CONCEPTUAL MODEL FOR IMPROVING LOCAL FOOD SUPPLY CHAIN LOGISTICS

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ABSTRACT

While food transport is inevitable to society and a major component of goods transport as whole, local sourcing could significantly reduce the transport work required in the food supply chain. Although local food has recently seen a strong market development in many countries, the producers of local food are often small and many are facing bottlenecks in logistics and transport when trying to expand their business. In order to realise the full potential of local food production, it is crucial to address these bottlenecks, conceivably by applying principles of transport coordination, route optimisation and logistics integration in a small-scale business context. The main objective of the current study was to improve logistics for small-scale local food producers by developing a conceptual model for strategic logistics development.

The study was based on case studies in different regions of Sweden, mapping out local food producers and their distribution channels and demonstrating innovative solutions to integrate small-scale producers in large-scale distribution chains. Producer characteristics and preconditions for successful implementation of logistics innovations were analysed.

Despite the fact that the studied companies were all considered local and small-scale food producers, the case studies revealed considerable variability in terms of size, mode of operation and sales channels. A conceptual model for strategic analysis and identification of appropriate logistics solutions for producers of local food was developed, taking into account factors such as transport distance, turnover and market opportunities.

The case studies demonstrated positive effects of applying general principles of coordination, optimisation and integration. At the same time, it was concluded that different groups of producers require different technologies and logistics solutions to be considered in relation to location and market opportunities. Strategies and possibilities were identified to improve logistics for different kinds of producers of local food, which can improve the competitiveness of local food products and thereby reduce transport work for food distribution. Directions for further research and development regarding low-cost, user-friendly technologies for integrated logistics systems were identified, including the need for additional case studies and further development and evaluation of low-cost, user-friendly IT-solutions and integrated logistics solutions.

Keywords: Local Food, Food Supply Chain, Distribution, Transport, Integrated Logistics

INTRODUCTION

After decades of centralisation and structural rationalisation of food chains in the industrialised world, recent years have seen an increasing consumer demand for small-scale and locally produced food. Jones *et al* (2004) and Ilbery and Maye (2006) among others have described the development of local food markets in Europe, while the phenomenon of local food (*i.e.* food produced and consumed within the same geographical region) has also been studied in North America and Australia as well as developing countries such as Honduras (Blandon, Henson & Cranfield, 2009). The customers' motives for choosing local food are manifold, including perceptions of genuine, small-scale, natural and environmentally responsible products of high quality and full traceability, but also the positive effects on regional development (Wretling Clarin, 2010). While food transport is inevitable to society and a major component of goods transport as whole, local sourcing could significantly reduce the transport work required in the food supply chain.

Although the local food system has recently seen a strong market development in many countries, the producers of local food are often small and many are facing bottlenecks in logistics and transport when trying to expand their business (Saltmarsh & Wakeman, 2004). It is generally agreed that logistics in the sector is under-developed and producers claim that bringing products to the market is one of the most important hurdles to overcome, in order to develop their businesses (Björklund *et al*, 2008, Ljungberg *et al*, 2012). Inherent characteristics of the companies and their products pose challenges to the development of effective logistics systems. Typically, the sector is characterised by small-scale businesses with limited resources, marketing premium products with uniqueness rather than cost-cutting standardisation as selling point. Furthermore, the production is geographically scattered in small units located in rural areas away from the consumers in urban areas. In addition, less-than-optimal solutions based on personal vehicles are used for bringing the products to the market. While it has been argued that the food miles do not have a significant effect on many products' total environmental load, it is not even evident that all local food products reduce the environmental load of transport (Wallgren, 2006; Coley et al, 2009), due to the inefficiency problems in the transport chain.

In contrast, the conventional food supply chain (FSC) has seen a consequent development towards structural rationalisation and centralisation. Logistics development has been a key factor in developing competitive FSC:s, resulting in a situation with a few retail chains in a strong power position in the supply chain. This development has involved the introduction of third-party logistics solutions, Just-In-Time delivery, supply chain integration and electronic communication systems. All of these are now integral parts of the conventional FSC. At the same time, none of these are evident in the local FSC.

In order to realise the full potential of local food production (and avoid a potential backlash in public opinions if consumer-perceived values are not satisfied), it is therefore crucial to address the bottlenecks in the local food supply chain. Conceivably, this problem can be addressed by applying general principles of transport coordination, route optimisation and logistics integration, and adapt solutions to the small-scale business context of the sector.

