NEW MODEL FOR URBAN FOOD TRANSPORTATION

Project U-TURN: Describing the approach to simulation modelling and revealing industry survey results

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In this second collaborative article from Project U-TURN, we will:

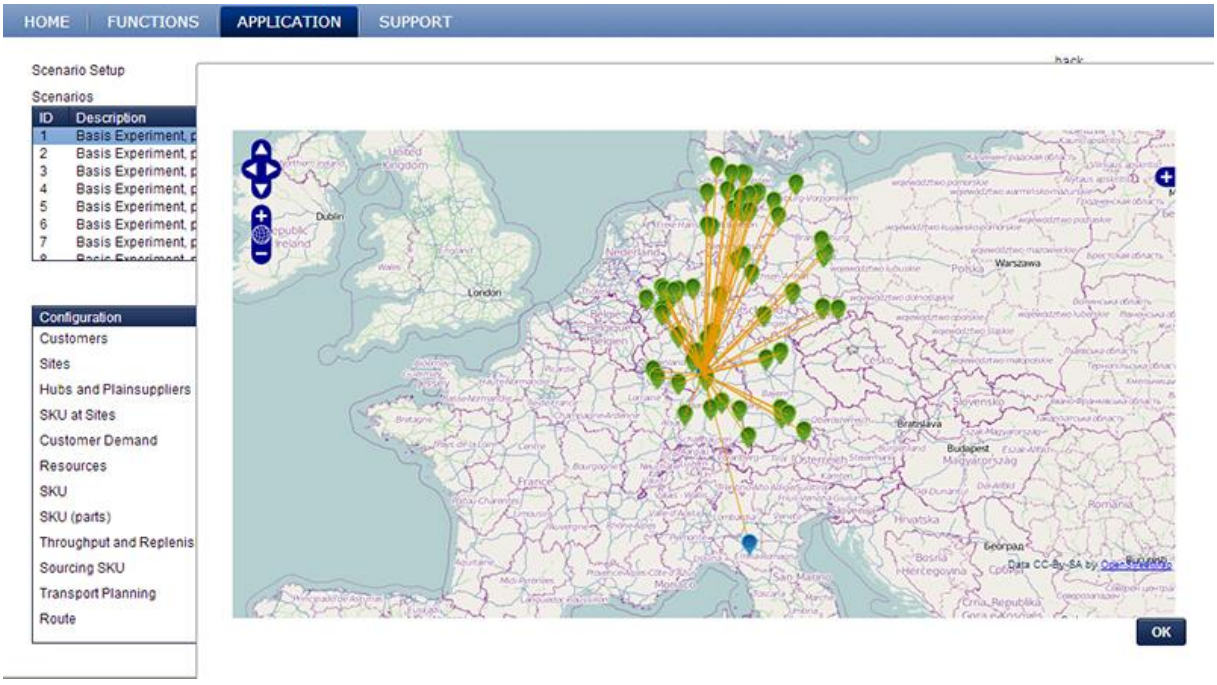
- Describe the simulation modelling approach and tools deployed for Pilot 1 – Distribution to Grocery Stores in Athens
- Reveal the results of the industry survey carried out for Pilot 2 – Distribution from Local Producers to Consumers in Milan
- Articulate the approach for modelling collaboration in Pilot 3 – Home Delivery of Online Groceries in London

Distribution to Grocery Stores in Athens – Modelling Approach and Expected Benefits

