The social network

Network diagrams can be valuable statistical tools for analysing short food supply chains.

Social networks

In popular culture the term 'social network' has become ubiquitous. The field of social network analysis (SNA) has its origins in the social sciences, and involves using network representations to model the pairwise relationships or exchanges between individuals, groups, or organisations (Newman, 2010). Visualisations, in the form of network diagrams, are often used to support the interpretation of network data, and can be particularly illuminating where food chains are concerned. Short food supply chains (SFSCs) are defined by policy as chains "with no more than one intermediary between farmer and consumer" (EC, 2014), which means that only one change of ownership of the product can occur. However, successful SFSCs involve multiple and diverse collaborations between primary producers and collaborators without a change of ownership occurring.

Social network analysis in SKIN

The SKIN project, funded by the European Commission's Horizon 2020 programme, has collected over 100 'good practices' in SFSCs, which are tested and validated innovations that are transferable to other contexts. Teagasc's role in SKIN was to develop a methodology for the identification and collection of best practices EU wide, which included network analysis.

In the project, we use SNA both as a data visualisation tool, and also to provide insights into the interactions and flow of resources (e.g., information, equipment sharing) between actors and institutions. In these networks, actors involved in the chain are represented as 'nodes' (circles), and the relationships/exchanges between actors are conveyed by 'edges' (lines connecting pairs of nodes). The flow of resources in these networks are naturally weighted and directed. In our visualisations, edge weights are indicated by the thickness of edges, while the visual curvature of edges denotes the direction of resource flows.

Results

From the overall set of networks that were created, the example networks presented in this article focus on 'food hubs', which are critical components of SFSCs' "logistical and organisational platforms for the aggregation and distribution of source-identified food products" (Berti and Mulligan, 2016). We can use network diagrams to visually represent the operation of hubs, illuminating at a glance how they connect producers with consumers. As an example, **Figure 1** shows the functionality of Ireland's Larder 360 hub, represented as a network of 32 nodes, where the purple nodes denote primary producers. The anticlockwise direction of the edges from the farms signifies inward flows of produce to the central Larder 360 node, while the clockwise direction of the edges from Larder 360 to consumers denotes the flow of produce to consumers.

Another advantage of using network representations in this context is that it allows us to make use of a wide variety of existing measures and metrics that exist for characterising networks. **Figure 2** shows a network representing DistriKempen, a Belgian food hub involving a co-operative of primary producers, which comprises 29 nodes and 55 edges. **Table 1** provides a corresponding set of results for analyses performed using a set of standard network measures. The average degree of 3.8 edges indicates the level of flow of resources through the network. The density of the DistriKempen network is low, which reflects a function of SFSC hubs where actors are few but strategic, rather than widely involved (unlike networks

FIGURE 1: Larder 360 SNA.

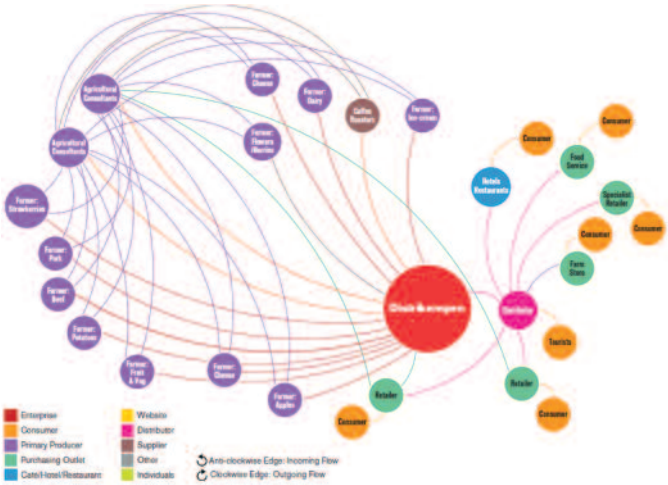

FIGURE 2: DistriKempen SNA.

Table 1: A statistical overview of the DistriKempen network.

Measure	Score	Description
Number of nodes	29	Total number of nodes in the network
Number of edges	55	Total number of edges in the network
Average degree	3.8	How many edges there are compared to the number of nodes
Average weighted degree	9.1	Average of the sum of the weights of the edges for all nodes in the network (network-specific criteria – subjective perception of 'indispensability of relationship' ranked 1-5)
Network diameter	4.0	Total network diameter between farthest nodes in the network
Graph density	0.1	Number of edges in the network, divided by the total number of possible edges (i.e., where all nodes are connected)
Average path length	2.6	The average of all shortest possible paths between any pair of nodes (e.g., via intermediary nodes)

on social media platforms). Relationships are ranked as highly important by the actors involved. Despite an average path length of 2.6 "hops" between nodes, most nodes are closely connected to the central hub. Again, this is an intrinsic function of hubs, where efficiencies are generated by concentrating interactions and flows within a strategic node.

Implications and discussion

Social network diagrams have the potential to visually demystify organisational innovations. Furthermore, network analysis can act as a valuable statistical tool, identifying strategic relationships and 'good practices', as well as areas for growth and development.

References

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