4.4 contribution of tunnel farming to income and Livelihood improvement

The findings show that vegetable farming under plastic tunnels has become an important source of cash income in households of Meghang Rural Municipality. The income is carefully utilized by farmers in different aspect of daily life such as food, education, healthcare, savings and reinvestment in agriculture outputs. This shows that, tunnel farming not only generates farm income but also strengthened different dimensions of rural Livelihood by improving household income and financial stability.

These findings are consistent with a recent study in Nepal. Kc et al. (2021) reported that the adoption of tunnel technology increased production opportunities, with higher farm income and employment and improved livelihoods. Similarly, Subedi et al. (2023) reported that protected vegetable farming was economically profitable with better financial returns compared to conventional production systems, although profitability depends on production cost, crop choices, market access and farm management. Likewise, Sapkota et al. (2022) reported that farmers viewed protected vegetable farming as a viable method for boosting household income and enhancing economic stability, despite challenges related to input costs and marketing.

However, the current study relies on a cross-sectional survey and descriptive analysis. Thus, the observed results related to livelihood should be seen as association rather than direct causal relationship with tunnel farming. Further research should be done including longitudinal data, before and after comparison, and economic evaluations to provide stronger evidence of long term contribution of protected farming in livelihood improvement. Finally, having easy access to quality inputs, urban markets, and technical knowledge and extension support will bring more profit to business and a happier livelihood to rural peoples.

4.5 Market dependency, institutional support and policy implications

In Meghang Rural Municipality, farmers relied on middlemen and cooperatives to market their vegetables rather than selling directly to the consumers. The dependency on intermediaries is likely due to limited access to urban markets, inadequate transportation facilities, small production volumes and the convenience of selling products via middlemen. Though middlemen provide an access to market, farmers often have limited bargaining power and receive lower farm gate prices.

These findings are consistent with previous studies in Nepal. Subedi et al. (2023) indicate that while protected vegetable farming is lucrative, insufficient market access, price fluctuations, and weak institutional support remain major constraints to its sustainability. Likewise, Sapkota et al. (2022) identified marketing difficulties, high transportation expenses, and reliance on middlemen as common challenges encountered by protected vegetables growers. Lamichhane et al. (2023) further highlighted that strengthening cooperatives, advancing extension services, and developing market infrastructure are crucial for promoting the adoption and long term success of protected cultivation in Nepal.

The current results indicate that improving market systems is equally important as advancing production technologies. Strengthening farmer cooperatives, encouraging collective marketing, improving market information services, and investing in rural transport and storage facilities could boost farmers bargaining power and improve the profitability of protected vegetable farming. Such institutional backing would contribute to more resilient vegetable value chains and improve the livelihoods of smallholder farming households.

4.6 Study limitations and future research needs

This study provides valuable insights into the role of plastic tunnel vegetable farming in income generation and livelihood improvement among farmers in Meghang Rural Municipality. However, certain constraints should be acknowledged. The study was based on a cross sectional survey of 100 farming households from a single rural municipality, potentially restricting the applicability of the results to the other agro ecological areas in Nepal. Moreover, the analysis relied primarily on farmers self-reported information on production and income, which may be recall bias and seasonal variations.