Geographical Information System (GIS) Implementation Success: Some Lessons from the British Food Retailers

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EXECUTIVE SUMMARY

Geographical Information Systems (GISs) are becoming more prevalent for retailers in their use for both day-to-day and strategic long-term decision-making. Given the array of internal and external databases they use, as well as the amount of organizational development, systems implementation is a most opposite picture of how GIS support retailing decision-making. This chapter presents the results of in-depth case studies, reflecting upon the GIS implementation experiences of a key UK food retailer, Highway Stores PLC. The company is one of the strongest contenders in UK food retailing (fourth in rank). More sites throughout the country are being explored and considered for development, and the implementation of GIS has supported Highway in determining locations where new stores can be built-up that fascinate new customers and ensure that existing customers are retained.

BACKGROUND

Highway, the fourth largest food retailer in the UK, is a subsidiary that belongs to the Ali group of companies. As part of the Ali group since 1987, Highway has become the group key retailing face (accounting for more than 80% of the group retail sales). Throughout the country, Highway had a total of 490 stores comprising 400 Highway stores and 90 Presto stores. In 1996, Highway accounted for about 92.5% of Ali's operating profit and turnover. As a result, Highway's Board of Directors decided to change its name from Ali to Highway Plc. Highway has had a successful period in terms of sales growth. In the 1991-1996 period, it has achieved the third highest growth rate, beating J. Sainsbury. During this period, Highway's sales performance has been inspiring (whose sales area in 1991 was less than three-quarters of that Asda). It ranked second after Asda in terms of sales density growth. A key factor behind the rising sales was, however, increase in sales footage.

Competition, Market Share

Key food retailers make up the bulk of Highway's competitors. Highway battled with other large food retailers while facing a high degree of competition as one of the leaders in the industry. Table 1 shows Highway's performance in terms of market share and operating profit among other key food retailers. Both sets of data show the same trend, notably the ever-growing concentration of power among the key grocers (focusing its efforts on fulfilling market needs in evolving market segments). Moreover, Table 2 shows the performance of the UK's top four grocers.

Although Highway's average store size has grown, it remains smaller than that of its key competitors, with the exception of Waitrose.

Table 1: Highway's Market Share and Operating Profit Performance Amongst Other Key Food Retailers (1997)

	1997	
	Market Share (%)	**Operating Profit (£M)**
Tesco	23.6	760
J. Sainsbury	19.6	661
Asda	13.5	365
Highway	***10.8***	***410***
Kwik Save	5.8	74
Somerfield	4.5	115
Wm Morrison	4.0	134
Iceland	3.0	65
Waitrose	1.6	74

Table 2: The UK Top Four Food Retailers' Performance (1997)

	Turnover (£M)	Operating profits (£M)	Operating profit margins (%)	Sales per square foot per year (£)	Operating profit per square foot per year (£)
Tesco	13,118	760	5.8	935	54
J. Sainsbury	10,852	661	6.4	1,045	67
Asda	6,883	365	5.3	713	42
Highway	***6,590***	***410***	***5.9***	***655***	***48***

SETTING THE STAGE

In the UK, for the last 25 years GISs have rapidly developed as Decision Support Systems (DSS), notably employed by retailers are becoming increasingly crucial to support both operational day-to-day and strategic long-term decisions. A GIS is defined as:

> "*An emerging science of spatial information, it deals with how to collect, compile, store, analyze and display spatial data within a digital environment, raising explicit questions that have previously always been implicit within spatial analysis, such as the measurement of accuracy of spatial data.*" (NCGIA[1], 1989)

In retailing, GIS is also known as "geodemographics." It is derived from the combination of both geographic and demographic terms. The system was initially employed to support site selection decisions, but have developed to support an array of marketing mix decisions. As GIS "re-engineers" the traditional working approaches and involves continuous commitment from all the parties (senior managers, system developers and users) in the organization, the system fundamentally changes the existing organizational working approach towards site selection and other marketing mix decisions.

