



## The Implementation of Global Position System (GPS) among the Cement Transporters and its Impact to Business Performance

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### ABSTRACT

This study aims to investigate the implementation of Global Positioning System (GPS) among the cement transporters and its impact to business performance. Due to the lack of knowledge and awareness, the use of GPS technology was limited to monitor the speed limit, navigation and update the delivery location. Whereas, the actual capability of GPS technology can be extended towards Planning and Scheduling, Geo-fencing, Fleet management and maintenance, Safety management, Reporting, Auto alert as well as interface to other MRP software to support the business performance. The research employed a mixed method of a qualitative and quantitative to gather the primary data. In employing this mix method, the research was split into two phases. Phase 1 was started with the qualitative method which involves in-depth interview with selected transporters to investigate the issue and the resulting themes. Saturation model was employed to determine the actual number of respondents required in qualitative method. The result of Phase 1 was then used to formulate a questionnaire for large survey among the cement transporters. In order to comply with the research ethics, the research selected the respondents for this study from those who are having knowledge in the implementation of GPS in their organizations which includes the owner of the organization or the operation manager in the organization. The findings from this research provided adequate evidence of limited usage of GPS application among the cement transporters due to the lack of knowledge in utilizing GPS potential. This study also found that restriction in cost has also become the obstacle to explore the potential benefit of GPS technology. This preliminary study has set a foundation into future research in understanding GPS technology potential to a greater extent in the organization.

**Key words:** Supply Chain Management, Logistics management, Global Positioning System (GPS).

### 1. INTRODUCTION

Global Positioning System (GPS) is a space-based satellite navigation system that was initially developed to provide location and time information in all weather conditions for military purposes. However, the application of GPS technology has been evolved into other areas such as mining, aviation, surveying, agriculture, marine, recreation, and transportation [1].

In the transportation business, GPS is widely used for tracking the location, navigation, and monitoring of the speed limit. The research about GPS implementation in Malaysia mainly focuses on Haulage [2], conventional [3] and buses [4]. However, similar research among the cement transporters which is also significant in terms of a number of fleets has been lacking for reference and this warrants an investigation in understanding GPS technology adoption and implementation among cement transporters.

### 2. BACKGROUND OF RESEARCH

GPS is a network of orbiting satellites that send the details of their position in space back to earth. The signals are obtained by GPS receivers such as navigation devices which are used to calculate the exact position, speed and time of the vehicle's location. Nowadays, the GPS system has been developed to drive the business performance by maximizing the productivity and the need for cost savings. In transportation business, GPS have been redesigned to able interface with other applications such as RFID, MRP, web platforms and other software applications to improve the transportation business. In developed countries, GPS is used to increase productivity by managing real time operations which involves Geo-fencing, planning, scheduling, tracking, reporting, invoicing, fleet maintenance and management, managing driver's driving behavior etc. The maximized potential application of GPS technology however is not being fully utilized in Malaysia which the implementation merely as part of customer requirement to track the delivery.

### 3. PROBLEM STATEMENT

The use of GPS has become one of the requirements in transportation business. This is due to the pressing demands by many customers who require their transporters to install GPS device onto their fleet in order to monitor the delivery of the goods. In response, many transport companies have decided to invest into this device to help them to perform route planning of various destination in a given time, track delivery performances as well as to monitor their driver's behavior by analyzing the speed limits. However, these functions of GPS application are considered to be basic features of GPS technology.

This is due to the lack of knowledge and exposure among the users about the actual capability of GPS technology. The other features of GPS technology such as Geo-fencing, fleet management, fleet maintenance, planning and scheduling, safety management, reporting, and its ability to interface with other devices such as RFID and MRP system is at its minimum among the transporters in this country. Hence, the potential and capability of GPS technology to improve transporters' business performance will be the focal point in this study.

### 4. RESEARCH OBJECTIVE

The research will investigate the capabilities of GPS system and its impact to the business performance of cement transporters. The study is focusing to achieve the following objectives;

- 1) To investigate the implementation of GPS system among the cement transporters.
- 2) To examine the effectiveness of the GPS system to the business performance.
- 3) To identify possible improvements in GPS implementation among cement transporters.

### 5. GPS IMPACT TO THE BUSINESS PERFORMANCE

Most fleet owners comprehend that GPS fleet tracking offers benefits that can enhance business execution. It supports the operation by improving the routing and dispatching process which results in quicker service times, expanding client fulfillments and enabling drivers to go up against more employments [5], [6], [7], and [4]. These days, various operation software can be customized to be interfaced with GPS to enhance its functions. The function of this software will be more significant when it is linked or interfaced with GPS technology. The combination of this software with GPS technology has created a new improvement tool for the operation such as geofences, fleet engine diagnostics, roadside help, satellite mix scope, fuel programs, programming combination, and various itemized reports. As

indicated by [8], transporter companies can further optimize its fleet by adopting GPS technology.

