

EPSRC CENTRE FOR INNOVATIVE
MANUFACTURING IN



Distributed and Localised Manufacture of Food Products

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Manufacturing Food Futures
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Contents

- Distributed and Localised Food Manufacturing (DLM)
- Considerations and Models for DLM implementation
- DLM Simulation tool for DLM
- Conclusions

Future Manufacturing Trends

Control systems will support smaller batches and product diversity.^[1]

Manufacturing organisations will be decentralized requiring new structures.^[2]

Factories of the future will be smaller, trading with local communities.^[3]

**Distributed
Manufacturing**

[1] Leitão, P., 2009. Agent-based distributed manufacturing control: A state-of-the-art survey. *Engineering Applications of Artificial Intelligence*, 22(7), pp.979–991. Available at: <http://www.sciencedirect.com/science/article/pii/S0952197608001437>.

[2] Montreuil, B., Frayret, J.M. & D'Amours, S., 2000. Strategic framework for networked manufacturing. *Computers in Industry*, 42, pp.299–317.

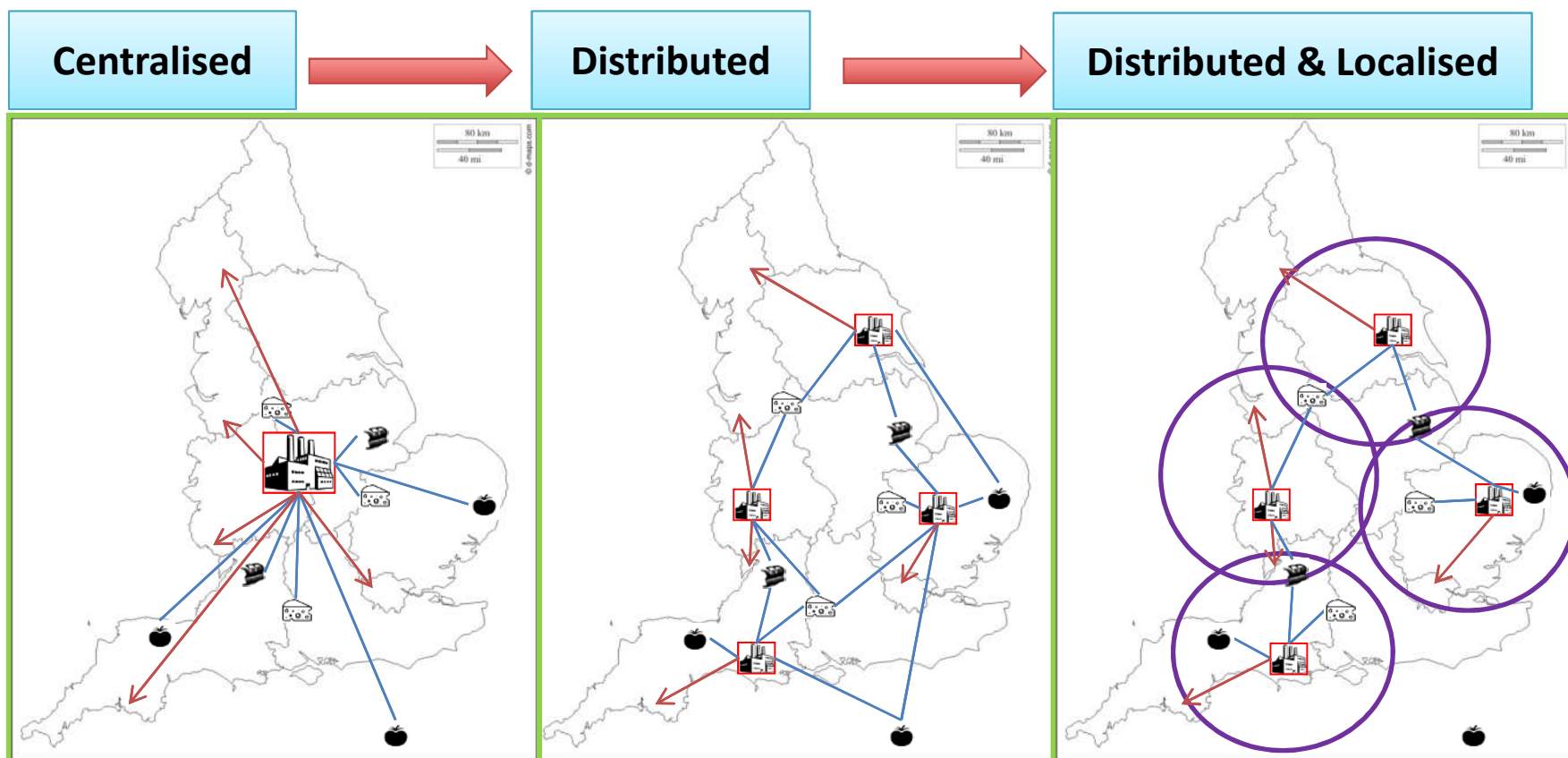
[3] Ball, P. & Jolly, M., 2015. Sustainable manufacturing for the future. Investigating the current and future landscape across the food and drink industry in Great Britain. , (June).