Given the scope and flexibility of a GIS, more and more retailers of various types are employing the system, examples being Boots the Chemists, Marks and Spencer and W. H. Smith. The need for retailers to analyze their market has grown as the competition faced by the retailers becomes more intense, for example, the opening-up of new markets, particularly in the European Community. This situation further justifies why retailers are changing their focus towards GIS technology.

Its relative advantage lies in its ability to locate the customers through its discriminatory power, i.e., the system is capable of merging various retailers' internal and external databases. This integration has allowed site researchers

to make full use of the existing datasets. The availability of GIS databases at a national level—for example, in the UK, the Target Group Index (TGI) and National Readership Survey (NRS)—is also one of the continuing factors in changing retailers' perspectives towards this evolving system. These databases are also becoming more portable at a reasonable cost (from mainframe to CD-ROM). The data will be more costly if it is self-acquired by the retailer.

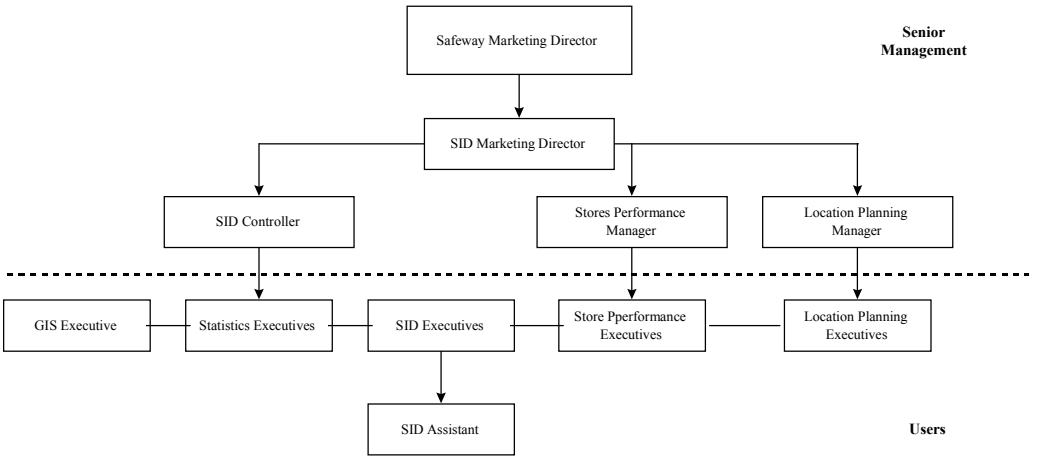
In short, GIS has been employed by retailers in all sorts of marketing mix decisions, e.g., direct mailing, such as door-to-door distribution of leaflets through postcodes clusterings, selecting newspaper readers and television audiences, merchandise management and sales forecasting. Such systems are established as giving competitive advantage, enhancing organizational planning and decision-making in a wide array of functions.

CASE DESCRIPTION

GIS Implementation Process at Highway

Operating in a mature market where there were many competitors offered a challenge in terms of analyzing which stores should close and where new ones should be opened. The Stores Information Department (SID) key function was to advise Highway on where the organization should invest in new sites. An average of 25 key decisions were made every year on site selection for new stores. In addition, SID also provided advice on the performance of existing stores. As one of the top food retailers, SID was responsible for monitoring the 490 Highway stores. There were about 16 site researchers working with the department. Figure 1 illustrates the SID organizational structure.

Figure 1: Stores Information Department (SID)'s Organisational Structure



Much work has been done on streamlining the stores by eliminating the poor performers. Highway reduced its number of stores while raising its total selling space (see Table 2). Furthermore, during the 1995-96 period, 20 Highway stores were closed. The development trend was to have a relatively small store size. Although the average size of the stores was smaller than most of its competitors, Highway managed to cram in a wide range of services, including coffee shops, dry cleaners, petrol stations, pharmacies and even post offices in many of their larger stores. These were seen as significant complimentary services to their main store offerings.

