

Analysis of strategies to enhance motorcycle courier safety through perceptions, attitudes, and driving behaviors in Bogor City, Indonesia

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Abstract

The rapid growth of e-commerce has increased the phenomenon of the gig economy where many workers are not employed full-time, but are paid based on the number of services they successfully provide. One of the main transportation modes for goods delivery is the motorcycle. Motorcycles play a very vital role because they are small and agile, allowing riders to navigate traffic congestion more efficiently. However, motorcycles are also the type of vehicle most prone to traffic accidents because they do not have a protective frame for the rider compared to other types of vehicles. Therefore, this study aims to determine the causal factors of traffic accidents and develop preventive strategies for motorcycle courier drivers based on perceptions, attitudes and driving behaviors. Questionnaires were distributed to motorcycle courier drivers in Bogor City. The Moderated Regression Analysis (MRA) method and a fishbone diagram were used to identify the internal and external factors contributing to traffic accidents. The results showed that more positive perceptions and driving attitudes were associated with safer driving behavior. Driving experience significantly moderated the relationship between perception and driving behavior but did not significantly moderate the relationship between driving attitude and driving behavior. Furthermore, fishbone analysis identified excessive cargo loads as the main external factor contributing to unsafe driving. Descriptive analysis also identified several unsafe practices, including smartphone use while riding, headset use, carrying loads between the handlebars and the motorcycle seat, and working for two courier companies simultaneously. Based on these findings, the recommendations focused on preventing excessive loads by using the RACI matrix to define stakeholder responsibilities for vehicle inspection, proper cargo placement, and safety monitoring before delivery operations.

Keywords: Driving behavior; Fishbone diagram; Moderated Regression Analysis, Motorcycle courier; Traffic Safety; RACI matrix

1. Introduction

The digital era is responsible for the increased development of technology toward meeting the needs of society. This explains that technological innovations ultimately change the shopping and transportation modes of people. From this context, one of the changes is the increase in trade transactions through *e-commerce*, where sellers and buyers do not have to meet and interact directly during transaction processes. Based on several data, the volume of *e-commerce transactions* has reportedly reached 150.16 million in Indonesia. In 2019, the value increased by 79.38% annually from 83.71 million transactions (1). The consumption patterns of people have also changed due to the convenience of technology, which has enabled easier order of food known as the MoD (*Mobile on Demand*) concept (2). Furthermore, the development of *e-commerce* provides opportunities for logistics companies to increase their business and support successful establishment regarding community economic activities (3). The logistics companies with the task of delivering goods are also required to build trust toward the prevention of supply-chain relationship failure due to a lack

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of partnership honesty and integrity (4). This condition specifically influences the increasing number of people working as couriers for goods delivery. In this context, couriers are tasked with applying the concept of *the gig economy*, with the workers often paid a salary per service unit (5). This phenomenon leads to the development of workforce confusion, where workers have no clear guarantee of security during job performance.

Based on Minister of Transportation Regulation No. 60 of 2019 concerning the implementation of freight transportation, the transportation modes in courier service activities contained passenger cars, buses, and motorcycles. This indicated that motorcycles were the most vulnerable vehicle type compared to others. In this case, the vulnerability was attributed to the lack of a protective frame, which left drivers and passengers more exposed to being thrown from the motorcycle during an accident. The small size and limited balance of the vehicle also indicated that drivers were required to have good driving skills (6). This study aims to examine the driving behavior of motorcycle courier drivers (7–9) using driving attitude (10–13), and driving perceptions (12,14,15) as the main factors. Several previous studies also specifically emphasized couriers, with maximum and minimum articles prioritizing the survey data obtained in developed and developing countries, respectively. Another form of challenge for couriers was the carriage of large loads on trips while ensuring the safe condition of the goods during their arrival at their destination. The regulations issued by the government were also inconsistent with the reality experienced by the field drivers, regarding the transported loads. From this context, the loads exceeding the capacity of the vehicle was one of the violations by couriers. Another challenge prioritized the need for couriers to use mobile phones in determining delivery locations, causing fatal pressure and distraction (5).

The desire to improve safety, specifically for motorcycle couriers, is necessary for the consideration of perception, attitude, and behavior, to identify the causes of risky characteristics. This present study appropriately provides internal and external analyses, as well as the prioritization of recommendations. From an internal perspective, this study examines couriers' perceptions, attitudes, and driving behavior within the framework of the Theory of Planned Behavior (16). Furthermore, perception was selected due to its close relation to courier-driving safety, where perception of drivers influenced the riding pattern of a person (17). According to Ramadhan (18), low level of safety driving perceptions caused a lack of the knowledge. Attitude was also selected due to being part of the procedure and output of the perception model, after undergoing organizational selection and interpretation processes (19). Meanwhile, human behavior was selected because unsafe driving characteristics were the most common factors causing traffic accidents, such as high speed, surpassing red lights, risky overtaking, and unfollowing vehicular directions (20,21).

