

Accepted Manuscript

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Zeinab Sazvar, Mina Rahmani, Kannan Govindan



PII: S0959-6526(18)31145-4

DOI: [10.1016/j.jclepro.2018.04.118](https://doi.org/10.1016/j.jclepro.2018.04.118)

Reference: JCLP 12699

To appear in: *Journal of Cleaner Production*

Received Date: 27 September 2017

Revised Date: 10 April 2018

Accepted Date: 12 April 2018

Please cite this article as: Sazvar Z, Rahmani M, Govindan K, A sustainable supply chain for organic, conventional agro-food products: The role of demand substitution, climate change and public health, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.04.118.

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A Sustainable Supply Chain for Organic, Conventional Agro-food products: the role of Demand Substitution, Climate Change and Public Health

Zeinab Sazvar^{1a}, Mina Rahmani¹, Kannan Govindan^{2ab}

¹Industrial Engineering Department, College of Engineering, University of Tehran, Tehran, Iran

²Center for Sustainable Supply Chain Engineering, Department of Technology and Innovation, University of Southern Denmark, Denmark

Abstract

In today's marketplace, conventional agricultural products are produced all around the world due to economic reasons. However, recent environmental challenges such as global warming and climate change has strongly been affected by the high volumes of chemical pesticides and fertilizers used to produce these products. Several published reports have indicated the negative effects of the chemicals used in conventional agriculture as well as the effect of climate change on human health.

The aim of this study is to develop and analyze a multi-objective linear mathematical model for a sustainable supply chain with an agro-food deteriorating product. The product is produced by two different methods, both by organic and conventional means. In this way, we attempt to create a balance between the production and consumption of conventional and organic products in order to achieve three objectives: reducing costs, reducing environmental degradation, and increasing levels of consumer health. Partial backorder for each product, as well as conventional demand substitution by organic products, are taken into account. In order to assess the impact of supply chain operations on public health, we define a new function based on each product's production and consumption amounts as well as the amount of wastes. The developed model is solved by augmented ϵ -constraint method. Numerical results indicate the important role of supply chain's managers in the formation of sustainable health production and consumption patterns.

Keywords: Sustainable Supply Chains, Organic and Conventional Agricultural Products, Partial Backorder, Substitution, Deterioration, Climate change.

1 Introduction

Reports of the NASA's Goddard Institute for Space Studies (GISS) show that the average temperature of the Earth has increased approximately 0.8 Celsius degrees from 1880 to 2015 (India Water Portal). In addition to the natural consequences of this increase, such as the melting of glaciers, the World Health Organization (WHO) reports that climatic changes over recent decades have probably already affected some health outcomes. This organization

^a Corresponding author (kgov@iti.sdu.dk)

^b The author order is based on the second author's PhD requirement.

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