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Post Office Network Reinvention – Using Geographical Modelling to Optimise Post Office Locations

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1 Introduction

The Post Office are currently faced with a number of commercial challenges. In particular, from 2003 the Benefits Agency will pay all benefits directly into bank accounts. As a result of this and further pressures from increased competition, the Post Office are seeking to "reinvent" their network of outlets to ensure its medium and long term commercial sustainability.

Much of the rationale behind the need for change is outlined in the PIU report 'A Counter Revolution: Modernising the Post Office Network'. This report emphasises the community role played by Post Offices in rural areas and some deprived urban areas and thus rules out rationalisation of the network in these locations. In urban areas it emphasises the current high density of the network and concludes that urban areas would be better served by 'larger and better quality offices' which would 'reduce the need for such a large number of outlets in urban areas'.

The Network Reinvention Project has the overall aim of producing the largest commercially sustainable network given the political, financial and social constraints within which the Post Office must work.

Given the sheer size of the Post Office Network (some 18,000 outlets), certain features differentiate the Post Office from other retail organisations:

- Centrally located network planners do not have first hand familiarity with the entire network of stores.
- The density of the network results in catchment areas for post offices which are heavily overlapping. Whereas for most retailers, a smaller network would imply reduced business levels at the overall company level, it is recognised that the Post Office could potentially maintain business levels with fewer, strategically placed outlets.
- Unlike other retail organisations, the Post Office does not operate on a purely commercial basis. Commerical sustainability is certainly a prerequisite, but the ultimate aims of the organisation remain service delivery. The network needs to be efficient and commercially focused but also needs to deliver effectively and equitably both geographically and socially.

Organisation of the Network Reinvention

The network reinvention project has the following strands:

- A data strand which merges a wide range of internal and external geographic and business information into a relational database and provides a process for continual update of the current status of the Post Office network.
- The Network Reinvention Model (NRM) – a spatial interaction model developed by GeoBusiness Solutions to support catchment and income modelling.

- The IT/IS infrastructure to deliver the model and other management information to a centrally based Location Planning Team and to locally based Network Development Teams. This includes an intranet mapping capability linked to the model and the NRM database.

- A workflow system to process business cases and to manage the implementation of network change.

A key feature of the project is the interdependency between these 'strands'.

Whilst the focus of this paper is the Network Reinvention Model itself, the delivery of this to business users is also of key importance.

Developing the model

GeoBusiness Solutions have developed a Spatial Interaction Model (Network Reinvention Model) which underpins the Network Reinvention Process. It should be emphasised that the model is a Decision Support Tool which assists human analysts in evaluating a number of options and local scenarios.

A spatial interaction model allocates demand from a set of origin zones to a set of destinations or outlets on the basis of the relative attractiveness of destinations and the relative trip cost to each outlet. Such models have been widely adopted for store forecasting in retail markets because they not only provide robust sales estimates for new stores based on locally available demand, but also model the impact upon the existing store network. The basic equation governing the level of interaction is well documented in a number of texts (See Wilson 1974).

The process of turning the Spatial Interaction equation into a functional market simulation for the Post Office Network required the following steps.

- The division of the UK space into a set of demand zones. 1991 census enumeration districts (EDs) were selected as the smallest geographic units for which sufficient relevant data was available.

- The estimation of the level of demand by product in each zone to produce a 'demand surface'. This included:

    - Residential Demand, estimated using the Post Office's in-house market research merged with a geodemographic classification.

    - Workplace demand, estimated from census special workplace statistics modelled to ED level.

    - Shopping demand determined using CB Hillier Parker's National Survey of Local Shopping Patterns (NSLSP).

    - Business demand, determined using a geocoded database of all UK businesses segmented by the size of business measured in number of employees.

    - Demand elasticity: the flexing of the demand surface to take into account variation in demand owed to the quality of supply to the ED.

- The identification and geocoding of all potential outlets. This involved:

    - The merging of three retail databases containing listings of all multiple and independent retailers. Within this dataset it was possible to identify all existing and potential trading partners for the Post Office.

    - Geocoding using Address Point.