According to several previous reports, attitude and perception influenced driving behavior. This was in line with Dinh et al (12), where a relationship was observed between attitude, perception, and driving behavior in Vietnam. This indicated the establishment of an association between attitudes toward traffic safety, risk perceptions, and pedestrian behavior. The model also proved that the perceived risk containing non-risk and traffic uncertainties was a significant determinant of attitudes toward driving safety. In line with the driving process, Rundmo and Ulleberg (22) stated that risk perceptions and attitudes simultaneously influenced the risky driving behavior of adolescents in Norway. In this case, the perception of risk was a weak predictor of driving behavior, with a more positive attitude leading to less chance of risky riding characteristics. Therefore, perception and attitude toward behavior are capable of representing this study, which focuses on motorcycle couriers as experimental objects. In this case, four demographic variables are involved as the moderating factors in the regression test, namely age, gender, years of experience working as a motorcycle courier (driving experience) and accident experience.

Age is the difference between the young and old, indicating that older periods lead to decreased driving skills (23). The male gender is similarly observed and considered to have better driving skills than women (24–26). Driving experience also shows that more flying hours cause greater skill reliability (27–29). However, the experience of accidents indicates that more frequent occurrence leads to higher risk behavior, according to Nguyen-Phuoc et al. (30) and Truong (29). In this case, the *Moderated Regression Analysis* (MRA) test is responsible for implementing the four demographic factors as moderating variables. These results should then be comprehensively and technically compiled in the *Responsibility, Accountable, Consulted, and Informed* (RACI) matrix (31). Therefore, this study aims to determine the level of perception, attitude, and behavior of driving safety among couriers. It also aims to carry out the following, (1) examine the influence between perceptions and attitudes on driving safety behavior, (2) identify the basic factors causing the relationship between the three variables (perceptions, attitudes, and driving safety behavior), and (3) provide recommendations to improve traffic safety for couriers through the RACI Matrix.

2. Study Methods

This study was carried out in the city of Bogor, where data was obtained from various locations using courier services. An *accidental sampling* approach was also used to select the required samples, which were 105 motorcycle drivers. From this context, the demographics of the participants are shown in Table 1.

Table 1 Demographic Characteristics of Participants

Characteristic	Category	n	%
Gender	Male	103	98
	Female	2	2
Age	17–21 years	0	0
	22–29 years	31	30
	30–39 years	60	57
	>39 years	14	13
Education Level	Junior High School	3	3
	Senior High School/Vocational School	98	93
	Diploma	2	2
	Bachelor Degree	2	2
Work Experience	< 6 months	15	14
	6 months–1 year	18	17
	1–5 years	70	67
	> 5 years	2	2

The inclusion criteria for this study were also determined as follows, (1) the participant should be a motorcycle courier in Bogor City, (2) a driving license (SIM) C needs to be possessed (32) and (3) the standard age should be between 17-70 years old (33).

Figure 1 showed the conceptual model, which consisted of independent, dependent, and moderating variables.

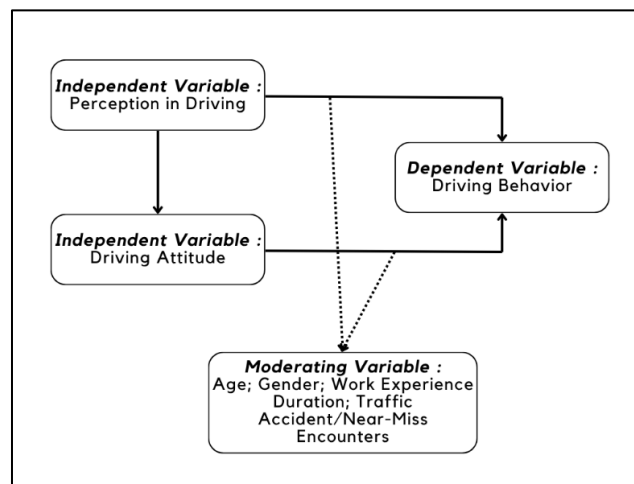


Figure 1 The Conceptual Model

The roles of the demographic factors were similar to those of moderating variables in the relationship among linear regressions, to measure the association strength between the independent and dependent variables. This indicated that the demographic factors were used as independent and moderating variables, to equally affect the dependent determinants (34,35). In this case, the following variables are implemented:

