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- Chandel K.S. (2009): "Ethics in Commerce Education." Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

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LOCATION INTELLIGENCE, THE MERGING OF GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND BUSINESS INTELLIGENCE (BI)

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ABSTRACT

*Today's decision makers are required to make many different kinds of decisions, decisions that are accurate. To make accurate decision, managers need inputs from disparate departments at a single point. To be effective and efficient decision makers need the right kinds of tools. One such tool is Business Intelligence (BI), which transforms data from an organization's disparate operational data, into a common environment (data warehouse) for turning data into information, information into knowledge, knowledge into strategies for profitable business activities. Typical BI systems handle the '**who', 'what'** and '**when'** but the "**where"** is underexploited or sometimes unexploited. Geographic Information Systems (GIS) enables the analysis of the **"where"** because eighty percent of company's data has location component. Further visualization helps the analyst interrogate the data and acts as an excellent means of explaining the information to a broader audience. Thus the need for a more complete operational picture of the business has led to the merging of GIS with BI systems. Location Intelligence is the ability to take organizational data and apply location to allow effective decision-making.GIS enhances BI analytics by exposing the influence of geography on behaviour, activities and processes. Adding maps to the reporting output of BI allows decision maker to easily visualize the geographically influenced behaviour, activities, trends and processes, communicate the same within the organization for improved analysis and decision making.*

KEYWORDS

Business Intelligent (BI), Decision Making, Geographic Information Systems (GIS), Location Intelligence, Spatial data.

INTRODUCTION

Information Technology (IT) is revolutionizing the way in which we live and work. It is changing all aspects of our life and lifestyle. The digital revolution has given mankind the ability to treat information with mathematical precision, to transmit it with high accuracy and to manipulate it at will. Today's decision makers relies on informal commitments and networks to establish goals, a flexible arrangement of teams and individuals working in task force, and a customer orientation to achieve coordination among employees. The new decision maker appeals to knowledge, learning and decision making of individual employee to ensure proper operations of the firm. Information technology makes this style of management possible.

The traditional means of presenting data to users has been columnar reports, either printed or viewed on the screen as an excel sheet, or as simple histograms or as pie charts. Can a simple histogram or a pie chart handle the complex, interrelationship of multidimensional data? Can a manager really report and communicate all the necessary information content with just a bar graph or a pie chart? The answer is a "definite no".

Location is a critical component in almost every business transaction. Although a lot of data have a location dimension, whether it be customers, stores, warehouses or other assets, this information is rarely exploited in traditional BI analysis. To gain maximum value from the ever-increasing volumes of data, companies need to make use of the location element to gain deeper business insight in order to improve competitiveness and business performance. Moreover, by excluding geographic (spatial) information in the analysis, any data made available for analysis is artificially constrained; thus decision making is compromised.

Typical BI Systems handle the who, what, when and how but the where is vastly underexploited or sometimes unexploited. Spatial data enhances the who by creating new informational content as well as directly enabling the analysis of where. Further interrelationships that might other wise be difficult to explain are often readily understood when visually presented. Visualization helps the analyst interrogate the data, acts as an excellent means of explaining the information to a broader audience, including company's executives and customers.

It is the visualization of spatial relationships that delivers accurate, high impact informational content, enabling decision makers to gain a fast understanding of the critical issues that lie beneath the surface of the obvious data. In this paper we try to understand the role of GIS in BI systems.

WHAT IS BUSINESS INTELLIGENCE (BI)?

Business intelligence is defined as the processes, technologies and tools needed to turn data into information, information into knowledge, knowledge into plans that drive profitable business action - Data Warehouse Institute. Gartner (2006) defines Business Intelligence as the use of information that enables organizations to best decide, measure, manage and optimize performance to achieve efficiency and financial benefits.

There have been some graphic elements visible in business intelligence systems like business graphics, typically charts, which are now common components in any reports. The whole idea of full business intelligence is to have lots of data in a central repository, or warehouse, so that this data can be used effectively to drive profit and better systems.

Franklin (1992) says as about eighty percent of an organization's data can be associated with a geographic location (spatial component); this can include customer or competitor locations, store locations and sales territories. Thus today's business problems need geography (space) to be taken into account. To gain deeper insights of the business and gain competitive advantage decision makers have to take care of the location component present in the data. For example the following are daily business questions that arise in the minds of the decision maker:

1. Where are my customers located?
2. How big is my market area?
3. What is my share of the market area?
4. Which market offers the greatest potential for growth?

5. How many stores can this market support?
6. What's the best product mix to carry in each store?
7. What media channel will reach the audience I'm targeting?
8. Where should I open new outlet?
9. Can I consolidate outlet without hurting customer service?