Prior to the implementation of the system, much time was spent by SID managers in manually evaluating Highway's potential sites and their catchments through the overlaying of the available spatial information, e.g., Ordinance Survey maps and census data. This traditional approach to site selection decisions inherited three significant problems:

- The external (for instance, National Shoppers Survey) and internal (for instance, EPOS) data sets were somewhat in disarray as the amount of both data increased, so did the difficulties of storing the data.
- The outputs of traditional approach were in the form of non-graphical data. To graphically represent and analyze potential sites, SID had to manually place different color pins on paper-based maps.
- Senior management pressure to hold its current position in the market (one of the company aims) forced SID to shorten its site selection process, as the traditional approach was somewhat deliberate.

At Highway, two basic reasons for investing in GIS were;

- That GIS would lead to a productivity increase by expediting the site selection process, e.g., more sites could be analyzed and selected for expansion.
- That GIS would save money by automating the collection and storage of surveyed data for use in site selection decisions.

The first system used by SID was a PC-based GIS (stand-alone), which ran on an MS-DOS platform. The system was primarily undertaken for operations support to the site selection decisions. It represented significant operational tasks vital in the day-to-day running of the department. As the amount of data increased, the system was incapable of managing effective existing databases in which greater volumes of data were flowing into the department. The system was also incapable of providing customized SID internal site selection needs, i.e., the requirement for more rigorous and sophisticated analysis (an increasing significant feature as GIS applications had developed). In addition, the SID Director was increasingly frustrated at his department's inability to accurately select new sites for Highway's stores

because with the traditional approach of analyzing potential sites, there was always a backlog of surveys to analyze. As a result, he decided to go for a thorough network-based GIS implementation.

An investigation into the suitability of GIS was started by an enthusiastic champion. A series of GIS implementation discussions were conducted with GIS specialists in non-competing organizations outside Highway, examining how they implemented GIS in their organizations, i.e., discussions on the issues faced in designing the databases. Further, by engaging users with the implementation project, SID managers had the opportunity to reinforce the sense of users' commitment and ownership to the GIS through participating in the project's conception. Through presentations and discussions, users at all levels developed a reasonable understanding of what was being built and what was going to be built. Highway GIS had been developed with emphasis upon human-computer-based interfaces that were easily utilized by site researchers, which required minimal support from the Information Systems Department (ISD).

It was not possible to purchase an off-the-shelf GIS solution. This was because off-the-shelf GISs were unable to be customized. The system chosen was an object-oriented (OO) network-based GIS by Laser-Scan (known as Market Analysis) which ran on the organization's IBM workstations. It was chosen to be the backbone of the Highway GIS. The applications were developed by both Laser-Scan and SID specifically in location planning and other marketing activities, e.g., promotions and product development. The flexibility of this system was described by one of the SID managers as:

> "*Laser-Scan's solution gives us the flexibility to analyze spatial data against a geographical backdrop and thereby make the optimum decisions.*"

