



## Expression of interest

### Contact details

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### Short description of the organisation

*Provide a short description of the equipment available, the relations with the industry, the profile of the main researchers*

Koc University (KU) is an endowed, non-profit institution of higher education, located in Istanbul, Turkey. Founded in 1993 by the Vehbi Koc Foundation, KU is a leading research university, attracting accomplished, and high-calibre researchers from all over the world. Majority (97%) of KU faculty have Ph.D.'s selective and reputable universities mainly in the US and Europe. As of 2013 academic year, Koc University has an enrolment of over 5500 students with over 470 faculty members. The modern campus buildings are equipped with state-of-the-art classrooms, teaching and research laboratories, library, and computer facilities. The University maintains strong relations with Universities in Europe, U.S. and Far East through collaborative efforts including joint seminars, academic programs, and research projects.

From 2004 to December 2022, 1200 research projects from various disciplines were sponsored by national, European and worldwide institutions. KU's performance Under EC's FP7 is as follows (at the end of 2013): A total of 62 participations with a total EC contribution of €13.5M; 40 coordinated actions under Marie Curie, 19 partnered cooperation projects, 3 ERC coordinatorships. If the grants received by TÜBİTAK are excluded, KU was the third most active university in Turkey of the FP7 Programme.

Under Horizon 2020, KU became the most successful organization in Turkey, with 53 participations and an EC contribution of €24M. Among these, the university coordinated 16 ERC actions, 17 MSCA projects, 1 ERA Chair, 1 Twinning action, 1 Euro-HPC action. KU collaborated with numerous other European research and industrial organizations as a consortium partner in 17 other Horizon 2020 projects.

Under Horizon Europe, KU has so far secured 16 grants, with a total EC contribution around €15M, currently the leading organization in Turkey.

Koc-IBM Supply Chain research Center will participate that was founded in 2008 with the goal of conducting innovative research on sustainable supply chains, logistics and transportation. The center is staffed with experts and also has state-of-the-art computing infrastructure.

**Metin Turkay**, Professor and Chair of Industrial Engineering, Department expert in data mining and optimisation theory and algorithms (<http://home.ku.edu.tr/~mturkay/>) and applications to sustainable supply chain management and logistics. He is head of the SystemsLab (<http://systemslab.ku.edu.tr/>) and of the Koc-IBM Supply Chain Research Center (<http://kocibm-scm.ku.edu.tr/>). He received BS and MS degrees from METU and PhD degree from Carnegie Mellon University. He worked as Principal Consultant at Mitsubishi Corporation, Japan on the development of optimization models and algorithms for supply chain management, preventive maintenance planning and scheduling, and logistics prior to joining Koc University in 2000. His research interests include data mining, optimisation theory and algorithms and applications in sustainable supply chain management and logistics, energy efficiency and manufacturing systems. He received AIChE/CAST Ted



Peterson Student Paper Award in 1997 for best published work by a PhD student in USA, TUBITAK Young Scientist Incentive Award in 2006, IBM Supported University Research Award in 2007, and an IBM Faculty Award in 2009, IBM OCR Award in 2012. His innovative logistics optimisation solution at Arcelik-Beko resulted in 20% cost savings and he was awarded as the most successful Koc Employee in 2018. He later established SmartOpt that focuses on machine learning and AI based end-to-end supply chain and logistics software services and SmartOpt was selected as one the top 5 global startup impacting logistics by StratUs in 2021 and voted as the Most Innovative AI Company in 2022 in Turkey.

## Specific skills related to the project

Koc-IBM Supply Chain Research Center focuses on the conceptual design, planning and operation of sustainable supply chain and logistics solutions. Our expertise is focused on the following:

- **Conceptual design of sustainable logistics/transportation systems** from the triple bottom line accounting including social impact. We already have analytical methods, data science models and algorithms to analyze social impact in addition to environmental impact. We aim to extend our models to include Carbon footprint compliance and also behavioral nudging mechanisms.
- **ML/AI for transport/logistics systems** for analysing transportation pattern to forecast and classify consumer profiles and seasonal variations in demand patterns. This also enables us to develop a fast and accurate digital twin of the underlying system. We aim to extend our approach to generate more accurate forecasts and profiles applying deep learning and reinforcement learning methods as well as developing the digital twin automatically from data and system topology.
- **Modeling/Simulation/Optimization of intermodal transportation/logistics systems** in the design, planning and operation. We have developed multi-objective optimisation algorithms for sustainability analysis of intermodal/synchromodal transportation/logistics systems. We aim to extend our models and solution algorithms for Carbon footprint compliance and behavioral nudging.
- **Pilot design and setup** for multi-modal transportation systems that integrates public transportation and logistics. We have collaborated extensively with Istanbul Municipality in demonstrating the effectiveness of sustainable transportation systems in a mega city of Istanbul with a population of 16.5 million. The previous demonstrations were mainly focused on land use, time value (congestion) and GHG emissions. We want to extend the pilot setting to include social consideration as well.

## Proposed activities for the project

*Indicate which activities you would like to implement during the project*

- **Data Analysis:** Developing and testing new generation multimodal, flexible, agile and adaptable and resilient transport network and traffic management systems, leveraging state of the art technologies using artificial intelligence and machine learning (big data). We will extend our machine learning based models on forecasting and classification for
- **Modeling:** Assessing and simulating the effects on multimodal network and traffic management of new forms of mobility (e.g. zero-emission, connected and automated vehicles and vessels, car sharing/pooling, active-/micro-mobility, sustainable land/air transport modes and drones) in different urban and rural environments, considering the socio-economic acceptability and different user needs (including vulnerable and gender groups).
- **Simulation/Optimisation:** Performing simulations for network-wide optimisation of traffic models, aiming towards a “social optimum” and an evaluation of mobility options for multimodal mobility and freight flows (including last-mile), enabling a modal shift to more sustainable modes (leveraging public transport), while addressing planned and unplanned events of mobility and freight systems under disruption.



- **Pilot Organisation in Turkey (Istanbul or another city):** Performing early pilot activities on multimodal network and traffic management of limited scale in mobility hubs (e.g. rail nodes, maritime or inland ports), where cross-modal or hinterland inter-connections are present for passenger and freight traffic flows.

## References

Previous research projects:

Project acronym / starting date	Main objectives	Main activities	Role in the project
Log4Green	Transport Clusters Development and Implementation Measures of a Six-Region Strategic Joint Action Plan for Knowledge-based Regional Innovation (287091)	Green transportation system design for urban logistics and traffic flow	Partner
InTraRegio	Towards an Intermodal Transport Network through innovative research-driven clusters in Regions of organised and competitive knowledge (286975)	Intermodal transport network design, planning and operation in regional/urban planning	Partner
OSIRIS	Energy consumption reduction in urban rail systems (284868)	Development of automated and machine learning based tool passenger traffic forecasting in metro systems	Subcontractor
Finest	Future Internet enabled Optimization of Transport and Logistics Business Network (285598)	Development of process and data flow architectures for logistics chain modeling	Subcontractor
MapDriver	Towards a Roadmap to boost Demand for ICT in Transport (SI2 664658)	Analysis of ICT innovation capacities of logistics sector	Partner

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