Abstract

Agricultural systems worldwide need to adopt sustainable cropping solutions to address existing issues of malnutrition, food insecurity, resource depletion, and lifestyle health issues. Millets offer one such solution as they have nutritional, environmental, and economic superiority over the most common staple grains in India, namely rice and wheat. Millets are gaining popularity among the masses as a healthy alternative to rice and wheat. Hence, it is important to strengthen the value chain by solving the existing issues to enable large-scale adoption. Since the issues involve different segments of the value chain, it is essential to adopt an integrated approach to resolve these issues. This thesis analyses and improves the millet value chain using operations research and statistical modeling techniques. The work focuses on assessing the scope of convergence in millet promotion, formulating demand-creation strategies, and developing a framework for millet promotion.

Firstly, this thesis analyses the scope of convergence in millet promotion. Several policies and initiatives have been implemented in the past few decades to promote millets in India. Evaluating the policy effectiveness, assessing internal disparities, and promoting balanced development are necessary to meet the future demand. The thesis analyses the convergence of different regions utilising the well-established techniques of convergence assessment. The research methodology is based on policy mapping to shortlist the most focused value chain component, identification of the key economic indicator, and the application of convergence assessment methods to evaluate the identified indicators. Based on the policy mapping, a convergence assessment is undertaken for millet production. The convergence across different states and districts within major producing states is assessed using agricultural yields. At the state level, the findings indicate an absence of overall convergence, large divergent clubs, and small convergence clubs. The lack of convergence underscores the need to clearly define targets and timelines in policy formulation. At the district level, the findings indicate relatively better performance, indicating diffusion of knowledge and best practices.

Secondly, this thesis identifies consumption as one of the least researched components of the value chain in policy mapping. Hence, this thesis subsequently develops targeted marketing and communication strategies to increase millet consumption. This work is based on a stated-preference analysis conducted to explore the possibility of enhancing consumption by mitigating barriers to consumption. This research utilises non-parametric tests to identify targeted demographic factor-specific strategies. The major results of this analysis indicate that

ensuring the availability of millet-based products, providing cooking recipes, targeted awareness initiatives, and improved shelf life have the potential to increase overall consumption. The work presents market-size estimates for each strategy and provides implementable recommendations for industry players and the government.

The subsequent work assesses the scope of subscriptions as a demand creation strategy for millets. Subscriptions are envisaged to enable consumers to directly connect with millet producers and retailers, thereby removing several barriers to millet consumption. This thesis assesses consumer perceptions of subscription to millet-based products and their willingness to subscribe. Through the amalgamation of three consumer behaviour theories, namely, the Extended Theory of Planned Behaviour, Perceived Risk Theory, and Theory of Consumption Values, the work assesses the consumers' willingness to subscribe to the millet-based products. The work employs binary logistic regression to assess demographic factors and structural equation modelling to assess motives and barriers influencing consumers' willingness to subscribe. Finally, a Consumer Trait Matrix is developed that can be utilised by industry players to devise their marketing and communication strategies for millet promotion. The findings of this work show that nearly 59% of the respondents are willing to subscribe. The higher the frequency of millet consumption, the higher the willingness. In terms of motives and barriers, "attitude towards millets", "subscription attitude", and "past behaviour" positively influence willingness to subscribe. In addition, "consumption motives" and "consumption barriers" significantly influence the "past behaviour" of consumers. This work contributes to advancing the research by assessing subscriptions as a strategy to promote millet consumption.

Consumers' subscription willingness suggests the potential of subscription as a demand-creation strategy. However, food product subscriptions are driven by strong subscriber perception and challenged by severe logistical complexities. They involve several trade-offs, including subscriber acquisition versus retention, profit margins versus subscriber acquisition, and ordering versus inventory decisions. Consequently, this thesis presents a framework for optimal planning for a millet-based product subscription business. The framework employs an operations research-based prescriptive analytics approach to initially identify the preferred box options through conjoint analysis and subsequently determine the box prices, inventory levels, and ordering quantities using a linear programming model. The demand incorporates probabilistic distributions to represent periodic churn rate and acquisitions. The framework incorporates sensitivity analyses of subscriber count, price, and cost parameters, as these are crucial for developing marketing strategies and undertaking contract negotiations.

Finally, this thesis offers strategic recommendations to the national and state-level millet missions for consideration by the Government of India and industry players.

Keywords: Millets, Sustainability, Value Chain, Convergence Assessment, Consumer Perception, Stated Preference, Motives and Barriers, Subscription, Pricing, Marketing Strategy, Optimisation