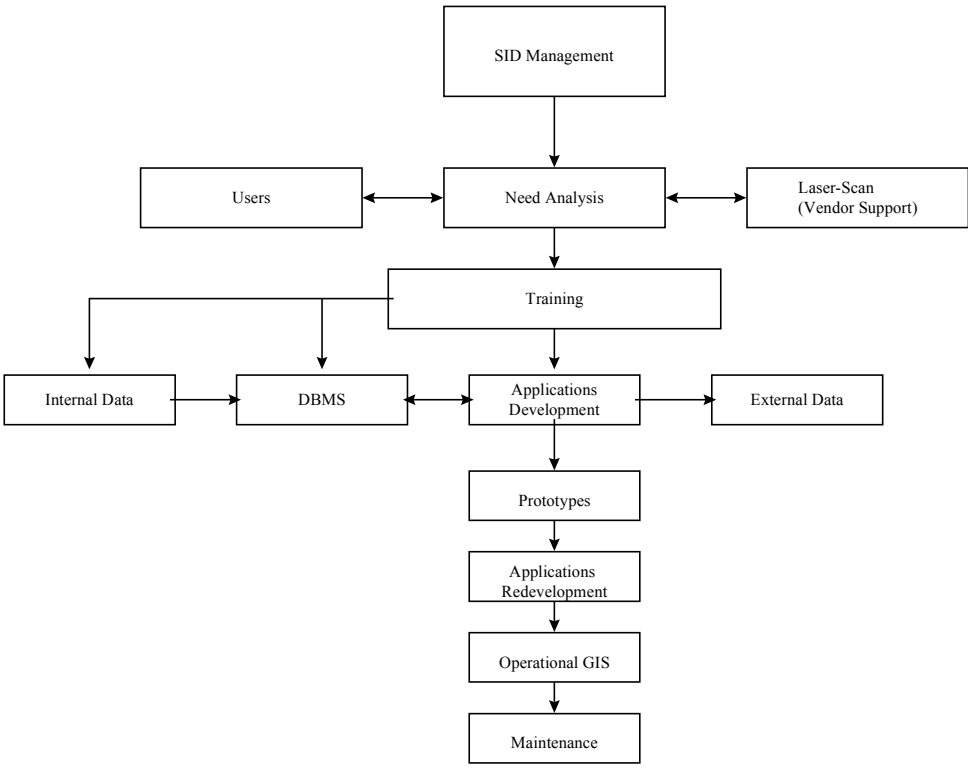
A conceptual framework of the entire GIS implementation process was established after a series of discussions among SID managers, and through the wide involvement of managers and site researchers in various job roles, a team was able to develop the system. The purpose of this framework was to create a shared understanding of the general GIS once it was operational. Its ultimate objective was to implement a system that met all critical departmental business needs. The database, for instance, servers and workstations were accessible throughout the various departments and were associated with remote posts, through distributed terminals. GIS technology was used throughout this period and was recognized as a decision support tool for SID.

At the time of the study, Highway was using Laser-Scan's Strategist to great effect in assisting their location planning activities. Site selection decisions could be achieved in a much shorter period (it had facilitated

strategic decision-making and helped to ensure the integrity of the organization, particularly as competitive pressures increase). As the SID Director described, "We see this type of technology as key in maintaining our competitive edge." The introduction of GIS was seen as offering the potential of spreading the applications around other departments within Highway, as it was significant to integrate the GIS into the entire corporate information systems. The interest in the technology opened a good cooperation between SID and other departments. Its openness to exchange data yielded an infrequent but useful communication of mutual benefits. Figure 2 summarizes the SID's GIS implementation process framework.

Further, system developers paid careful attention to users in developing the applications, as they believed that applications, e.g., user interfaces, should accommodate user needs and not the other way around. They had taken a problem-based approach[1] in designing those applications. Application prototypes were developed for the application and database designs to evaluate the system prior to its actual implementation (different applications necessitated a careful prototype design to meet the needs of a particular situation). The experience gained enabled progress to be made towards the

Figure 2: SID's GIS Implementation Process Framework



implementation process. These processes demonstrated a real working GIS to the users. Users gained more confidence with the system in which they were able to perform routine site selection decisions.

GIS implementation proceeded slowly with commitment and support from SID management due to the belief that lies in the ability of the technology. Management support was described by one of the users as:

"Initially it was not brilliant, it was not brilliant. It tended to be a real mix of people. Some users are really forward; some executives are really forward but not everybody. So it's a real mismatch. We did not have a broad level of support."

She further added:

"I am very lucky because my boss [SID Director] is the person that has fought for the implementation of the GIS. So he is very interested. It is good to actually have a manager who is really into the GIS."

The SID Director played his role by supporting the project. He made the ultimate decision to purchase a Laser-Scan GIS and led the purchasing negotiations. The purchase was made with the departmental funds with the permission from the Highway Board of Directors. He committed himself entirely to the idea of implementing the system within Highway (he was seen as the key advocate of the system and led the Laser-Scan network-based GIS purchase). Besides him, there were also a few managers and users who also acted as champions. It was widely accepted that without champions, Highway could not successfully implement a GIS. They also spread the news about GIS to potential users in other departments. They tirelessly pursue the goal of GIS implementation and its benefits by "hardly" selling the idea to management and co-users. They also communicated the needs of GIS implementation activities up front and make potential users comfortable and productive when they understood what was expected of them more.

