

# Business Intelligence Dashboard for Driver Performance in Fleet Management

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## ABSTRACT

Transportation is at the center of logistics as it represents the physical movement of materials between points in a supply chain. The problem involve in the transportation industry is fleet management. Fleet management is the broad topic that involve vehicles maintenance, operation capacity, driver selection and so on. This project focus on performance of the driver in fleet management. Imbalance driver contribution in fleet management decline the productivity of the organization especially in transportation industry. Each driver should be evaluated and analysed on their productivity and contribution towards the organization based on their performance. The aim of this project is to identify the factors influencing driver performance in logistic transportation and provide business intelligence dashboard for visualize driver performance for organization in their decision making. One transportation industry has been selected for the case study relying on business intelligence framework and tools for the development of dashboard. As the finding of this project, a conceptual model representing factors influencing driver performance is proposed. A dashboard was developed to provide business insight and help the organization in decision making based on the conceptual model proposed. The dashboard comprises of four main components which are summary, delivery, driver profile and driver behaviour. The dashboard was evaluated with respondents who involved in fleet management.

## CCS Concepts

• **Applied computing** → **Enterprise computing** → **Business process management** → **Business intelligence**

## Keywords

Business Intelligence; Driver Performance, Fleet Management

## 1. INTRODUCTION

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Transportation is at the middle of logistics as it indicates the physical maneuver of stuffs between points in a supply chain. High consumer assumptions and less liberality for poor performance generate a competitive situation for operating a fleet, which influence fleet managers to acquire high levels of dependability and cost-efficiency [1]. Logistics is a component of the supply chain process that scheme, execute and manage with efficient storage of goods, services and associated information to fulfil customers' demand from the point of beginning to the point of consumption. Transportation and fleet management have strong connection which role of fleet management is to permit organizations which depend on transportation in business to eliminate or reduce the risks related with vehicle investment, enhance efficiency, productivity and minimizing their altogether transportation and staff costs [2]. Fleet management system has many applications such as vehicle maintenance [3], vehicle tracking and diagnostics [4], improving driver performance [5], speed control and fuel management [6].

Many internal factors such as technology implemented, management skills, corporate culture, inter-firm relations and collaboration that can give an impact to the effectiveness and efficiency of logistic operators. In order to maintain competitive advantage, the quality of human capital need to be optimize for transportation company [7]. The human capital in this project focus on driver in the organization because each level play a different roles and the driver are important role on deliver raw materials to the final product so that the customer can get the product at the market. Besides, road transportation delivery is highly attributed to the driver. As a consequence, it would be very beneficial to be able to identify driver who engage in unsafe driving habits, as well as providing just the right driver coaching to change risky behaviour. The main issues regarding logistic transportation industry is the fleet management optimization. Fleet management is the broad topic that involve vehicles maintenance, operation capacity, driver selection and others. The significance of logistics and related activities in physical of materials is well acknowledged by the company. Despite that, there is an increasing need to concern regarding on how logistics and other operational can be done more effectively. Imbalance driver contribution decline the productivity of the organization. Every driver should be analysed on their productivity and contribution towards the organization. The aim of the project is to investigate the factors influencing driver performance in logistic transportation for fleet management purposes and provide the business intelligence dashboard for decision making.

This paper is organized as following. First section described introduction on fleet management and driver performance. Second section explain the details of factors influencing driver performance. Meanwhile, third section discussed the methodology involved in this study. Following section describe the dashboard development for this study. Next, an evaluation results for the project is presented. This paper concludes the findings by summarizing the project output and related contributions.

## 2. FLEET MANAGEMENT

Fleet management system is defined as a tools for operational control and fleet management for various types of operations such as distribution, vehicle rentals, passenger transportation and so on. Based on reported research in [8], fleet management system generate main controls and reports. One of the control on fleet management is staff performance appraisal that also refers to the drivers. The cost involve in the fleet management including labor cost. Cost of the labor is the sum of all wages paid to employees, as well as the cost of employee benefits and payroll taxes paid by an employer [9]. Driver management is one of the important element in fleet management. The fact is, with a poorly executed driver management system, a trucking company is bound to lose hundreds of thousands of dollars (if not millions) which can easily lead to its collapse.

One of the aspect of the driver management is investigating driver performance towards fleet management operation. Driver performance can be measured by driver profiling and driver behaviour. Driver profiling focus on the driver profile itself such as age, gender, experience and so on while driver behaviour measure on driver skills or the habit of driver when driving the vehicle usually related with driving data such as speed ,acceleration, breaking, steering, location. Driving data collection getting from several kinds of sensors. From previous finding, the researcher investigated on driver behaviour or the combination of driver behaviour profiling to get a better understanding and potentially improve productivity of driver [10].

## 3. FACTORS INFLUENCING DRIVER PERFORMANCE

Based on the literature review from other researcher, we identify the factors that related with performance and from that we come out with the factors influence driver performance such as age, gender, experience, schedule and offence in transportation. Generally, the factor influence performance were demographic characteristics, travel mode use, psychological factor and knowledge [11]. Demographic characteristics measured by age, number of children, annual km driven, gender, education, income, occupation. Travel mode use is different types of transportation such as train, bus, car, metro, tram, bicycle walking. Psychological factor consider as environmental-economic attributes, instrumental attributes, symbolic attribute, egoistic values, altruistic values, biospheric values, hedonic values, general environmental beliefs, awareness of consequences and personal norm.

