CENSUS MAPPING FOR MARKET RESEARCH AND PRODUCTS ADVERTISEMENT

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Abstract: Retail business managers are keenly interested in having a detailed picture of their markets, particularly in terms of identifying existing and potential customers, and learning who would be most responsive to marketing communications, sales efforts and promotional offers. This paper starts with the existing need for using demographic (spatial) information in the business environment, represents the approach of using Geographical Information Systems (GIS) technologies and Census data to support the visualization of market for market research and products promotions. The case studies demonstrated that maps, generated by integrating internal business data with Australian Census data, provide clear pictures of business markets for decision making support. The maps have been produced for showing market information on market area and business locations planning, distributions of existing and potential customers, market potentials by neighbourhoods, and target marketing analysis.

1. INTRODUCTION

Geographical Information Systems (GIS) technology is increasingly being used as a primary information technology tool by the marketing business professionals, providing market analysis in such mission-critical areas as sales/service site selection, target marketing, prospect analysis, territory allocation. Census data, collected on a regular basis, are one of the most complete, reliable, and widely available demographic information for marketing research and this has promoted a number of highly successful geo-demographic systems in marketing. Furthermore GIS software and Census data are often assembled as packages. For example, CDData96 and CDData2001, the 1996 and 2001 Australian Census of Housing and Population on CD-Rom, make full use of the features and tools of MapInfo Professional. These trends, in terms of increasing availability of relevant Census data in digital form, widely developed geo-demographic data bases, as well as the integration of Census data with GIS software, have increased the potential for using GIS and mapping techniques in marketing research.

Maps are a powerful way to view information. They quickly reveal the impact of proximity and geography on business, and make it easy to see untapped potential and over served markets at-a-glance. As the customer-dominated markets become more sophisticated and competitive, opportunities and threats increasingly have a spatial dimension. Census mapping supported by GIS has really helped business decision makers evaluate market presence in the different areas and examine business potential in the marketplace. Marketing professionals are increasingly discovering the unique ability of GIS and Census mapping to help them visualise the market situation, analyse data, and build realistic models that predict how changes in strategy might affect their business.

This paper focuses on how GIS technology and Census mapping can help marketing professionals turn the raw data collected into valuable and powerful information which provides business companies marketing efficiency and competitive advantage. The case studies demonstrated that maps, generated by integrating internal business data with Australian Census data, provide clear pictures of business markets for decision making support. The maps have been produced for showing market information on market area and business locations planning, distributions of existing and potential customers, market potentials by neighbourhoods, and target marketing analysis.
2. CENSUS DATA AND GIS

The richness of Australian Census data can be seen from the set of questions asked in 2001 Census Survey (ABS, 2002). To preserve confidentiality, census data are usually made available for spatial aggregates and not for individuals. Census data are usually made available at a number of geographic scales. For instance, in Australia, individual data are aggregated at census collection districts (CCD) level, groupings of which form states. Most census data are, therefore, hierarchically structured in terms of spatial scales. These levels are not, however, simply ‘spatial resolutions’ or ‘units of analysis’ for the purpose of publication of Census. Instead, they often relate to the workings and needs of federal and local government (Figure 1). The strength of census data thus lies in its geographical detail at different scales (Subramanian, et al. 2001).

![Figure 1. ASGC & Census Geographic Area](source: ABS, 2002)

The Census Collection District (CCD) is the smallest geographic area defined in the Australian Standard Geographical Classification (ASGC) - a hierarchically structured classification used by the ABS for the classification of spatial units by geographic areas within Australia. It has been designed for use in the Census of Population and Housing as the smallest unit for collection, processing and output of data, CDs are created or boundaries adjusted to conform with changes to Local Government Area (LGA) boundaries. CDs also serve as the basic building block in the ASGC and are used for the aggregation of statistics to larger ASGC areas, such as CD-Derived Postal Areas or Suburban Areas. In urban areas, there is an average of 225 dwellings in each CD. In rural areas the number of dwellings per CD declines as population densities decreases.

It is well established that analyzing such aggregates risks the invalid transfer of results from the aggregate level of places to the individual level of people (Gehlke and Biehl, 1934). Despite this, there remain good reasons for using census data. First, there is an intrinsic interest in the different levels at which census data are released (Boyle and Willms, 1999). Clearly, aggregate analysis in market research need not always be a result of a lack of individual data, but also an understanding of market spatial contexts is important in itself (Macintyre, 1997). Second, the extensive area coverage in census data, importantly at multiple spatial scales, provides a unique basis to explore the scale contingencies in the nature and degree of spatial effect on geographic variations.
GIS uses the geographical elements of the data to display and analyze the data, thus the relationships between these different layers of data are allowed to be looked in detail. GIS can be used for many different marketing activities, various GIS business and marketing applications developed include spatial data display, sales territory management, site selection, trade area analysis, business data modeling, media planning, distribution planning, competitive analysis, sale prospecting and more. Business marketing application currently is an important and fast-growing area of GIS, and there is a substantial body of literature on the subject (Beaumont 1991; Birkin et al. 1996; Clarke and Clarke 1995; King 1993; Longley 1995; Morrall 1996; Maguire 1995; Openshaw 1995). To date, GIS in business has been used predominantly for database management, low order mapping and visualisation, and for traditional location and trade area analyses. However, recently more attention is being placed on the integration of conventional GIS software and model-based analysis for better planning and decision making by evaluating and testing different strategies (Birkin et al. 2002; Longley et al. 2005)