Building a GIS was a matter of constructing graphic and non-graphic databases, developing its processing capabilities, installing the appropriate hardware and software and implementing the procedural changes needed to operate and use the system successfully. These were the essential tasks to be accomplished but could not be started until all participating users knew what they expected the system to do for them. Addressing the users' needs assisted in GIS implementation by encouraging users to participate in this process allowed refinement of Highway's GIS implementation as well as exposing strengths and weaknesses of the system. User issues raised under the prototyping process brought up to the meeting for further discussion, i.e., should a GIS be installed as a common resource to meet all departmental requirements or should it be implemented to provide task-specific applications? It was the

responsibility of SID managers that users were identified as being involved in the process.

The SID Director also ensured that anyone whose work was affected by GIS was properly trained. Training strategies were determined by SID managers. There were two modes of training offered by Laser-Scan as the key vendor of Highway GIS:

- *Scheduled Courses*—Laser-Scan ran quarterly scheduled training courses for managers, and users. Individual training sessions range from one to seven days' duration and were held at Laser-Scan's premises on the outskirts of Cambridge.
- *Nonscheduled Courses*—Besides the planned courses, there were also nonscheduled courses. These training sessions were usually conducted at Highway premises.

Users developed considerable expertise and acquiring an excellent reputation for reliability in running the system. A training need analysis was carried out by SID managers to survey users' needs and to ascertain what was the needed training and support. A training assessment was conducted based on the users' tasks (as implementation progressed, there was an attempt by the managers to avoid the "blanket approach" in training users). The SID Director expected that the effort could be repaid by ensuring users had the right training they needed. Training manuals were developed as the implementation process went on by both SID and ISD. The outcomes were described by one of the users as:

> *"They will have the chance to make mistakes, when that [GIS] is installed on the PC, they are not scared of everything, they are quite familiar."*

Database management system (DBMS) was an appropriate tool for effective GIS management. Without it, fast access to internal and external data out of the large amount of operational data collection was difficult to achieve. Besides relying on external data vendors, internal data were converted internally by SID with some help from ISD. Further maintenance, e.g., updates of the databases, was handled internally by SID on day-to-day basis. Data were gathered on a regular basis and fed into the system. The data were available to be distributed so that each site researcher had fast access to it. The loyalty scheme was an attempt to secure a greater proportion of each customer's total spending. The company claimed that its loyalty card has brought them real benefits. By March 1996, 4 million customers had signed up for the Highway's card. Highway believed that much of its 5% profits and sales increase (1995-96) were due to the card. A significant aspect of this scheme was the degree to which the information in the spatial database

was maintained. Through their GIS, Highway launched a promotion aimed at encouraging regular card use and recruiting new cardholders to the scheme. Highway planned to use its card database to full advantage, e.g., a link has been established with Lloyds Bank to market insurance products directly to cardholders.

PRESENT CHALLENGES FACING THE ORGANIZATION

Database Management

One of the data issues that SID faced was the problem of the system's base maps, where the accuracy was a critical factor. Perhaps this issue was the most critical issue in the implementation of the GIS project. As the SID Director described:

"The only and the most critical problem faced was the conversion of the maps, the base-maps of the system."

Most of the internally generated data were stored in mainframes, resulting in minimal problems of data conversion. The external data were bought from data vendors and were also stored in mainframes as common GIS data needed by most of users were stored in a central position while individual or other data were kept by users themselves. There was a continuing attempt to keep both internal and external data together in one place. Further, in transferring the data throughout the department, SID used Local Area Network (LAN). The critical issue faced at this point was the "downloading" of huge bytes of map files which were required in almost all the applications.

