Multimodal Traffic Management (MTM): Future Training emphasizing Collaboration and Coordination

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Abstract: This paper is a part of the ORCHESTRA project (Horizon Europe 2021-2024), where the vision is a future where it is easy to coordinate, negotiate and synchronize traffic across all modes (road, rail, sea, and air). Multimodal Traffic Management (MTM) orchestrates traffic across modalities, and with that optimizing capacity in the total transport network. Thus, we may reduce negative impacts of traffic, such as emissions and delays, and still get people and goods to their destination on time. This paper aims to present piloted traffic manager training and reflect upon traffic manager's future competence and training needs, labelled Traffic Orchestrators (TO). The paper presents critical traffic orchestration concepts, measures, and recommendations regarding future TO education. In addition, to learn how to use management tools specific related to their own governance area (GA), TOs also need knowledge on coordination and negotiation with other TOs managing traffic in affected surrounding areas. The pilot form TO training modules for (I) Basic and fundamental competencies, (II) Future scenario handling (normal operation, foreseen events, unforeseen events), and (III) Follow-up modules, refresh studies and specification.

Keywords: Knowledge Creation, Polycentric Multimodal Traffic Management, Education, Inter-Organizational Coordination, Resilience

1. Introduction

This paper is a part of the EU project ORCHESTRA, 2021-2024, addressing the problem that traffic caused by transport has many harmful effects, such as congestions and emissions. These challenges are hard to handle due to a lack of coordination both within and across different transport modes (road, rail, sea, and air). The paper addresses the gap of knowledge and competencies that traffic managers possess today and future requirements for inter-organizational coordination and pro-active traffic orchestration.

The long-term vision of ORCHESTRA is future *Multimodal Traffic Management* (MTM) through *traffic orchestration*, i.e. by coordination and synchronizing traffic management across all modes to cope with diverse demands and situations and to increase optimization and resilience. The general objective is to provide European policymakers, public authorities, transport providers and citizens with new knowledge and technical and organizational solutions to enhance traffic orchestration. The definition of *traffic* is the accumulated vehicles that use infrastructure as a means of travelling from place to place, while *transport* is the movement of people and goods from one place to another using vehicles in all modes (road, air, rail and sea). This paper aims to present a framework for future education, and to reflect upon competence and training needs of future traffic managers, labelled *Traffic Orchestrators* (TO). TOs are key stakeholders in the coordination and cooperation of traffic across governance areas (GA) and network modes. The paper addresses the key questions: (1) What knowledge and competencies do future traffic managers need, and how does it differ from today? (2) How should knowledge creation processes be? (3) How should a future training program look?

1.1 The System of Interest and Key Concepts

ORCHESTRA describes an MTM ecosystem (MTME) and a future polycentric management architecture (PMA). Based on existing structures, policies, regulations, GAs and actors – *polycentric management* aims to bridge communication, coordination and collaboration between several centres through data sharing, described by a PMA and an MTME. Multimodal transport of people and goods may facilitate traffic capacity across networks for optimal transport, avoiding sub-optimization within one modality. MTM includes managing and synchronizing traffic across all transport modes optimizing resources and minimizing negative impacts.

