

## Logistics Solutions, Supply Chains, Climate Change, and Sustainable Development in Somalia



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### ABSTRACT

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#### **Keywords:**

*logistics solutions, supply chains, climate change, sustainable development*

The aim of this study is to provide a critical analysis of the interplay and missing links between logistics solutions, supply chains during times of climate change, and the sustainable development of logistics firms in Mogadishu, Somalia. Descriptive survey and correlational research designs were utilized, targeting 57 logistics firms in Mogadishu, where a census method was applied. The respondents, who were the units of observation, were the supply chain managers from these firms. Information was gathered from primary sources using a questionnaire that underwent a validation process and a determination of reliability before being administered. The processing of the gathered information was guided by means and standard deviations, as well as regression analysis, and the presentation was made through tables and figures. The p-values for logistics solutions, supply chains, and climate change were all less than 0.05, indicating that the variables were significant. Thus, logistics solutions, supply chains, and climate change significantly predict the sustainable development of logistics firms in Mogadishu, Somalia. Supply chain managers working in logistics firms in Mogadishu should improve their logistics solutions and supply chains by adopting modern transportation vehicles to reduce energy consumption.

## 1. INTRODUCTION

### 1.1 Background to the study

This paper aims to provide a critical analysis of logistics solutions, supply chains in times of climate change, and the sustainable development of logistics firms in Mogadishu, Somalia. It addresses the link between these contemporary issues that have attracted significant scholarly debate. The concept of sustainable development is particularly important and strongly anchored in the global Sustainable Development Goals (SDGs) [1]. Within the supply chain context, logistics solutions describe a set of activities that control both the reverse and forward movement, as well as how goods are handled and stored between the points of origin and distribution. Various logistics solutions include warehousing, transportation, inventory management, importation and exportation, material handling, including packaging and order processing [2]. On the other hand, supply chains constitute a network that covers all individuals, business entities, technologies, and resources involved in creating and selling a product. It entails all activities from delivering material from suppliers to logistics firms to its final delivery to the end consumer [3]. Climate change is a sustained variation in weather and temperature patterns that can be either natural or human-induced. Sustainable development is progress that meets present needs without compromising the ability of future generations to meet their needs [4].

Logistics solutions and supply chains are interrelated components that allow a firm to access suppliers for the raw materials needed for daily operations [5]. Close interaction and

collaboration between the firm, its suppliers, and other parties within the supply chain can help promote eco-design and the production of environmentally friendly raw materials by suppliers, thus contributing to environmental protection as important aspects of sustainable development [6]. Some logistics solutions, like transportation, entail the emission of significant amounts of gases into the air, leading to air pollution. This can, in turn, have a negative effect on sustainable development [6]. Therefore, it can be asserted that achieving sustainable development without considering logistics solutions and supply chains is not feasible, hence the motivation for the present study.

Sustainability remains a challenge, especially for logistics firms, given that they release significant amounts of gases and other waste materials from their processes [7]. The daily operations of these firms have continually contributed to environmental pollution, thus raising sustainability concerns. However, this issue has not received considerable attention in both theory and practice. Existing studies have failed to address the root causes of sustainability issues and concerns among these firms. Somalia is a country quickly recovering from long periods of civil war, and the logistics sector has been identified as one of the key pillars of these recovery efforts. This has led to a significant increase in the number of logistics firms in Somalia, more so in Mogadishu, given its central location. This rapid increase in the number of logistics firms in Somalia has sparked a scholarly discourse on sustainability concerns, forming a strong motivation for the present study. Against this backdrop, the present study sought to establish the implications of logistics solutions and supply chains during times of climate change for the sustainable development of

### 1.2 Research objectives

The paper was guided by the following objectives:

(1) To establish the effect of logistics solutions and supply chains on sustainable development of logistic enterprises in Mogadishu, Somalia.

(2) To determine the effect of climate change on sustainable development of logistic enterprises in Mogadishu, Somalia.

### 1.3 Research hypotheses

The paper sought to test the following hypotheses:

H-01: logistics solutions and supply chains have no statistically significant effect on sustainable development of logistic firms in Mogadishu, Somalia.