It is widely accepted that GIS is a powerful data visualization tool, which is the major function used in this paper. However, the benefits of full-featured GIS like ArcGIS go far beyond data visualization alone. The real strength of these tools is their ability to perform spatial analysis for exploring the relationship between data sets. GIS spatial analysis function is used as well but without further elaboration.

3. CENSUS MAPPING FOR MARKET RESEARCH AND PRODUCTS ADVERTISEMENT

1. Marketing Area Planning

An important business application of GIS is for the delimitation of trade areas that are fundamental for marketing analysis (Beaumont, 1991). All too often, sales territories are creating using the easiest possible definitions. Administrative boundaries such as states, Postcodes, Local Government Areas (LGAs), might be good enough for company's sales management goals, but GIS can be used to produce much more realistic, efficient, productive, and results-driven sales territories. Consideration should be paid to underlying market potential, competitive activity, workload per sales representative, customer locations, etc. Typical uses might include the aggregation of household level data matching certain criteria to user-defined boundaries.

The example presented in Figure 2 is sales territory creation and optimization. The GIS is used for balancing territories based on multiple criteria. Figure 2 shows the original boundary of marketing area with bridge line and the optimized marketing boundary with solid one. The map shows that, spatially, there are significant discordant between the distribution of existing customer and the current marketing area. Clearly, existing customers are clustered in the eastern part of marketing area, and there exist large amount service customers who are located outside of eastern and southeastern boundary. These are obviously area where the company should focus its marketing and other business programs. GIS functions have been used to plan the new territory that includes the 80 percent existing service customers and corresponds to other sale territories for the same company. Meanwhile the closest postcode or Census Collector District (CCD) boundaries are matched to the boundary of new sale territory, based on the considering of marketing mail out and sales management activities.

2. Spatial Targeting for Product Advertisement Application

Advertising is an integral part of the marketing efforts of firms in a competitive environment. And the limited advertising budgets must be effectively allocated among media and/or geographic regions. Direct mail campaigns offer relevant illustration of the allocation problem. The process usually begins with an analysis of the firm’s present customers. After determining characteristics of current customers, the firm can selectively mail promotional letters or leaflets only to areas which contain large proportions of individuals or households with the desired characteristics. Census provides variables and data frequently used in descript the characteristics and also discover spatial aggregation of such demographic population.

A simple example of GIS application on business expansion and spatial target marketing is provided in Figure 3. The business shop has profitable customer base who are 20-40 years old and have annual family income $100,000 or above.
Figure 2. Marketing Territory Optimisation

Figure 3. Customer Segmentation and Spatial Targeting for Business Expansion
Currently the Shop is considering to expand business and the manager wish to know the best areas for business targeting. GIS techniques and Census data are used to determine the optimal areas based on the Census Collection Districts (CCDs). The number of high income families is obtained from census data as a aggregated number in each CCD. The spatial distribution of these high income families provides the targeting areas for business expansion and direct marketing of products. The map shows that there are significant clusters of high income families along the inner water front areas, the CCDs, which have high proportion of targeting families and have the distance between 5 to 10 km to the shop, are the areas where the company should focus its marketing effort. This provides efficient information for the manager to plan its expansion plan, targeting potential markets, and pinpointing advertising dollars.

3. Integrating Census Variables for Market Analysis

The most basic level of application is to use the facilities of GIS for mapping the distribution of different spatial variables over space, such as automobile dealers/service providers locations, and the distribution of working population that may be used to indicate the demand for automobile services (Figure 4). Such a simple mapping provides Automobile decision makers with an effective and immediate visual impression of the network of service stations at the aspect of their distribution. For example, patterns of clustering of service station with respect to customer segmentation can be identified so that potential problem areas can be identified visually and singled out for further consideration and analysis.

The facilities of GIS also can be used in addition to enable different layers of data to be superimposed to provide new information. An example is the superimposition of data on transport, population, business competitors, and commercial centres to generate composite maps. This superimposition can be performed visually and the different layers can be integrated in the database. In either case, the system is able to generate additional information that is generally useful for interrogation and to support analyses. Typical products generated using GIS may be used, for example, to map demographic and social conditions, customer segmentation and the demand for car services; relationships between new entry/exit of service stations and the population affected for planning service network.

Figure 4. Distribution of Auto Dealers and Working Population
Furthermore, the integration of different census variables can be used for generating new indicators for marketing analysis. In Figure 5, based on the analysis of customer profile, the typical profile variable for a brand of car is generated by combining several census variables. The spatial distribution of profile population shown in Figure 5 provides an easy to understand picture to indicate where the potential customers are.