The finding from previous research provides significant outcomes on the implementation of GPS in the transport industry which is discussed in the following sections:

#### 5.1 GPS Applications in Fleet Management

GPS technology can be used to track fleet location data to facilitate real-time reporting. It can help to provide a service solution for all sizes of fleets like fleet maintenance and cost-effective tracking [9]. GPS can help fleet management improve efficiency by providing real-time vehicle status and location reports or routes and driving history collection [10]. This information can help trucking organizations to assess their delivery performance to improve the route plan, fleets scheduling and dispatching capabilities [11]. In the logistics and transportation business, the capability to manage and report real-time information will distinguish the transporter in terms of performance and profitability compared to others [12].

#### 5.2 Fleet Management Functions

By using GPS, information related to the truck performance can be automatically updated in the system without human interaction. The tedious task to identify truck location, optimizing routes, defining drop off points as well as driver's assignment is now can be linked to the system automatically using GPS technology. It can also be linked to a real time video recording installed onto the truck which helps the fleet management team to provide fast response and quick decision to locate the truck and send the required support to the driver in case of breakdown or accident [13],[14],[15]. All the potential GPS features are helping the fleet management team to be more efficient by keeping their focus at value adding tasks such as a planning and forecasting.

#### 5.3 Routing and Scheduling Support

GPS technology is also capable to suggest the shortest route to maximize the profitability of the delivery operations. It is capable of responding to a real-time traffic condition which will help the driver to decide to change to a new propose route and automatically inform the customer of the new expected arrival time as well as revises the driver's next trip automatically [11], [10], and [16]. This will help management in making fast decisions to prevent service deficiencies.

#### 5.4 Employee Safety and Drivers' Behavior

GPS can be linked to a camera installed in the truck to monitor driver driving behavior on a real-time basis. Any

unusual signs toward the fatigue can be detected immediately to prevent any incident and/or accident. GPS also can be customized to suggest a journey management plan to equip the diver about suitable routes, weather conditions, places of rest and speeding requirements which are crucial in fatigue management [13]. The behavior of the driver will be recorded and stored in the data based which is essential to evaluate the driver's performance and identify the training needed for driver improvements [14]. Having a GPS technology helps the driver to maintain safe driving behavior and provide a mechanism to the transporters to continuously assess the performance of the drivers.

**5.5 Prevent Pilferages**

GPS technology also can help to prevent the issue of pilferages such as fuel theft or cargo theft by providing feature of auto alert in alarming the operation team on the sign of pilferages. Security is one of the top most concerns among transporters as it has a direct impact to the cost and customer loyalty [17].

A summary of literature about the functions of GPS technology is shown in Table 1.

**Table 1:** Summary of Literature Review

Author	Year	GPS Usage
J. Barceló et al	2008	Routing and Scheduling
Pradip, et, al; Manav Singhal et al;	2014 2012	Tracking System
G. R. Jagadeesh, et, al Kuien Liu, et, al	2015 2012	Accurate Map Matching
Ashish Manwatkar, et, al Yogesh J et al	2015 2014	Safety
Peter H. Dana	1997	Service Timing
Pradip Suresh et al Robert J. Hall Roula Michaelides	2014 2013 2002	Customer Satisfaction
Dmitry Namiot	2009	Geo-fencing
Trimble.com Telematics.tomtom.com	2016 2016	Fleet Management
Intouchgps.com	2016	Fleet Maintenance
R.Monisha, et, al	2014	Auto Alert

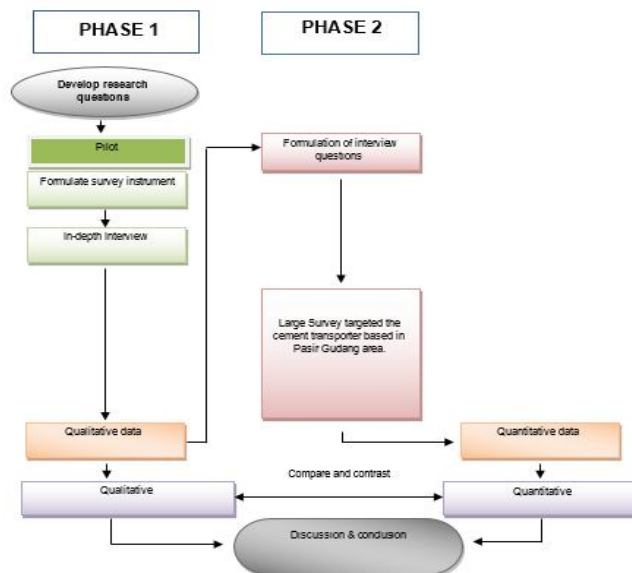
**6. RESEARCH METHDOLOGY**

Mixed methods research has attracted increasing attention in social science studies. Hence, in this study, a mixed-method was adopted to allow for the initial generation of rich data to the relatively unexplored area of GPS technology, and then to expand this knowledge with the added benefits of a broader study to reveal more general findings. This approach is in line

with research conducted by [2] & [18] in their study about organizational assimilation employed in an exploratory design. They first explored the research area qualitatively and developed themes from their qualitative data. They then developed an instrument based on these results and subsequently used this instrument in the second, quantitative phase of the study. Similar to this approach, our study was split into two distant phases, namely a qualitative phase (Phase 1) and a quantitative phase (Phase 2). The process started with qualitative data collection to explore the phenomenon and then builds to a second, quantitative phase (see Figure 1). Since the design begins qualitatively, a greater emphasis was placed on the qualitative data. The research used the results of the qualitative phase to design and build a test instrument by identifying variables or stating propositions for testing based on an emergent theory or framework. These developments connect the initial qualitative phase to the subsequent quantitative component of the study.