H-02: climate change has no statistically significant effect on sustainable development of logistic firms in Mogadishu, Somalia.

## 2. LITERATURE REVIEW

### 2.1 Climate change, logistics solutions and supply chains

Climate change, in the context of this study, includes unpredictable natural hazards that expose supply chains to disruptive risks. Only a robust supply chain and logistics system can withstand such shocks occasioned by climate change. The wide variety of natural hazards includes floods, hurricanes, earthquakes, and droughts. When the weather is extreme, airfreight can be grounded, resulting in supply chain disruptions within an organization [8]. Similarly, climate change may have significant implications on the availability of raw materials due to disruptions that may arise from floods, hurricanes, or droughts. There are several strategies adopted to respond to supply chain disruptions caused by climate change, including the adoption of digitalization and localization of supply chain systems. Climate change causes extreme weather-related events that have negative effects on power grids, causing power outages. These power outages then negatively impact activities, such as maintaining schedules at the factory level and timely delivery [9].

### 2.2 Climate change and sustainable development

Logistics activities along supply chains result in pollution, which negatively affects sustainable development. Through the institutionalization of sustainable practices—for instance, collaborating with suppliers to reduce the emission of greenhouse gases—there can be improvements in supply chains. Supply chains bear both environmental and social responsibility to limit their effect on the general ecosystem [7]. Around the world, firms across various industries emphasize the need to institute relevant practices to ensure they operate sustainably to protect the environment. In the 2030 SDGs, climate change is recognized as one of the key challenges for countries to realize these goals. The rate at which greenhouse gases have accumulated in the atmosphere is at an alarming 33 per cent, posing a challenge in achieving the SDGs at the country level [10].

### 2.3 Logistics solutions and supply chains and sustainable development

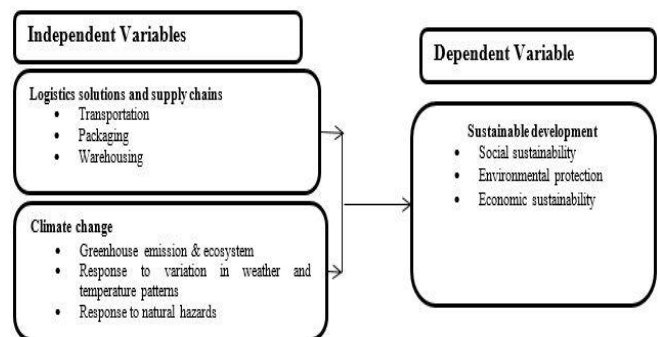
A focus on supply chains is vital to the overall efforts for social and environmental governance. This is because more than 90 percent of gas emissions at the firm level are attributable to an organization's supply chain systems [11]. Efforts are also being made in these countries to reduce risks and raise the level of innovation, thereby increasing their return on investing in sustainable supply chains [12]. To achieve sustainable development, companies should aim to address the legal, economic, social, and environmental concerns stemming from their supply chain activities and operations. The spillover effects that arise from a firm guided by sustainable development include the reduction of environmental impacts, improved continuity of supply, and protection of reputation [1].

### 2.4 Logistic solutions, supply chains, climate change and sustainable development

Centobelli et al. [6] noted that greenhouse gases and other emissions are not the only threat posed by logistics service providers, especially after transport services have been offered to customers by these firms. Jawaad and Zafar [5] indicated that green supply chain practices, like eco-design, play a significant role in sustainable development efforts. Ghadge et al. [13] demonstrated that extreme weather-related conditions drive climate change, which in turn affects transportation as a logistics solution, access to natural resources, and overall food production. There was a significant interplay between supply chains and climate change, where each of these variables was found to be influencing the other through gaseous emissions and natural disasters. Klimecka-Tatar et al. [14] noted that sustainable development had significant implications on transport management as an aspect of an organization's logistics solution.

### 2.5 Conceptual framework

This study indicates Logistics Solutions, Supply Chains, Climate Change, and Sustainable Development in Somalia. Based on the extensive literature review, this section illustrates the research framework as shown in Figure 1. The research framework has five variables which is logistics solutions and supply chain, climate change, and sustainable development.



