ABSTRACT

Agro-industry is a value-adding business sector that adds value to agricultural product through transformation, preservation, and preparation for intermediate and final consumption. Several activities over agro-industrial supply chain can enhance profitability of various enablers like farmers, wholesalers, transporters, manufacturers, distributors, retailers, customers. Quality issues and uncertainty plays an important role in the success or failure of Agro Industrial Supply Chain. Moreover, decisions made decision to achieve supply chain profitability in agro-industry always deals with vague, ambiguous, and imperfect information throughout different enabler in supply chain.

In agro based countries like India and Thailand, agro –industrial supply chain are functioning in unorganised manner where in decision makers deal with vague and ambiguous information. Decisions are not made in an integrated way by considering all the parties in order to maximise the value generated which in turn affects the supply chain profitability.

This research was based on two case studies: Banana in India and Bamboo Shoot in Thailand. This study deals with uncertainties and imperfect
information to meet the appropriate strategies and achieve sustainable supply chain profit in agro-industrial supply chains.

This research work commenced with interviews and discussions with banana growers, traders, commission agent, wholesalers, faculty members and researchers involved in banana supply chain. Risk issues and risk factors were obtained through interviews and discussions. Twelve screened elementary factors obtained through interviews and discussions were used to develop Causal Loop Diagram (CLD) a tool from systems dynamics (SD). Fuzzy Delphi Method (FDM) was used to quantify the fuzzy to crisp values before evaluating them through AHP and to obtain value of elementary risk factors.

Analytic Hierarchy Process (AHP) was applied for selection of the most appropriate post-harvest technology alternative. Six possible post-harvest technological alternatives are pairwise compared with Nine evaluating criteria that influence the post-harvest technology selection. Availability of products and comparable products is identified as the most important criteria with the weightage of 0.1485 and the modified atmosphere packing technology was the highly recommended post harvest technology for Banana with the priority value of 0.234.

Dynamic Programming (DP) was used to find the optimal post harvest handling route of supply chain considering quality attributes.
Multistage fuzzy goal programming (MFGP) approach was employed to deal with uncertainty in price, quality attribute, and operation cost of post harvest technological action in order achieve the maximum profit and the most reasonable risk in profit loss.

For Bamboo Shoot supply chain in Thailand, data were collected through interviews and discussions with the stakeholders. Fuzzy Delphi Method (FDM) was used to obtain values from elementary risk factors (operation cost, delivery time, price, carrying cost, etc.) In short term, risk with respect to different enabler in the chain can result in different values. Fuzzy Inference System (FIS) was applied to quantify sustainable risk value that contributes to risk at each and every stage of entire supply chain. It was found that the sustainable risk was the highest due to chemical hazard risk. Hence, selection of post-harvest treatment method in order to mitigate this risk was determined using Analytic Hierarchy Process (AHP). The Food safety was identified as the most needed criteria with the weightage value of 0.536 and the blanching was recognized as the highly preferred Post harvest handling technology with the priority value of 0.403.

System Dynamics (SD) approach was used to construct and simulate bamboo shoot supply chain in order to get higher profit for bamboo shoot growers. Four different policies (I, II, III, and IV) were tested through the system dynamics model to assess the total cost and profit obtained from the
system. The ANOVA was performed to identify the significant factors and compared those results with the optimal result obtained through Response Surface Method. On comparison, Policy III (Irrigation capital investment at high level, fertilizing capital investment at average level, and pre-harvest treatment capital investment at low level) was found to be closer to the optimal results achieved by response surface method. Hence, Policy III is recommended to mitigate risk in Bamboo shoot supply chain.