Previous research in Sweden (summarised by Ljungberg *et al*, 2012), where the local food sector has been studied in a general survey and several case studies, provide a basis for research into the possibilities for coordinated and integrated logistics development in the local food production sector. Related research on strategic supply chain development guidelines for locally grown produce have also been developed by Berruto, R. and Busato, P. (2009).

Different ways of distributing local food are described in Figure 1. The alternative paths from production to consumption greatly affect the need for transport and logistics, since the products are marketed on or close to the site of production (self-pick and farm outlets) as well as in the consumers' domestic location (home delivery alternatives, including box schemes and e-trade). In addition, a producer may sell directly to private customers on Farmers' markets, on the retail or catering markets via wholesalers or directly to individual restaurants or retailers.

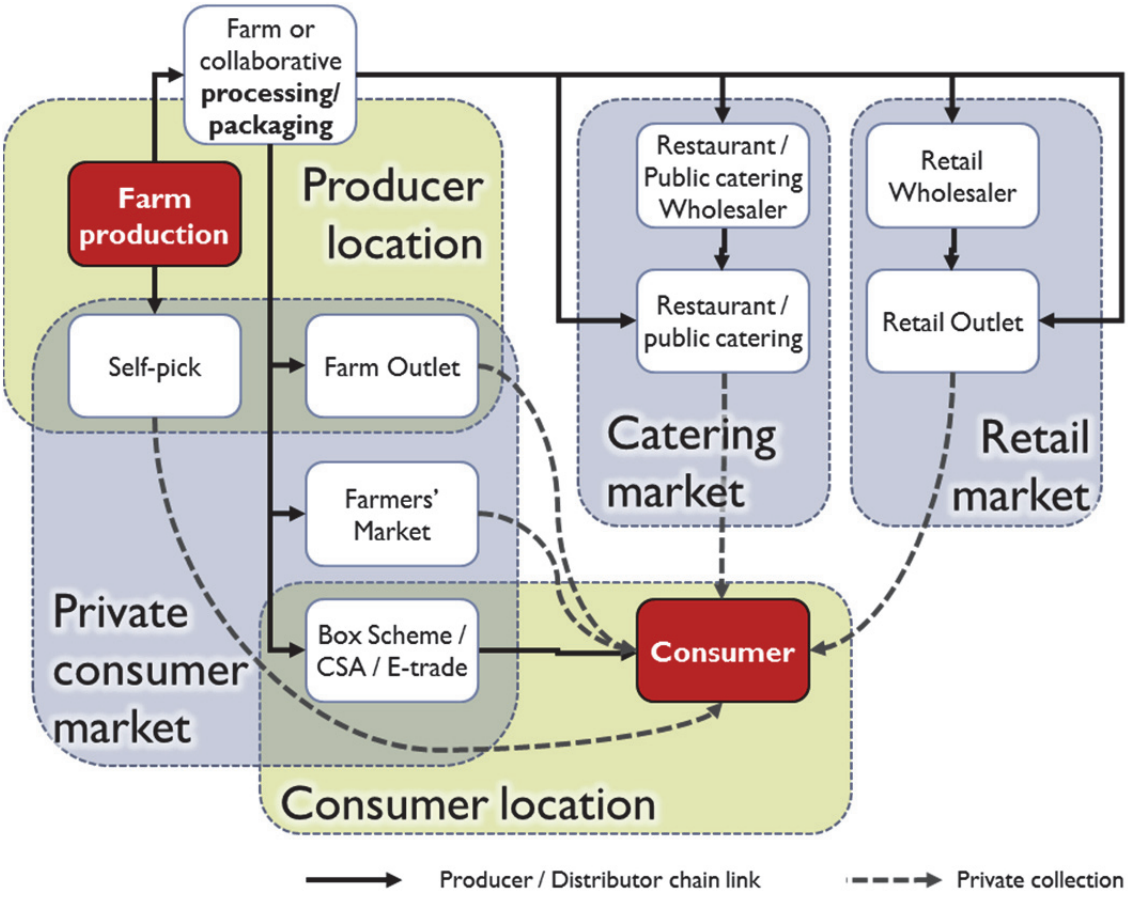

Figure 1. Alternative distribution channels for local food, from production to consumption via catering, retail and private consumer markets.

All these different paths from production to consumption represent distribution channels and while the choice of distribution channels may be one of the most strategic logistics decisions to be made, there is not always a lot of effort put in this process. Instead, the producers rely on ad-hoc distribution solutions by tradition, lack of resources, time or competence for planning. The development of tools and methodologies for a simplified, strategic analysis could be of great benefit for these companies and for decision makers that have an interest in developing and evaluating incentives and policy instruments. A prerequisite for this development to become more specific than generic methodologies for analysis of business competitive advantage, is that it is based on empirical data from the sector.