![Renault Profile Population](image)

**Figure 5. Integrated Census Variables for Market Analysis**

### 4. Dealership Location Planning

Determining where to properly locate a dealership network in relation to its potential market is the underlying key to success in automobile sales. The need to make the automobile dealership networks more effective is the primary factor in fuelling the process of rationalization, that is derived from the geographically and temporally dynamic nature of the demand for and supply of automobile products and services. Strategic planning is needed to be applied to the problem of where to locate new dealers and where to consolidate existing ones, that makes it is necessary to constantly revise competitive strategies to reach customers through changing sales and services location distribution.

GIS visualisation techniques have demonstrated its unique value on helping one of the automobile manufacturers who is considering to rationalise its dealership network in Sydney City, New South Wales. In order to increase its market penetration, the current 6 dealerships in the city have been assessed. Figure 6 shows the current dealership locations using dot symbols and the service areas within 5, 10, 15 minutes travel buffers. It is obvious that the current dealers (Waitara, Brookvale, Parramatta, Leichhardt, Randwick, and Sutherland) are sparsely located in Sydney metropolitan area, in the Southern and Northern part of the city, the dealerships at Sutherland and Waitara are so close to the national parks, within service areas defined by the above travel zone, large areas are actually national parks without population around, whilst in the southwest and Northeast areas, the automobile manufacturer does not have a dealership there to provide the products and services, this makes the potential demand customers in the region travel more than 20km to buy the manufacture’s brand cars or get their cars served. The map shows this shortage of spatial appearance and suggests the target area for improvement. The solution could be opening a new dealership/service station in the target area, but the less efficiency with existing dealership is another problem too. Thus the whole dealership network needs to be treated as an integrated one and the planning exercise should overview all dealerships at the same time.
Before the decision makers can reach the final decision for the rationalisation of the current network, they would like to have more information to understand the market and the problem. For example, Where should the dealerships locate? What proportion of the spatial market will the manufacturer have? How well will the new dealership network meet the potential demand? etc. All these questions need to be answered.

The key factor in this process is the potential customers—the demand. Although the category of potential customers is determined by more than one demographic factor, by way of example, the working population is used as an important target demand group. That supposes the number of potential customers is direct proportion to the number of working population in each region. The working population data is obtained from Australian 2001 Census. Based on such demand data, GIS Location-Allocation models have been used to generated different scenarios as the references for decision making process (Zhao & Lu 2002).

One scenario plan of the dealership locations and the original ones are displayed on Figure 7 which also shows the areas, where the proposed planning dealerships can serve within 20 minutes travel time. The analysis suggested that the dealership network could be made more efficient by combining the model suggestion and current ones. For example, some of the current dealerships could be kept (such as Parramatta, Brookvale and Leithhardt), some of the dealerships (such as Sutherland and Waitara) could be moved to better locations (Castle Hill and Penshurst), two new locations (North Ryde and Liverpool) generated by the model could be added to new network, and original Randwick dealership could be closed. The area coverage of new dealership network planned is much larger than the current one’s within 20km travel distance. And the map in Figure 7 also shows that the service area for the new plan extends towards Southwest and Northeaster areas comparing with current service area.

There are three requirements for a successful business: location, location, location. Finding that perfect location is the challenge that GIS technology is helping to meet. “what-if” analysis plays a pivotal role in business planning. Business companies whose products are sold primarily to specific demographic groups (eg, age group, occupation group, etc.) analyse the scenarios in relevant demographic groups by using Census data. The scenarios are then used to aid the
decision makers in planning sale and/or service facilities. Census provides readily available data for such decision support analyses, which results in the advantage of such informative and systematic approach as opposed to intuitive, no-analytical method.

![Proposed Locations for New Dealership Network](image)

Figure 7. Proposed Locations for New Dealership Network

5. CONCLUSION

These GIS analysis and Census mapping gives business managers more information to make better advertising and customer targeting decisions. The market area analysis would be extremely valuable for planning a business expansion and pinpointing where to target advertising based on the understanding the spatial aggregation of profitable customers.

These case studies show that using GIS and Census databases for market analysis can help to generate better information, so a company is now able to use the information to answer wide-ranging questions and greatly improve their overall return on marketing and sales efforts with a more appropriately tailored marketing plan. These case studies also highlight the way in which GIS can be used as a tool to integrate the various components of the marketing mix to assist marketing strategic decision.

With the ever-present potential for rapid change in the business climate, driven by such factors as unrelenting competitiveness in traditional markets and the need to understand and respond immediately to emerging and niche market opportunities, it is clear that the use of GIS technology and Census data provides the competitive edge and is indispensable to the business marketing strategist.
Taking Automobile industry in Sydney as an example, however, the research paper aims at improving the use of GIS technology and Census data in market research, the outcomes are expected to provide valuable information for decision makers in other industries as well.

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