**Figure 1.** Conceptual framework illustrates missing links between logistics solutions, supply chains, climate change and sustainable development

### 3. RESEARCH METHODOLOGY

#### 3.1 Research design

The study adopted descriptive survey and correlational research designs. While descriptive survey design provided a good opportunity for providing description of the study variables, correlational design helped in testing the cause effect relationship between the study variables. This helped in drawing informed inferences in the relationship between variables and the significance of the same.

#### 3.2 Target population

The study targeted 57 logistic firms in Mogadishu Somalia as the unit of analysis while the unit of observation who were also the participants in the study entailed the supply chain managers or their equivalents from these firms. This added to 57 respondents. Since the population was small and could be easily be accessed, census was adopted. According to Liamputtong [15], census is appropriate when population has fewer elements less than 200 which is as per the present study.

#### 3.3 Data collection

Information was obtained from primary sources gathered with the help of the questionnaire that was designed based on the literature reviewed and the existing scales.

#### 3.4 Validity and reliability of the questionnaire

Validation and determination of reliability of the questionnaire was done in advance before actual data gathering. Two experts in the field of logics and supply chains were engaged to review the contents of the questionnaire after which they shared their respective views that were incorporated in the final version of the study tool before proceeding to the field. For reliability, the questionnaire was pilot tested among staff working in non-logistic firms in Mogadishu and the responses were used to computed the values of Cronbach Apha with the threshold value being 0.7 and above as recommended [16].

#### 3.5 Data analysis

The analysis of the gathered information was done through SPSS version 24 guided by means and standard deviations, correlation as well as regression. Below are two regression models that were adopted during analysis of the evidence:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon \tag{1}$$

where, Y=sustainable development;  $\beta_0$ =Constant;  $\beta_1$  is the beta coefficients;  $\varepsilon$ =error term;  $X_1$ =logistics solutions and supply chains.

$$Y = \beta_0 + \beta_2 X_2 + \varepsilon \tag{2}$$

where, Y=sustainable development;  $\beta_0$ =Constant;  $\beta_2$  is the beta coefficient;  $\varepsilon$ =error term;  $X_2$ =climate change.

According to Dźwigoł [17], regression analysis is suitable for studies that entail determination of the effect of one variable to the other.

### 4. RESULTS AND DISCUSSION

#### 4.1 Response rate

The researcher administered 57 questionnaires to supply chain managers or their equivalents from logistic firms in Mogadishu out of which 41 were dully filled and collected. This translated to a response rate of 72% as demonstrated in Figure 2.

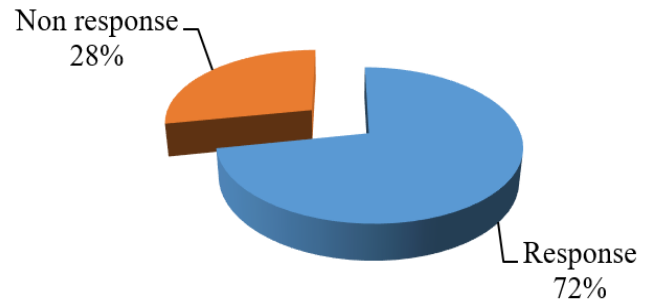


Figure2. Response rate

The response rate in Figure 2 agrees with Harris et al. [16] who observed that an above 70% response rate is good for supporting an analysis in a survey.

#### 4.2 Logistics solutions, supply chains and sustainable development

The first objective of the study was to determine the implication of logistic solutions, supply chains on sustainable development.

##### 4.2.1 Descriptive statistics on logistics solutions and supply chains

Table 1 gives a breakdown of results of descriptive statistics on logistics solutions and supply chains.