Defining Distributed and Localised Food Manufacturing (DLM)



- **Food Manufacturing Objectives:** commercial large scale production and packaging of food, transforming raw ingredients into products.
- **DLM Objectives:**
 - Responsive and flexible manufacturing network
 - Decentralised and closer to consumer production
 - Shorter supply chains
 - Supports local economies

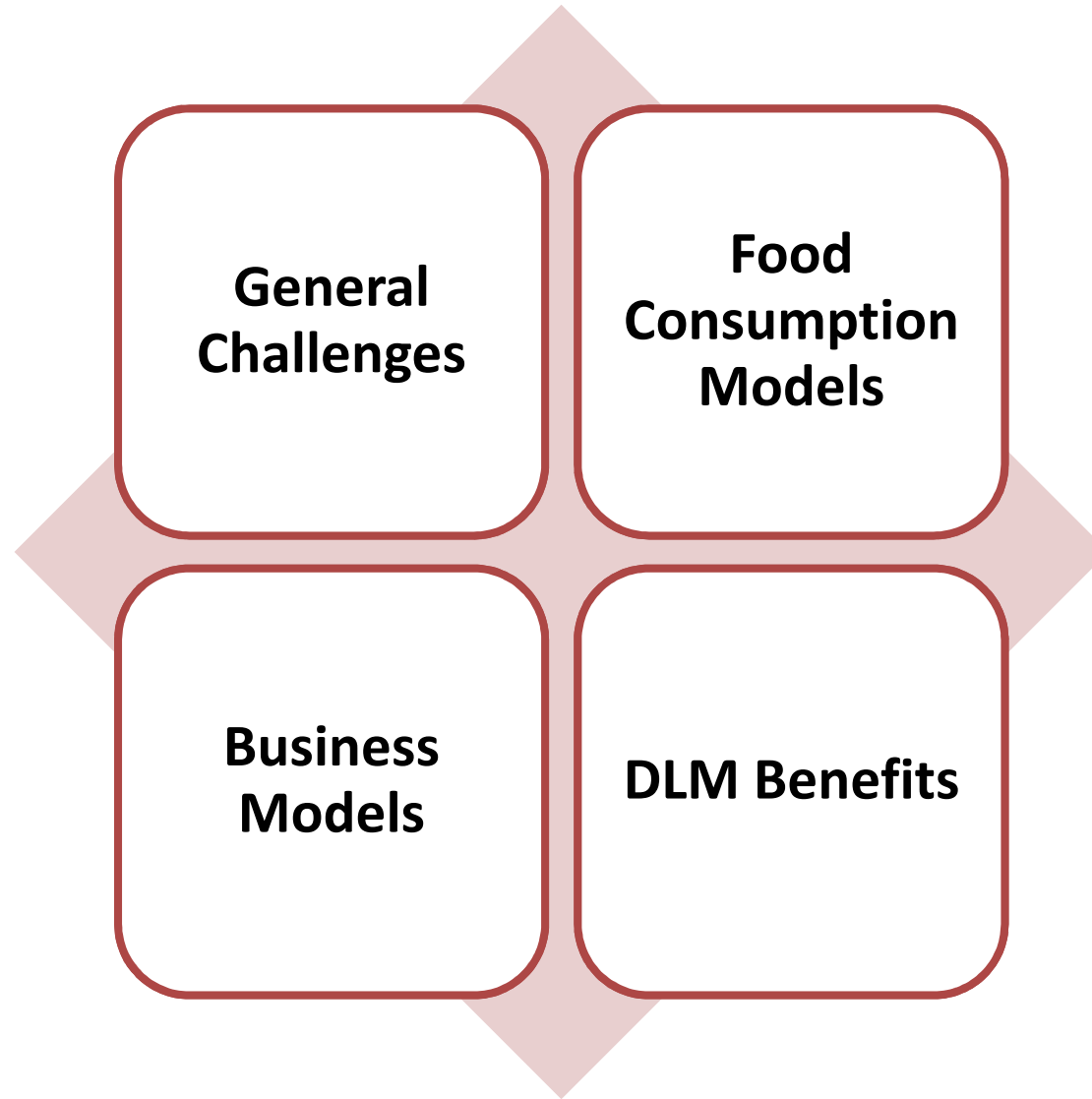
From Centralised Manufacturing to DLM



Key

Cheese	Factory	Supply
Tomatoes	Bread	Delivery

Considerations for DLM implementation



General Challenges

Shelf Life

- *Extension in quantity and quality*

Weight-Distance

- Yield of conversion of raw materials

Environmental

- *Emissions and resource usage optimisation*

Legislation

- Requirements and constraints

Food Security

- *Availability and variability*

Food Choice

- Customisation options

Food Consumption Models



Distributed and Localised Manufacture of Food Products

Business Models

Does DLM make business sense?



How to generate revenue and increase profit from DLM?

