PUBLIC SUMMARY OF DELIVERABLE

D10.3 – Dynamic Supply Networks Release 1

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Authors:	George Bravos [ITML], Florian Flocke [FRAUNHOFER], Anastasia Griva [AUEB], Ioanna Kelepouri [AUEB], Miltiadis Kritikos [INTRASOFT], Lefteris Manousakis [AUEB], Christina Milioti[AUEB], Yiannis Mourtos [AUEB], Vega Rodrigalvarez [ITAINNOVA] , Eleni Zampou [AUEB], George Zois [AUEB]
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This document is a public summary of a confidential deliverable of the TT project. It serves as a summary of the release 1 demonstrators and provides links for external actors to connect to the TT pilot leaders if they are interested in more information.

DISCLAIMER

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Motivation

TransformingTransport (TT) demonstrates, in a realistic, measurable, and replicable way the transformations that big data can bring to the mobility and logistics market. TT is structured into 13 different pilots in 7 pilot domains, which cover areas of major importance for the mobility and logistics sector in Europe.

The **Dynamic Supply Networks** domain focuses on transport and logistics issues in e-commerce. E-commerce represents one of the high priority sectors in European Economy that has grown to 530 billion euros in 2016 and was expected to grow at 603 billion euros in 2017. The sector presented a steadily growth of 14% in 2017 that differs strongly per country with around 57% of European internet users shopping online[1]. On top of that, the omnichannel growth has created new challenges for retailers. Whether their business is online, in physical stores or both, all retailers need to deliver a seamless customer experience at every touch-point, maximize sales across every channel and device, and live up to their promises regarding product availability and delivery.

To be more precise, in this dynamic and turbulent e-commerce environment the key challenges for online retailers are related to delivery and payment options, e.g., speed up delivery, improve shoppers' control over goods delivery (e.g., flexibility over delivery times and locations, efficient tracking services), and avoid parcel re-deliveries. Since the e-commerce market is expected to reach 1.3 billion parcels annually by 2018, this growth sets the need to develop new delivery services to meet consumers growing expectations and avoid customers experience problems during delivery process. In this context, logistics and delivery costs are recognized as major ones and online retailers are looking for ways to reduce them.

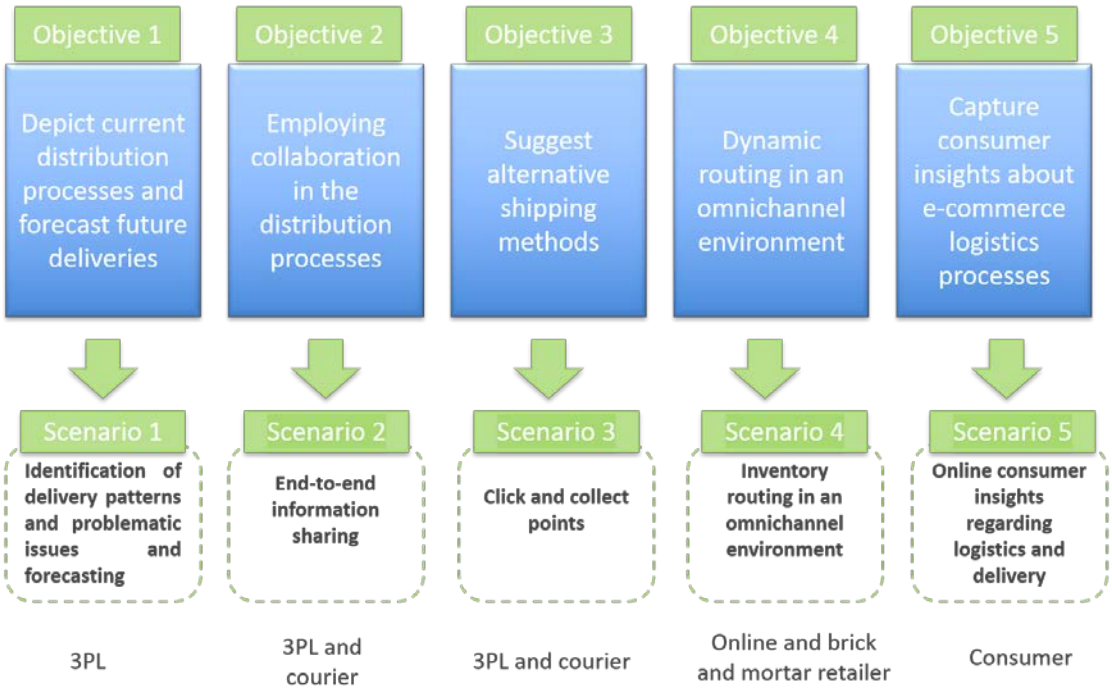
The above backdrop, together with the significant market growth that is experienced, provides the right characteristics for new delivery models and the exploitation of big data and business analytics to improve logistics performance. Big data collection and analysis could make activities in logistics much more efficient. Personalized services, dynamic pricing, predictive analytics, supply chain optimization and visibility are some of the core big data application areas in the field of logistics. In the e-commerce context, big data can be used to improve decision-making in all activities involving infrastructure and operation on one hand, and consumers' behavior on the other, thus achieving a better matching between supply and demand.