The main objective of the current study was to improve logistics for small-scale local food producers by developing a conceptual model for strategic logistics development.

METHODOLOGY

The study was based on a general survey mapping out the local food sector and three case studies with complementary analyses in different regions of Sweden, mapping out local food

producers and their distribution channels and demonstrating innovative solutions to integrate small-scale producers in large-scale distribution chains. Findings from the general survey and the case-studies have been previously reported by Ljungberg *et al* (2012), Bosona *et al* (2011*a*, 2011*b*), Bosona *et al* (2012) and Nordmark *et al* (2012). The current study takes the analyses further, and synthesises the general survey and the case studies into a conceptual model for strategic logistics development.

The general survey was based on literature, interviews with key informants in the food trade sector and in producer networks, and a national web-based producer survey. For each case study, data were collected using interviews with producers and other key persons, collection of documentation from carriers and clients, and own observations and measurements.

Producer characteristics and preconditions for successful implementation of logistics innovations were analysed, taking a participatory research perspective, involving end-users in the case studies to ensure the applicability of the project results.

Using software and map databases for geographical information systems and route optimisation, as well as statistical processing, the information collected from the studied systems was analysed. The experiences of the case studies were synthesized into a conceptual model for small-scale producers' strategic logistics development, and needs for continued research and development were identified.

INVENTORY

General survey

Results from the general survey have been reported by Ljungberg *et al* (2012). The dataset from the web-based survey included 77 producers, covering all counties of Sweden and all predominant branches and distribution channels. Due to some incomplete answers (lacking response to detailed questions related to distribution and logistics) cross-tabulations of some of the questions resulted in about 40 answers.

The web-based survey revealed a practical producer's perception of 'local food': Among the producers, 82% sold their products exclusively within their own or neighbouring counties, and 58% exclusively within their own county. Considering the maximum distance to a delivery location, 80% had a maximum distance to delivery locations of 200 km, while 66% delivered their products to locations within 100 km.

The analysis of producers in the survey was based on two factors: the annual economic turnover and the maximum distance to delivery destinations. The turnover was considered to be associated to scales of operations and ability to make investments, while the distance was considered to be associated to logistics challenges. Figure 2 displays the producers' distance to delivery destinations *vs* economic turnover (based on 43 complete answers).

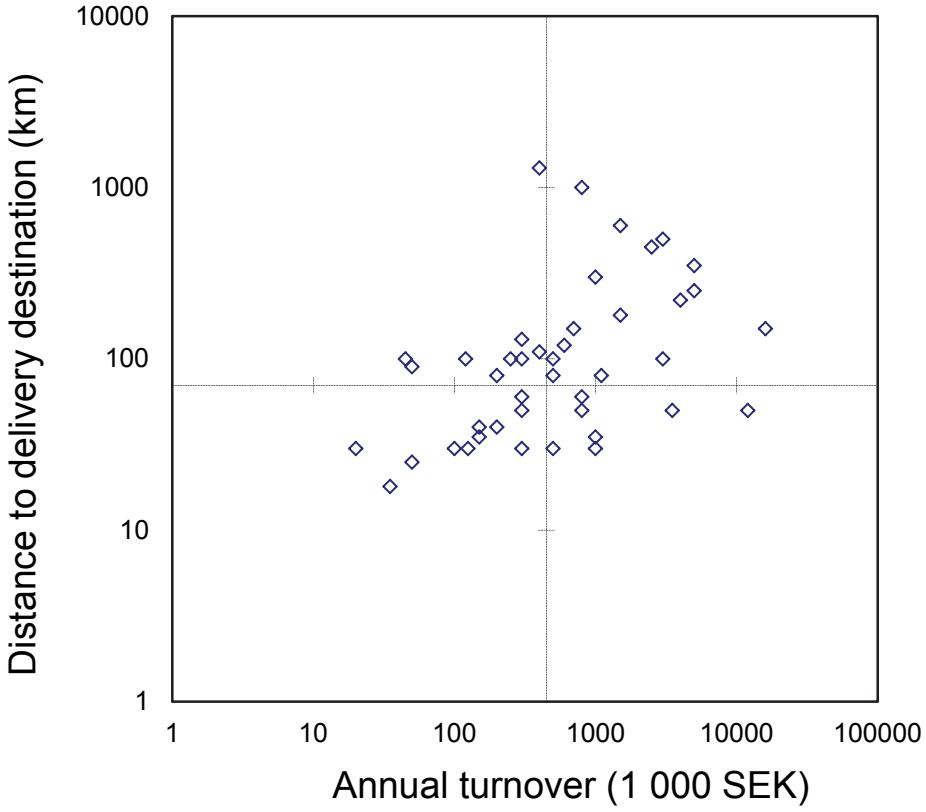

Figure 2. Distance to delivery destinations in relation to annual sales volumes for local food producers, on log-transformed scales (1 SEK ≈ 0.11 EUR)