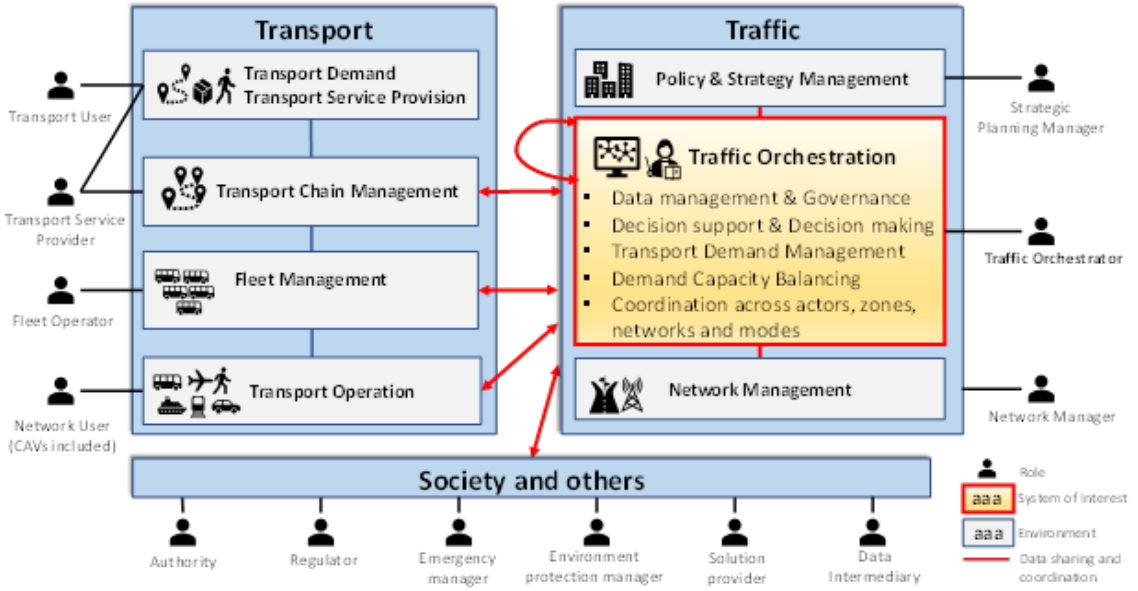

Figure 1: Multimodal Traffic Management Ecosystem (MTME) with System of Interest in its environment).

Figure 1 illustrates the ecosystem constituting Transport, Traffic, and Society and others (Natvig et al, 2024). Stakeholder archetypes represent generic roles with defined responsibilities. Real actors may play one or more roles. A *Traffic Orchestrator* is the executive stakeholder using new measures for:

- *Coordination, cooperation and negotiation across actors, zones, networks, and modes* aiming to arrange for optimization and resiliency using the total transport system.
- *Transport Demand Management* (TDM) aims to arrange everyday traffic flow according to policy and overall strategy of the transport system.
- *Demand Capacity Balancing* (DCB) aiming to cope with current and upcoming situations involving an imbalance between transport demand and capacity in the network.

TOs differ from fleet managers or vehicle operators in the way that they don't manage the fleet or the vehicle but *orchestrate the traffic* generated by fleets and vehicles when transporting people and goods. Traffic orchestration requires knowledge beyond the individual TO's defined governance area (GA), including understanding traffic flows between GAs, co-handling incidents, consequences and ripple effects across networks and GAs. A TO does, therefore, need training in using tools specific to manage traffic within their own GA, and to coordinate and negotiate with other TOs in surrounding GAs.

2. Theoretical Perspectives

One main ORCHESTRA result is to develop enabling toolkit supporting the realisation of MTME, including designing training modules and piloting training adapted to the two Living Labs. The resilience perspective will highlight the following questions: (1) What knowledge and competencies do future traffic managers need, and how does it differ from today? Theories on knowledge creation are presented regarding (2) How should knowledge creation processes be designed? (3) How should a future training program look? In the context of MTM, an educational design model is used.

2.1 Resilience

Resilience is identified as an important aspect for MTM and PMA and is central in the education of future TOs. Numerous definitions of the resilience concept are proposed. The definition used in the ORCHESTRA project is: *"A system is resilient if it can adjust its functioning prior to, during, or following events (changes, disturbances, and opportunities), and thereby sustain required operations under both expected and unexpected conditions"* (Hollnagel, 2019). One main characteristic of a resilient system is *adaptability*, i.e. the adaptive capacity to adjust patterns of activities in the entire ecosystem, for some stakeholders or organisations. Resilient traffic orchestration lies in the PMA, and stakeholder's and organisation's willingness to adapt, negotiate, communicate, and co-manage traffic through harmonising regulations, policies and defined work processes

between organisations and governance areas. Training modules are designed to clarify basic competencies for traffic orchestration of the MTME, and competencies to facilitate resilience in actual traffic orchestration under normal, changed, disrupted and disaster conditions.

Key characteristics of a resilient system are *monitoring* critical issues to know what to do; *anticipating through simulations* potential scenarios to know what to look for; *responding* in actual situations to know what to do; and *learning* of experiences and historical events to know what has happened and to be better prepared in the future. In addition to efficient recovery to a normal stage, to be resilient, a system must develop the ability to adapt both to new conditions and to future changes and surprises. Future work on MTM must build on knowledge about e.g. the safety of CAVs, traffic planning and management, and cyber security.

In MTM, resilience is closely linked to the ability to utilize any available capacity when needed. Today's traffic management is reactive, and done in silos, creating sub-optimization by not being able to efficiently be prepared for events, and utilise spare capacity in neighbouring governance areas or networks. Defined and learned operations for cooperation, proactive measures, coordination and negotiations can enable better utilization of total capacity across networks.