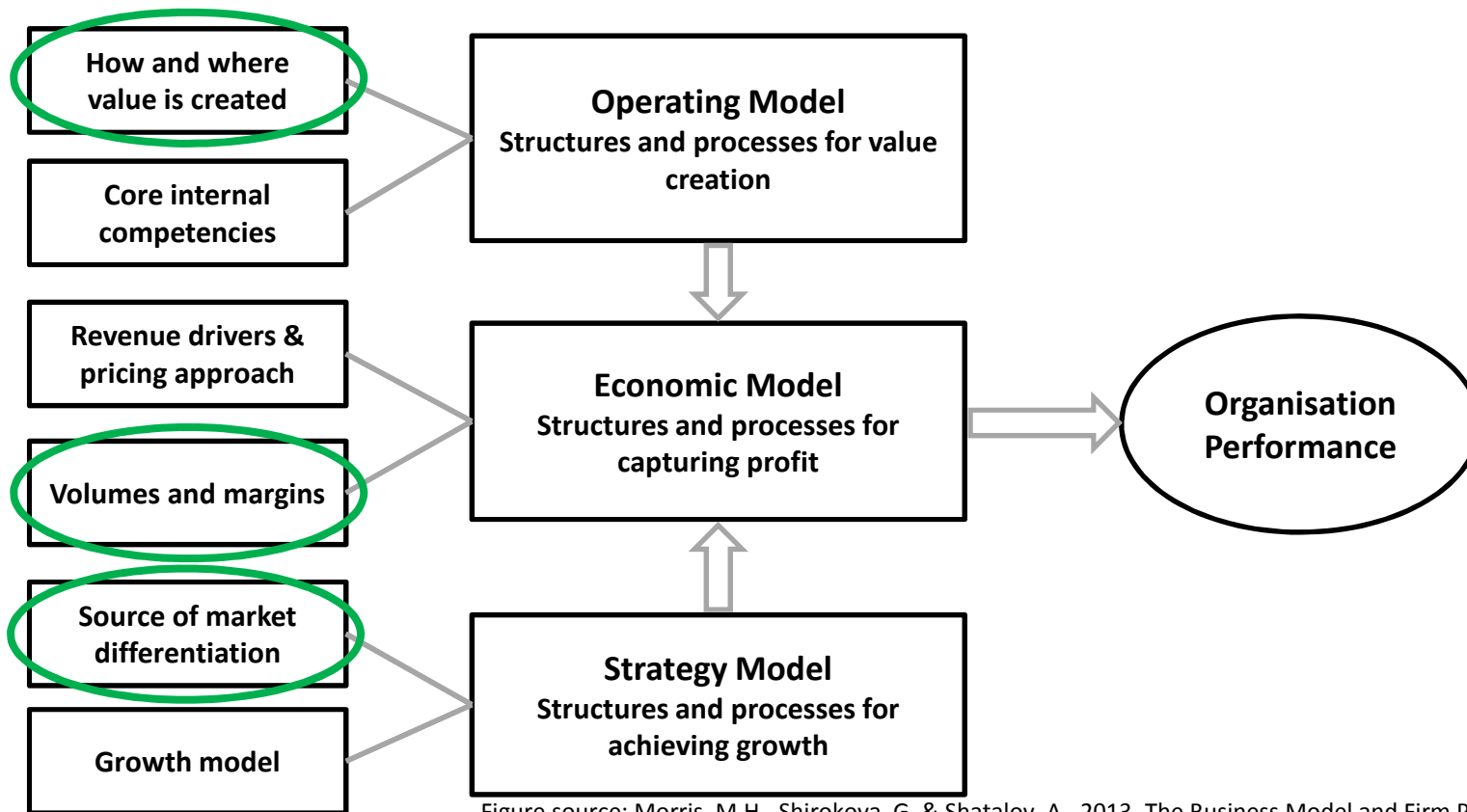