Astrid Klueter – Technical University of Dortmund

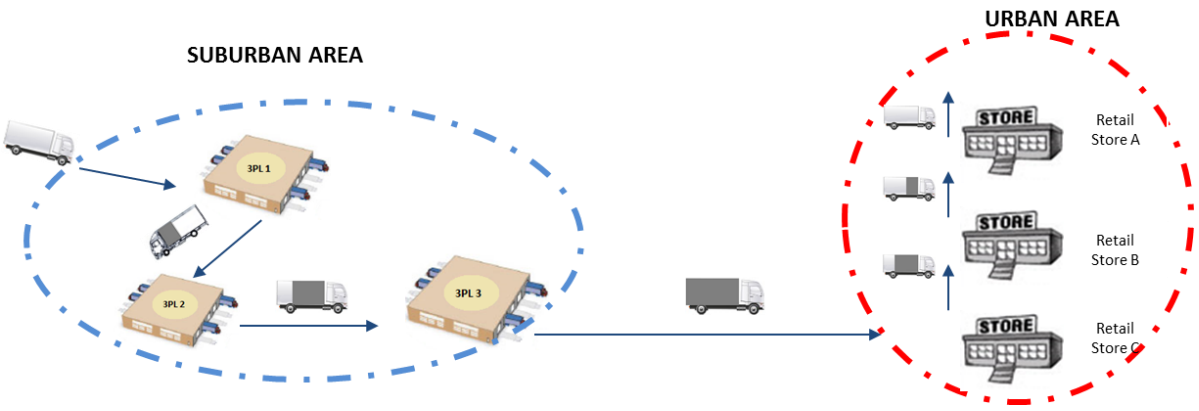
The application of simulation to analyse complex supply chain structures is getting more and more important. Simulation is employed to discover optimisation potentials in logistics or to identify risks for critical situations. However, the use of simulation to evaluate collaboration practices is not very widespread at present. The U-TURN project is employing simulation technology in pilot applications, in order to demonstrate its applicability in supply chains for urban delivery and to show the advantages of novel approaches to improve the overall efficiency of such delivery, for example by changing the delivery structures or implementing collaboration. For the simulation of the first the pilots, a discrete event simulation tool named SimChain is employed. This tool has originally been developed as a class library for the simulation tool Plant Simulation under the name ICON-SimChain. SimChain consists mainly of three major parts: a graphical user interface used for model configuration, a database in which all configuration data and simulation results are stored and a DES Supply Chain Simulation Framework based on PlantSimulation. All model elements are generated automatically in PlantSimulation using predefined building blocks from a predefined template library. In order to instantiate different scenarios, a specific template combination is used with the aim to support Supply Chain decisions. The data model of SimChain contains database tables for all the essential information that is needed to describe a supply chain and includes basic tables and configuration tables. The information from the basic tables describes the general structure or layout of the logistics system (e.g. geographical information of sites, suppliers and customers), whereas the configuration tables are used for the detailed specification of the dynamics of the system. This includes the allocation of Stock Keeping Units (SKUs) to sites or the customer demand for SKUs at a site. As a sample, a network consisting of many sites in SimChain is shown in Figure 1.

Figure 1 Screenshot of a network in SimChain



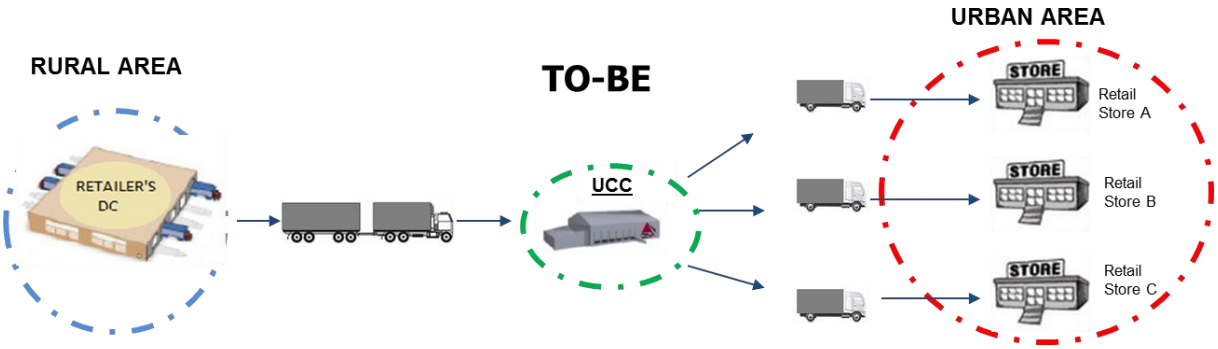
With the help of the simulation, different collaboration scenarios will be evaluated. Comparing the results from these scenarios allows us to assess which approaches deliver benefits and keep cost increases to a minimum. For the scenario comparison, different performance indicators are available: service level, transport costs, number of vehicles, number of deliveries and delivered SKUs.

Figure 2 Possible to-be scenario organized for direct transport



Delivery of goods into urban areas can be organized either by direct transport (Figure 2) or by using UCCs (Urban Consolidation Centre's) for consolidated transport (Figure 3). The UCC concept enables the shipper to use full-truck-load (FTL) transport for long haul to the consolidation point outside the city. Afterwards, routes are created for smaller vehicles to deliver inside the city using the "milk-run" principle.