The producers can be arranged in four classes according to distance and turnover (Table 1) and based on this classification, Table 2 presents the producers' choice of distribution channels.

Table 1. Division of producers in four classes

A **{** ≥80 km; <500 000 SEK **}**	**C** **{** ≥80 km; ≥500 000 SEK **}**
B **{** <80 km; <500 000 SEK **}**	**D** **{** <80 km; ≥500 000 SEK **}**

Table 2. Choice of distribution channel by different producer groups (highest score per channel in bold style)

Distribution channel	Percentage of producers in group A-D using each channel				Total
	A (*n=9*)	**B** (*n=11*)	**C** (*n=16*)	**D** (*n=7*)	(No. of producers)
Private consumer market					
Farm shop (on the own farm)	8	**24**	13	17	*58*
Farm shop (out of the farm)	5	**7**	5	3	*16*
Farmer's market	**21**	**21**	15	9	*51*
Subscription / Box scheme	3		1	**6**	*4*
E-trade			**5**	3	*9*
Self-pick	3			**9**	*5*
Retail market					
Retail outlet (single)	16	17	11	**20**	*46*
Retail chain (national)	8	2	**9**	6	*17*
Local wholesaler	**8**		7	3	*16*
E-trade			**5**	3	*6*
Catering market					
Private restaurant	16	**19**	13	11	*45*
Catering (public sector)	5	**10**	5	6	*14*
Wholesaler	5		**9**	3	*15*
E-trade			**3**	**3**	*4*
Other distribution channels	**3**		1		*4*

It was found that producers in group A were the most common to sell their products on farmer's markets (on par with group B) and at local wholesalers, while group B were the most common to sell their products in farm outlets and farmer's markets, as well as private restaurants and public catering customers (*e.g.* schools and pre-schools). The producers in group C were the most common to use e-trade channels and to have retail chains and local wholesalers as customers and group D were most common to use subscriptions or box-schemes and e-trade in the catering sector, and to sell to individual retail shops.

The producers stated that transport was the most important impediment, followed by marketing, inventory and administration. The main distribution bottlenecks identified were the handling of cold chain requirements and the logistics costs, particularly for transport and green refrigerated vehicles.

Case study 1: Logistics integration of small-scale producers in large-scale retail chain

In the county of Halland, a national retail chain pursued a pilot project intending to integrate a number of small-scale food producers in the retailer's national distribution network and e-

trade system. The producers involved displayed and sold their products in an electronic marketplace, from which possibly any retailer in the network could order the products in the same way as for the regular assortment. The physical distribution system arrangement was that the producers collected their deliveries in a transport hub, from which they organised a coordinated transport to the retail chain's distribution centre (DC). From the DC, the products could be delivered to any retailer in the network at no cost for the producer. The e-trade system was made available to the producers at a discount in order to attract interest in the system. Figure 3 describes the arrangement transport coordination and information management in the pilot project.

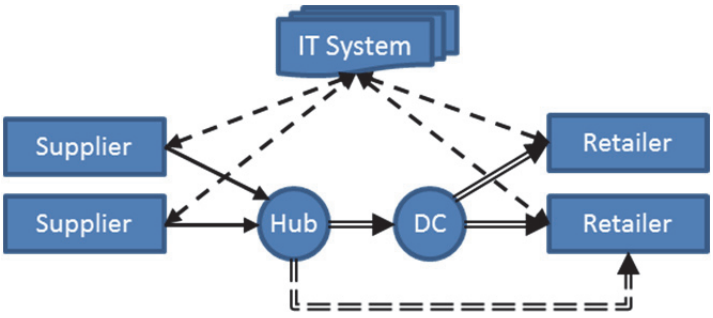

Figure 3. Concept of physical distribution and information management in the pilot project (Case 1); 'Hub' = Producer transport coordination hub; 'DC' = Retail chain distribution centre; ←- - → information; ⟹ goods