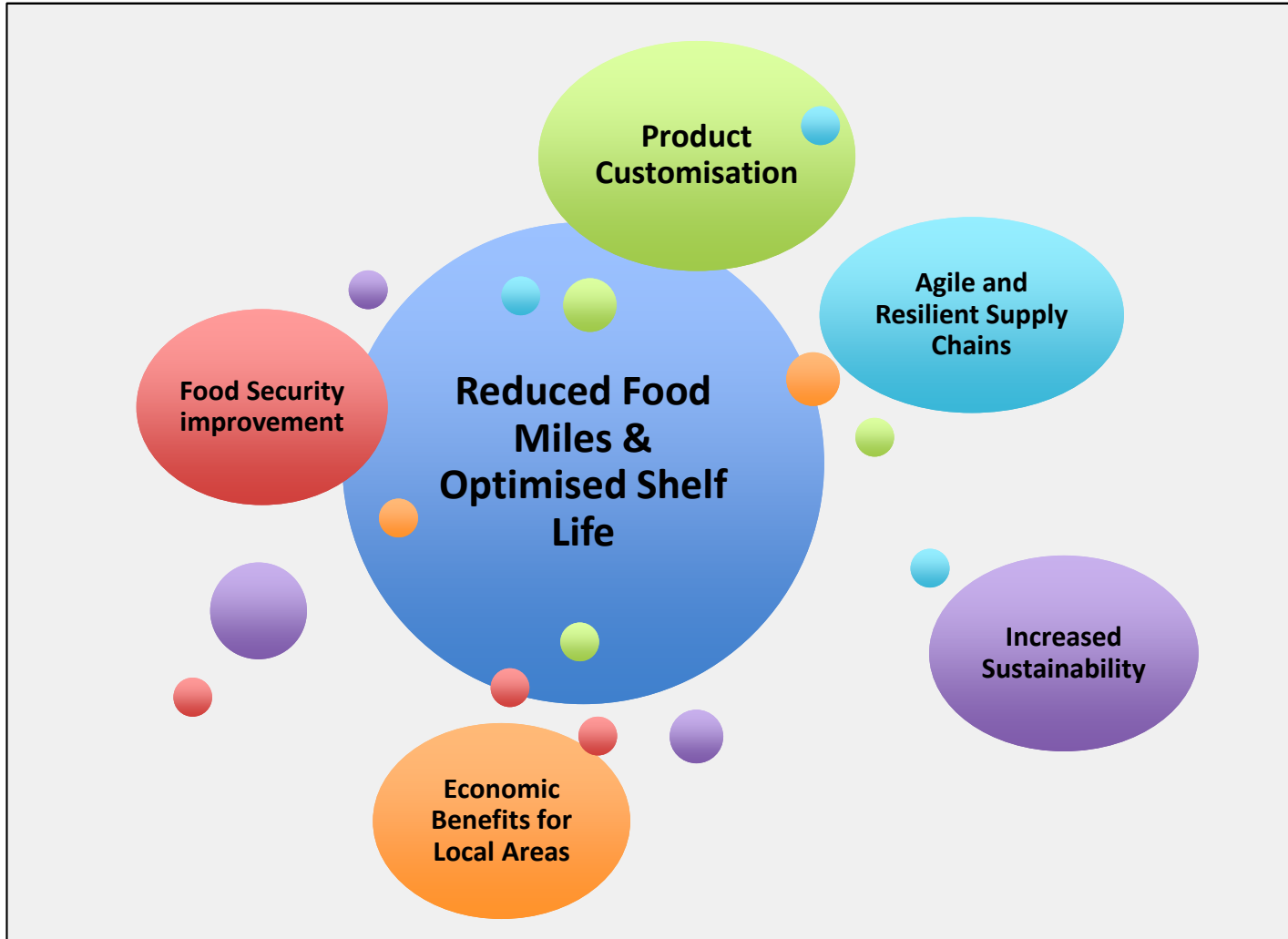