Table 1. Descriptive statistics on logistics solutions and supply chains

|  | Mean        | Std. Dev    |
|--|-------------|-------------|
| Your company has invested in modern transportation vehicles that consume less energy     | 2.98        | .764        |
| Recyclable materials are used during packaging of products in your company               | 3.02        | .768        |
| All wastes in the warehouse of your company is recycled                                  | 3.53        | .889        |
| All gaseous elements within supply chain systems are effectively managed in your company | 2.34        | .763        |
| <b>Average</b>   | <b>2.97</b> | <b>.796</b> |

Table 1 shows that there were challenges in logistics solutions and supply chains activities and operations of most logistic firms in Mogadishu that contributed towards sustainability concerns (M=2.97, SD=0.796). These issues included ineffective management of gaseous elements within supply chain systems (M=2.34, SD=0.763). The finding concurs with Mastos et al. [11] who observed that above 90 percent of gas emissions at firm level is attributable the supply chain systems of the organization. The other concern noted

about the logistic solutions and supply chains of these firms was and limited investment in modern transportation vehicles that could consume less energy (M=2.98, SD=0.764). The only area that the logistics solutions and supply chains of the logistic firms in Somalia were doing well include recycling of waste from their waste houses (M=3.53, SD=0.889).

#### 4.2.2 Regression results linking logistics solutions, supply chains and sustainable development

Regression analysis was adopted to analyze the link between logistics solutions, supply chains and sustainable development and the findings were determined and summarized as shown in Table 2.

**Table 2.** Regression results linking logistics solutions, supply chains and sustainable development

|   | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. |
|---|-----------------------------|------------|---------------------------|--------|------|
|   | B                           | Std. Error | Beta                      |        |      |
| (Constant)  | 7.549                       | 2.444      |                           | -3.090 | .002 |
| Logistics Solutions and Supply Chains   | .612                        | .185       | .802                      | 3.306  | .001 |
| <b>R=0.826    R<sup>2</sup>=0.682    Adj. R<sup>2</sup>=0.675    Std. Error of the Estimate=1.71701</b> |                             |            |                           |        |      |

Table 2 results into the following predicted model:

$$Y=7.549+0.612X_2+\epsilon \quad (3)$$

where, Y=Sustainable Development;  $\epsilon$ =error term; X1=Logistics Solutions & Supply Chains.

Table 2 indicates that 67.5% of variation in sustainable development of logistic firms in Mogadishu Somalia is explained by variation in their logistics solutions & supply chains. Taking the significance level as 5%, it became evident that logistics solutions and supply chains were direct and significant predictors of sustainable development of these firms ( $\beta=0.612$  &  $p<0.05$ ). This implies that an improvement in logistics solutions & supply chains of these firms would enhance their sustainable development. These findings agree with Awan et al. [1] who observed that in order to achieve sustainable development, efforts should be made by companies of addressing the legal, economic, social and environmental concerns from their supply chain activities and operations.

### 4.3 Climate change and sustainable development

#### 4.3.1 Descriptive statistics on climate change

Table 3 is a breakdown of results of descriptive statistics on climate change.

Table 3 indicate that majority of the logistic firms were effectively responding towards climate change (M=3.70, SD=0.803) so as to reduce supply chain disruptions (M=3.87, SD=0.0.872). This means that effective response to climate change can allow the firm to minimize its exposure or probability of supply chain disruption. These findings agree with Zimon et al. [8] who noted that when the weather is so extreme, airfreight can be grounded resulting into supply chain disruptions with the supply chain of an organization. Similarly, effective response towards climate change allowed the studied firms to attain supply chain resilience (M=3.65,

SD=0.763) among other numerous benefits. The operations of this company seek to protect the ecosystem (M=3.54, SD=0.975) and that there was effective response to greenhouse emission (M=3.53, SD=0.765).

**Table 3.** Descriptive statistics on climate change

|  | Mean        | Std. Dev     |
|--|-------------|--------------|
| Effective response towards natural hazards like floods has reduced supply chain disruptions in your company      | 3.87        | .872         |
| Proper response towards variation in weather patterns has allowed your company to attain supply chain resilience | 3.65        | .763         |
| The company has in place right strategies to respond towards variation in temperature patterns                   | 3.57        | .773         |
| There is effective response to greenhouse emission   | 3.53        | .765         |
| The operations of this company seek to protect the ecosystem   | 3.54        | .975         |
| <b>Average</b>   | <b>3.63</b> | <b>0.830</b> |

#### 4.3.2 Regression results linking climate change and sustainable development

Regression analysis was conducted to establish the effect of climate change on sustainable development and Table 4 is a breakdown of the findings.

