GIS and GPS Applications in Emerging Economies: Observation and Analysis of a Chinese Logistics Firm

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ABSTRACT

The rapid development of Geographic Information System (GIS) and Global Position System (GPS) has attracted the attention of both business practitioners and academic researchers. GIS and GPS technologies, through providing optimized schedules, routings, and guidance, are especially important and helpful in transportation and logistics businesses. Though GIS and GPS technologies have been witnessed in many business sectors in developed countries, wide application of these technologies is still in its preliminary phase in companies in developing nations. In this paper, the authors present a study on the application of an integrated intelligent system that consists of GIS, GPS and related technologies to optimize logistic distribution of perishable products in urban environments. Through investigating GIS and GPS usage in a medium-sized logistics company in the unique settings of emerging economies, this paper addresses how these technologies enhance the management of businesses and analyze the interaction of GIS/GPS implementation and several key characteristics of the logistic distribution context by identifying major benefits, challenges, and limitations associated with the use of GIS and GPS.

Keywords: Case Study, Emerging Economies, GIS, GPS, Logistics and Transportation

INTRODUCTION

Logistics management has been an area that attracts the attention of both academic researchers and business practitioners for decades. Logistics and transportation are significant concerns in supply chain management since they play key roles in the physical movement of raw materials, semi-finished and finished products in a system that consists of a variety of entities such as suppliers, manufacturers, distributors, and customers. Logistics costs usually account for a quite significant share of the total costs for a firm. Both fixed and variable costs, such as the cost of vehicles, labor costs of drivers and dispatchers, cost of fuel, can be found in the logistic distribution process. Hence, one of
the biggest challenges in the management of logistic distribution is how to efficiently move the required goods from one entity to another while effectively have these costs under control.

In recent years, the advancement of Information Technology (IT) has substantially facilitated business decision making in countless ways. In particular, the introduction and application of Geographic Information Systems (GIS) and Global Position Systems (GPS) in the past decades provide diversified benefits to both commercial and individual users. The research and development of GIS and GPS technologies can be traced back to the 1970s (Parkinson, 1996), when the NAVSTAR Global Positioning System was designed and launched by a small group of military officers and civilians. The plan was to develop a new navigation system that would utilize radio-ranging measurements from a constellation of satellites. Later, wide application of these new technologies was first found in military, where they are used as effective data collection and planning tools, then in a wide-range of civil/commercial situations, such as emergency management (Derekenaris, Garofalakis, Makris, Prentzas, Sioutas, & Tsakalidis, 2001), vehicle delivery and routing (Keenan, 1998), urban and forest planning (Sui, 1998), as well as construction and material management (Li, Kong, Pang, Shi, & Yu, 2003).

Among a variety of commercial applications of GIS and GPS technologies, vehicle delivery and routing become vitally important in modern logistics and supply chain management. High costs in the distribution process perplex logistics managers and they become even more critical to the survival and success of every business given that demands for fossil-based energy continue to grow and expectations from customers continue to rise.

The control of logistics costs is especially difficult when considering that goods in the shipment are perishable and specialized equipments/handling are necessary and required (Butler, Herlihy, & Keenan, 2005). Problems can arise from both the storage and delivery operations since perishable products are usually expected to be stored and delivered within a particular time frame, and therefore the resulted costs are much higher.

On the other hand, even though the implementation of GIS and GPS technologies has been seen in many business sectors, due to the newness of the commercialization of these technologies, academic research on these issues has a relatively short history. Indeed, current research on the development and usage of GIS and GPS technologies is limited to practices in developed nations and many problems are largely unexplored. In particular, very few studies have investigated issues such as: a) what are the roles played by GIS, GPS and related technologies in logistics companies in developing countries; b) what are the major benefits and challenges generated by using these technologies for transportation and distribution of perishable goods; c) what lessons and insights can be learned from the process to improve logistics management. In this research, we aim to address these issues and present a case study of a Chinese company who focuses on distributing perishable products to its customers.

This paper is our first attempt and is a preliminary step towards answering the aforementioned questions. Based upon existing literature on GIS/GPS practice and theories, as well as our own observations and interviews with business practitioners, we investigate the interaction of GIS/GPS implementation and several key characteristics of the logistic distribution context and attempt to identify the benefits, challenges, and limitations associated with using of GIS and GPS in the unique settings of emerging economies.

Our research findings demonstrate how the usage of these technologies helps to facilitate the effective and efficient management of the distribution of perishable goods. We discuss challenges encountered by firms in developing nations and compare these issues with those faced by companies in developed countries. For instance, compared to firms in the United States and the western European countries, logistics companies in China have to deal with more obstacles such as sparse digital mapping resources, inadequate technological supports,