Examining the Relationship between Topology and Performance of Supply Networks in the Presence of Random and Targeted Disruptions

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In this study we examine the relationship between supply network's topology and its robustness, responsiveness and dynamism in the presence of random and targeted attacks. The investigation uses the theoretical and modeling framework proposed in Sterman (1988) as the basis for examining adaptive behavior in an inventory management decision context. The linear supply chain in Sterman (1988) is extended to form supply networks that have distinct topological characteristics. Specifically, the two dominant topological paradigms of random networks and scale-free networks are considered to form supply networks. The robustness, responsiveness and dynamism of these networks are examined by considering random node failures and targeted attacks on nodes. The study considers supply chain performance measures, such as inventory levels and cost, as well as network performance measures, such as characteristic path length, size and length of largest connected component, maximum distance in the largest connected component and clustering coefficients. Based on the findings of these computational experiments we develop several research propositions that would potentially enable further theory development of complex adaptive supply networks.

Keywords: Supply Networks, Topology, Disruptions, Agent Based Models, Complex Adaptive Systems, Theory Development

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