The analysis of routes and locations has been reported by Bosona *et al* (2011*b*) and an economic and environmental analysis of the outcomes for the producers was reported by Nordmark *et al* (2012). An optimised network for the 14 producers involved in the project was created based on optimisation and location analyses in three steps; (i) description of routes from producer to delivery points in the original case, (ii) determination of the optimal location of a coordination hub from which deliveries to the DC were consolidated, (iii) route optimisation of deliveries to retailers, with and without the distribution centre. Four scenarios were put up:

- Scenario 1 (reference) – Direct deliveries from each producer to their delivery points
- Scenario 2: Delivery from producer to hub, coordinated delivery from hub to DC and to retailers or integrated delivery in the retail chain delivery system from DC to retailers.
- Scenario 3: Coordinated collection from producers to the hub, coordinated delivery from hub to DC and to retailers or integrated delivery in the retail chain delivery system from DC to retailers.
- Scenario 4: Simultaneous, coordinated collection from producers and distribution to retailers, without hub.

The results of the route analyses are summarised in Table 3.

Table 3. Summary of route analysis results

Scenario	No. of routes	Travel distance [km]	Travel time [hh:mm]	Loading and unloading time [hh:mm]	Total time [hh:mm]	Improvement compared to Scenario 1 [%]		
						Travel distance	Travel time	No. of routes
Scenario 1	23	6158.6	68:53	29:00	97:53	–	–	–
Scenario 2,								
Option I	16	3773.7	42:24	27:00	69:24	38.7	29.1	30.4
Option II	11	726.8	08:24	27:00	35:34	88.2	63.7	47.8
Scenario 3,								
Option I	8	3492.8	39:31	28:15	67:46	43.3	30.8	65.2
Option II	3	445.9	05:41	28:15	33:58	92.8	65.3	87.0
Scenario 4	4	2342.9	29:54	24:10	54:04	62.0	44.8	82.6

This case study demonstrated an effective integrated logistics solution for marketing, management and physical distribution. The solution demonstrated can reduce costs in retail and distribution and provide affordable access to expanded markets, but the systems are also associated with costs that could exclude vendors with small volumes.

The major part of IT costs was financed by the retail chain, which is reasonable given the resulting retail store rationalisation (as long as the products were part of the desired product range). Even so, the producers had to have a minimum economic turnover to finance its share of the cost of an integrated IT system. For the smallest producers, especially when the IT habit is also limited, the cost of licenses and support could be disproportionate.

The cost of the transport hub was funded jointly by producers while the return unit system and the distribution to the DC was financed by the retail chain. Again, probably a certain volume may be required to motivate the added cost for the retail chain, and also to motivate the producer to invest a portion of the costs of a common hub.

Case study 2: Coordination and route optimisation for producers in a home-delivery box-scheme for vegetables

Three producers in the county of Uppsala co-operated in a home-delivery box-scheme for locally produced vegetables. The producers had separate production and packaging, while co-operating regarding marketing (with a common brand name) and distribution. In the case study, which has been reported in detail by Bosona *et al* (2011*a*), distribution routes were registered and analysed using route optimisation software (DPS RouteLogiX). Optimised routes were created for the delivery points of each registered route, and based on all the registered delivery points, optimised solutions for multiple routes were created.

In this case study, the producers could only justify small investments in the logistics system. The number of customers is so small that the administration is possible to manage manually, and the transport distance is so short that the possibility of rationalizing them is limited. Route optimisation resulted in small improvements (usually less than 10%) could be made when optimising individual routes, but greater savings were achieved from the optimisation of multiple routes. For example, joint optimisation of two routes resulted in reduced distance by 55% and travel time by 34%. However, coordinating two routes would require increased vehicle capacity, possibly incurring added cost for vehicle purchase or hired transport. A change of vehicle could also involve a change to alternative fuels, possibly leading to a reduction of the environmental impact of transport by up to 81%.

In the current system, every distribution route took one day per week, and the alternative value of that time could justify a more rational approach to distribution. At the same time, producers need to carefully consider the benefits of the current system, in terms of flexibility, total control over the entire supply chain, and direct customer relationship.

Case study 3: Coordinated delivery system for food distribution to municipal units

In the city of Borlänge (Dalarna County), the municipal authorities have arranged a common distribution system for all food deliveries to municipal units such as schools, nurseries and homes for elderly people. All the food deliveries arrive at a common DC, from which a local transport company arranges the distribution to each unit.