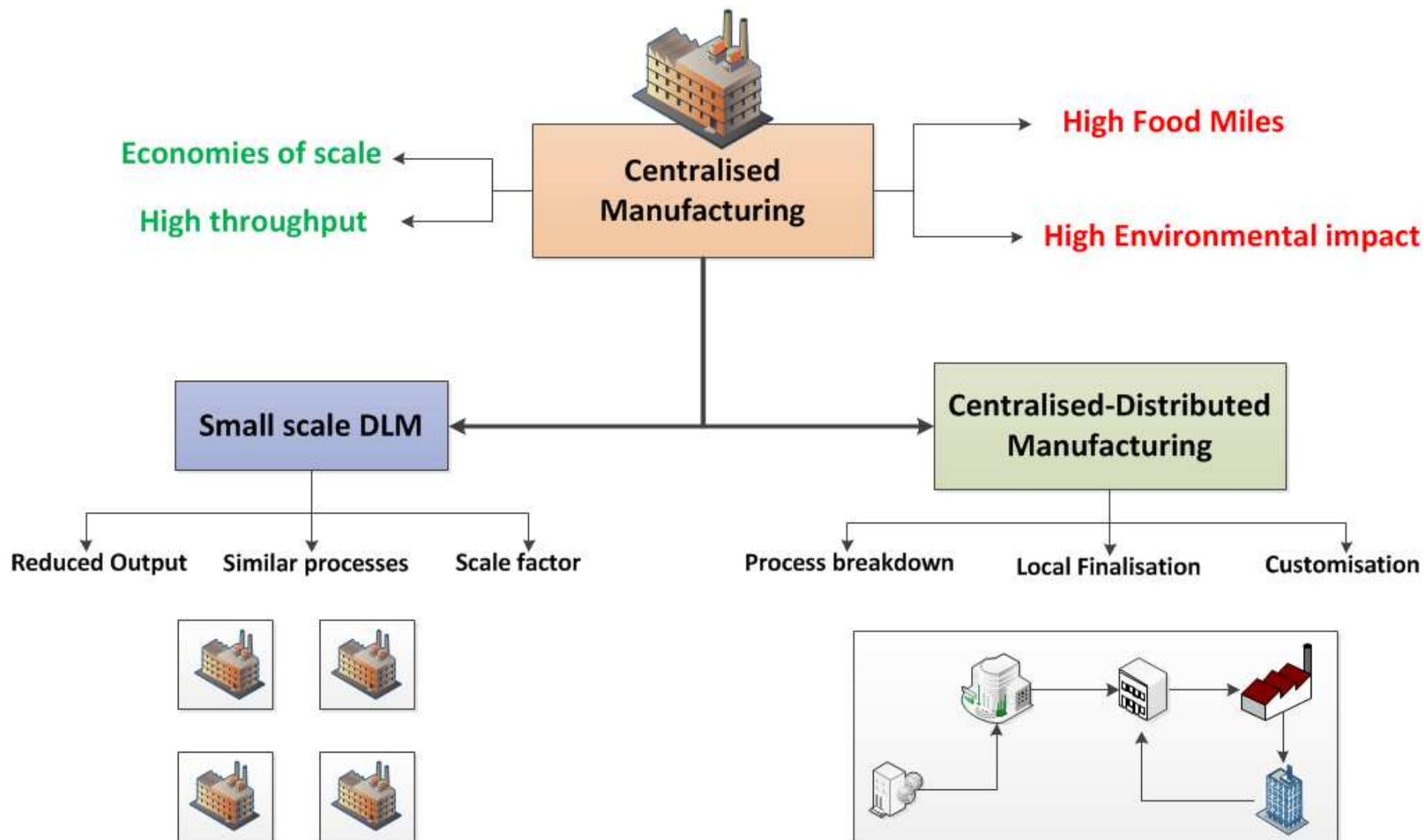


