

Interaction between Climatic Extremes and Vegetable Supply Chain Performance: Conceptualizing a Pre-Preparedness Mechanism

I.J.A. Ruhunuge ^{1,2*}, A.W. Wijeratne ³, M. Esham ³, S.P. Fernando², I.V. Kuruppu ⁴

¹ *Faculty of Graduate Studies, Sabaragamuwa University, Belihuloya, Sri Lanka*

² *Data Management Division, Hector Kobbekaduwa Agrarian Research and Training Institute, Colombo, Sri Lanka*

³, *Faculty of Agricultural Sciences, Sabaragamuwa University, Belihuloya, Sri Lanka*

⁴ *Faculty of Agriculture and Plantation Management, Wayamba University, Sri Lanka*

* *isuriruhunuge999@gmail.com*

Developing a comprehensive understanding of the direct impacts of climate change and the cascading impacts of climate variability is essential for examining the influence on vegetable supply chain performances. However, there is a lack of well-established methodology for capturing the complex interaction between climate extremes and vegetable supply chain performances in Sri Lanka. Hence the objective of this study was to develop a conceptualized model to capture this complex interaction in the vegetable supply chain. The field data collection was designed as a focus group discussion that consisted of 65 vegetable farmers and 10 wholesalers in Nuwara Eliya which was conducted in November 2023. This conceptualized approach had three main phases; including (1) Developing a graphical interpretation between climatic extremes and vegetable supply chain performances (Cognitive mapping), (2) A field data collection to identify variables involved in climatic extremes and vegetable supply chain performances, (3) Assessing the conceptualized dynamic model using multiple case scenario technique. It was observed that temperature and rainfall extremes directly affected different performance dimensions of the vegetable supply chain, especially production, and logistics. More than 90% of the sampled vegetable farmers and 83 % of wholesalers stated that climate change was a significant risk for their supply chain nodes. The findings showed a significant decline in the availability of raw materials, which increased the risk of stock-outs. The common scientific basis of these three methods is the systematic identification, analysis, and modeling of the relationships and impacts of climatic extremes on vegetable supply chain performances to understand and predict system behaviors. Hence this suggested model mainly disclosed two different cost categories influenced by climate change: production costs due to resource scarcity and logistic costs. This conceptualized interaction between climate extremes and supply chain performances can be utilized as a baseline study to develop a pre-preparedness mechanism in the vegetable sector.

Keywords: Climatic extremes, Cognitive mapping, Dynamic model, Supply chain

The authors gratefully acknowledged officers and field workers of the Provincial Department of Agriculture Seetha Eliya, who shared their experiences and field data with us.