These questions illustrate how spatial considerations are part of many business problems. Typical BI tools do a good job of analyzing the basic who, what, when and how questions about customer's activities. But these tools fall short in answering the why and where of the customers in relation to their purchase.

KNOWING GEOGRAPHIC INFORMATION SYSTEMS (GIS)

A GIS is a computer system for managing spatial data, the word ***geographic*** implies that location of the data items are known in terms of geographic co-ordinates (Latitude and Longitude). The word ***information*** implies that the data in a GIS are organized to yield useful knowledge, often as coloured maps and images, but also as statistical graphics, tables and various onscreen responses to interactive queries. The word ***system*** implies that a GIS is made up from several interrelated and linked components with different functions. Thus GIS has functional capabilities for data capture, input, manipulation, transformation, visualization, combination, query, analysis, modeling and output.

However from a decision makers perspective ***"GIS is a managerial decision making tool for decision making, involving a spatial dimension as one of the variable among a set of variables considered for decision making[1]"***

GIS technology brings together common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it valuable for use in a wide range of applications to solve problems and plan ahead by looking at data in a way that is quickly understood and easily shared.

GIS is one of the most effective means to pick up an insight into the heavy volume of detailed data that organizations continuously generate. It provides the most efficient method for reveling problems or opportunities in a single organized view for users, and show interrelationships that might otherwise be difficult to explain, all of which help in faster and better managerial decision making.

The following four are the critical distinctions of GIS:

UTILIZES EXPLICIT REAL WORLD RELATIONSHIPS: In spatial data, there is an explicit relationship between the real world geometric features and its associated attribute information, so that both are always available when one works with the data, which is not possible with tabular data.

GEO-CODED TO KNOW LOCATIONS: Spatial data is geo-referenced to known locations on the earth's surface.

EXPLOITS SPECIFIC GEOGRAPHIC FEATURES: Spatial data is designed to enable specific geographic features and phenomena to be managed, manipulated and analyzed easily and is flexible to meet a wide range of needs.

THEMATICALLY ORGANIZED: Spatial data is organized thematically into different layers. There is one layer for each set of geographic feature for which the information will be recorded. For example streets, buildings, rail track, customer location will be stored as separate spatial layers.

GIS's ability to integrate data from different business units and source systems by using this location element as a common denominator. GIS also provides significant advantages in spatial analysis capability and visualization of information to show conditions, patterns and trends.

WHY MERGE GIS INTO BI SYSTEM?

A Business Intelligence (BI) system enables better decision making by combining the extraction, analysis and presentation of business information. In the BI system, data is accessed from backend systems like inventory and asset management, customer relationship management and human resources and moved into the warehouse for efficient analysis and reporting usually through charts and graphs.

Organizations data is associated with geographic location this can include customer or competitors locations store locations and sales territories, etc. BI systems with its typical charts and graphs fail to answer the location part of the data.

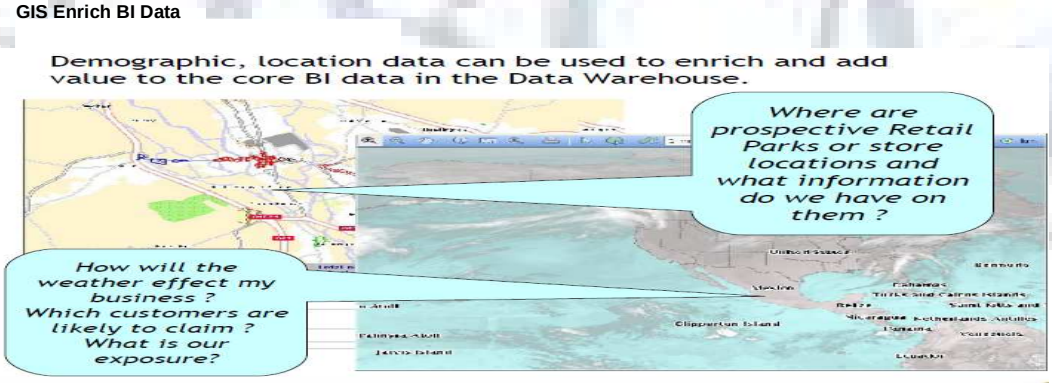
GIS allows adding maps to existing BI systems. People are visually oriented thus, when decision maker see something on a map as opposed to a spread sheet or a chart, they understand it much better, and it allows them to see relationships between different pieces of business data. Thus by adding demographic information to an organization's existing business data, maps become truly interactive through the capability for users to drill down to data associated with any given location. What is the average income in areas where the highest performing stores are located? Where are the competitors stores located in relation to the one that is being planned? This kind of information is valuable when planning new store locations. Typical BI system cannot provide this kind of information.