**Table 4.** Regression results linking climate change and sustainable development

|   | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. |
|---|-----------------------------|------------|---------------------------|--------|------|
|   | B                           | Std. Error | Beta                      |        |      |
| (Constant)  | 6.623                       | 2.426      |                           | 2.730  | .007 |
| Climate Change  | .566                        | .041       | .740                      | 13.704 | .000 |
| <b>R=0.740    R<sup>2</sup>=0.548    Adj. R<sup>2</sup>=0.545    Std. Error of the Estimate=2.03303</b> |                             |            |                           |        |      |

The following is the predicted model from Table 4:

$$Y=6.623+0.566X_2+\epsilon \quad (4)$$

where, Y=Sustainable Development;  $\epsilon$ =error term; X2=Climate Change.

Thus, 54.5% change in sustainable development of logistic firms in Mogadishu Somalia is explained by climate change. Similarly, the study noted that climate change has positive and significant effect on sustainable development of these firms ( $\beta=0.566$  &  $p<0.05$ ). This implies that effective response towards climate change can allow a firm to achieve sustainable development. However, this finding disagrees with Toukabri et al. [10] who established that in the 2030 SDGs, climate change is recognized one the key challenges for countries to realize these goals.

### 4.4 Discussion

The key contribution of the findings from descriptive statistics is that the studied firms were facing challenges and concerns as far as their logistic and supply chain activities were concerned. These challenges entailed poor waste management practices that had negative spillover to the

environment. On climate change, the spillover effects from the same had been felt by the studied logistic firms. This means that climate change was one of the key environmental forces that affected operations of the studied logistic firms. Kahn et al. [4] regarded this climate change as a sustained variation in weather and temperature patterns that can be natural or human induced. Sustainable development is progress that achieves the present needs without straining the ability which future generations will attain their needs.

One key finding from this study is that logistics solutions & supply chains explained greater variation in sustainable development of the studied firms as compared to climate change. Surprisingly, all these variables were anticipated to have negative effect on sustainable development, the outcome indicated positive relationship. This means that not all logistic and supply chain activities as well as climate change activities had negative effect on environment as some helped to conserve the environment. The findings agree with Centobelli et al. [6] who noted that greenhouse gases and other emissions are not the threat posed by logistic service providers especially after transport services have been offered to customers by these firms. Jawaad and Zafar [5] established that green supply chain practices like eco-design play a significant role in sustainable development efforts. Ghadge et al. [13] demonstrated that extreme weather related conditions drive climate change that in turn affects transportation as a logistic solution, access to natural resources as well as overall food production.

## 5. CONCLUSION AND RECOMMENDATIONS

### 5.1 Conclusion

There were challenges in logistics solutions and supply chains activities and operations of most logistic firms in Mogadishu that contributed towards sustainability concerns. These issues included ineffective management of gaseous elements within supply chain systems and limited investment in modern transportation vehicles that could consume less energy. Over half percent variation in sustainable development of the logistic firms in Mogadishu was explained by their logistics solutions and supply chains. Most importantly, logistics solutions and supply chains play an instrumental role as far as sustainable development of the firm is concerned.

Effective response to climate change can allow the firm to minimize its exposure or probability of supply chain disruption and it can also allow an organization to attain supply chain resilience among other numerous benefits. Over half percent variation in sustainable development of the logistic firms in Mogadishu was seen to be explained by climate change. The study concludes that logistic solutions, supply chain and climate change are key enablers of sustainable development of the firm. More importantly, logistic solutions and supply chains explain a greater variation in sustainable development as compared to climate change.

### 5.2 Recommendations

(1) The supply chain managers working in logistic firms in Mogadishu Somalia should improve their logistics solutions and supply chains through adoption of modern transportation vehicles that could reduce the amount of energy consumed.

(2) More improved supply chain strategies like eco-design should be adopted by logistic firms in Mogadishu in response to climate change for sustainable development.

(3) Green transportation and warehousing practices should be implemented by logistic and supply chain managers working with logistic firms in Mogadishu Somalia.

(4) All wastes including gases from logistic processes of these firms should be managed effectively to avoid environmental pollution.

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