Part of the motivation for setting up the system was to make it easier for local food producers to compete in municipal procurement, in that they could be able to deliver to a single delivery point. Thus, for local food suppliers to the municipalities, the system presents an opportunity to integrate their distribution in a centralised distribution system and deliver their products to one terminal rather a large number of delivery units. However, while the system has been in operation for over ten years, only a few local suppliers were involved by the time of the current study, and the municipality has identified constant need for efforts to help more producers to tender in the procurement.

Starting in Borlänge in 1999, the distribution system currently involves five municipalities and delivers 50 tonnes food per week to 149 units. However, until the study recently presented by Ljungberg et al (2012) the system had not been properly evaluated from a logistics point of view. This study collected data from the distribution system concerning location, goods volumes and distribution routes for all the suppliers and all delivery points in the system. Location analyses and route optimisation using ArcGIS Network Analyst were carried out, where different distribution scenarios were set up to reflect the situation without any coordination (reference scenario), with the common distribution system (Scenario 2; as is and after optimisation of delivery routes), and with integrated coordination of collection and delivery. Furthermore, the study analysed environmental effects of the transport system.

Like case study 1, this was an example of coordinated distribution, although on the public catering market, and with focus on coordinating the last mile distribution rather than on collection from producers. From the optimisation analyses it could be seen that the current

system, with coordinated distribution from the DC, reduced the transport distance by 64%, transport time by 60%, the number of routes by 44% and the number of delivery stops by 53% compared to the reference scenario. If all collections and deliveries were coordinated and optimised with flexible delivery times, the transport distances could have been reduced by up to 78% compared to the reference case.

The analyses of the transport system were complicated by the fact that the distribution was carried out by a transport company who also performed other assignments. Regardless of this, several interesting effects could still be identified. When shipments from suppliers to the DC were coordinated, relatively large gains could be made. The one factor having the greatest impact on system performance was the allowed time window for delivery. More flexible delivery times could therefore result in very substantial savings in time and transport distance. It would also involve major benefits in terms of road safety around schools and nurseries, reduced workload for the staff who would otherwise have received supplies, and opportunities for increased utilisation of vehicles and consolidation terminals.

In the current situation, there was no electronic ordering system in use, but there were plans to implement one in the near future. With an open electronic ordering system, opportunities open up for other actors, including independent schools and private restaurants, to benefit from the system when ordering from connected suppliers.

SYNTHESIS AND MODEL DEVELOPMENT

It is a challenge is to create effective logistics systems for a heterogeneous group of small-scale, geographically scattered producers with irregular goods flows. From the studied cases, it can be concluded that there is not one single distribution channel or marketing strategy to fulfil the needs of every producer. Among the small-scale and local food producers, there is large variety in terms of scale of operation and delivery distances, and in terms of resources, products assortment, value added, customer base etc. This synthesis aims to generalise from the case studies and present a conceptual model for strategic logistics analysis.

While conventional food systems benefit from centralisation and streamlining operations, reducing variety and the number of distribution channels, the local food system is characterised by diversification; in product assortment, in distribution channels and in business branches. This diversification may incur costs since it counteracts specialisation but contributes to resilience and less vulnerability to changing conditions. Logistics development needs to take this into account and avoid exclusive solutions. Even so, the producers need to address some strategic questions to identify their possible development strategies, including:

- Which parts of the business and the distribution chain needs to be developed, and are there elements that could be removed?
- How much resources are used for logistics and distribution?
- Which distribution channels are used and are these appropriate?

- Which possibilities exist for cooperation with other producers, wholesalers, retailers and other actors?

When addressing these questions, limited resources for development have to be allocated between processing, packaging and marketing of products, logistics development, product development, quality improvement, and cost reductions. The proposed conceptual model for business development aims to support this process for the benefit of producers and other actors (such as retailers, transport service providers and regional authorities) with an interest in developing the local food sector.

Proposed conceptual model

The proposed conceptual model is applied in three steps; inventory of development strategies, identification of the producer's conditions, and matching strategies to conditions. *First*, logistics development possibilities need to be assessed. Based on the inventory and case studies performed, these can be categorised as:

- *Transport coordination*, including utilisation of co-loading and return transport for improved transport efficiency;
- *Transport optimisation,* including route optimisation of individual or multiple routes and scheduling and localisation of depots and co-loading facilities;
- *Integration,* referring to strengthening the supply chain linkages between production and consumption, e.g. based on personal communication (between producer, retailer or restaurant and consumer), or information and communications technology (ICT), including systems for e-trade, ordering and factoring; and
- *Choice of distribution channel,* via retail, restaurant or directly to consumers, via public or private channels, and distribution systems including customers' collection, third-party or own-account distribution.