GIS enhances BI analytics by exposing the influence of geography on behaviour, activities and processes. Adding maps to the reporting output of BI allows decision maker to easily visualize the geographically influenced behaviour, activities and processes, communicate the same within the organization for improved analysis and decision making. GIS can fold many layers of data into the analysis and use powerful tools such as grid surface that translate complex data into useful and understandable representations that incorporate ***many variables***. Visualization helps the analyst interrogate the data and acts as an excellent means of explaining the information to a broader audience.McDonald's uses GIS system to overlay demographic information on maps to help identify promising new store sites (Alan, 2004).

THE ADVANTAGE OF MERGING GIS INTO BI

ombining the analytical power of databases with the geographic capabilities of maps, allows business users to explore and analyze relationships between geographic data and business data. While BI tools are ideal for analyzing who, what and when (customer, product, time), this analysis falls short of answering questions in relation to where, such as the relationship between where customers live and where they make their purchases. The ability to take organizational data and apply location to empower effective decision-making is called '***Location Intelligence'.*** Organizational data comes from the BI system, while the location aspects are taken care by the geographic information system (GIS). Figure 1 is an example of how GIS enriches BI data.

FIGURE 1: MERGING OF GIS INTO BI SYSTEM FOR BETTER UNDERSTANDING



Source: beta.gisdevelopment.net/images/pdf/mme07_chris.pdf

[1] GIS Definition derived during the courses of research on "Business Graphics –A New Approach to Decision Making", Vinod N. Sambrani

LINKING INTERNAL AND EXTERNAL DATA FOR COMPLETE VIEW OF BUSINESS

Businesses operate within an internal and external environment. Understanding the bigger picture of what the internal and external environment look like and how they relate to each other is critical to make correct strategic and tactical decisions. GIS is pivotal in linking the gap between internal and external data assets. Vector and raster topographical maps, aerial photographs, census and other demographic data become extremely valuable business information if analyzed together with internal data in a common framework.

SEEING IS BELIVING

Reporting is a mainstay of BI with "dashboards" currently gaining in popularity. The dashboard is a familiar graphic tool for business users to access key performance indicators, and can be used to better understand what has happened, when and why. Enhancing these dashboards with mapping visualization also offers businesses the opportunity to bring spatial analysis to a wider audience, making it a true tool for all business users. No other reporting format can match a map's ability to condense information and compare multiple variables of a problem. GIS enhances management reports and "dashboards" with insightful maps and graphics that take less time to evaluate and are easier to understand.

FASTER ANSWERS TO QUERIES

To gain competitive advantage over competitors decision makers should have the right kind of information. Information is of value in the business environment if it reaches the right decision maker, at the right time and in an easily understood format. GIS has the ability to locate more data and information faster by tying many internal and external data sets together through location. In effect the GIS enhanced BI system becomes a true "one stop information shop"

IMPROVING DATA QUALITY AND CREDIBILITY

Due to the vast amounts of data stored by companies on almost every conceivable aspect of their business operations, it is maybe inevitable that errors sometimes occur which degrades the usefulness and credibility of information. With many data types being used, some of these errors may be difficult or even impossible to detect in tabular database formats. Often it is only when this data is pulled into a GIS through a process like geo-coding and mapped or spatially analyzed that some of these errors can be detected.

CONCLUSION

Map makers have always known that a map is not just a tool for showing how to get from here to there. GIS is a technique for organizing and embedding knowledge in a manner readily understood by all. But the typical BI tools implemented in organization are far more simplistic. Many BI systems place the burden of discovery and information insight on the user with little help from excel sheets, columnar reports and pie charts.

With GIS technology it is now possible to integrate GIS into BI to support both traditional and spatial data (locational data). Value affecting data such as demographics and geographically influenced risks can easily be updated in GIS. Data visualization evolves into a means of transforming data quickly into information, information into knowledge, knowledge into strategies for profitable business activities. Thus we can conclude that merging of GIS into BI systems provide an effective tool for decision makers to analysis and present the finding on a map which is more realistic and makes understanding of the solution much better than compared to traditional methods of presenting outputs on graphs and charts. Top companies around the world have made GIS and the related spatial analysis a top priority. However the Indian market is still at a nascent stage, major growth can be achieved if the government decides to follow progressive policies similar to other countries with respect to sharing of spatial data.

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17. Building Geospatial Business Intelligence Solutions with Free and Open Source Components http://geosoa.scg.ulaval.ca/fr/index.php
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