The traffic managers should be trained on how to interpret recommendations of technical tools to avoid disruptions, and on how to take the best decision in case a human intervention is advised (Søråsen, 2024; Grosse et al, 2021). Data sharing and orchestration measures will be significant characteristics to facilitate a pro-active, and more resilient multimodal transport management.

2.2 Knowledge Creation

Future MTM will constitute collaboration and coordination across management levels, organizations, and stakeholders. Learning objectives will transform from current silos focus into polycentric considerations, and from reactive to pro-active orchestration of traffic. *Organizational knowledge-creation* should focus on the active, subjective nature of knowledge (Nonaka & Takeuchi, 1995). Knowledge constitutes "*explicit*" or codified knowledge that is transmittable in formal, systematic language and "*tacit*" knowledge deeply rooted in action, commitment, and involvement in a specific context (Nonaka, 1994). In an organisation explicit knowledge may be seen in newsletters, documents and lectures. Tacit knowledge consists partly of technical skills (*know-how*) and cognitive elements (e.g. mental models and images of reality and the future; *what is* and *what ought to be*), Organisational knowledge creation is often described as a spiral with possible transfer between individuals, to groups, organisation and inter-organisation.

In addition to acquiring knowledge, knowledge creation regarding traffic management involves imagination and understanding future practices for management, including dynamic and continuous adaptation to changing circumstances. *Social construction perspectives* hold that individuals learn and develop when participating in social activities. These are regarded as mutual processes between the individual and society. Later approaches are often cited as e.g. situated learning, socio-cultural theory, cultural-historical activity theory, and distributed cognition (Stene, 2021). All regard the *context* as essential to what humans learn and how they develop. Socially developed *artefacts* are considered mediators between individuals and social contexts. While language is seen as the most significant artefact in learning, thinking, and reflection, dialogue and communication are essential. Artefacts are usually perceived as cultural tools and may also include e.g. serious games, written text, maps, illustrations, and diagrams.

Collaboration may support *scaffolding,* implying what a person can learn by assistance, guidance, or help from others. Reflective practice can be viewed as reflection-in-action and reflection-on-action (Schön, 1998), making a distinction between reflection *during* engagement in an activity and reflection *after* the event.

2.3 Design and Evaluation of Training Programs

This section presents a general theoretical, didactical model used for designing training programs. While pedagogy studies the learning processes at a social level (strategies, methods and techniques), didactics focuses more on the learning processes in a school or organisation.

The didactical model includes six elements for planning and designing training programs (Stene, 2010; Timoshenko et al, 2021). The elements are interrelated, i.e. the specification of one element will influence the other elements. Likewise, when changing or modifying one element we must consider implications for the other elements. (1) *Objectives* may be separated into learning objectives and training objectives/purposes. *Learning objectives* are competencies that the participants should have acquired at the end of the education program (or

specific module). These may be defined knowledge, performance, or attitudes. Requirements to goals are that they should be relevant, realistic, meaningful, and clear (to the participants). This element is associated with "Why" the learning is necessary. *Training purposes* are defined from the perspective of the educator or responsible institution and targets the intended effects on the system. (2) *Learning qualification* means the knowledge, attitudes, and performance the participants face the training with. (3) *Framework conditions* are conditions which make learning possible or place a limitation on learning, for instance teaching aids, time, room facilities and artefacts. (4) *Content* describes the curriculum of the training subject and issues to be covered. The element is related to "What" to learn. (5) *Learning process* concerns "How" to learn. This includes both the teaching and instruction methods used by a facilitator or teacher (e.g. lectures, instructions, demonstrations) and the participants' working methods (individually or in teams). (6) *Evaluation* may involve both the learning process, the goal and the participant's learning.

3. Methodology

3.1 Designing the Training

3.1.1 Design of MTM Training Program

ORCHESTRA includes two work packages that emphasize future MTM training. Kalbere & Stene (2023) present the theoretical approach and suggested program including modules, while Nguyen, Stene and Skuggevik (2024) specify the piloted training trials related to the Living Labs for freight and personnel transport.

3.1.2 Validation of the MTM Program

Validation intended to ensure quality, efficiency and sustainability of the training. To get feedback on the design, strategy and modules, a general program was presented at a Community of Practitioners (CoP) workshop constituting both partners and external stakeholders. Further, partner feedback on drafts of modules and digital training were given in a web-meeting and a plenary face-to-face meeting.

3.1.3 Preparing Training Trials

Prior to the Norwegian training, the authors specified the schedule in the context of the Arendal project (see 3.2) and ORCHESTRA projects, developed a playscript, and specified the six educational elements (see 2.3).

