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## Mapping Better Business Strategies with GIS

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## Mapping Better Business Strategies with GIS (Geographic Information Systems)

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*The value of location as a business measure is fast becoming an important consideration for organisations. GIS (Geographical Information Systems), with its capability to manage, display, analyse business information spatially, is emerging as a powerful location intelligence tool. In the US, Starbucks, Blockbuster, Hyundai, and thousands of other businesses use census data and GIS software to help them understand what types of people buy their products and services, and how to better market to these consumers. For example, McDonald's in Japan uses a GIS system to overlay demographic information on maps to help identify promising new store sites.*

*Singapore Management University information systems professor Kam Tin Seong is a strong advocate and promoter of GIS as a tool for doing better business. Kam has over eighteen years of geospatial technology experience, including a stint with the United Nations Centre for Regional Development (UNCRD) in Nagoya, Japan. He is also the author of over 40 scientific papers and a book on applied GIS and remote sensing.*

*In Singapore, GIS is widely used by the public sector for urban development, infrastructure planning, environmental management and a host of other purposes although, increasingly, it is also being applied in the business arena across diverse industries such as retail, banking and healthcare. Knowledge@SMU talked to Kam about GIS in general, and about his research project using GIS as a tool to better understand Singapore's sizzling property market.*

**Knowledge@SMU:** What prompted you to promote GIS in business?

**Kam:** More than 80% of organisation data are location-related – locations where transactions are done, where retailers are found, and where the customers are to buy their products. Recently, there has been a growing interest in the business community to use GIS to enhance decision making processes at both strategic and operational levels. The use of GIS in business, however, tends to be confined to simple map visualisation, mainly due to the general lack of geographical concepts and geospatial analysis skills among business analysts. This is particularly true in Singapore whereby geography is considered a peripheral subject in school. To promote the appropriate use of GIS in business, I believe it is my duty to pursue, capture, discover, create, and share knowledge about the way geospatial information and technology are developed, managed, and used in enhancing business intelligence.

**Knowledge@SMU:** Is GIS being used mainly for marketing research?

**Kam:** No, it can be used for marketing research or to identify locations for new outlets -- what we call site selection. It can even be used for sales territory planning, meaning that a business will know how to deploy its sales staff so they don't overlap with each others' territories. GIS can also help optimise their "catchment" area. Understanding location is even more important when businesses go into new location such as China and Vietnam. For Singaporean businesses it is even more important to have a better understanding of space because, over here, you can get from one place to another within a few minutes. This is not so overseas. For example, MacDonald's map their market potential using GIS in Malaysia but not in Singapore. In fact, MacDonald's operations in other parts of the world use GIS as well.

**Knowledge@SMU:** Does this mean that GIS is more useful to businesses in larger countries?

**Kam:** Not really. It depends on how business managers utilise location intelligence in their business decision making process. In Singapore, only a few companies use GIS to plan site locations or to understand their business potential, mainly before they venture overseas. GIS as a location intelligence tool is relatively new here. Many businesses assume that they know the local market very well. However, over time, you'll notice that many of them open and close outlets frequently. By and large, they make decisions based on gut feel instead of applying scientific methods to help them decide where to open retail outlets to optimise their distribution network and maximise sales territory.

In other parts of the world, such as in the US and Europe, they started using GIS in the late '90s. For example, Carrefour plan all their outlets using GIS; also MacDonald's, Levis, insurance companies and healthcare providers. Even commodity markets monitor the production of agriculture and oil using satellite images to monitor vegetation growth so they can estimate how much [commodities] will be released into the market. For example, with palm oil, GIS can detect droughts in certain parts of the world leading to reduced production and shortages in the global market. The commodity analysts may then decide to buy in and stock up; when the prices go up, they sell.

