MODULE 4

WORKSHEET 4: HYDROGEN TRANSPORT MANAGEMENT SIMULATION WITH TMS

Substantive introduction

Efficient hydrogen transport is just as important as its storage. In this worksheet, we'll focus on simulating the planning and execution of hydrogen transport using a TMS, taking into account the challenges of safety and logistics.

TMS modules typically include:

- **Route planning:** Optimization of paths, taking into account road restrictions, driving time, fuel.
- **Fleet management:** Assigning vehicles and drivers, monitoring their availability and technical condition.
- **Shipment monitoring:** Real-time tracking, status updates.
- **Document management:** Generating waybills, permits.
- **Transport cost accounting:** Budget optimization.

In the case of hydrogen transport, the TMS should additionally take into account:

- **ADR/RID regulations:** Standards for the transport of hazardous materials.
- **Vehicle safety:** Technical condition of tanks, certificates.
- **Fueling station availability:** Refueling planning.
- **Driver rest times:** Compliance with regulations.
- **Monitoring parameters of transported tanks (IoT):** Pressure, temperature.

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Task: Hydrogen Transport Planning and Implementation Scenario

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Task objective: Simulation of hydrogen transport planning and implementation using TMS, taking into account integration with data from WMS and IoT.

Scenario: You are dispatchers for a hydrogen transportation company. You need to plan transportation for three orders that have been completed in the warehouse (from Job Card 3). You have a specific fleet of vehicles at your disposal**.**

Instruction:

1.Initial data:

- Orders for transport (from Appendix 3 of Worksheet 3).
- Warehouse location (e.g. Krakow).
- Customer locations (e.g. Customer A: Wrocław, Customer B: Warsaw, Customer C: Gdańsk).
- Available vehicles (Annex 4).

2.Route planning:

- For each order, manually or using an online route planning tool (e.g. Google Maps), determine the optimal route from the warehouse to the customer.
- Take into account estimated travel time and distance.
- Consider whether one car can serve more than one customer on one route (optimization).

3.Vehicle allocation:

- Assign available vehicles to individual routes, taking into account their capacity and status.

4.Monitoring (simulation):

- Assume you have IoT sensors in your vehicles and tanks. What data (e.g., location, tank pressure, temperature) would you like to monitor in real time and why?
- What would you do if the TMS system alerted you to a sudden pressure drop in the H2-001 tank during transport?
- What would you do if a driver reported a delay due to traffic? How could TMS help manage this situation?

5.Documentation:

- What documents should TMS generate before starting transport (e.g. waybills, permits for the transport of hazardous materials)?

Appendix 4: Sample Table of Available Vehicles

Vehicle ID	Vehicle Type (Tanker/Flatbed Truck)	Loading Capacity (Number of Tanks)	Status
TRK-001	Tanker	10	Free
TRK-002	Flatbed Truck	5	Free
TRK-003	Tanker	8	In Transit

Tips:

- Focus on how TMS automates and optimizes processes that would be very time-consuming and error-prone manually.
- Think about how integration with WMS (data about tanks ready for shipment) and IoT (real-time data) impacts the decisions made in TMS.
- Pay attention to safety and compliance aspects.

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