2.1. Independent Variables

In this study, the independent variables include the perceptions and attitudes of couriers. For perception, the measurement scale emphasized perception on safe driving, such as regulating speed limits through turn signals when turning, avoiding the use of a telephone, as well as adhering to headlights and passenger capacity rules (36). The questionnaire of this variable also used a 5-point scale (1-5) to measure 16 questions with favourable and unfavorable alternatives. Subsequently, the data instrument contained traffic regulations, speed, opportunity to access technology, vehicle overtaking policies, regulation for turning on lights during the day, etc. Based on attitude, the measurement scale prioritized the action indicators or efforts for safe driving culture. These efforts included vehicle assessment before use, passenger capacity, riding completeness, switching on the turn signal, routine servicing, the physical and sleepy conditions of driver, etc. The questionnaire of this variable also employed a 5-point scale to measure 14 questions with favourable and unfavourable alternatives.

2.2. Dependent Variable

The dependent variable was the driving behavior of couriers, whose measuring scale emphasized several indicators. These indicators included the speed prioritizing aggressive behavior, safety violations, control errors, external disturbances, traffic disobedience, prediction mistakes, exterior human interference, braking misdemeanor, and selfish character. In this case, the Indonesian Motorcycle Rider Behavior Questionnaire (IMRBQ) was implemented, using a 4-point scale to measure 23 questions with favorable and unfavourable alternatives (37).

2.3. Moderating Variable

The moderating variable prioritized the demographic factors, which contained age, gender, work experience duration, and traffic accidents or near-miss encounters. These factors were used to determine the influence level of the relationship between perception and attitude on behavior of motorcycle couriers.

The preparation of the questionnaire was obtained from several selected literature related to traffic safety for couriers (11,14). In this case, the questionnaire emphasizing the driving behavior of couriers was used, based on the culture of Indonesians (37).

2.4. Operational Definition and Variable Measurement Scale

Table 2 shows the operational definitions and variable measurement scales. The total score of each variable was calculated by summing the scores of all questionnaire items, and the median score was used as the cut-off point for categorizing respondents into two groups.

Table 2 Operational Definition and Measurement Scale

No	Variable	Definition	Criteria	Scale
(1)	(2)	(3)	(5)	(6)
1.	Perception in driving	Personal judgment in interpreting traffic safe driving (38)	Total value of $X \leq \text{median}$ = Relatively low safe driving perception Total value of $X > \text{median}$ = High and good safe driving perception (39)	Likert (Interval)
2.	Driving attitude	Responses as expressions, beliefs, and tendencies of participants in performing safe driving activities (38)	Total value of $X \leq \text{median}$ = Risky attitude that leads to unsafe driving behavior Total value of $X > \text{median}$ = Non-risky attitude that leads to safe driving behavior (39)	Likert (Interval)

3.	Driving behavior	All behaviors carried out by participants before, during, and after driving (40)	Total value of X is middle to lower = Unsafe driving behavior Total value of X is middle and above = Safe driving behavior (41)	Likert (Interval)
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2.5. Study Hypothesis

Based on the experimental problem description, the following hypotheses were formulated (H0 = Perception and attitude do not significantly affect driving behavior & H1 = Perception and attitude positively influenced driving behavior).

Data processing was initially carried out through validity, reliability, and classical assumption tests before the performance of linear regression analysis. In the linear regression, the analytical steps also emphasized the t tests, as well as determined their relationship levels by using the coefficient of determination (42). In addition, a Moderated Regression Analysis (MRA) was implemented by using SPSS software.

During the analysis stage, the processed data related to the influence between the variables were compared, including the demographic factors and descriptive statistics. In this case, the fishbone diagram was implemented to determine the general identification of problems (holistic) (43). The RACI matrix was also used to provide more strategic recommendations, such as assigning appropriate responsibilities to each role of employees and members working in a logistics company (44).

3. Results and Discussion

Based on the results, all variables were valid ($r > 0.192$) and reliable (Cronbach Alpha > 0.6), with Table 3 showing the descriptive statistical analysis.