Four (4) cement transporters were involved in the qualitative phase where the respondent's selection was guided by saturation principle. The input from qualitative research was used to develop the survey questionnaire for the quantitative phase. During the quantitative phase, twenty (20) transporters have responded to the survey which was used in the quantitative analysis. The findings from both phases were then compared to identify similarities and differences. The process flow of the research is shown in Figure 1.

This study adopted a qualitative approach where focus group interviews were employed which was aimed at enhancing confidence in the research findings [13], [19]. Figure 1 provides an overview of the research design employed in this research.



**Figure 1:** Research Process Flowchart

**7. RESULT AND DISCUSSIONS**

The findings from this study provide significant outcomes to understand implementation of GPS technology among the cement transporters. The summary of the major findings of the research are as follows:

**7.1 Findings for Research Question 1**

Research question 1 attempted to investigate the implementation level of GPS system among the cement transporters. The followings were identified through the mix method employed in the research shown in Table 2.

**Table 2:** GPS Implementation level

Qualitative Phase	Quantitative Phase
GPS technology implementation has not achieved its fullest potential. Instead, it is limited to basic features such as truck positioning and speed tracking.	There is awareness about the benefits of GPS technology. However, the usage is limited to areas concerning safety and security involving speed monitoring and truck positioning..

The mix method provided identical findings. Hence, it can be concluded that there is insufficient knowledge and awareness about comprehensive features about GPS technology.

**7.2 Findings for Research Question 2**

The aim of the second research question was to investigate if effectiveness of GPS system influences the business performance. The following Table 3 reports the findings obtained from the mix method used in the research:

**Table 3:** GPS effectiveness

Qualitative Phase	Quantitative Phase
Respondents indicated that the business performance is driver by customers who are satisfied with provision of real time information about delivery status apart from truck positioning. When needed, a manual delivery planning is also performed to ensure that business performance is not affected. On the other hand, the respondents also reported that truck speed monitoring is also important since its adverse effects have direct impact to the business performance.	Majority of the respondents finds that GPS technology influences the business performance by providing delivery location updates and tracking the driver performance in terms of speed monitoring. However, a very few respondents reported an extended use of GPS technology which includes geo-fencing and fuel-monitoring.

The comparative analysis of qualitative and quantitative findings provided adequate evidence to conclude that GPS technology does influences the business performance although the features being used at present are basic functions.

**7.3 Findings for Research Question 3**

The possible improvements in the implementation of GPS system was the main issue being addressed in research question 3. The findings are reported in the Table 4.

**Table 4:** GPS improvements

Qualitative Phase	Quantitative Phase
The findings indicated that the respondents are aware of the extended improvements that can be offered by GPS technology. However, absence of knowledge and expertise to lead the improvement initiatives and cost constraints are the hindrances faced by them in exploiting the real capabilities of GPS technology.	Respondents concur that there are many other features that can be offered by GPS technology including scheduling, geo fencing, safety dash board, maintenance, journey management, and customer services.

The findings indicate that as long as there is knowledge and expertise in leading improvements supported by adequate financial aids, the transporters are willing to exploit and make full use of the GPS technology.

**8. CONCLUSION**

Applying GPS technology in business operations is a very good approach to overcome the problems faced by the transporters in maximizing fleet utilization and enjoying effective cost management. It offers a platform for various improvements considering its flexibility to interface with any other software with limited complexities. Even though the transporters are needed to invest in development cost for the installation and customization of the technology, the tangible and intangible return of the GPS technology implementation will be superseded by its initial cost and eventually will shift the operational practice towards resource improvement and optimization.

The results in both qualitative and quantitative method has provided sufficient evidence that currently GPS technology has limited use among cement transporters in Malaysia in spite of its wide ranging features and attributes. The respondents in both phases used GPS technology mainly for speed monitoring and truck positioning functions. There is almost no effort to exploit GPS technology potential into other

related areas such as GPS interface with other operation software. No much effort was also observed for GPS usage in other capacities such as Geo-fencing, Safety Dash board, Journey management, Planning & scheduling, Auto alert, Live journey recording, service maintenance.

The absence of expertise and knowledge in enabling the respondents to explore the potential of GPS technology is also the major obstacle found in this study. The majority of the respondents are not being exposed to the capabilities of GPS technology and found to be very skeptical about the cost involved in exploring GPS technology potential.

This research is an exploratory study that investigated implementation of GPS technology among transporters using mixed method. It sheds some light on how the combination of quantitative and qualitative approaches can better explore a complicated social phenomenon. Given the advantages that mixed methods research can offer, more research that combines and integrates quantitative and qualitative methods in different ways should be undertaken in the GPS technology area to produce in depth insights in understanding the issue. A larger sample size in the future research may also enable developments of new insights in providing stronger theoretical foundations towards GPS technology in the logistics industry.

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