How can we improve the operational efficiency of food hubs?

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Coordinating logistics

Food hubs can provide a viable solution to the many logistical challenges faced by small-scale food producers to get their (often perishable) goods to consumers, *writes Dr Arijit De, Assistant Professor, University of Manchester.*

By gathering products from various local and regional producers in one place and fulfilling customer orders placed on the internet, they can contribute to local economic development while benefiting from economies of scale in transportation. This, in turn, can reduce logistics costs and environmental footprint for suppliers while increasing convenience for customers and reducing their travel. But it isn't all win-win. Several factors determine the extent to which a food hub can function well in fulfilling last-mile delivery and decreasing operational and environmental costs, such as coordinating product and delivery aggregation and logistics efforts, and the nature of vehicles used.

Focus on FADNE's Local Heroes

I collaborated with Dr. Barbara Tocco and Prof. Matthew Gorton from the National Innovation Centre for Rural Enterprise (NICRE) to successfully address the food hub distribution issue faced by community interest company, and NICRE's innovation partner, Food and Drink North East (FADNE). During the Covid-19 pandemic, FADNE introduced Local Heroes, which aimed to provide an e-commerce platform for more than 150 local and regional producers to sell their food and drink products to customers.

Our research focused on improving the operational and environmental efficiency of food hubs by minimising transport costs and carbon emissions. It involved using Microsoft Power BI to analyse a large data set obtained from FADNE to obtain useful insights regarding the quantities sold and number of customers served. Furthermore, the research work also involved development of an AI model using the underlying theory of Mathematical Optimisation to address the complex logistics and inventory operations involving different, stakeholders such as producers, hub and customers. The AI model was solved through adopting optimisation software IBM CPLEX which is widely used in industry.

Our empirical results show that horizontal collaboration in logistics between producers contributes to improving vehicle utilisation which, in turn, can significantly reduce carbon emissions by up to 16%. Additionally, by switching to electric vehicles, transport costs can be reduced by 31.5%, helping to optimise operational costs and reduce environmental impacts. Our findings provide useful evidence for improving logistics strategies which could benefit those managing food hubs. It also demonstrates that data visualisation software and tools can play an important role in better understanding performance metrics and optimising logistics solutions.

Future research

This project has reaffirmed the need to conduct further study into rural logistics, as this area is currently under-researched. Specifically understanding how public transportation and cargo logistics can be integrated to provide economic, environmental, and social benefits is key. I worked with NICRE and FADNE, as a Turing Exchange Fellow, in addressing rural business needs and innovation/market opportunities via the enhancement of resilient supply chain logistics by developing advanced artificial intelligence (AI) models and working with big data sets.

Furthermore, we'll be starting an exciting new project with NICRE, FADNE and Northumberland County Council, to assess the role cargo buses could play in improving small businesses' logistics and enhancing the viability of rural bus services. A four-year fully-funded PhD student will be starting later this year.

Watch this space to keep up to date with developments as our research progresses.

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