting the data to avoid drawing invalid conclusions. To a considerable extent these problems can be mitigated by the integration of external, more reliable, local data such as the ABS accommodation statistics or Department of Main Roads, road traffic counts. The integration of these external, verifying datasets provides a supplementary source of data to support the conclusions drawn from the disaggregated data. It is even possible in this system to incorporate other data such as public records or privately gathered data to enrich the analysis.

By way of example, in the TTNQ-TEL project the relative tourism performance in three towns in the Atherton Shire, namely, Atherton, Tolga and Mareeba was identified and analysed. Furthermore, this performance can be represented in a density map. As well, for example, a new tourism entity made up of the townships located along the Kennedy Highway, which has tentatively been named the ‘Kennedy Tourist Route’ was created within this system. By incorporating the ABS accommodation statistics and the DMR traffic counts, a clearer, more reliable understanding of tourism performance along this trail can now be obtained.
The product utilises three different programs to manage two and possibly more datasets which then feed into the three main Microsoft Office output programs:

- Excel to organise and collate the data in preparation for statistical analysis
- SPSS to manage and generate the specialist tourism statistics provided by TRA as well as any other relevant statistics such as ABS accommodation statistics or DMR traffic counts
- MapInfo to produce the maps of the tourism statistics
- Excel, Word and PowerPoint to present the tables, graphs and maps.

Data can be collected and managed using Excel. Both SPSS and MapInfo can import and export data from and to Microsoft Office products, especially Excel. Therefore, ‘pivot tables’ (statistical results) from SPSS can be directly imported into a Word document or into Excel where it can be graphed or into PowerPoint for formal presentations. Similarly MapInfo maps can be presented in PowerPoint or put into a Word document. This process can be displayed using the following schema.

**Figure 1: Schema of inputs, processes and outputs**
Chapter 5

THE OUTCOMES

The approach provides potential for several key outcomes. These include:

- Ratio data for more detailed and creative analysis
- Intra-SLA analysis
- Creation of new geographies
- Common key (UC and SLA concordance) to enable inter-database integration and analysis
- Host-Visitor analysis
- ABS accommodation statistics
- Main Roads traffic counts
- Geocoding for visual data presentation (maps)
- New research focii.

More Detailed and Creative Analysis

Advanced statistical techniques were used to develop more detailed and creative analysis. For example, Cluster Analysis can be used to form new, natural market segments based either on visitation patterns or multiple socio-demographic variables. In addition, discriminant functions can be used to try and explain visitation in terms of visitor profiles. Finally, a direct comparison of multiple locations can be undertaken.

Intra-SLA analysis

This approach now provides some opportunity for intra-SLA analysis. This can be particularly helpful when assessing the relative potential and merits of funding programs for urban centres located within the broader region; for developing strategies to improve an urban centre’s performance; and, for developing marketing campaigns for an urban centre. The map on the following page highlights the differences in the UCs within the Atherton SLA.
New geographies
As an example, a new geography called ‘Kennedy Trail’ was developed for use in subsequent analysis. To assess the impact of the Kennedy Highway, five townships were consolidated to create a new geography, Kennedy Trail. The towns were: Kuranda, Mareeba, Tolga, Atherton, and Ravenshoe. This data can also be tabulated and graphically presented. The following table highlights the level of visitation of those who travelled along the Kennedy Trail (but not Cairns) to that of Cairns (who did not travel along the Kennedy Trail) in terms of purpose of visit.

<table>
<thead>
<tr>
<th>Purpose of Visit</th>
<th>Domestic Visitors to UCs Count</th>
<th>Domestic Visitors to Rural Balance Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>All others</td>
<td>3</td>
<td>0 (276)</td>
</tr>
<tr>
<td>0 to 0</td>
<td>(276)</td>
<td></td>
</tr>
<tr>
<td>1 to 10</td>
<td>(8)</td>
<td></td>
</tr>
<tr>
<td>10 to 20</td>
<td>(38)</td>
<td></td>
</tr>
<tr>
<td>20 to 50</td>
<td>(12)</td>
<td></td>
</tr>
<tr>
<td>50 to 15,000</td>
<td>(29)</td>
<td></td>
</tr>
<tr>
<td>100 to 4,670</td>
<td>(14)</td>
<td></td>
</tr>
</tbody>
</table>
Table 5: Main purpose of trip to New Kennedy Highway geography and Cairns

