Improving Performance Through Task Technology Fit: A Case Study

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***Abstract*- Information technology (IT) is more likely to have a positive impact on individual performance if the capabilities it has more closely matches the tasks that the individual must perform. The objective of this research is to examine how improvements in the information quality can lead to quantifiable improvements in individual performance. A case study involving a spatial decision support system (SDSS) that generated delivery route directions for a parts supplier in the automotive industry is discussed. Significant improvements in information quality (e.g., traffic information, fuel charges, toll roads, road conditions) enabled truck drivers to make better decisions resulting in measurable improved performance (e.g., lower costs, decreased delivery time, improved driver satisfaction). This research builds upon the task-technology fit literature and presents recommendations for practitioners. The paper also identifies directions for future research and ends with some concluding remarks.**

***Keywords*- task-technology fit, spatial decision support system, case study**

I. INTRODUCTION

Many organizations today are given greater access to technology that was once prohibitive due to technological or organizational constraints. As such, there is a wide portfolio of tools and technologies that organizations may consider to adopt which can be applied to address any challenge or seize upon new opportunities. Though organizations have many more technological options available to them, management must ensure that the approach they pursue is appropriate for the task at hand.

Information technology (IT) is more likely to produce benefits for an organization if its capabilities more closely match the tasks that need to be performed. Consequently, the objective of this research is to examine how improvements in information quality can lead to quantifiable improvements in individual performance. A case study involving a spatial decision support system (SDSS) that generated delivery route directions for a parts supplier in the automotive industry is discussed followed by directions for future research and some concluding remarks.

II. SPATIAL DECISION SUPPORT SYSTEMS AND GEOGRAPHIC INFORMATION SYSTEMS

Geographic information systems (GIS) have been used by businesses as a tool to support a wide range of decisions that have location dimensions due to the belief that the use of GIS would improve decision-making (Dennis and Carte, 1998) and the fact that about 80% of data used in making business decisions have geographical dimensions (Worrall, 1991). Dennis and Carte (1998) found that using GIS maps, compared to tables, led to faster and more accurate decisions in geographic adjacency tasks, whereas using maps in geographic containment tasks resulted in less accurate but faster decisions.

Jarupathirun and Zahedi (2007) argue that by incorporating appropriate spatial data with additional GIS functionalities, GIS based SDSS can be created to deal with more complex and the multi-dimensional nature of spatial information. They found that users' perceptions of SDSS success depends on the perceived task-technology fit and goal commitment, which in turn are influenced by personal spatial aptitude, self-efficacy, and outcome expectation. They also suggest, however, that the perceptions of SDSS success do not always align with the objective measurements of success, such as speed or accuracy of results.

III. TASK-TECHNOLOGY FIT THEORY

According to Venkatraman (1989), there are several types of fit and each type of fit can be determined by the choice of anchoring the specification of fit-based relationships, the number of variables in the fit equation, and the degree of specificity of the function form of fit-based relationships. Goodhue and Thompson (1995) propose Task-Technology Fit (TTF) as a critical construct, which explain linkage between performance and technology (see Figure 1). Their dimensions of task-technology fit are the user perception of information quality, system reliability, and production timeliness. Unlike the TTF of Goodhue and Thompson, which is based on the user's perception, TTF of Zigurs and Buckland (1998) is determined by system developers or system designers. They specify a particular combination of tasks and GSS/technology functionality or a fit schema that will enhance the group performance.

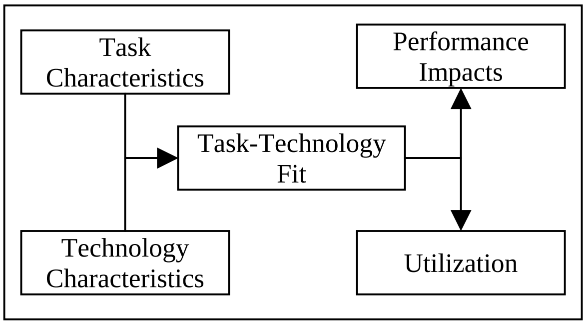
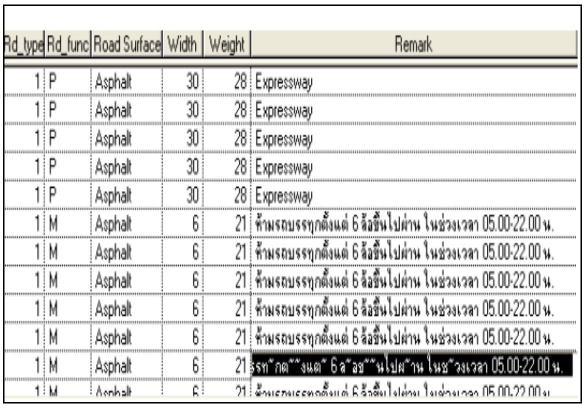


Figure 1. Task-Technology Fit, Adapted from Goodhue and Thompson (1995)

In the context of SDSS, Jarupathirun and Zahedi (2007) argue that advanced tools of web-based SDSS are appropriate (fit) for a more complex task, while a simple task can be effectively/efficiently performed using basic tools of web-based SDSS, such as a map representation. For every day driving, typical GIS is used to find the best route based on the driving distance and time. However, for logistics management to delivery products, its capabilities may not be efficient to lower the logistics costs. In this study, we developed prototype GIS based SDSS that provide more functions to process road network information including toll fees, types of road, and road conditions for better route and vehicle selection in logistics management. We argue that our prototype is more fit to a route selection task for product delivery than a typical GIS. Thus the use of the prototype will lead to a better decision in selecting a route.