Table 3 Descriptive Statistical Analysis

Variable	Items	Mean	Median	Std Dev	Min	Max
Perception in driving	16,00	4,19	4,20	0,36	3,40	5,00
Driving attitude	14,00	4,04	4,00	0,39	3,14	5,00
Driving behavior	23,00	3,38	3,41	0,27	2,68	3,91

Based on Table 3, the median value of perception was positive or high and good safe driving perception (median > 3), with the following two items reflecting relatively negative perceptions, namely (1) the use of a smartphone when driving, and (2) the participation in two companies. The value of attitude was also included in the good criteria or leads to safe driving behavior, with one item reflecting an unsafe attitude, namely the use of the space between the handlebars and motorcycle seat as a cargo area when driving. Regarding behavior, the value obtained was categorized as safe, with the exhibition of one unsafe element, namely the use of a headset while driving. These results were considered the required inputs for the development of a fishbone diagram, with unsafe driving behavior among motorcycle couriers serving as the root cause of the fishbone diagram (Figure 2).

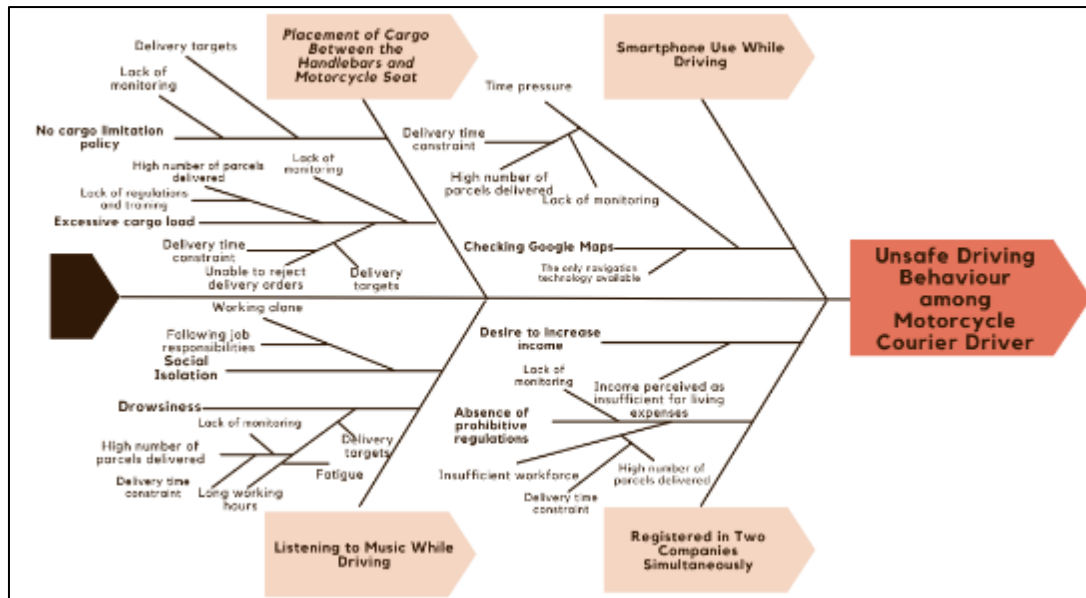


Figure 2 Fishbone Diagram Studies

Firstly, the use of mobile phones by couriers when driving was a secondary or additional activity commonly observed in developing countries. This indicated that calling while driving and reckless overtaking had the highest and lowest prevalence values at 74% and 32.2%, respectively (45). When using a cellphone while driving, the risky behaviors considered were calling, sending SMS, and searching for information (45). These phone usages were due to the limited time for couriers to deliver goods related to the business strategy of the logistics company (46). This proved that the patterns of completing courier tasks in a short time depended on the use of a mobile phone to quickly search the addresses of consumers through the Google Map application. Moreover, the number of shipped items was very large with a very limited delivery deadline. This indicated that the excess goods in vehicles often caused the loss of stability and balance while driving (47). The number of these uncontrolled goods was due to the absence of monitoring on each courier. This result was in line with Christie and Ward (5), where a manager in a logistics company only monitored the period for packages/goods to be delivered (5). In this case, the use of Google Map while driving was the only technology available to couriers during the delivery process.

Secondly, couriers often placed cargo/goods between the seat and handlebars of their motorcycle. This placement caused several problems for motorcycle spare parts, such as brakes, drive chains, suspension systems, and tires (48). The shortcoming was also due to the non-restrictions on goods, which greatly affected stability, balance, and focus when driving (47,48). These non-restrictions emphasized the lack of monitoring, regarding the target number of goods to be delivered at that time (5). In addition, the high volume of cargo prioritized inadequate regulation and training on safe driving, company policies based on time targets and minimum deliveries, as well as the amount of revenue generated. In this case, the workers were not often provided with jobs when they refuse excess loads (5).

Thirdly, couriers often listened to music through a headset while driving, to reduce drowsiness (49). This was a mild subjective violation, which was highly risky regarding the occurrence of a serious accident (50). This proved that 67.5% of accidents in two-wheeled vehicles occurred due to loneliness or driving alone (33). Long working hours also caused the tiredness of couriers, causing the option of listening to music to reduce fatigue.