<table>
<thead>
<tr>
<th>Main purpose of Trip</th>
<th>Kennedy Hwy %</th>
<th>Cairns %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Visiting Friends</td>
<td>9.7</td>
<td>5.0</td>
</tr>
<tr>
<td>2 Visiting Relatives</td>
<td>26.2</td>
<td>15.6</td>
</tr>
<tr>
<td>3 Holidays</td>
<td>39.0</td>
<td>43.9</td>
</tr>
<tr>
<td>4 Unused</td>
<td>2.3</td>
<td>1.5</td>
</tr>
<tr>
<td>5 Entertainment</td>
<td>0.4</td>
<td>1.0</td>
</tr>
<tr>
<td>6 Sport participation</td>
<td>2.4</td>
<td>1.4</td>
</tr>
<tr>
<td>7 Sport spectating</td>
<td>3.6</td>
<td>0.9</td>
</tr>
<tr>
<td>8 Shopping</td>
<td>0.3</td>
<td>1.1</td>
</tr>
<tr>
<td>9 Work</td>
<td>0.4</td>
<td>3.1</td>
</tr>
<tr>
<td>10 Business</td>
<td>12.5</td>
<td>19.2</td>
</tr>
<tr>
<td>11 Conferences</td>
<td>0.2</td>
<td>2.2</td>
</tr>
<tr>
<td>12 Training &amp; Research</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>13 Education</td>
<td>1.1</td>
<td>0.6</td>
</tr>
<tr>
<td>14 Employment/leisure</td>
<td>0.2</td>
<td>1.1</td>
</tr>
<tr>
<td>16 Personal appointment</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>17 Health related</td>
<td></td>
<td>1.9</td>
</tr>
<tr>
<td>18 Providing transport</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>19 Not given</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>98 Other not stated</td>
<td>0.6</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Inter-database analysis
The approach developed and extended in this research can assist in a raft of analysis using other data sources.

Host-visitor research
Using both the Census data and the IVS and NVS datasets, it is possible to compare the local residents with the visitors in a particular location, or identify locations that have similar socio-demographic profiles with overall visitors. This type of research can enhance understanding of host-visitor interaction and satisfaction.

ABS accommodation statistics
The ABS accommodation statistics provides three key measures:
- rooms available (properties as well)
- rooms sold
- rooms revenue
from which occupancy and average rate can be calculated.

They can also be used to assess the performance of the accommodation sector at multiple geographies:
- UC (where the ABS releases such detailed data)
- SLA
- Major city
- Region
- State

Finally, the ABS data can be integrated with the IVS and NVS data as well as the Census data to provide measures of industry efficiency and performance. For example, the average room rate in areas, such as UCs, that are ‘dominated’ by particular market segments.

Department of Main Roads traffic counts
The data from the DMR can also be integrated with existing datasets to reinforce and support the patterns and trends identified in the IVS and NVS data. However, this needs to be done cautiously because it is such a ‘crude’ measure in that traffic counts do not discriminate between residents or visitors.

Any database that has a common geographic key
Because of the geocoding approach used, it is possible to incorporate an existing TTNQ-TEL survey that has say, a postcode of the respondent. This can then be compared to the overall socio-demographic profile of that postcode (from the Census) to see if that respondent is ‘typical’ and thus a ‘cypher’ for that market segment. This can also be incorporated into the NVS statistics using the concordance of postcode and SLA to make similar comparisons. This approach can greatly extend the ‘reach’ of existing research.
New market segments
The integration of visitor profiles and visitation patterns from the IVS and NVS, coupled with the ABS Census data provides a raft of opportunities to develop new market segments.

For example, the following table highlights the distribution of ‘new’ market segments based upon visitation patterns to the urban centres in the region. Using a K-means cluster analysis, five market segments were formed. Subsequent analysis focussed on the travel patterns of the five groups. This analysis identified the five groups:

- those who visited Cairns only
- those who visited Townsville only
- those who visited neither Cairns nor Townsville
- those who visited both Cairns and Townsville, but where Townsville dominated.
- those who visited both Cairns and Townsville, but where Cairns dominated.