Secondly, the description of preconditions for the producers is supported by the four-field categorisation introduced in the inventory study. Based on economic turnover and distance to delivery destinations, four producer groups with different characteristics can be formed and identified by fictitious brand names (Figure 4):

Figure 4. Producer types in a four-field model typology identified by fictitious brand names (where the x- and y-axes relate to turnover and distance, respectively)

A. *'Taste of the region'* are the smallest producers, located relatively far from the market. Own-account transport is expensive and inefficient. The farm shop is a typical distribution channel, reducing transport cost and developing the personal communication and brand values.

B. *'Season's harvest'* represents small-scale producers close to the city. Short distances limit transport costs despite low volumes; however these can increase in home-delivery systems. Many distribution channels can be used.

C. *'Local challenger'* are producers with slightly higher turnover and distance to the market (e.g. the producers in Case study 1). These producers produce competitive products but logistics is a key issue to overcome the transport disadvantages.

D. *'City favourite'* are producers with higher turnover, located close to their main market (some of the producers in Case 1 fit even here). A local brand can have important value for retailers and transport costs are a less critical issue.

Third, development characteristics and producer preconditions are matched to identify appropriate strategies for each producer group. While individual factors may motivate other priorities, general strategic guidelines are presented in the following.

A. *'Taste of the region';* Transport cost limit profitability and small volumes are impediment for investments. Focus on product development (e.g. value-added activities, catering, tourism) on the farm, transport coordination (necessary to improve transport efficiency without heavy investments) and low-cost solutions for optimisation and integration (i.e. based on personal communication).

B. *'Season's harvest'*; Low transport costs and small volumes limit investments. Manual routines are adequate in transport, planning and communication. Focus on product quality, marketing and personal communication.

C. *'Local challenger'*; Many distribution channels are possible and the volumes allow some investments, but the products need to be competitive. Public procurement could be an option if tenders are small. For the retail market, logistics need to be effective and integrated to make ordering and deliveries rational. Transport distances and volumes require effective distribution. Focus on transport coordination and optimisation, and producer collaborations in common hubs. Integration and electronic communications and continuing development of products, processes, packaging and marketing are also important.

D. *'City favourite'*; Own-account transport take advantage of the short distance but many distribution channels are possible and some investments may be possible. Sales to several retailers require effective administrative routines. Focus on integrated solutions. If there are own-account transport resources, take advantage of the short distance by offering coordinated delivery services, e.g. by hosting a delivery hub.

Strategic development areas for the producer groups are summarised in Figure 5.

Figure 5. Strategic logistics development areas for local food producer categories

Development of integrated logistics tools for local food producers

Some of the recommended development strategies require further development to be effective in small-scale implementations. The access to free mapping and simple routing

services has dramatically increased with the introduction of smartphone and web-based services during the recent years. However, more advanced routing and scheduling software still carry high costs. More transport coordination possibilities could be identified using GIS-based cluster analyses (strategically) and electronic matching services of transport demand and carrier capacity (operatively), if a centralised service organisation could be established.

Existing solutions for integration in conventional supply chains (such as the EDI system) are often too investment intensive and applicable only in large-scale systems, and the introduction of any new system requires time for adaptation and training. However, with decreasing hardware and software costs, it would be possible to develop low-cost implementations of these functions.

Retail chains, catering chains and other private or public professional buyers could support this development in order to increase the availability of these products, which are often in high demand. Many of the requirements are not exclusive to the food sector but common to a most small-scale e-trading companies. Societal concerns for small-scale entrepreneurship and regional development may motivate public initiatives to support this sector in the organisation of public procurement and in support to the development of coordinated and integrated logistics solutions, education and training. Figure 6 illustrates a framework of how different logistics tools could be included in a framework for effective logistics, integrating small-scale producers with large-scale supply chains.