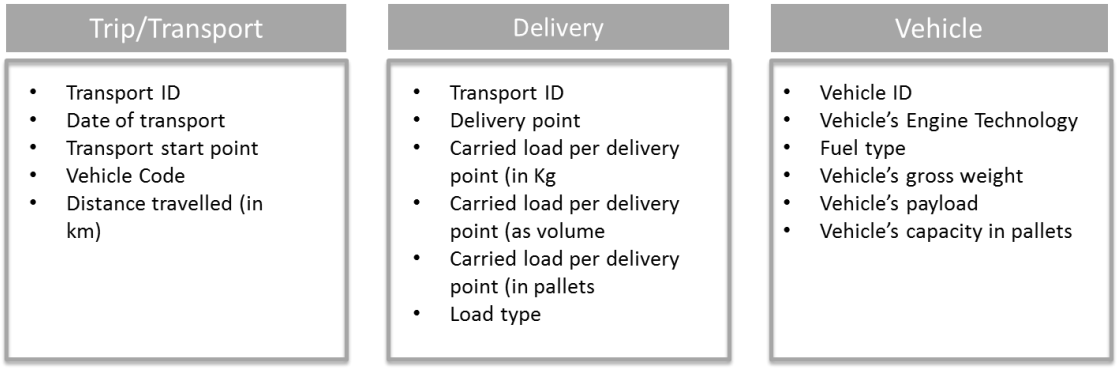
Figure 3 Possible to-be scenario with a UCC



For the first pilot under investigation, the data set represents exemplary food supply chains in the Athen's metropolitan area from different companies. The structure of the data set is shown in

Figure 4.

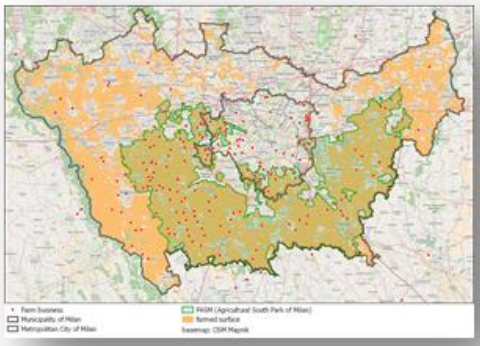
Figure 4 Structure of data set of Pilot 1



The expected results will be used to demonstrate the applicability, the value and the effectiveness of collaboration practices. Additionally, in case of the UCC scenario, we are able to model different UCC locations. By comparing the results, we will know which location will fit best.

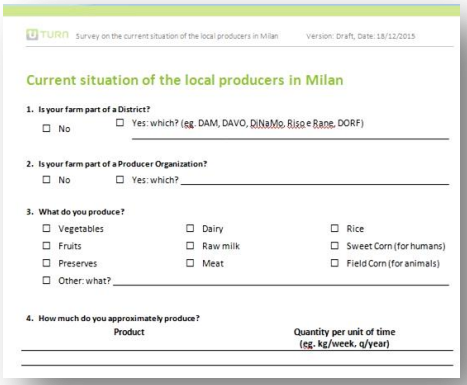
Distribution in Milan: from Local Producers to Consumers in Urban Areas – Summary of Survey Results

Daniele Apicella, Ettore Gualandi – TRT Trasporti e Territorio



Nowadays, the local food producers located around the rural area of Milan work with a low level of cooperative strategy, operating separately and trying to maximize their utility with many difficulties to reduce transport and logistics costs. This means that each food producer organizes the transport of each single order mainly using its own transport vehicle.

The development of the pilot action, where logistics pooling will be supported by the U-TURN project, requires specific knowledge of the business realities that make up the As-IS scenario. The adoption of a large-scale survey let to assess the current practices and verify the availability of the local food producers to share relevant information and set up a more competitive logistics scheme that the U-TURN platform could provide. Up to date, the survey has led to collect the information of 23 local producers (the contacts were more than 200), pointing out the existing of several sales channels that are used to reach the customers: shops, restaurants or final consumers, in order to guarantee a wider market of buyers.



U-TURN Survey on the current situation of the local producers in Milan Version: Draft, Date: 18/12/2015

Current situation of the local producers in Milan

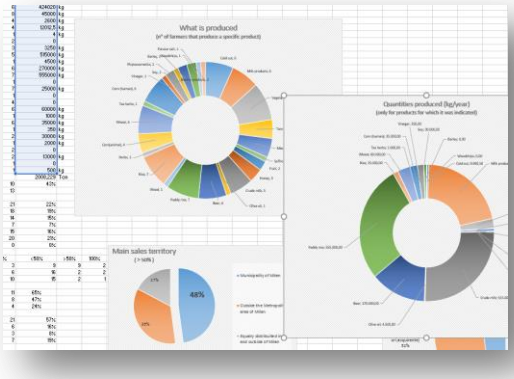
1. Is your farm part of a District?
☐ No ☐ Yes: which? (eg. DAM, DAVO, DiNaMo, Riso e Rane, DORF)

2. Is your farm part of a Producer Organization?
☐ No ☐ Yes: which?

3. What do you produce?
☐ Vegetables ☐ Dairy ☐ Rice
☐ Fruits ☐ Raw milk ☐ Sweet Corn (for humans)
☐ Preserves ☐ Meat ☐ Field Corn (for animals)
☐ Other: what?