Whilst the distribution of respondents across the five groups is somewhat lopsided, the data highlights the existence of a variety of travel patterns in the North Queensland area.

Table 6: Market segments based on visitation to Urban Centres 1999–2005

<table>
<thead>
<tr>
<th>Segment</th>
<th>Number of Respondents (000’s)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cairns only</td>
<td>10</td>
<td>.1</td>
</tr>
<tr>
<td>Townsville only</td>
<td>2</td>
<td>.0</td>
</tr>
<tr>
<td>Neither Cairns nor Townsville</td>
<td>3</td>
<td>.0</td>
</tr>
<tr>
<td>Cairns dominated by Townsville 1 to 19</td>
<td>99</td>
<td>.7</td>
</tr>
<tr>
<td>Cairns dominating Townsville 1.7 to 1</td>
<td>14 870</td>
<td>99.2</td>
</tr>
<tr>
<td>Total</td>
<td>14 984</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Further analysis
Provided that the data is not stretched beyond acceptable confidence intervals, it is possible to undertake analyses that incorporate all of the details with the IVS and NVS as well as additional datasets that have a common geographic key, namely a geocoded location within an SLA such as an UC or even street intersection.
APPENDIX A: TRA CDMota Dataset

TRA (part of Tourism Australia) is responsible for gathering statistics on tourism in Australia. It does this through two major datasets: The IVS—International Visitor Survey and the NVS—National Visitor Survey.

The International Visitor Survey
The IVS is an ‘intercept’ sample based survey conducted in departure lounges at all international airports throughout Australia. It is weighted (for country and seasonality) by analysis of international arrivals according to the ‘Arrivals card’ and ‘Departure card’ that DIMA collects at customs. Data for the IVS has been collected for more than twenty years; however the most reliable period is from 1999 to the present. Over the previous six years 64 806 surveys have been collected. Results are distributed annually and are available through TRA publications and its website.

The IVS contains questions on Nationality and Country of Origin; City of Arrival and Departure in Australia; Quarter of Departure; Travel Party; Purpose of Trip (main and multiple); Age Group (five year brackets); Gender; Marital Status and; Travelling Party Composition.

The National Visitor Survey
The NVS is a telephone based survey conducted on a monthly basis throughout Australia. It is weighted by population statistics and reports are produced annually. It is also more than twenty years old, with the most reliable period from 1999 to the present. The NVS data consisted of 34 728 respondents over six years.