**Knowledge@SMU:** How does GIS compare with conventional market research?

**Kam:** In Shanghai, we were recently involved in a project to carry out a market research study using GIS. The client, a retailer, had previously engaged a market research company to study how the market in Shanghai operates. The director wanted to know where exactly the relevant channel stores that would help distribute their products were located, so they could then decide on how many to start building relationships with. The study identified 'mama' stores and other possible channels of product distribution and how they performed. This is a classical way of doing market research. For a 'real' operation, however, this is not enough. The research company didn't know where these stores were, and whether they formed clusters spatially and so on. If they were randomly distributed, then the retailer would have to pump in a lot of resources to locate them and build relationships. But if they were in clusters, then they could target one group first before catching the rest.

**Knowledge@SMU:** How did you use GIS to help this company make sense of the data?

**Kam:** For conventional uses, such as land management and planning, GIS can map the data according to special administrative boundaries, as seen in thematic maps which show spatial patterns according to themes or attributes. These are sufficient for scientists and planners because they are easy to construct, but not good enough for businesses. A lot of people try to apply conventional GIS to business and misuse it. A thematic map has a lot of flaws because it misrepresents certain areas, especially for the clusters. For example, the retailer in Shanghai could be misled into thinking that the stores in a particular area are evenly distributed even if just one corner only had a high concentration of stores. That is why at SMU we are trying to deliver more appropriate and advanced methodologies for businesses. We've devised this method, 'kernel density estimation', and integrated it into GIS to enhance its capability for business use.


**Knowledge@SMU:** What was the final outcome for the retailer?


**Kam:** They now have a better idea of where the hot spots are located, and can focus their resources on the high concentration areas. Likewise, the SME supermarkets are not at the same locations. They now get better picture of the concentration and can start delineating and deploying their staff accordingly. They can also prioritise in the sense that they can find out the locations of the top 10% sales volume stores. If they have limited resources, they can zoom in on these stores or areas first. The next part of the study was to find out the relationship between the high performing stores and the office locations. For example, the hypothesis is that more office workers are buying the expensive, high-end foreign products. There is a big difference in price; foreign products are RMB9 and above compared to RMB3 or lesser for local ones. We employed a spatial point patterns analysis method – bivariate K function -- which allowed us to find out the relationship between high performing stores and the location of the office blocks. The statistical significance will tell us whether there are any relationships. Before that, you could only speculate on the relationship. Now, businesses can prove certain hypotheses or assumptions observed in the field by using the new methods we've incorporated into conventional GIS.

**Knowledge@SMU:** What other research elements can you add into a GIS system?

**Kam:** For example, I am now working on a study of the Singapore property market where we take transaction prices, map out the locations of these transactions, and then analyse the factors contributing to the price differentiation. I'm not just looking at the location and time, but also want to find out the factors that contribute to price variations. For example, the newspapers state that the central region will fetch higher prices, but what are the contributing factors? These can be proximity to MRT (Mass Rapid Transit) stations, to the Integrated Resorts [Singapore's new entertainment hub under construction] and so on. I try to relate the factors and test their statistical significance on price differences. Once we put our data into GIS, we can easily calculate the distance from a given property, for example, to the MRT, shopping mall, services etc.

Instead of using conventional econometrics modelling techniques, I'm incorporating a new spatial statistical methodology called the 'geographically weighted regression (GWR) model' within a GIS environment to construct a hedonic house price model for Singapore. The GWR is a local modelling approach that explicitly allows parameter estimates to vary over space. One advantage of GWR is that the spatial patterns inherent in the parameter estimates can be easily mapped and visualised. For example, we could test if it is true that proximity to the MRT contributes to relatively higher prices and so on. This will give you a more complete picture of what the contributing factors are to price differences instead of blindly speculating as people do now. In addition, I can reverse the mapping to find out the locations of properties where prices are highly affected by proximity to elite schools, public transport and so on. All these factors will provide a more objective view of property prices, show more reasonable value of properties and, we hope, help to stabilise Singapore's real estate market, the world's hottest property this year.

 [back to top \(#top\)](#)

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