

TACKLING POST-HARVEST WASTE: MAPPING BARRIERS TO SUSTAINABLE AGRI-FOOD SUPPLY CHAINS IN DEVELOPING ECONOMIES

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ABSTRACT – Post harvest waste (PHW) is a significant threat to the sustainable agri food supply chains. It can be occurred in different stages but in developing countries food waste is basically occurred early stages of the supply chain. The purpose of this study is to identify the barriers for sustainable logistics network of vegetable supply chains (VSC) in developing economy perspective by examine the Sri Lankan VSC and develop the interrelationship between them. 12 barriers were identified and derived the connections among barriers under 6 levels using the Interpretive Structural Modelling (ISM) method. Barriers are clustered into four categories according to their driving and dependent power through the MICMAC analysis. Both analyses are verified that technological issues, lack of communication platform and lack of trained personnel in VSC are root causes for the unsustainability of the logistics network in VSC in developing economies.

Keywords: Vegetable supply chain; Sustainability; Logistics network; Developing economies; Interpretive Structural Modelling

1. INTRODUCTION

The global population is rapidly growing, and it is expected to reach 9.8 billion in 2050 [1]. As a result, 70% of expansion in global food production is anticipated to fulfill the world's food demand [1]. But one- third of the global food production which is produced to world's consumption is lost annually [2]. PHW has basically occurred in the initial stages of the supply chain including manufacturing, handling, storage, processing, packing, and transportation in developing countries, whereas in developed countries, it occurs during the consumption stage [3]. In Sri Lanka, 30–40% of total agri production is lost as postharvest waste, with inefficiencies in the distribution and transportation processes accounting for 48% of this total. The agriculture economy of Sri Lanka suffers losses of about 20 billion per year due to poor transport systems. About 75% of PHW in Sri Lanka are caused by improper packaging techniques as overpacking and tight packing. It emphasis that almost half of the agri production is wasted during the logistics operations [4]. Existing literature has identified the barriers for sustainable fresh VSC by representing the perspective of the developed economies where the retailers are the leading role of the agri food supply chain. But different countries have different market channels for agri food supply chain and consist with the supply chain dynamics. It derives the significance of analyzing the barriers for sustainable fresh agri produce supply chain in different economies [5]. This study is conducted to fill this gap by identifying the barriers for sustainable logistics network of VSC in developing economies considering the Sri Lankan VSC.

2. MATERIALS AND METHODS

Existing literatures are referred to identify the barriers for sustainable logistics network of VSC in developing economies. 28 research papers are selected after screening process using inclusion and exclusion factors. Studies focused on perishable foods, agri foods, vegetables or both vegetables and

fruits supply chains within developing economies are included while studies concerning developed economies, fish and fresh flower supply chains and studies not aligning with the research objectives are excluded from the pool of literatures. 12 barriers are identified from screening the existing literatures. Interpretive Structural Modelling (ISM) along with the MICMAC analysis is used to develop the framework as it is a well-structured multi criteria decision making method [6]. Contextual relationships between barriers are gained through the 28 experts' judgments. It is commenced from the 17 key stakeholders in the VSC including farmers, wholesalers/ retailers, transport service providers and the management of Dedicated Economic Centers, and the 11 academics related personnels in this domain. Based on that, Structural Self-interaction matrix (SSIM) is derived. Reachability Matrix (RM) is obtained from SSIM. Final Reachability Matrix (FRM) is derived by checking the transitivity links. Barriers are clustered into 4 categories in the MICMAC analysis with respect to their dependence and driving power [7].

3. RESULTS AND DISCUSSION

As the results of ISM model in Figure 1, Technological issues (B11), Lack of communication platform (B9) and Lack of trained personnel in the vegetable supply chain (B8) are found as the major barriers for the unsustainability of logistics network in the VSC in the context of developing economies. These barriers are root causes to drive the other barriers and it is aligned with the earlier studies' results [7].