Figure source: Morris, M.H., Shirokova, G. & Shatalov, A., 2013. The Business Model and Firm Performance: The Case of Russian Food Service Ventures. *Journal of Small Business Management*, 51(1), pp.46–65.

DLM Benefits

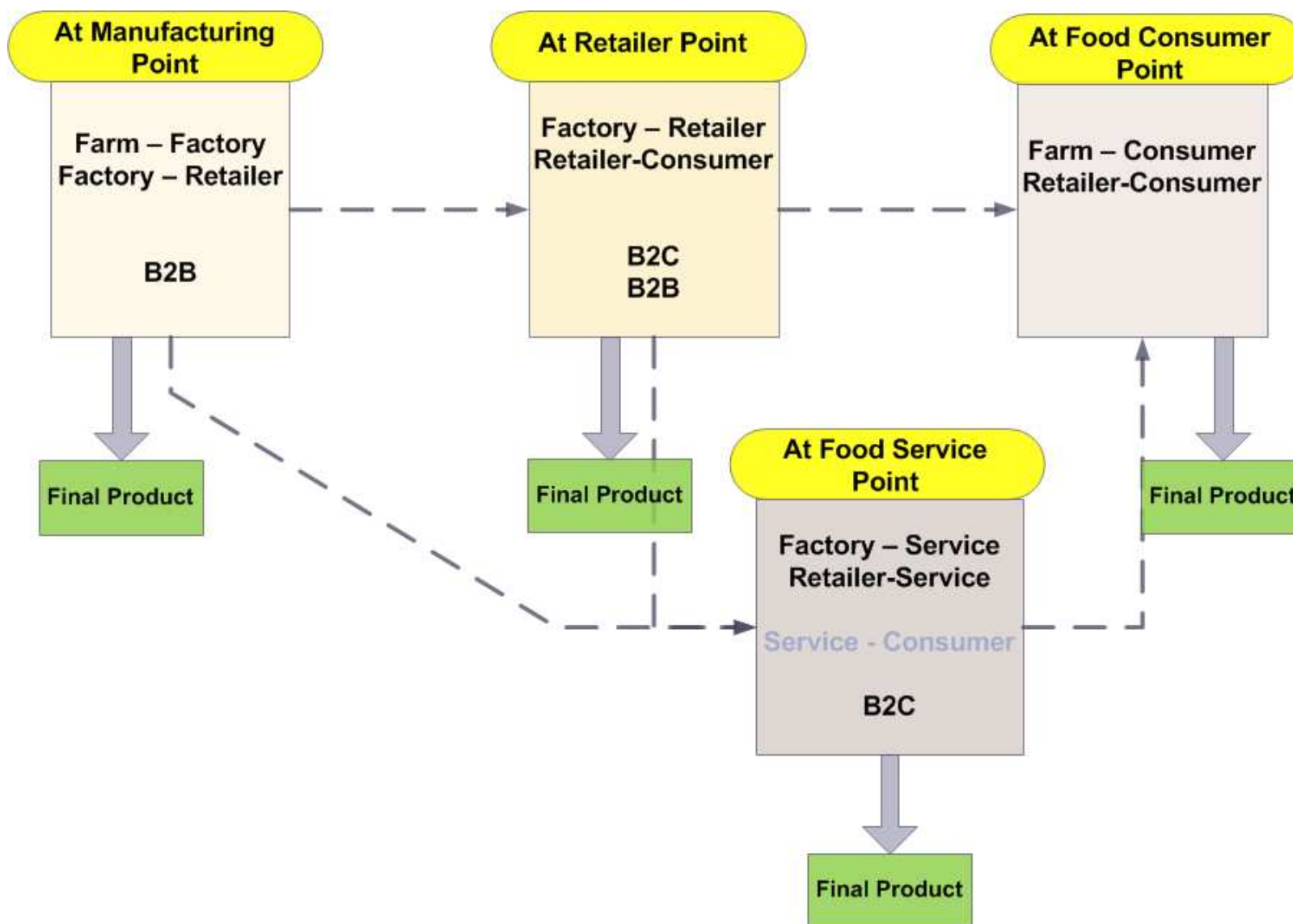


New Structures for DLM

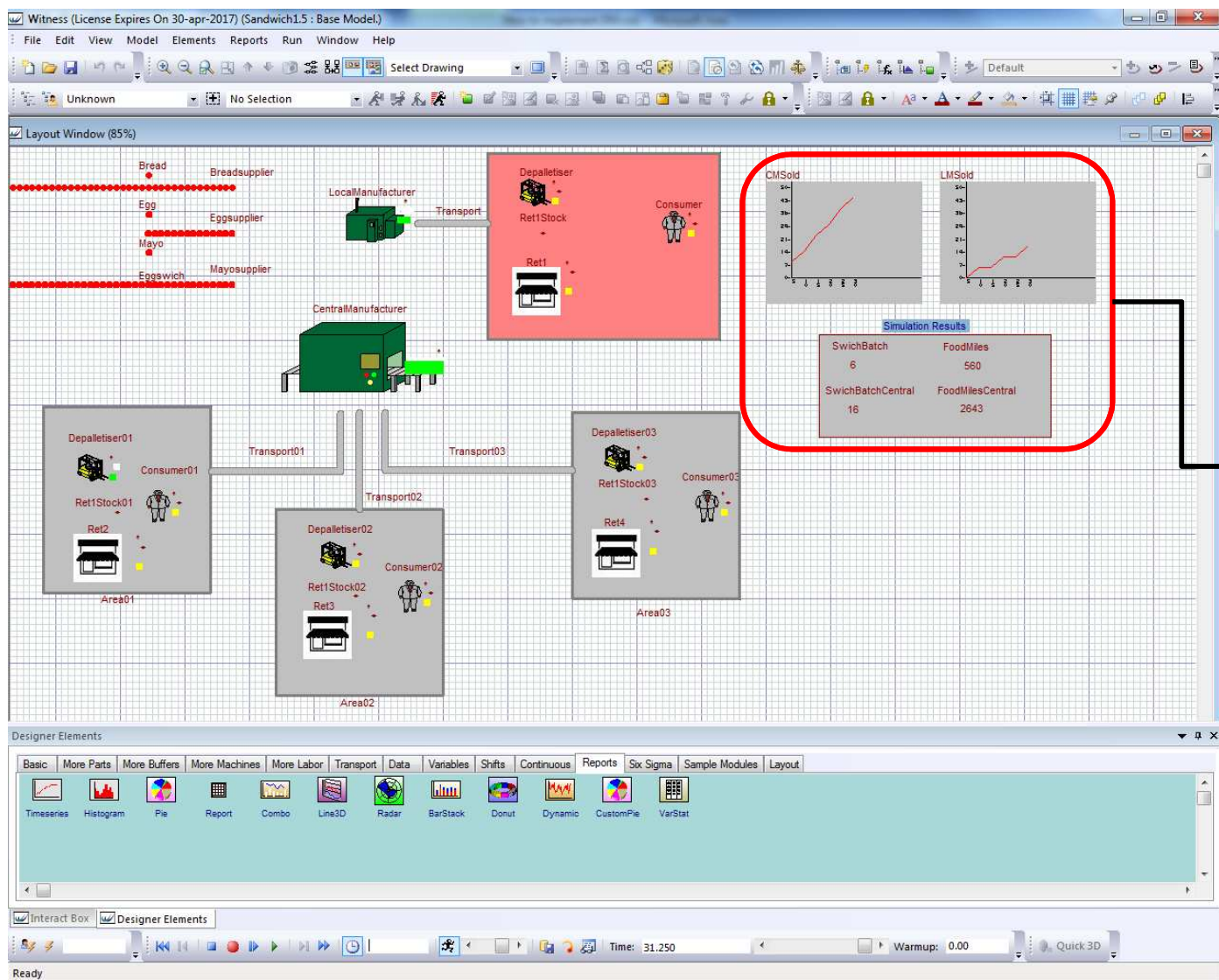


Distributed and Localised Manufacture of Food Products

Application Scenarios for DLM



Modelling and decision support simulation for DLM



KPIs from Model

Conclusions

- DLM is awakening interest for future food production development.
- DLM parameters to help identifying opportunities of application are key to have successful future implementations.
- Positive changes in the structure and flow of operations in the food manufacturing scene have the potential to produce a more sustainable future while granting social and economical benefits.

Distributed Manufacturing is one of the top 10 emerging technologies identified by the World Economic Forum

Thank you