Demographic data, alcohol drinking habits, driving technique, general evaluation of risk in everyday life, sensitivity to prize and penalty and anger during driving [12]. In demographic the variables involved such as age, gender, driving experience, education level. Alcohol drinking habit measured by AUDIT (Alcohol Use Disorders Identification Test), driving technique measured by MDSI-Spain (Multidimensional Driving Styles Inventory Spain), hazard perception in different aspects of life measured by DOSPERT (Domain-Specific Risk-Taking), sensitivity to prize and penalty measured by SPSRQ-20 (Sensitivity to Punishment and Sensitivity to Reward

Questionnaire) while anger in driving measured by DAS (Driver Anger Scale).

Other than that, based on [13], there are internal and external factors in prefactual assumption of the driver. The variables used regarding prefactual thinking were gender, age, marital status, level of education, optimistic and pessimistic expectation measured by LOT (Life Orientation Test) and mood states determine by PANAS (Positive and Negative Affect Schedule). Factors cause driver distraction which are alcoholic, perception power, fatigue, phone usage [14].

From reviews conducted shown in Table 1, authors highlight age as main factors influencing of driver performance, and gender as second factor. As for experience, there are papers stated as one of the factor, 9 papers highlight distance travel influence the performance and 7 papers indicated time travel. There are 4 papers highlight the capacity loaded while 3 papers mention offence as the factor influence driver performance. Therefore, those variables significantly proven as the conceptual model for driver performance. Table 1 shows the factor according to the authors and frequency.

**Table 1 : Factors Influencing Driver Performance**

Author	Demographic			Schedule			Offence
	Age	Gender	Experience	Distance Time	Driving	Capacity Loaded	
[11]	/	/		/			
[12]	/	/	/				/
[13]	/	/		/	/	/	
[14]	/				/		
[15]	/	/					
[16]	/	/		/	/		
[17]		/					
[18]	/		/	/			
[19]	/		/		/		
[20]	/	/	/				/
[21]				/	/		
[22]	/		/		/		
[23]				/		/	
[24]				/	/	/	
[25]				/		/	
[26]	/	/		/			/
<b>Total</b>	<b>11</b>	<b>8</b>	<b>5</b>	<b>9</b>	<b>7</b>	<b>4</b>	<b>3</b>

Based on Table 1, it shows that the highest frequency of factors influencing driver performance based on the literature is from Age. Figure 1 shows graphical image or view of factors influencing driver performance that will be further treated as variable from the dataset to be analyse later on. However, with the limited number of available variable related from the datasets gathered, demographic information on the driver and schedule will be further use for analysis purpose. The variables use will be visualized from the business intelligence perspectives for decision making purpose .

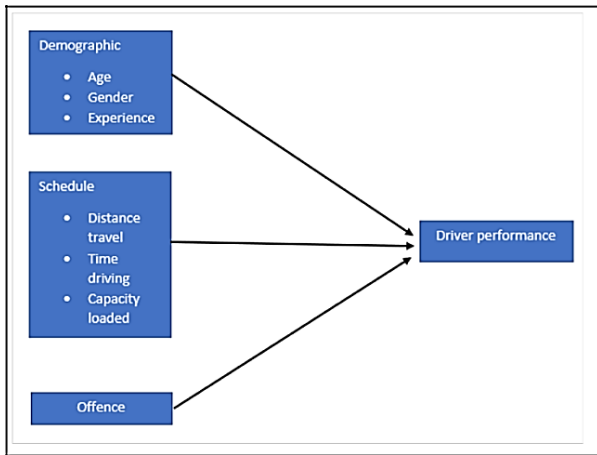


Figure 1. Factors Influencing Driver Performance

## 4. METHODOLOGY

Business intelligence framework have been used in research design and methodology for this study. We adopted process flow from [28] to develop the dashboard. The process begin with data from the identified sources to data warehouse must go through the Extract, Transform and Load (ETL) process. ETL process will validate data, cleaning data, transform data, group data and then the data will be load. In data warehouse, all the different data will be store at one place. At the end of the flow, end-users will be able to view dashboards, create reports and conduct analysis. This is the overall process of business intelligence framework. The source of data comes from one of the selected case study in transportation and logistics that involved in fleet management.