The NVS contains questions on State, City and SLA of Origin; Quarter when trip was undertaken; Number of persons in the household, under and over fifteen years; Travel Party; Purpose of Trip (main and multiple); Age Group (five year brackets); Gender; Marital Status; Employment Status; Household Income and; Travelling Party Composition.
<table>
<thead>
<tr>
<th>ESTIMATE</th>
<th>VISITS RANGE +/- %</th>
<th>NIGHTS RANGE +/- %</th>
<th>VISITS MIN</th>
<th>VISITS MAX</th>
<th>NIGHTS MIN</th>
<th>NIGHTS MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,000</td>
<td>93.5 n/a</td>
<td></td>
<td>130</td>
<td>3,870</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>5,000</td>
<td>60.6 n/a</td>
<td></td>
<td>1,970</td>
<td>8,030</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>10,000</td>
<td>43.7 n/a</td>
<td></td>
<td>5,630</td>
<td>14,370</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>20,000</td>
<td>31.5 n/a</td>
<td></td>
<td>13,700</td>
<td>26,300</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>50,000</td>
<td>20.4 n/a</td>
<td></td>
<td>39,800</td>
<td>60,200</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>100,000</td>
<td>14.7 n/a</td>
<td></td>
<td>85,300</td>
<td>114,700</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>200,000</td>
<td>10.6 n/a</td>
<td></td>
<td>178,800</td>
<td>221,200</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>500,000</td>
<td>6.9 65.8</td>
<td>465,500</td>
<td>534,500</td>
<td>171,000</td>
<td>829,000</td>
<td></td>
</tr>
<tr>
<td>1,000,000</td>
<td>4.9 46.0</td>
<td>951,000</td>
<td>1,049,000</td>
<td>540,000</td>
<td>1,460,000</td>
<td></td>
</tr>
<tr>
<td>2,000,000</td>
<td>3.6 32.1</td>
<td>1,928,000</td>
<td>2,072,000</td>
<td>1,358,000</td>
<td>2,642,000</td>
<td></td>
</tr>
<tr>
<td>5,000,000</td>
<td>2.3 20.0</td>
<td>4,885,000</td>
<td>5,115,000</td>
<td>4,000,000</td>
<td>6,000,000</td>
<td></td>
</tr>
<tr>
<td>10,000,000</td>
<td>1.7 14.0</td>
<td>9,830,000</td>
<td>10,170,000</td>
<td>8,600,000</td>
<td>11,400,000</td>
<td></td>
</tr>
<tr>
<td>20,000,000</td>
<td>1.2 9.7</td>
<td>19,762,000</td>
<td>20,238,000</td>
<td>18,060,000</td>
<td>21,940,000</td>
<td></td>
</tr>
<tr>
<td>50,000,000</td>
<td>0.8 6.1</td>
<td>49,583,500</td>
<td>50,416,500</td>
<td>46,950,000</td>
<td>53,050,000</td>
<td></td>
</tr>
<tr>
<td>100,000,000</td>
<td>0.6 4.2</td>
<td>99,416,900</td>
<td>100,583,100</td>
<td>95,800,000</td>
<td>104,200,000</td>
<td></td>
</tr>
<tr>
<td>200,000,000</td>
<td>0.4 3.0</td>
<td>199,183,660</td>
<td>200,816,340</td>
<td>194,000,000</td>
<td>206,000,000</td>
<td></td>
</tr>
<tr>
<td>500,000,000</td>
<td>0.3 1.8</td>
<td>498,571,405</td>
<td>501,428,595</td>
<td>491,000,000</td>
<td>509,000,000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESTIMATE</th>
<th>VISITS RANGE +/- %</th>
<th>NIGHTS RANGE +/- %</th>
<th>VISITS MIN</th>
<th>VISITS MAX</th>
<th>NIGHTS MIN</th>
<th>NIGHTS MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>20,000</td>
<td>50.0 n/a</td>
<td></td>
<td>10,000</td>
<td>30,000</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>50,000</td>
<td>50.0 n/a</td>
<td></td>
<td>25,000</td>
<td>75,000</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>80,000</td>
<td>41.5 n/a</td>
<td></td>
<td>46,800</td>
<td>113,200</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>100,000</td>
<td>37.5 50.0</td>
<td>62,500</td>
<td>137,500</td>
<td>50,000</td>
<td>150,000</td>
<td></td>
</tr>
<tr>
<td>200,000</td>
<td>27.4 50.0</td>
<td>145,200</td>
<td>254,800</td>
<td>100,000</td>
<td>300,000</td>
<td></td>
</tr>
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EC3, a wholly-owned commercialisation company, takes the outcomes from the relevant STCRC research; develops them for market; and delivers them to industry as products and services. EC3 delivers significant benefits to the STCRC through the provision of a wide range of business services both nationally and internationally.

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The Sustainable Tourism Cooperative Research Centre (STCRC) is established under the Australian Government’s Cooperative Research Centres Program. STCRC is the world’s leading scientific institution delivering research to support the sustainability of travel and tourism – one of the world’s largest and fastest growing industries.

Introduction
The STCRC has grown to be the largest, dedicated tourism research organisation in the world, with $187 million invested in tourism research programs, commercialisation and education since 1997.

The STCRC was established in July 2003 under the Commonwealth Government’s CRC program and is an extension of the previous Tourism CRC, which operated from 1997 to 2003.

Role and responsibilities
The Commonwealth CRC program aims to turn research outcomes into successful new products, services and technologies. This enables Australian industries to be more efficient, productive and competitive.

The program emphasises collaboration between businesses and researchers to maximise the benefits of research through utilisation, commercialisation and technology transfer.

An education component focuses on producing graduates with skills relevant to industry needs.

STCRC’s objectives are to enhance:

- the contribution of long-term scientific and technological research and innovation to Australia’s sustainable economic and social development;
- the transfer of research outputs into outcomes of economic, environmental or social benefit to Australia;
- the value of graduate researchers to Australia;
- collaboration among researchers, between researchers and industry or other users; and efficiency in the use of intellectual and other research outcomes.