Fourthly, couriers were registered with two companies at the same time. This was due to the inexistence of relevant restrictions, as drivers commonly wanted to supplement their income for the necessities of life (5). The absence of these regulations prioritized several field occurrences, namely the lack of human resources and monitoring (5).

3.1. Internal and External Factors

Based on the influence test, several insignificant differences were observed for age, gender, as well as driving and accident experience (asympt sig. > 0.05), as shown in Table 4. This indicated that the observed driving behavior did not significantly differ based on these demographic characteristics. However, the regression analysis showed that perception significantly and positively affected attitude ($B = 0.735$, $p < 0.001$) and driving behavior ($B = 0.394$, $p < 0.001$). Attitude also significantly and positively affected driving behavior ($B = 0.439$, $p < 0.001$). These findings

indicated that more positive perceptions and attitudes were associated with safer driving behavior. From this context, safe driving behavior was observed with longer driving experience (51,52).

As a moderating variable, driving experience significantly moderated the relationship between perception and driving behavior ($B = -0.556$, $p = 0.010$). However, the interaction between attitude and driving experience was not significant ($B = 0.321$, $p = 0.102$). This indicated that driving experience played a significant moderating role specifically in the relationship between perception and driving behavior, but not in the relationship between attitude and driving behavior. This was in line with Castro et al. (53), who found that driving experience moderated the relationship between maneuvering errors and hazard detection. Ramisetty-mikler and Almakadma (10) also found that drivers with less driving experience, particularly young drivers such as teenage boys, were more likely to engage in risky activities while driving.

The findings regarding perception are consistent with Salihat and Kurniawidjaja (54), who reported a positive relationship between risk perception and safety-related behavior. In their study, respondents with poor perceptions of driving safety risks were 72 times more likely not to use a seatbelt. Although the overall perception was positive, some indicators were still very negative. This difference may occur because individuals can perceive and interpret the same object or situation differently during the perception process (55,56).

Table 4 Results of Influence Test between Variables

Relationship	B	Std. Error	Beta	t	Sig.	R ²
Perception → Attitude	0,735	0,071	0,716	10,413	0,000	0,513
Perception → Behavior	0,394	0,102	0,357	3,880	0,000	0,128
Attitude → Behavior	0,439	0,097	0,408	4,539	0,000	0,167
Perception × Age → Behavior	0,025	0,270	1,877	0,921	0,360	0,192
Attitude × Age → Behavior	-0,230	0,027	-1,563	-0,864	0,390	
Perception × Gender → Behavior	-	-	-	-	-	-
Attitude × Gender → Behavior	0,300	0,601	0,692	0,500	0,618	0,423
Perception × Driving Experience → Behavior	-0,556	0,212	-4,653	-2,622	0,010	0,492
Attitude × Driving Experience → Behavior	0,321	0,195	2,423	1,649	0,102	
Perception × Accident Experience → Behavior	0,183	0,173	1,440	1,056	0,293	0,439
Attitude × Accident Experience → Behavior	-0,102	0,185	-0,756	-0,551	0,583	
— = Interaction term excluded due to perfect multicollinearity (Tolerance = 0.000), resulting from the highly imbalanced gender distribution.						

Based on the results, attitude positively and significantly affected driving behavior, indicating that better attitudinal activities caused safer behavioral performance. This was supported by Hendrawan (57), where attitude impacted or had a relationship with safety riding behavior. Regarding a relevant recommendation, the educational training containing the aspects of knowledge, alertness and driving skills need to be conducted. The training should also contain the use of safe and appropriate riding equipment (jackets and masks), routine checks on motorcycle readiness, as well as understand and comply with traffic regulations (58). Moderation analysis showed that driving experience was the only demographic variable that significantly moderated the relationship between perception and driving behavior. In contrast, age, gender, and accident history did not show significant moderating effects ($p > 0.05$). The interaction between perception and gender could not be estimated due to severe multicollinearity resulting from a highly skewed gender distribution. Furthermore, the driving experience model yielded the highest coefficient of determination ($R^2 = 0.492$), indicating the greatest explanatory power among the moderation models tested.