The main ambition of this pilot is to provide: a) a roadmap for applying big data analytics to tackle specific requirements in the e-commerce logistics, and b) empirical evidence about the impact that big data analytics could have on e-commerce logistics.

[1] For academic and industrial literature relevant to this summary see the main body of the Deliverable 10.3.

Dynamic Supply Networks pilot

After extensive user requirements elicitation and analysis, a set of pilot objectives (see upper part of below figure) have been identified, and associated with the implementation of five application scenarios (lower part of figure) by taking into account both business requirements and value that could be derived from the actual data sources. The results implemented so far refer to Scenarios 1, 3, 4, and 5 shown in the figure, and have been mainly formed using delivery, routing and contextual data received by a 3PL Partner, LOGIKA, that is one of the project beneficiaries. Moreover, more data were collected by other sources such as contextual data by two top Greek courier companies, order and deliveries data by online and brick and mortar retailers in Greece, open data and various social media sources, as well as customer product reviews. The working team of this pilot includes the following beneficiaries: ELTRUN - Athens University of Economics and Business, INTRASOFT International S.A., ITAINNOVA, ITML, Fraunhofer IML, LOGIKA.



A summary of pilot requirements - Objectives and Use cases - Scenarios

A series of interesting data analysis results have been raised at this stage for the various scenarios:

- By taking advantage of the descriptive analytics dashboard developed for Scenario 1, we offer users interaction with the 3PLs delivery data, through the selection of various criteria/dimensions as well as through a set of appropriate visuals. This descriptive analytics

framework has already provided valuable information to our 3PL Partner (LOGIKA), by properly adjusting the dashboard's parameters and filters on a specific set of depositors, within a fixed period, in the area of Attica. In addition, we propose a business analytics approach to extract shopper insights and behaviours from the available delivery data that may have a significant impact on managerial decisions.

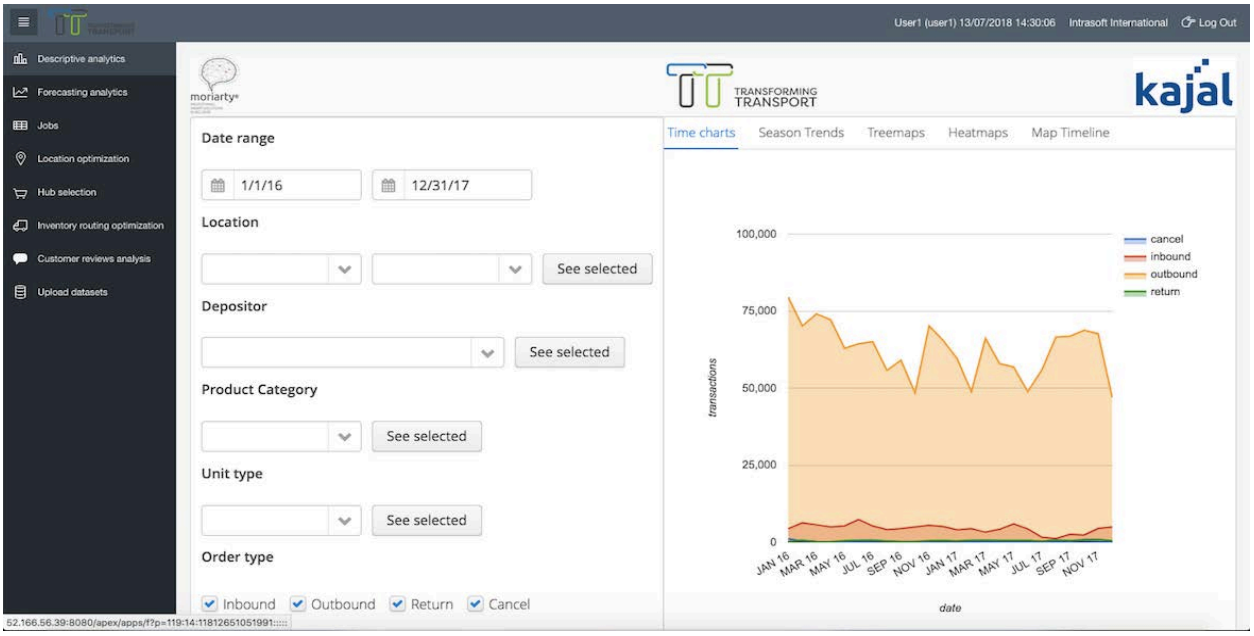
- By combining 3PLs delivery data and couriers delivery network with other open economic and geographical data sources, in terms of Scenario 3, we model logistics networks as capacitated p-median location allocation problems (separated to different optimization layers, e.g., central hub to shop, shop to customer, etc.) and we examine two interesting use cases: a) Shared logistics with shared hubs in Greece and b) Click and Collect (C&C) micro hubs in Athens metropolitan area. In both cases we apply efficient optimization algorithms, achieving minimum total distance with respect to warehousing and transportation costs. On the one hand, the optimization shows that by adding more shared hubs in the Greek area, the increase in distances is going to stagnate and the overall distances will reach a threshold where any further increase in the number of hubs will not provide any measurable benefit to the network. On the other hand, based on different candidate sets of C&C locations in the Athens metropolitan area, various optimization procedures show that the delivery time and resulting network costs are drastically reduced, as the customer itself is now tackling last mile costs.