4. How much do you approximately produce?
Product | Quantity per unit of time (eg. kg/week, q/year)

The study sample is quite heterogeneous, with 26 different food productions, so it properly represents the agricultural food production around Milan metropolitan area. In particular, the 43% of farmers produce only a single product concentrated in Rice, Vegetables, Corn and Wheat, but the majority of the survey sample has more diversified food production for a total annual food production of more than 2.000 tons. An interesting result comes from the territorial distribution of the sales market, fairly concentrated in the Municipality of Milan as was indicated by 20 producers out of 23. Even if the urban area never represents the whole sales market, it is the main reference market for the 48% of producers, showing signs of an expanding business.



Another result coming from the preliminary stakeholders consultation and confirmed by the online survey is the existing of different sales channels actually used by the local producers. Excluding the sales channels where there are no transport operations (on site direct selling) or the presence of the producer is mandatory (urban market) and those where the selling is managed by an intermediary (online, wholesaler, district), the sales channels that could potentially be involved in the pilot action are: Ethical

Purchasing Group, Retailer & Restaurant, Online farm website (online shop owned by the producer). These sales channels showed a great potential in terms of quantities yearly moved, in fact if we just take into consideration the survey sample we count more than 150 thousands of kilograms yearly moved from the rural area to the urban area of Milan mainly by small size vans (< 35qn) owned by the farmer.

Through the questionnaire, we tried also to verify the availability of the interviewees to collaborate for the transport and logistics services through different collaborative strategies: logistics sharing, with a 3PL providing transport service, and logistics pooling where only farmers are involved. The survey pointed out a high interest in setting up collaborative strategies that could be supported by the U-TURN platform.

Home Delivery of Online Groceries in London, UK – Modelling the impact of Collaboration

Dimitris Zissis – Cranfield University

The UK online grocery market is the biggest after the Chinese online grocery market, in terms of size. The existing business model in the UK online grocery market is a competitive one, where each retailer battles for every point of market share. Therefore, the retailers operate individual distribution networks to fulfil their demand which results in increased logistics and the environmental costs, as many activities are being duplicated. For example, it is not uncommon that home delivery vehicles of retailers visit the same residential area at about the same time during the day.

The grocery retail has adopted the Omni-channel approach with home deliveries and click and collect services competently used by retailers not only to attract but also to retain as many consumers as possible. However, operational costs of these services compromise the retailer's profitability.

In this pilot, we focus on the distribution operation of UK retailers restricted to home deliveries of online grocery purchases. Under the existing business model (decentralized distribution network), the cost per home delivery is estimated to be around £20 on average; which is extremely high when the minimum order value imposed by retailers on the consumers to be eligible for home delivery is £40. Our main objective is to develop a new model focusing on collaborative transportation, in order to reduce the operational costs and reduce the environmental impact. In the proposed model, we test the theoretical improvements in the operational aspect of home deliveries where the retailers are hypothesised to collaborate in logistics. In this model, the home deliveries are done by a shared network of hubs and through a shared fleet of trucks, with a centralised approach to the last mile logistics. In such way, we are able to not only reduce the total transport distance but also the size of the retailer's fleet of trucks. The direct consequences are to reduce the total transportation cost, the traffic nuisance due to road congestion, and the CO2 emissions without compromising the customer service levels and to provide better services to the customers, in terms of available time windows and higher proportion of on time deliveries.

The evaluation of our proposed model will be through comparing specific sustainability performance indicators such as Cost per order, Cost of basket size, On time delivery, Total distance, Truck loading factor, Drops per route, CO2 emissions and Traffic nuisance between the existing and the proposed model. We have exclusive data from a well-known retailer spanning home deliveries of one year, according to the followings: i) Total number of deliveries, ii) Indexed numbers by the customers' locations, iii) The spoke serving DC, iv) Percentage of orders delivered by hour by day, v) Percentage of orders checked out by hour by day, vi) Average number of deliveries with the weight and the volume for each order. Moreover, we use data from the annual financial reports of Ocado, an online retailer in the UK, which has around 13% of the UK online grocery market. The results of the comparisons between the models indicate the relevance of a potential collaboration among retailers in logistics.