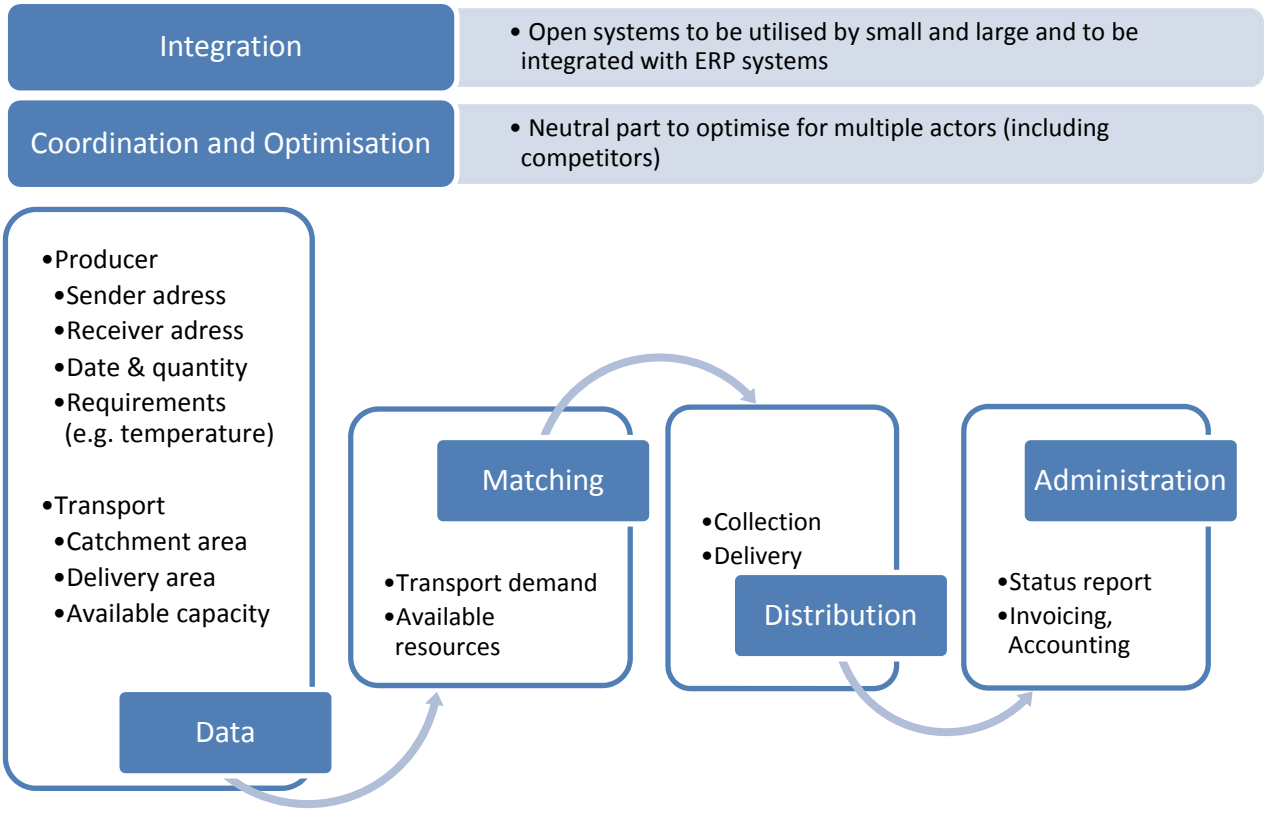

Figure 6. Tools for optimised and integrated logistics systems

CONCLUDING REMARKS

The current study has increased the knowledge of logistics systems for locally produced food. While all the food producers in the case studies and survey were considered local and small-scale, there was a considerable variability in terms of size, mode of operation and sales channels.

This study has revealed that logistics is seen as an important issue for many producers. The advantage of short distances does not compensate the logistics and transport disadvantages of heterogeneous, small-scale material flows and geographically scattered production. Coordination, optimization and integration can still create opportunities for logistics improvements, which have been demonstrated in the project's case studies.

A conceptual model for strategic analysis of logistics solutions for producers of local food has been developed, and shows that there is a need for different logistics solutions for different groups of producers, depending on market opportunities and locations.

Using the conceptual model, strategies and possibilities can be identified to improve logistics for different kinds of producers of local food, which can improve the competitiveness of local food products and thereby reduce transport work for food distribution. For these solutions to be likely to be adapted, they also need to encompass a great flexibility.

Based on the strategic development areas that can be identified in model, it can be concluded that there is need for further research and development regarding low-cost, user-friendly technologies for integrated logistics systems, and for evaluation of such solutions once they can be implemented. Further research is required to refine, develop and validate the model to fit more than the current areas. Some of the areas of development are

- Inclusion of additional parameters, *e.g.* product value (exclusive premium products, which are very little cost-sensitive)
- Consumer preferences may vary widely internationally and between different regions and their effect on the demand for local and small-scale food production needs to be further examined.
- Additional data collection for validation
- Case studies with in-depth analysis of individual companies

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