Resistance to Change

There was also user resistance, as users were somewhat "painful" in using the technology. However, as the implementation activities proceeded, resistance was slowly being overcome by users themselves, through the support provided by their senior managers. In encountering these resistances, the SID Director described his approach as,:

"There has been resistance and it's a bit like sort of rugby playing. All you can do is just bend down your head and keep going."

The design of a GIS can only be as good as the analysis of the need for that system. Prior to the purchase of the system, a survey on user needs was conducted by the SID Director. User need analyses were established within the context in which the system was to be used. Once the "understanding" of users was in hand, the SID Director moved forward by searching for a GIS, which was available in the market that could fulfill these specified needs.

Senior Management Support

As a result of a series of successful presentations to senior managers and users by the champions, GIS was well received and was consequently given a main concern for implementation. Continuous management communications, e.g., electronic-mail announcements and regular departmental meetings, were perceived as essential in smoothing the implementation process as well as clearing the "doubtful thoughts" possessed by senior management and users. As one of the users described:

> *"I think management has a very big role to play in helping and guiding you and we know it will take longer to use initially because you are not used to using this. Its quite a radical change in how you do work."*

Most users at Highway were "sold" by their superiors on the features of the system; in performing their tasks, due to the small number of staff members within SID, face-to-face communication was used as a major mode of discussion. Various types of support could be seen, e.g., GIS circulars, magazines and manuals were made available by senior managers to help users further understand the technology. Meanwhile, senior managers were also aware of the increasing intricacies in managing the system, e.g., resulting from the increasing amount of data. They believed that the team working spirit was high within their department, which in turn has smoothed the implementation process. There were also a few expert users who were "wandering" around the department to help other users with their queries about the system. In addition, after exposing the system to other influential senior managers (perceived to be possible champions), more discussions were held by the SID Director to promote GIS further.

ENDNOTES

1 Problem-based approach focuses on defining the problem so thoroughly that the appropriate solutions are almost obvious. Central to this approach is the development of a list of performance criteria that defines how the final application should perform.

FURTHER READING

The Analysis, Design and Implementation of Information Systems, (4th Ed.). (1992). New York: McGraw-Hill.

Azad, B. (1992). Case study research methods for geographical information systems. *URISA Journal*, 4(1), 32-44.

Campbell, H. J. (1990). The organisational implications of geographic information systems for British local governments. Paper presented at the *European Geographic Information Systems Conference,* April, 10-13. Amsterdam, The Netherlands.

Campbell, H.J. (1991). *Impact of Geographic Information Systems on Local Government (TRP101)*. Department of Town and Regional Planning, University of Sheffield.

Huxhold, W. E. and Levinsohn, A. G. (1995). *Managing Geographic Information Projects*. New York: Oxford University Press.

Kivijarvi, H. and Zmud, R. W. (1993). DSS implementation activities, problem domain characteristics and DSS success. *European Journal of Information Systems,* 2(3), 159-168.

Kraemer, K. L., King, J. L., Dunkle, D. E. and Lane, J. P. (1989). *Managing Information Systems: Change and Control in Organisational Computing*. San Francisco: Jossey-Bass Publishers.

Lucas, H., C., Jr. (1981). *Implementation: The Key to Successful Information Systems*. New York: Columbia University Press.

Mennecke, B. E., Crossland, M. D. and Killingsworth, B. L. (2000). Is a map more than a picture? The role of SDSS technology, subject characteristics, and problem complexity on map reading and problem solving. *MIS Quarterly,* 24(4), 601-629.

NCGIA. (1989). The research plan of the national center for geographic information and analysis. *International Journal of Geographical Information Systems*, 3, 117-136.

Onsrud, H. J. and Pinto, J. K. (1991). Diffusion of geographic information innovations. *International Journal of Geographic Information Systems*, 5(4), 447-467.

Prerau, D. S. (1990). *Developing and Managing Expert Systems*. Massachusetts: Addison-Wesley.

BIOGRAPHICAL SKETCH

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