- In Scenario 4, we examine the strategic cooperation between an online retailer and a retailer that owns physical stores under the goal of minimizing the transportation costs by integrating the set of physical stores as intermediate hubs. To this direction, we apply a decision support tool (based on Machine Learning algorithm approaches), which is using demand data from multiple sources in order to find the optimal hubs, to define the postcode assignments to the hubs, and to present descriptive analytics for the assignment. Two interesting facts that are deduced though the analysis are: a) geographical patterns of deliveries, and b) postcode assignment to hubs. For a) as we noticed there is an increased demand in the suburbs than in the city centre (where due to heavy traffic, a hub would face increased fuel consumption and longer delivery times), therefore, it is more cost-efficiently to serve the demands using hubs that are geographically dispersed in the suburbs. For b) by trying to equally balance the demand between hubs, we notice that the optimal solution is to create and serve areas expanded in a wide range concerning the maximum distance between the two most remote postcodes that each hub should serve.

- In terms of Scenario 5, we collect a set of consumer reviews from various online sources with information on online orders and product deliveries, and by careful data processing we identify a set of critical problems stressed by user comments. More precisely, by applying sentiment analysis we formulate a dataset of negative reviews and study the classification of these reviews in various problems. After stemming and lemmatization, the negative reviews are manually assigned to various identified problems (e.g. delay in delivery, delivered to

wrong address, no receipt, mistake in credit card charge, damaged product package etc.), which are grouped to problem categories (e.g., shipping, product, payment).

The big data infrastructure, provided by the pilot partners, has been utilized for supporting data manipulation and business analytics, while resulting to a unified dashboard[2], which exposes the main services of the pilot's system. An example is shown in the figure below.



The unified dashboard portal

Each service is formulated by considering the requirements of each different scenario and provides its own user interface so that potential end users can access it for deducing various types of decisions; from analyzing the current distribution processes in a 3PL, to inspecting the final consumers view regarding distribution processes. More precisely, for Scenario 1, the service consists of a dashboard for descriptive analytics where 3PLs delivery data is evaluated by end users, and a dashboard for forecasting analytics, where the user can predict the behavior of different types of data, depending on the selection of various criteria/dimensions, while presenting its forecasts through simple and convenient graphs. For Scenario 3, a web-service for location optimization in the whole Greek area and separately in the metropolitan area of Athens is developed on a virtual machine in the big data infrastructure, consisting of two main views (KPI and Map views), allowing users to create new scenarios based on different candidate data sets and configurations. The services of Scenario 4 provide a hub selection module and an inventory routing module, capable to present suggestions according to specific parameters

[2] http://52.166.56.39:8080/apex/apps/f?p=119:LOGIN_DESKTOP:14417459797897:::::

(e.g., the number of hubs to be used), which are fully implemented and integrated in the big data platform. Finally, the service of Scenario 5, offers visualizations relevant to consumer insights, i.e., a word cloud with the most frequent terms of the review, a wheel presenting association rules among frequent keywords, and a sunburst graph depicting the classification results. Overall, we provide some first concrete insights about the role of the big data and business analytics in the context of e-commerce logistics along with empirical evidences regarding their potential impact on improving operational efficiency, enhancing customer experience and introducing new business models.

Contact for more information about the pilot:
Eleni Zampou (zampoueleni@aueb.gr), George Zois (georzois@aueb.gr)