# LM4: Artificial Intelligence in Supply Chain Optimisation

## 1.1 Module objectives

***"The primary purpose of this module is to explore the application of artificial intelligence to optimise the overall food-supply chain. Modules will include hands-on demonstrations of AI concepts in supply chain issues. "***

## 1.2 Learning outcomes

In recent years agricultural production has increased worldwide with a different pace across regions and commodities. Disruptive technologies are playing a critical role in increased production and efficiency in overall food supply chain management. Farmers and Agri-tech businesses are constantly facing complex and critical decisions in agricultural production and supply chain management. These decisions include production efficiency, efficiency in logistics, on- and off-farm planning and scheduling, sales forecasting and precise agricultural processes to scale and serve the demand of rapidly growing population. Parallelly, global challenges are putting a limitation on a wide range of stakeholder involved in Agri-food system to reducing fossil energy consumption, GHG emission and reducing organisational and operational costs along the supply chain.

Traditionally, stakeholders used their experience and judgement to make such decisions. However, as the food demand is growing exponentially, farming and supply chain management practices also shifted toward short production runs and cut the costs in production methods. These added complications also made the decision-making process more complex. Many of the one and off-farm processes have become more automated and allow greater control of the supply chain. At the same time these processes also started generating enormous amounts of data coming from a wide variety of sensors across the food-supply chain. As the agribusiness are becoming more complex data analytics tool such as artificial intelligence (AI) have received increasing attention from both practitioners and researchers in the Agri-food domain. AI can effectively predict anomalies in the trajectory of the supply chain and optimise the entire process and help stakeholders making effective decisions supply chain operations. Several AI techniques, such as neural networks, genetic algorithms, fuzzy logic and evolutionary strategies have been applied successfully.

The course module will provide an opportunity to students to recognise and learn about Artificial Intelligence applications in agricultural practices and supply chain optimisation.

Co-funded by the Erasmus+ Programme of the European Union

Through this course student will learn fundamentals and application of various artificial intelligence techniques to assist decisionmakers in tackling key problems in the supply chain optimisation. AI application case studies will be explored for optimising the supply chain cost management, waste reduction, enhanced delivery timing and order-fulfilling volumes. Finally, the module will explore the statistical nature of agricultural data and supply chains in particular. To summarise, the learning outcome of this course are:

- To provide an overview of artificial intelligence (AI) and its application in Agribusiness supply chain.
- To make course participants aware of agribusiness supply chain management and logistics.
- To make course participants aware of a wide range of sensory technologies and data generated from these technologies.
- Providing students with a set of skills to evaluate different supply chain management systems and provide consultancy on their usage and to use it in future projects.
- To provide course participants with a set of skills that will enable them to manage the useful information gathered from sensors across the food supply chain, including decisions made by AI applications based on data gathered from the food supply chain

## 1.3 Course content

1. **Overview aartificial intelligence**
   - Search and planning
   - Expert systems
   - Machine learning and neural networks method
2. **Data sources like sensor**
   - Temperature, pressure,  and humidity sensors
   - Vision sensors
   - Sensors for structure/quality of soil/products
3. **Digital technologies**
   - Barcode, RFID, NFC
   - IoT/IIoT
4. **Logistics**
   - Production, materials handling, and packaging
   - Inventory and transportation
   - Warehousing
5. **Supply chain management and logistic**
   - Flows of material and Information
   - Flows of equipment, financial and human resources,

- Flows of intangible resources (relations between companies)

6. **Case studies**
   - Milk production
   - Beef production

## 1.4 Mode of teaching

- Lectures
- Literature study
- Case study, and
- Presenting the results to the group

## 1.5 Recommended study material

Selected examples of articles, book and online study material.


- Stuart J. Russell, Stuart Jonathan Russell, Peter Norvig, Ernest Davis (2020). Artificial Intelligence: A Modern Approach. Prentice Hall.
- Yan Zhang, Paris Kitsos (2019). Security in RFID and Sensor Networks. Security in RFID and Sensor Networks.
- Dawei Lu (2011). Fundamentals of supply chain management Dawei Lu & Ventus Publishing ApS.
- Yuhong Dong, Zetian Fu, Stevan Stankovski, Siyu Wang, Xinxing Li, Nutritional Quality and Safety Traceability System for China's Leafy Vegetable Supply Chain Based on Fault Tree Analysis and QR Code, (2020) IEEE Access
- Prodanović, R., Rančić, D., Vulić, I., Zorić, N., Bogićević, D., Ostojić, G., Sarang, S., Stankovski, S., Wireless sensor network in agriculture: Model of cyber security, (2020) Sensors (Switzerland), 20 (23), art. no. 6747, pp. 1-22. DOI: 10.3390/s20236747
- Stankovski, Stevan; Ostojic, Gordana; Senk, Ivana; Rakic-Skokovic, Marija; Trivunovic, Snezana; Kucevic, Denis, Dairy cow monitoring by RFID, Scientia Agricola, pp 75-80, 2012.
- Stankovski, Stevan; Lazarević, Milovan; Ostojić, Gordana; Ćosić, Ilija; Puric, Radenko, RFID technology in product/part tracking during the whole life cycle, Assembly Automation, 2009.
- Stankovski, Stevan; Ostojić, Gordana; Nićin, Miroslav; Baranovski, Igor; Tarjan, Laslo, Edge Computing for Fault Detection in Smart Systems, ICIST 2020 Proceedings, pp 22-26, 2020.

## 1.6 Coordinator

University of Novi Sad (UNS) , Serbia / AgTech7 online platform

Co-funded by the
Erasmus+ Programme
of the European Union