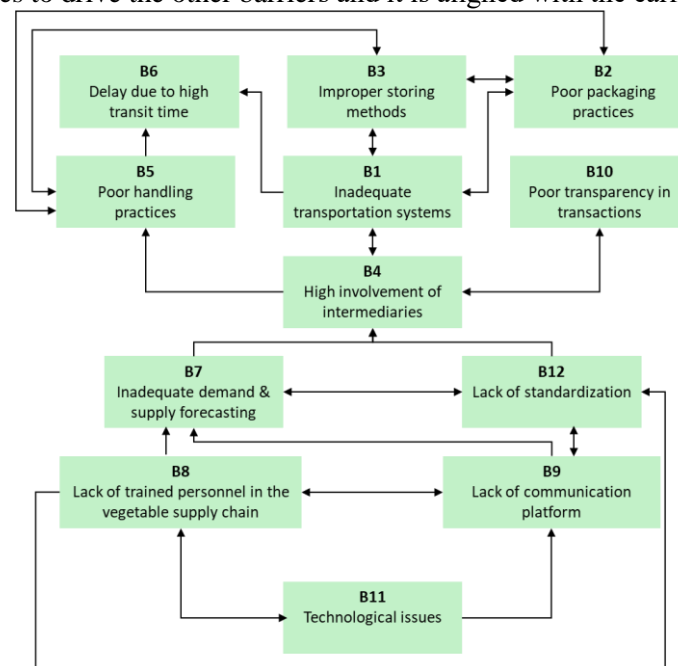


Figure 1. ISM Model

As the MICMAC analysis in Figure 2, all the barriers are clustered into 4 clusters based on their driving and dependence power. Barriers which have less driving and dependence power are categorized as autonomous barriers. There are not any barriers which are categorized as autonomous factors, and it is similar to the results of [7]. It implies that there are not any barriers which have less impact and are easily solved in the logistics network of VSC in developing economy perspective. Poor packaging practices (B2), Improper storing methods (B3), Poor handling practices (B5), Delay due to high transit time (B6) and Poor transparency in transactions (B10) are clustered as the dependent barriers as they have high dependence and less driving power. These barriers are dependent on the other drivers in the system and vulnerable to quick changes within the VSC. Inadequate transportation system (B1), High involvement of intermediaries (B4), Inadequate demand and supply forecasting (B7), and Lack of standardization (B12) come under the linkage cluster as they have both high dependence power and driving power. It means that these barriers impact themselves as well as the other barriers. Lack of

trained personnel in the vegetable supply chain (B8), Lack of communication platform (B9) and Technological issues (B11) are categorized as independent factors which have weak dependence power and strong driving power. These independent drivers can influence the other factors in the logistics network of the VSC.

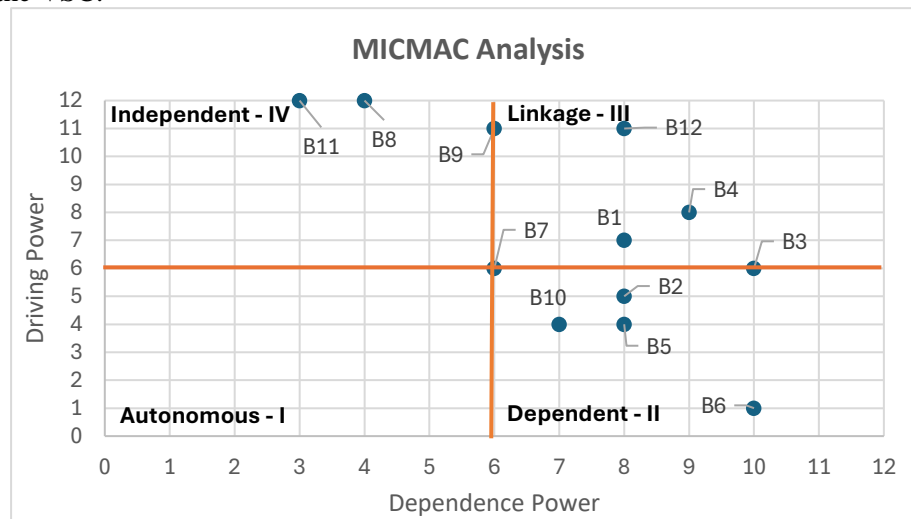


Figure 2. MICMAC Analysis

The interrelationships between the identified barriers according to the ISM model are affected to the environmental, economic and social aspects of the VSC and it leads to create unsustainable VSC.

4. CONCLUSION

This study explores the barriers for sustainable logistics network of VSC in developing economies by examining the Sri Lankan VSC and derives the interrelationships between them. Future studies can statistically validate the findings using an appropriate method and evaluate the dynamic behavior of these barriers relating to different commodities and the entire agri food supply chain.

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