Regarding external factors, some couriers were found to work for two courier companies simultaneously. This practice may be associated with their relatively low income, which was insufficient to meet their daily needs. At one of the courier companies (X), the basic salary for drivers was reported to range from IDR 2.7 to 3.89 million (59,60). However, this differed from the information provided by a courier interviewed in the present study, who reported that payment was based solely on the number of successfully delivered packages. Thus, the need to increase income may encourage

couriers to accept and deliver more packages. This tendency may also be influenced by social class and reference groups. Since income is closely related to the number of packages successfully delivered, delivering more packages may result in higher earnings. However, carrying excessive loads while riding poses considerable safety risks because it can affect the stability and control of both the motorcycle and the rider.

Based on these results, couriers often placed their belongings in an unsafe position, as observed between the seat and handlebars of the vehicle. This placement commonly caused a harder maneuver of the vehicle while riding. The total number of goods carried in one trip was also frequently around 90 packages. Moreover, the external factors included the feasibility of the implemented vehicle, indicating that the branch and the expedition company were not accountable for assessing vehicular eligibility before departure. Since the load of goods delivered was quite excessive, each vehicle owned by couriers was impacted. Another consideration was the measurement of dimensions, except the weight of the goods. This was to ensure easier navigation for couriers while on delivery missions.

3.2. Safety Improvement Recommendations Using the RACI Matrix

In this study, the recommendations emphasized the strategies for placing appropriate loads on a two-wheeled courier vehicle without overburdening drivers. This was because improper load placement was specifically risky and dangerous for drivers while driving, as instability often led to the occurrence of accidents. From the fishbone diagram, these recommendations were determined through the RACI matrix method (44,61,62). This method is shown in Table 5, where the roles of several stakeholders and the steps for preparing recommendations were comprehensively prioritized. Based on the results, the main problem emerging from the analysis of fishbone and RACI was the overload of couriers. This was because drivers did not have much control to reduce or delay shipments, due to the delivery targets from company regulations and time constraints, as well as the delivery time required for each package.

Table 5 RACI Matrix

No.	Responsibility	Organizational Units					
		<i>Operations Admin</i>	<i>Last Mile Coordinator</i>	<i>Regional Coordinator</i>	<i>Regional</i>	<i>Police</i>	<i>Consumer</i>
1	Establish standard procedures for carrying cargo/goods for couriers	<i>I</i>	<i>I</i>	<i>R/A</i>	<i>C</i>		
2	Record the dimensions and weight of the package to be provided to the relevant party asides from the address and contact details of the sender and recipient	<i>A</i>	<i>C</i>	<i>I</i>			<i>R</i>
3	Measurements of the load placement limits between the handlebars and the motorcycle seat are as follows:						
	The load position does not have a width that exceeds the broadness of the steering handlebar	<i>R</i>	<i>A</i>	<i>C</i>	<i>I</i>		
	The height of the load is not up to 900 mm from that of drivers' seat/seat	<i>R</i>	<i>A</i>	<i>C</i>	<i>I</i>		
	All loads are better placed behind drivers	<i>R</i>	<i>A</i>	<i>C</i>	<i>I</i>		
4	Field validation should be conducted despite having couriers placing goods between	<i>I</i>	<i>I</i>	<i>I</i>	<i>C</i>	<i>R/A</i>	

	the handlebars and motorcycle seat in Bogor City						
5	When loads are still placed between the handlebars and the motorcycle seat, corrective actions need to be conducted:						
	The logistics company is working with other parties to stop couriers placing goods between the handlebars and motorcycle seat in Bogor City	<i>I</i>	<i>I</i>	<i>I</i>	<i>C</i>	<i>R/A</i>	
	The task for specific parties is added to visually check each driver	<i>R</i>	<i>A</i>	<i>C</i>	<i>I</i>	<i>I</i>	
	Before leaving, couriers should understand a fence capable of scanning and determining the excessiveness or shortages of the loads to be delivered	<i>I</i>	<i>R</i>	<i>A</i>	<i>C</i>	<i>I</i>	
	When no load is placed between the handlebar and motorcycle seat (Continue without correction)						
6	Evaluation of Corrective Actions	<i>C</i>	<i>R</i>	<i>A</i>	<i>C</i>	<i>I</i>	

The RACI matrix also showed that regional coordinators had direct duties and responsibilities, to compile a standard setting team. This emphasized the placement of loads while driving, at the stages of setting standards with an R (responsible) role. The team building process was also carried out by communicating and consulting with regional parties as top management. This two-way communication should be presented to middle/low management, such as the operational admin and last-mile coordinator, as their roles were "informed". Although the role of A was "Accountable" as a decision maker, the responsibility was still provided to the regional coordinator at the standard setting stage, to measure the achievement levels.