    - Deduplication to arrive at a cleaned 'Retail Universe'.

- Clustering of the retail universe into a set of retail centres. In this case, approximately 27,000 centres were identified using raster analysis within a desktop GIS.

- Determining model attractiveness, the pulling power which each Post Office outlet exerts on its surrounding community. This required the fusing of information held on each Post Office outlet with attractiveness scores for each of the defined centres.
- Creation of a trip cost matrix based on road distance and travel time containing the travel impedance between 130,000 zones and 27,000 retail centres.
- Calibration of a set of model parameters against a database of customer postcodes.
- Modelling shopping trips using the National Survey of Local Shopping Patterns.

Applying the model to assist network change

The core model, described above, provides a prediction of expenditure flow between each ED and each Post Office. With four product groupings included in the model, this produces an output matrix of some 9.3 billion potential flows, the vast majority of which are close to zero.

To turn this matrix into management information fit for the purpose of supporting Network Reinvention a number of aggregated performance indicators are produced:

- An estimate of the degree of overlap between an outlet and its neighbours. This indicates the extent to which two or more outlets may be serving the same residential area.
- Estimates of the level of dependency that a zone has on any particular outlet.
- Estimates of pay, income and contribution.
- Location scoring. This is a composite measure based on a set of model outputs and indicates where management attention should be focused.
- Ring fencing. This identifies outlets which must be retained within the network. These are primarily based in rural and urban deprived areas. Regardless of any other model indicators, these outlets will not be considered moveable within the Network Reinvention process.
- Local Optimisation. This allows iterative running of the model within a local area testing a number of permutations of the network to find the optimal location for outlets.

System Implementation

The model and spatial databases are housed within a central system and have a set of 'power' users known as the Central Location Planning Team. The local Network Development Teams, responsible for the 'on-the-ground' implementation of Network Reinvention are location independent and require access to the model and information repositories from a variety of locations including their own homes.

The model and map data are served up to end-users through a web-based GUI incorporating a web-mapping service from which a host of spatial, financial and market information can be retrieved.

In addition, field users armed with hand-held GPS are able to feed back any discrepancies between the spatial database and the real world via a lotus notes service. In controlling the data in this way and feeding back changes to the original source within the Post Office, it is possible to avoid any database synchronisation issues.

Outlet data for Post Offices are refreshed on a regular cycle. External data are refreshed in accordance with newly released updates. The web has the clear advantage that a single database serves all. Differences in the requirements of the Central Location Planning Team and the local Network Development Teams are handled through assigning appropriate permissions to user levels within the database.

Conclusion

The network reinvention project is ground-breaking in a number of respects:

- Largest ever retail network modelled to individual outlet level.
- Fusion, deduplication and geocoding of three retail location databases using codepoint and addresspoint to produce an outlet table of over 300,000 records and digitised perimeters of 27,000 retail centres each scored on their retail vitality.
- Delivery of a spatial interaction model over an intranet linked to a web-mapping application.

Information Resources

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Counter Revolution : Modernising the Post Office Network, A Performance and Innovation Unit Report, June 2000 (downloadable from: http://www.cabinet-office.gov.uk/innovation/2000/postoffice/postindex.shtml)

GeoBusiness Solutions (1999), Profiting From Geographical Analysis – Using geographical analysis to ensure profitable business decisions, Geobusiness Business Guide Series, GeoBusiness Solutions, Wendover, Bucks (available free tel 01296 622555)

Walker, J. W. and Smith G. (1999) "Using Models to Optimise Network Planning", Profitable Decision-Making through Geographical Analysis, 1st Annual GeoBusiness Conference, SCI London

Walker, J. W. (1998) "Location Modeling for The Leisure Market", Retail Location 2000 Conference Proceedings, London

Walker, J. W. (1999) "Spatial Demand Elasticity Models" - paper presented at 'Understanding and Applying Gravity Modeling Profitably' Henry Stewart Conferences, Tuesday 20th April 1999, London.

Walker, J.W (2000) Developing a network optimization model for a major UK retail brand, AGI 2001 Conference Proceedings

Wilson AG (1974) Urban and Regional Models in Geography and Planning, London Pion