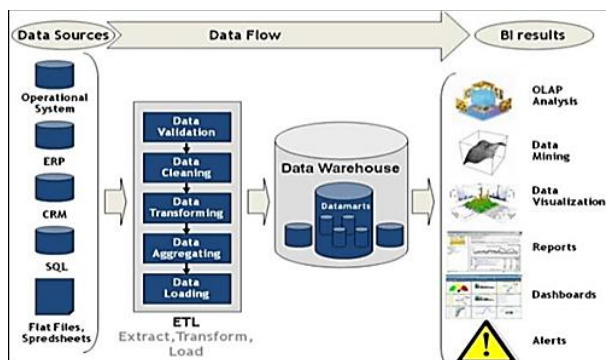


Figure 2 : Process Flow to Develop Dashboard [27]

### 4.1. Dashboard Development

The main reason to form the business intelligence dashboard for the organization with the information regarding driver performance to increase the efficiency and productivity in transportation industry. From the conceptual that shows factors influencing driver performance, we proceed with the development of dashboard based on the identified factors. The identified factors is identified as variables in data sets that we gather from the selected organization. Overall, this dashboard able to measure driver performance by its driver profiling and driver behavior. We are applying dashboard storytelling to tell the audience about driver performance.

### 4.2. Landing Page

For transportation industry, the dashboard will represent subject areas of lorry driver. Basically, dashboard development start the

story at landing page shown in Figure 3. This landing page provide the topic that we want to explore regarding driver analysis that consist of five topic which are current situation, summary, delivery, driver profile and driver behaviour.



Figure 3 : Landing Page

### 4.3. Sample: Summary Dashboard

Summary dashboard provide the information regarding overall performance of driver. The scatter graph shows the relationship between distance travel and time travel. It indicates that the longest distance travel, increase the time travel. However, there are one outlier that indicate the distance travel is short but it take the longer time. It will give the information that most of the driver perform well while some of the driver is inefficient. The bar graph shows top 10 of the driver that have highest delivery done. Treemap chart represent the vehicles that been drive by the driver. Usually, one vehicle will attach with one driver, however the driver tends to drive more than one vehicles. This is because a certain vehicle needs to do delivery but the driver that usually drive that vehicle could not attend and need other driver to do the delivery.



Figure 4 : Summary Dashboard

## 5. DASHBOARD EVALUATION

In order to measure user satisfaction of the usability of the dashboard, this research adapted Post-Study System Usability Questionnaire (PSSUQ). According to Lewis research, there are three sub-scales factor which are System Usefulness, Information Quality and Interface Quality [28]. System usefulness defined as easy to utilize and discover, completed the task effectively and productively. Information quality refers to result of the system provide to the user such as error message and the information to fix the error while interface quality refers to how satisfy the system to the users. The evaluation has been conducted with 11 experts in the related organization. Table 2 shows the summary of evaluation based on the items.

**Table 2 : Dashboard Evaluation Results**

Survey item	mean	std	min	max
The BI dashboard are necessity and valuable to identify company's problem (SysUsefulness)	4.82	0.40	4	5
The BI dashboard was effective in helping this company to complete the project (SysUsefulness)	4.91	0.30	4	5
This BI dashboard was designed to achieve company's objective (SysUsefulness)	4.64	0.50	4	5
I am satisfied with the design and features of the BI dashboard (SysUsefulness)	4.64	0.50	4	5
The information in this BI dashboard was clear (Quality)	4.64	0.67	3	5
This BI dashboard help company to solve their problem (Quality)	4.73	0.47	4	5
The company was able to complete the project quickly using the information in this BI dashboard (Quality)	4.82	0.40	4	5
It was easy to find the information of company needed (Quality)	4.45	0.69	3	5
The interface of this BI dashboard was pleasant. (Quality)	4.55	0.82	3	5
Company can analyse the information in this BI dashboard (Quality)	4.55	0.52	4	5
This BI dashboard has all the functions and capabilities I expect it to have. (Quality)	4.55	0.52	4	5
Overall I am satisfied with this BI dashboard (Quality)	4.82	0.40	4	5

The findings in Table 2 shows mean score is between 4.45 until 4.91 that indicates the level of usability of the dashboard is towards 4- Agree and 5-Strongly Agree. The highest scale is at 5-Strongly Agree while the lowest scale is 3-Middle and 4- Agree. In term of standard deviation represent the varies of the data point. For standard deviation 0.82, 8 people answer 5-Strongly Agree, 1 person answer 4-Agree and 2 persons answer 3-Middle meaning that the data point spread out over a large range of values. Overall, the respondents agree the usability of the dashboard.

## 6. CONCLUSION

This project was initiated by identify the problem in the fleet management and one of the problems regarding driver itself. Then, the study reviewing the literature on the factor influencing driver performance. The aim of this study to investigate the factors influencing driver performance in logistic transportation and provide the business intelligence dashboard for decision making especially in fleet management. The motivation for developing business intelligence dashboard comes from the problem that

imbalance driver contribution declines the productivity of the organization. Thus, this dashboard is intended to be more efficient and productive in the transportation industry. This project will be significant contribution to the logistics transportation and other industries that involve human capital from the bottom level. The amount of labours needed to execute the task given for every process involved. This project will give benefit to organization which depend on transportation in business to eliminate or reduce the risks related with vehicle investment, improve efficiency, productivity reduce their overall transportation and staff costs. Moreover, the result of analysis will help the organization in a decision making and suggest any improvement from time to time regarding human resource management. Driver performance may help the organization in determine the efficiency and productive of the driver itself towards the profitability of the company.

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