EVALUATING THE IMPACT OF ROAD ACCIDENTS ON THE ECONOMY

Chameen Rubasinghe[1], Sarala Gunathilaka[2]
Sri Lanka Institute of Information Technology, New Kandy
Road, Malabe, Sri Lanka.
[1]*en20430436@my.sliit.lk,* [2]*sarala.g@sliit.lk*

ABSTRACT – The occurrence of road accidents has had a significant impact on the country's economy, and it is affected by injury and crash related costs. A comprehensive study of costs incurred due to road accidents and how it affects the economy of the country is conducted in this study. The costs are classified according to their impact on the economy and according to the manner in which the costs are incurred. Basically, costs are estimated based on the data from insurance companies and other state authorities such as the Ministry of Justice. A detailed review of direct and indirect costs or losses including economic burden due to deaths, permanent disabilities, economic inactivity, medications, property damages, etc. is conducted in the study. The final output of the study is a mathematical relationship which represents the annual economic impact from road accidents and weights of different types cost components indicate the individual contribution to the total impact. This relationship can be used to predict the future impacts on the economy based on the past accident patterns. In addition to that, factors affecting the costs or losses are examined. This would be a valuable source for decision makers to monitor economic losses due to road accidents and take necessary precautions.

Keywords: Road accidents; Economy; Mathematical relationship; Costs; Losses.

1. INTRODUCTION

Around 1.25 million of people die annually and 20-50 million non-fatal injuries are caused by road accidents worldwide [1]. Cyclists, motorcyclists, and pedestrians are at a higher risk of accidents [2]. Road accidents affect the existence of human in many ways. Among them, the impact on the economy is prominent. Here, costs can be classified as direct costs and indirect costs [3]. Direct costs are immediate financial expenses that occur as a result of the accident [9]. It includes medical expenses, vehicle repair cost and property damage cost. Indirect costs are the expenses that arise due to the impact of accident on other aspects of life. It mainly includes loss of productivity, earning and cost of emergency services. Financial losses from accidents can be measured by adding up the costs of emergency services, medical, legal and court costs, property damage, lost workplaces and insurance administration [1]. The economic impact varies depending on the nature of road accidents. For an example, when considering a collision/accident between two vehicles, the severity of the accident and the impact on the economy will vary depending on the type of vehicle involved in the accident. Road accidents can cause damages to both public and private properties [4]. In this case, it should be investigated the type of property that was damaged more and the ways in which they occur more often. Road accidents affect property as well as lives. Injuries and deaths from road accidents have an impact on the economy. In addition to the loss of an economically active person, this causes a collapse of the family's economy as well [5]. The impact on the economy varies depending on the person involved in a road accident. Also, lawsuits for road accidents have an impact on the economy.

Previous studies conducted in Sri Lanka have not properly categorized the impact from different types of components such as costs due to production loss, medical costs, human costs, etc. Therefore, they should be properly classified and the individual effects of each component on the economy should be pointed out to have a thorough understanding of these impacts. According to data from the World Bank, the total cost of road accidents in Sri Lanka is estimated to be between 3-5% of GDP annually, which is a significant amount [6]. The cost of inaction is too high, and there were about 3,000 deaths and 8,000 serious accidents annually.

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There are no sufficient research or studies in Sri Lanka to assess the economic burden due to road accidents. Therefore, this research study attempts to conduct a comprehensive and detailed analysis on the economic impact due to road accidents and the factors affecting each cost component.

2. MATERIALS AND METHODS

2.1. Data Description

Data collection is conducted under two main categories. They are data on injury-related costs and crash - related costs. Medical costs and production costs can be classified as injury-related where property damages and administrative costs are categorized under crash-related costs [7]. Data are collected through a primary source; it is from insurance company. Mainly, data on total insurance claims and individual components of each claim estimates are collected. A case-by-case property damage claims, non-grievous claims, grievous claims and fatal accident claims are collected for the year 2022. A case-by-case analysis is conducted to identify the socio demography of victims and cost breakdowns in estimating claims. Only one insurance company was used for data collection. The variation in the claims method according to the insurance company hinders the study of the financial value of an accident. There is also the difficulty of obtaining long period data. Here, 986 property damage claims data, 21 injury claims data, 21 disability claims and 21 fatal accident claims data were collected.

Medical costs, and property damage costs are derived through the claims estimates. Administrative costs such as number of officials attend (police officers, insurance officials, etc.), number of hours attend by respective officials, etc., are collected from the Sri Lanka Police and insurance companies. Here, an average value is taken for each type of accident. However, production costs are difficult to be expressed in monitory values. Therefore, production loss is calculated based on the employment of the victim before becoming the economic inactive status [8]. A sufficient sample of recent data under different type of road accidents are collected for the year 2022.

2.2. Data Analysis

A descriptive analysis on total costs is conducted under different accident types such as property damage only accidents, non-grievous injury accidents, grievous injury accidents, and fatal accidents. Initially, all claims/compensations are classified according to the above accident types. Thereafter, how medical costs, production losses, property damages costs, and administrative costs are distributed among different accident types is analysed. For each type of accident, a multiple linear regression analysis is conducted to find a mathematical relationship among individual cost components and the total cost per an accident. Four different regression models are developed for property-damage only, non-grievous, grievous and fatal accidents. Initially, regression models are developed using the IBM SPSS software. These equations reflect the burden on the economy due to road accidents in a descriptive manner. Also, the influence of different factors on each cost component is analysed separately by developing regression equations.

3. RESULTS AND DISCUSSION

Considering the insurance data, the expenses for vehicle repair can be expressed as a percentage.

Motorcycles & Three wheelers	3.70%
Light vehicles	86.00%
Heavy vehicles	10.30%

The main outcome of this study is the mathematical relationship that gives the contribution of each cost component towards different types of accidents. For an example, this can be expressed as;

Total economic burden due to a fatal accident ~f (Medical cost,
$\qquad$ Production cost, Property damage cost, Administrative cost) (1)

Similar relationships are developed for the other three types of accidents. In addition to that, following relationships are expected.

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Medical cost ~f (Severity, Hospital stays, Socio demography of the victim, etc.)   (2)

Production cost ~ f (Socio demography of the victim,
            nature of the current disability/inability to work, etc.)   (3)

Property damage cost ~ f (Severity, number of properties/vehicles involved, etc.)   (4)

Administrative cost ~ f (Police time spent, Number of officers attend,
            time spent by insurance agents, etc.)   (5)

These relationships reflect how costs related to road accidents are distributed. These findings are a good addition to the existing literature and can effectively be used in budget allocations, economic analyses, implementing necessary precautions to minimize the costs, etc. Policymakers can use these predictions to allocate funds for road safety measures, emergency response services, and infrastructure improvements more effectively.

4. CONCLUSION

This study evaluates the impact of different road accidents on the economy of the country. This objective is approached by developing regression equations that show contribution of different cost components among four different types of accidents. Also, contributing factors for each cost component is analysed separately. Linear regression modeling framework is used to develop relationships. Based on the results, the magnitude of the total economic burden can be compared under different accident types. More importantly, findings allow decision makers to express any type of accident in equivalent property damage accidents based on the costs. Also, future circumstances can be predicted and effectively be used for planning activities and policy making.

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