ABSTRACT

Increasing population, urbanization, and industrialization across the world las led to an increase in social inequity, poor dietary habits, increased shortage in global food shortage. These factors have severely impacted the health of citizens of most countries. Most of the economies across the world face the threat of "triple burden of malnutrition" i.e., undernutrition, micronutrient deficiency, and overweight and obesity. Thus, the need for safe and nutritious food across all segments of society has emerged and an opportunity for nutraceuticals to reduce the challenges posed by the "triple burden of malnutrition". Malnutrition impacts economic and social development around the world especially in developing countries like India. Therefore, few of the high priority United Nations Sustainable Development Goals (UNSDG-2030) target these issues i.e. Zero Hunger (Goal 2), and Good Health and Well Being (Goal 3). Various studies in this thesis try to understand the challenges associated with this nutraceutical industry and suggest policy recommendations to better manage some of the pressing needs from the triple burden of malnutrition.

This study has been structured across six chapters of the thesis. The first chapter presents the introduction to the thesis highlighting the motivation for study, insights about the nutraceutical industry and its relationship to UNSDG-2030, and finally indicates the objective of the thesis. In the second chapter of the thesis, a content analysis methodology was used to collate 138 articles related to management disciplines in the Nutraceutical Industry. This study understood the growth of articles across geography, time, methodologies, theories used, and management issues with an emphasis on operations management, sustainability studies discussed. It is observed that most of the managerial studies have been done in the Non-GHI countries as compared to (Global Hunger Index) GHI countries like India. India contributes one-third of the malnourished population in the world. The lack of mathematical models to deal with challenges in GHI countries from a sustainability perspective was also highlighted. Further, the consumer behavior perspective is imperative for nutraceutical adaptation among consumers illustrated in Chapter 3. The study proposes a conceptual framework for consumer adoption of nutraceuticals with the aid of theoretical lenses, i.e. the health belief model and the theory of planned behavior.

Following that, the crucial proposition was made in order to better understand consumer behaviour in relation to functional foods/nutraceuticals. Consumers with a high locus of control and a high propensity to buy nutraceuticals were found to be more likely to adopt nutritious diets.

In Chapter 4 an attempt was made to improve the malnutrition status of Indian malnourished children. Despite India being considered as a land of agricultural resources with top producers of important crops, still it has one-third of the world's malnourished children. In addition, India has the highest mortality rate of female children compared to male children under the age of five in the world. The study in this chapter proposes a linear mathematical (with single objective as well as multi-objective perspectives) model for Sustainable Nutraceutical Supply Chain (NSC). The study intends to improve the extreme malnutrition scenario by considering economic, environmental, and social aspects. The analysis demonstrated the interventions of global and local manufacturers of Plumpy Nut (WHO recommended nutraceutical product) to feed malnourished children under the age of five. The model incorporated the parametric value retrieved from secondary sources. The findings were also validated through personal interviews with top executives. In this regard, the findings demonstrated that localization can reduce the cost to 40% as well as decrease greenhouse gas emissions by 95% (approximately). Aforementioned, localization might help in the reduction of the GHI score of India.

Chapter 5 explored the role of Sustainable Innovation (SI) in providing Plumpy Nut to the malnourished under-privileged sections of society. SI promotes new formulations to the conventional Plumpy Nut. Pulses such as chickpeas, mung beans, pigeon pea may reduce fertilizers, pesticides, water use, and other farm inputs less than the conventional (groundnut) ones. Hence, it might reduce the seasonality/perishability of agricultural materials, low cost, improved food quality, and food security. Consequently, this study used a linear mathematical modelling approach (focusing primarily on the conflicting multi-objective scenario) to reconsider the existing sustainable nutraceutical supply chain with a nutrient poor, high environmental footprint, high cost sourcing option into a nutrient dense, low environmental footprint, low cost nutraceutical sourcing of a portfolio mix of products to meet demand from malnourished children in a region. It recommends the locally available

plant-based resources for the product portfolio to substitute the conventionally used product. Hence, both studies (Chapter 4-5) intend to provide desired nutrition to the malnourished children in developing (as well as under-developed) countries. These studies are a positive step towards attaining the goals of Zero Hunger (SDG 2), Good Health and Well Being (Goal 3) through adopting Responsible Consumption and Production (SDG 12) practices.

Finally, Chapter 6 presents major findings, limitations, theoretical contributions, and future research directions. This research work presents significant policy recommendations to the government, manufacturers, farmers, future researchers. Future research work should focus on investigating the effect of localization and sustainable innovation in the dynamic environment from a sustainability perspective.