

Proceedings of the 1st Annual World Conference  
of the Society for Industrial and Systems Engineering,  
Washington, D.C, USA  
September 16-18, 2012

## **The Propagation Effects Of Disruptions Produced By Natural Disasters On Global Supply Chains Performance: A System Dynamics Approach**

**Alfredo Bueno<sup>1</sup> and Miguel G. Cedillo<sup>2</sup>**

<sup>1</sup> Department of Industrial Engineering and Manufacturing Science,  
COMIMSA (National Council of Science and Technology),  
Ciencia Y Tecnologia No. 790,  
Saltillo, CP 25290, Coahuila, México.

<sup>2</sup> Department of Logistics and Supply Chain Management,  
School of Mechanical and Electrical Engineering,  
Autonomous University of Nuevo Leon, Av.  
Universidad s/n. Ciudad Universitaria, C.P. 66451,  
San Nicolás de los Garza, Nuevo León, México.

Corresponding author's E-mail: [Alfredo.Bueno@comimsa.com](mailto:Alfredo.Bueno@comimsa.com)

**Abstract:** Understanding the security disruptions and how their effects propagate through the supply chain is critical to design a resilient supply chain. This research demonstrates that system dynamics is a powerful tool to simulate and understand the effects of simultaneous propagation of disruptions phenomena in export supply chains (ESC). It also evaluates the disruptive effect of the ESC borders operating under the just-in-time system. The research evaluates different scenarios and shows that the impact on inventory levels in the chain can increase 625% compared to normal operating conditions. Furthermore, it reveals that in the worst case the economic impact of the disruptions can be increased up to 490%. Finally, as a result of the phenomenon of propagation of the disruptive effect, it can be said that although the integrated supply chains are fast and cost-efficient, they are also susceptible to shocks that can rapidly escalate from localized events into broader disruptions. Finally, we discuss useful conclusions for both for academics and decision-makers.

**Keywords:** Supply Chain Risk; Natural Disaster; Propagation of Disruption; Cross border Effect, System dynamics, Transportation.