

Supply Chain Disruptions Propagation Caused by Criminal Acts

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ABSTRACT

To understand disruptions and their propagation along the supply chains is becoming critical for designing competitive global supply chains operating in emerging economies. It leads to economic damages to every organization involved in a supply chain, but it also decreases national logistics competitiveness. This research provides numerical elements in terms of significance of the security issue in Latin America, and at the same time, proposes a system dynamics assessment model based on real-life information, able to establish analysis scenarios in order to measure the impacts derived of supply chain disruptions propagation caused by criminal acts. Finally, useful conclusions for designing more resilient supply chains and future research are exposed.

Keywords: supply chain, disruption propagation, system dynamics, risk management, emerging markets.

RESUMEN

Entender las interrupciones y su propagación a lo largo de las cadenas de suministro se ha vuelto crítico para el diseño de cadenas de suministro globales operando en economías emergentes. Esto no solo implican pérdidas económicas a cualquier organización involucrada en una cadena de suministro, sino que además disminuye la competitividad logística nacional. Este trabajo provee elementos numéricos de la importancia de la seguridad en América Latina y al mismo tiempo, propone un modelo de evaluación desde la metodología de dinámica de sistemas con base en información real, capaz de establecer escenarios para medir los impactos relacionados de la propagación de interrupciones en la cadena de suministro causados por actos criminales. Finalmente, se presentan conclusiones para el diseño de cadenas de suministro más resilientes, así como propuestas de investigación futura.

1. Introduction

To develop timely efficient flow of legitimate goods while reducing its vulnerability to disruptions is one of the main goals of the most important export-oriented economies. However, security is a critical issue for designing supply chains process. Particularly in emerging countries, supply chain performance has become a significant issue, which has been analyzed by several authors [1, 2]. In fact, due to the potentially damaging social and economic effects of supply chain disruptions caused by criminal acts, security is compromising the competitiveness of certain nations in Latin

America (LatAm) [3]. Hence, the security risk has pernicious effects on the economy, decreasing competitiveness, national and foreign investment, as well as employment and productivity by making consumer products more expensive due to the extra costs involved.

According to Perez-Salas [3] as well as Bueno-Solano and Cedillo-Campos [4], disruptions in supply chains have enormous economic consequences not only by its direct damages, but also by the propagation effect to the rest of the

supply chain. In fact, it reduces logistics reliability, which, results in long lead times and stimulates larger safety stocks, among other factors decreasing national logistics competitiveness [5].

Although thefts have always been a risk in the transportation sector, globalization and the prevalent paradigm looking for designing integrated, faster and cost-efficient supply chains, have provided an operational environment susceptible to disturbances that can rapidly escalate from localized events to major disruptions [6].

Several authors [4, 7, 8, 9, 10, 11, 12] agree that there is no evidence in the literature of quantitative models to dynamically compute the propagation effect of disruptive phenomena at multiple stages of the supply chain. The aim of this article is to propose a system dynamics model based on real-life information, able to establish analysis scenarios in order to measure the impact regarding cost and service level in global supply chains, as a result of the disruptive propagation effect caused by criminal acts. Thus, from a global perspective of risk, our results provide information about the propagation of risks and costs, which can be used by decision makers during the proactive planning process.

The rest of the document is organized as follows. Section 2 presents a general background of risk factors that currently threaten global supply chains as well as an analysis of LatAm current status in terms of security. Section 3 describes the model developed, based on real-life information. In Section 4, the results obtained through the simulation of different policies and decision scenarios will be discussed. Finally, Section 5 presents conclusions and future research.

2. Background

In addition to direct losses from crimes, costs related to the incidents (attorney fees, delays in collecting insurance, etc.), as well as significant national productivity losses end up making exports and imports more expensive. Simultaneously, the image of the country is also seriously damaged by crime, which discourages new domestic investment and makes the country less attractive to foreign investors.

Thus, mitigation of supply chain disruptions caused by criminal acts requires a coordinated approach between the public and the private sector. Since supply chain disruptions directly impact the competitiveness of an economy, governments are responsible for providing the infrastructure and services needed to ensure an acceptable level of security as well as guaranteeing the proper functioning of transport infrastructure services (safety) under normal conditions as well as during disruptive events. On the other hand, companies are responsible for implementing internal security procedures to mitigate risk [3].

As several authors argue [3, 6, 13, 14,], LatAm countries with better security performance are also more competitive. In this sense, inside the upper left of figure 1, are located seven of the ten most competitive countries in the region where the frequency of crime and violence against firms is low (Barbados, Brazil, Chile, Costa Rica, Peru, Panama, Uruguay). Inside the upper right quadrant, there is a group of countries within good level of competitiveness at a regional level, but their low performance in terms of security reduce their potential competitiveness (Colombia, Guatemala, Mexico, Trinidad and Tobago). The lower left quadrant show countries with relative good competitiveness and satisfactory level of security (Argentina, Bolivia, Guyana, Nicaragua, Paraguay, Surinam). However in this group are located some countries where there is no reliable statistical data of cargo theft. Finally, inside the lower right quadrant are the nations with a competitive performance below the regional average and where the cost of crime and violence is lower than the regional average (Ecuador, Haiti Honduras, Jamaica, El Salvador, Venezuela).

Since supply chain disruption propagation is multidimensional, decision-makers do not count with a clear view on how to face and deal with disruptions [4, 15]. According to Sodhi et al. and Waters [11, 12], the fundamental basis of complexity when analyzing risk propagation is due to the fact that it can manifest itself in many different ways, virtually affecting any link along the supply chain. This is also identified by Wu et al. [7], who highlight the understanding of risk propagation in the supply chain as prerequisite for an effective integration of supply chains.

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