The initial process before the delivery of the package was the measurement of the commodity dimensions, regarding the domains and weight. This process was very necessary before prioritizing the standard of achievement. From this context, many couriers did not understand the dimensional measurements, leading to an accumulation of excess goods on motorcycle. This indicated that the measurement of the dimensions and goods was very important to provide cost prices and the safety of couriers (63). Another standard used in carrying loads while driving emphasized Government Regulation No. 74 of 2014. This showed that the position of the load did not have a width capable of exceeding the broadness of the steering handlebar, with the height not reaching 900 mm from the projected seat of drivers. In addition, all loads were better placed behind drivers, regarding the standard considered.

Based on Figure 3, a large number of couriers exceeded the load placement regulations in the field. Although the load placement was positioned behind driver, the overall height and width of the commodities were still not ideal, specifically reducing the comfort and safety of couriers. This load placement was considered a form of Over Dimension Overload (ODOL), which emphasized the non-linearity of a vehicle structure or design with production standards and traffic regulations, such as Law no. 22 of 2009. This policy indicated that drivers and/or freight transport companies, such as logistics organizations, were required to comply with loading procedures, carrying capacity, vehicle dimensions, and road classification. It was also accompanied by Government Regulation Number 8 of 2012, which contained the procedures for inspecting motorized vehicles and handling traffic violations on the road.

Setting was carried out directly by the regional coordinators (R) and decision-making parties (A/C), with the operational admin and mile coordinator only informed about the standard procedure for placing cargo (I). From this context, the initial process of sending goods started with the consumer willing to enter the package to couriers. This process was carried out by measuring the dimensions and weight of the package. In this process, the role of consumers

was very important, due to the capability to determine the better transportation modes of goods, either through four-wheeled or two-wheeled vehicles. When the dimensions of the goods were very wide, couriers had travelling difficulties.



Figure 3 Placement of Irrelevant Loads

Based on the results, the consumer (R) was considered the party with complete responsibility in this activity. Meanwhile, the operational admin obtaining the goods and their detailed data was tasked with determining the retrieval or non-retrieval of the packages (A). The mile coordinator was also considered a consultant when a mistake was observed in both the destination address and the dimensions of the goods (C). In this case, the informed party was the regional coordinator due to only observing the outputs of the overall recap, after the acquisition of all goods by couriers (I). This showed that the suitability of package weights and dimensions with standards was carried out with automated systems, such as conveyors and laser scanners/sheer curtains (transmitters/receivers). These systems were capable of measuring the length, width, and height of the package (63), although required appropriate packaging.

The standard measurement for each load placement limit between the handlebar and the motorcycle seat contained three criteria, namely the height, width, and overall position of the goods placed behind drivers. These criteria were conducted by the operational admin (R) through the mandate provided by the mile coordinator (A). Besides, the cargo placement limit was also consulted with the regional coordinator (C) and informed to the parties (I). From this context, the regional parties need to understand the activity, toward improving the safety of couriers. The activity also emphasized other standards, such as the position of the load without a width exceeding the broadness of the steering handlebar. This was accompanied by the height of the load, which was not more than 900 mm when placed on motorcycle seat. In this case, the placement of the load should also be behind couriers. Field validation was also used to determine couriers still placing cargos between the handlebars and motorcycle seat. This activity was carried out by the local police (R/A), through road patrols. In this case, regional parties only functioned as consultants, regarding the supervision by the police (C). Meanwhile, the operational admin, last mile coordinator, and regional coordinator were attempting to acquire input from regional parties for subsequent corrective action (I).

The next condition was the anticipatory activity, which was carried out based on the observation of couriers placing loads between the handlebars and motorcycle seat. This was observed from the efforts of the logistics company working with other parties to stop drivers who still wrongfully placing goods on motorcycles. Compared to the previous validation procedure, this cessation activity was conducted to avoided the repetition of similar issues. The responsibility and decision-making processes of this activity was also assigned to the police (R/A symbol). Regional remained in the Consulted (C) role, while the Last Mile Coordinator, Regional Coordinator, and Operational Admin were assigned to the Informed (I) role.

The next step was the activity provided to couriers before delivering the goods at the company branch. This step prioritized the assessments of each courier by the operational admin (R), according to the directions obtained from the last mile coordinator (A). The regional coordinator also provided consulting services during unwanted occurrences, such as the appearance of rust on the motor parts containing iron (C). From this context, the rust on the iron was a risky occurrence, which was capable of breaking motorcycle frame (64). However, the regional parties and the police were

the actors only informed (I). Some recommendations were also observed during these processes, such as the provision of an x-ray machine capable of loading motorcycle, with the fence scanning the packages carried by drivers. These recommendations were the responsibility of the last mile coordinator (R). The regional coordinator also carried out decision-making processes regarding the development of fences for each branch (A). Meanwhile, the regional party (C) was considered the consultant for both the last mile coordinator and the region, with the police and operational admin (I) informed about the preparation of recommendations. After the recommended corrective actions were implemented and the load was no longer placed between the handlebars and the motorcycle seat, the corrective actions were subsequently evaluated. This evaluation process was the responsibility of the last mile coordinator (R), with the regional organizer improving the safety of its employees (A). In this case the operational admin was considered the consultant for regional parties (C), with the police being informed and providing various perceptions as external organizational members.