IV. A PROTOTYPE SDSS DEVELOPMENT

ArcView 3.3, with the Network Analysis module, was used to develop the prototype SDSS software. The system also incorporated a spatial database of road network data from several sources (see Figure 2). Key additional network road data were, for example, road types (e.g. express, primary, secondary, local), road surface, weight capacity, the width of road, and other remarks (e.g. time allowed).



Rd_type	Rd_func	Road Surface	Width	Weight	Remark
1	P	Asphalt	30	28	Expressway
1	P	Asphalt	30	28	Expressway
1	P	Asphalt	30	28	Expressway
1	P	Asphalt	30	28	Expressway
1	P	Asphalt	30	28	Expressway
1	M	Asphalt	6	21	ห้ามรถบรรทุกตั้งแต่ 6 ล้อขึ้นไปผ่าน ในช่วงเวลา 05.00-22.00 น.
1	M	Asphalt	6	21	ห้ามรถบรรทุกตั้งแต่ 6 ล้อขึ้นไปผ่าน ในช่วงเวลา 05.00-22.00 น.
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1	M	Asphalt	6	21	ห้ามรถบรรทุกตั้งแต่ 6 ล้อขึ้นไปผ่าน ในช่วงเวลา 05.00-22.00 น.
1	M	Asphalt	6	21	รถ"กต""งแต" 6ล"อข""นไปผ"าน ในช"วงเวลา 05.00-22.00 น.
1	M	Asphalt	6	21	ห้ามรถบรรทุกตั้งแต่ 6 ล้อขึ้นไปผ่าน ในช่วงเวลา 05.00-22.00 น.

Figure 2. Spatial Database Table

The individual begins using the SDSS software by specifying the starting point and destination locations, the type of vehicle, and the carrying load. Before the system displays the routes for selection, the intention to use expressways can also be specified. The results are shown in both maps (see Figure 3) and tables (see TABLE 1).

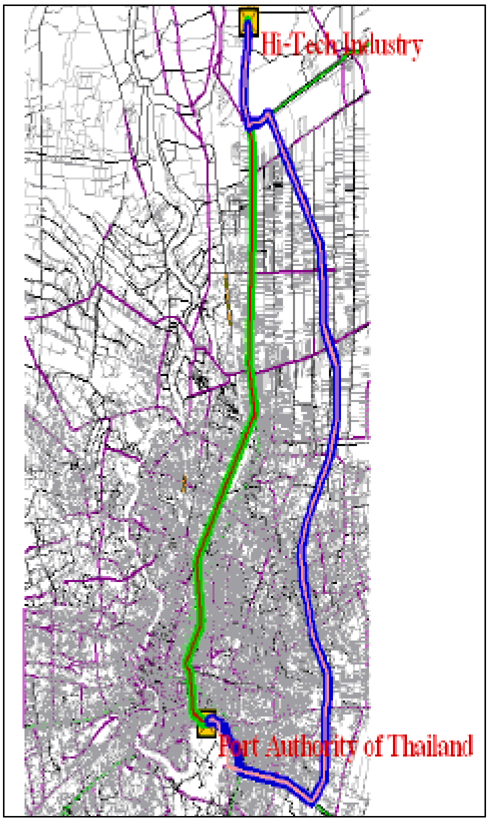

Figure 3. Visual Route Selection Result Display

TABLE 1
TEXT ROUTE SELECTION RESULT DISPLAY

Route	Toll Fee	Distance	Time	Remark
1	100 baht	64.2km	1h 35min	
2	45 baht	74.7km	2h 15min	
3	130 baht	90.6km	55min	
4	60 baht	99.2km	1hr 15min	

V. RESULTS

Multiple in-depth interview discussions were held with various decision makers for the prototype SDSS software, including truck drivers and logistics managers. During these discussions, the decision makers were asked to evaluate the SDSS software by selecting the delivery route between the Hitech Industrial Estate in Ayutthaya province and the Port Authority of Thailand in Bangkok. Comparing both the before and after use of the SDSS software, the interviews indicated that decision makers using the software had much greater confidence and satisfaction with their decision made.

Prior to the use of the SDSS software, decision makers used paper maps or their own personal experience to make a decision. Decision makers with the least amount of experience did not know for certain the cost of toll ways, the shortest route, or the least amount of time for a particular route when asked to select a deliver route. Decision makers with more experience did not always select the best route based on the criteria (time and costs – gas and toll way fees), instead, the experienced decision makers simply selected the route that is familiar the most.

After introducing the system, decision makers were better informed with multiple feasible, different routes. In addition to total distance (which can be converted to the gas cost based on the vehicle mileage) and total time, the system provides information about toll way fees and time allowed for each route. As a result, decision makers are satisfied with the system and their decisions of route selection. Decision makers can make their decisions faster, with better accuracy, and with a greater amount of confidence.

VI. CONCLUSION

This research presented a SDSS software prototype that generated delivery route directions for a parts supplier in the automotive industry. Multiple decision makers, including truck drivers and logistics managers, were interviewed to assess the capabilities of the software. The results of these discussions supported the contention of the task-technology fit theory, which asserts that an improved matching of technology to a particular task can lead to improvements in performance and usage. Specific to this research, significant improvements in information quality (e.g., traffic information, fuel charges, toll roads, road conditions) enabled truck drivers to make better decisions resulting in measurable improved performance (e.g., lower costs, decreased delivery time, improved driver satisfaction).

Future directions for this research will be to improve the SDSS software prototype so that the system could be Web-enabled and can link to real-time traffic information and road conditions. These improvements will continue to advance the quality of the information available to decision makers, and we expect corresponding improvements in performance and usage. Empirical, quantitative evidence can also be collected to support the qualitative findings identified from this research. Additional sampling and usage data from decision makers where the SDSS software is applicable can improve the generalizability of this research study's findings.

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