These various occurrences were observed in Indonesia, Korea, and the United Kingdom (UK). In the UK, couriers often encountered accidents because the average worker had less than six months of experience (33). Compared to Korea, a shipping company in the UK also accounted for 42% of drivers that died in accidents due to fatigue. Moreover, couriers were under pressure due to the need to meet the time required to successfully deliver goods to consumers (5). The use of smartphones while driving was also the reason most collisions were observed almost regularly. Based on a previous study in Indonesia, post office expeditions were emphasized in Semarang City, with 42.6% of couriers driving with unsafe/risky behaviors (65). As a motorcycle courier in several countries, including Indonesia, the issues of the working conditions were not highly different. This indicated that the driving experience to work was an important safety factor, with lesser practices leading to more unsafe behavior and traffic accident risks. The issues of fatigue and pressure were also common for motorcycle couriers due to the time-consciousness of the work rhythm.

From these RACI matrix outputs, several suggestions prioritized the strategies for increasing couriers safety. In this case, the cause of inadequate driving behavior was the placement of the loads that exceeded the length and width limits, specifically the packages between the handlebars and motorcycle seat. This indicated that the development of a safe place for the goods was an improvement to the placement of loads. The design of this item also endured easy operation and was expanded based on three points or an ergonomic triangle, namely a handlebar, seat, and the position of the foot (66). Furthermore, the placement of small items were between the handlebars and motorcycle seat after collection into one sack. This proved that the height did not exceed the projection of the motorcycle handlebars. It was also calculated from the base of the footrest and approximately 30 cm wide. Compared to the cargo placement in front area, the space behind couriers was capable of accommodating various items when fit, strong, and unshakeable while driving. Based on the mitigation of risks, the placement of loads behind drivers was not expected to protrude back and forth on the motorcycle. The width of the placement was also increased by approximately 15 cm, to prevent the endangerment of other motorists on the road. This width increase subsequently emphasized easy entrance into small alleys when the intended location was a fairly narrow street. From these results, the height of the cargo placement should be arranged around approximately 50 cm, without exceeding the stature of drivers when driving.

According to Abdul Manan et al. (67), the factors influencing the speed behavior of couriers on Malaysian roads were emphasized, such as the cc engine capacity of each motorcycle and the load. From this context, several couriers need to be educated regarding various body techniques when driving, including braking, leaning/bending the body of the vehicle, and heading out. During braking, the motorcycle's weight shifts toward the front wheel. Therefore, on a dry, paved road surface, greater braking force can generally be applied to the front brake than to the rear brake. Proper braking helps maintain motorcycle stability and control, particularly when carrying a load.

4. Conclusion and Future Study

Based on the results, low safe driving perceptions were observed, namely (1) the use of a smartphone while driving, and (2) the participation in two companies at the same time. One risky attitude was also observed during the analysis, namely the load placement between the handlebars and motorcycle seats. Despite this, an unsafe behavior was still found, emphasizing the use of a headset while driving. From the results, perceptions and attitudes positively affected driving behavior. These findings suggest that driving experience plays an important role in shaping how drivers translate their perceptions into driving behavior. However, no significant evidence was found to indicate that driving experience changes the influence of driving attitude on driving behavior. From the fishbone diagram, the recommendations emphasized the load aspect carried by couriers. This indicated the necessity to carry out monitoring activities for the increased safety of drivers. Stakeholders such as operational admin, police, as well as the regional coordinators and parties, were also involved in formulating a traffic safety strategy, regarding the monitoring of load placement on the vehicles.

According to these results, several recommendations should be formulated for conventional couriers, to address the placement of loads between the handlebars and motorcycle seat. The formulation was also necessary for understanding other causal factors, such as the use of smartphones and headsets while driving, as well as the registration with two companies at the same time. In addition, motorcycle couriers are recommended to use appropriate delivery bags for carrying packages/loads safely.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

Statement of informed consent

Participation in this study was voluntary. All respondents were informed about the purpose of the research. Participant confidentiality and anonymity were maintained throughout the study.

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