3.2 Training Period and Population

The piloted trials were performed in the January - February 2024 in Norway and Italy. In Norway the training was a two-day physical workshop (face-to-face) that included 10 participants and two facilitators. The participants represented six different organisations involving both external institutions (Agder County, Arendal Harbour, Arendal Municipality) and project partners (ROSAS, HIP, ITS-Norway). The training trials were designed and facilitated by two project partners and the authors of this paper.

In Italy the training was a three-hour digital workshop with six project partner organisations. They included 11 participants (Deep Blue, SEA, TU Delft, Enav, FSTecnology) and two facilitators (ROSAS). The training in Norway served as a blueprint for this shortened, digital version.

4. Piloting Traffic Orchestration Training

This chapter's main part concerns the didactical aspects of the practical and specific training trials. It describes key concepts and measures and the TO training strategy.

4.1 Concepts and Measures

TOs will use *Transport Demand Management* (Figure 2) according to the policy of respective governance areas. The policy will be the condition for measures that are chosen to orchestrate traffic. TOs need to be able to understand the flows and conditions of the information across roles inhabited by actors in the specific MTME and assess the consequences of implementing different measures. Measures used in ordinary situations may include information, traffic calming, access control, priority, and monitoring.

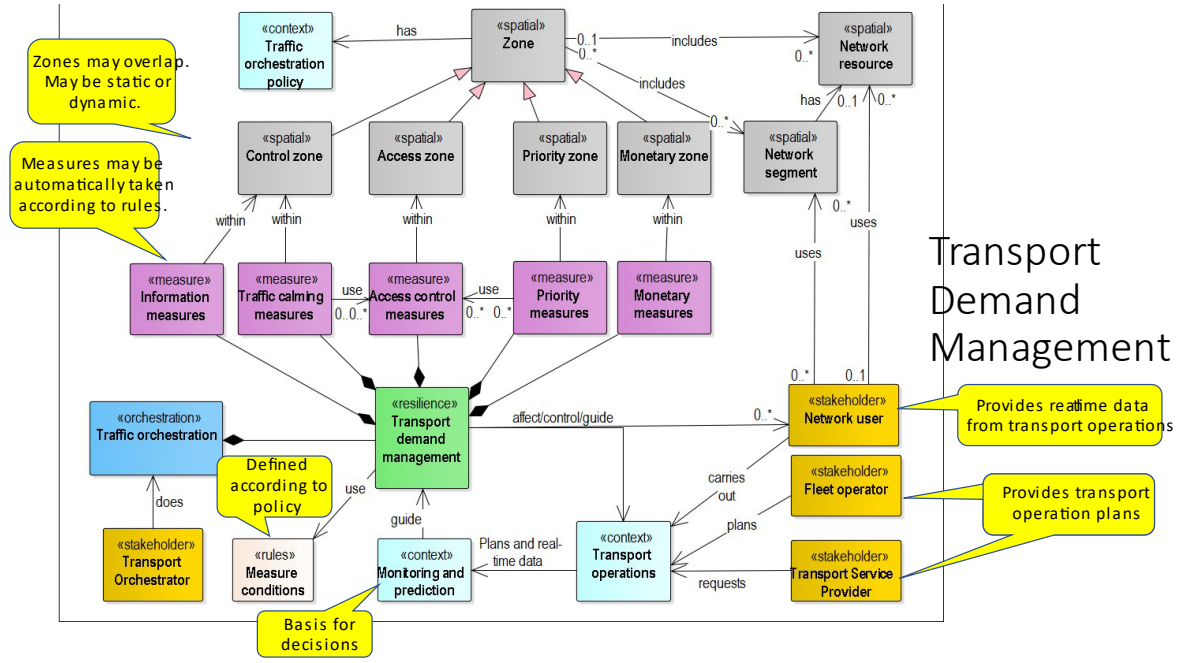

Figure 2: Traffic orchestration using Transport Demand Management (Natvig et al, 2023).

Demand Capacity Balancing may be needed when accidents, increased risks, or events with an unknown cause suddenly strain capacity (Figure 3). In addition to measures used in Transport Demand Management, TOs may need to use more individual measures and measures for capacity adaption. Incidents may also affect neighbouring governance areas, requiring TOs to coordinate and negotiate through coordination measures. To understand the consequences of the implementation of various measures, simulations of "what if" scenarios explore possible plans of operation, giving TOs decision support to effectuate pro-active measures.

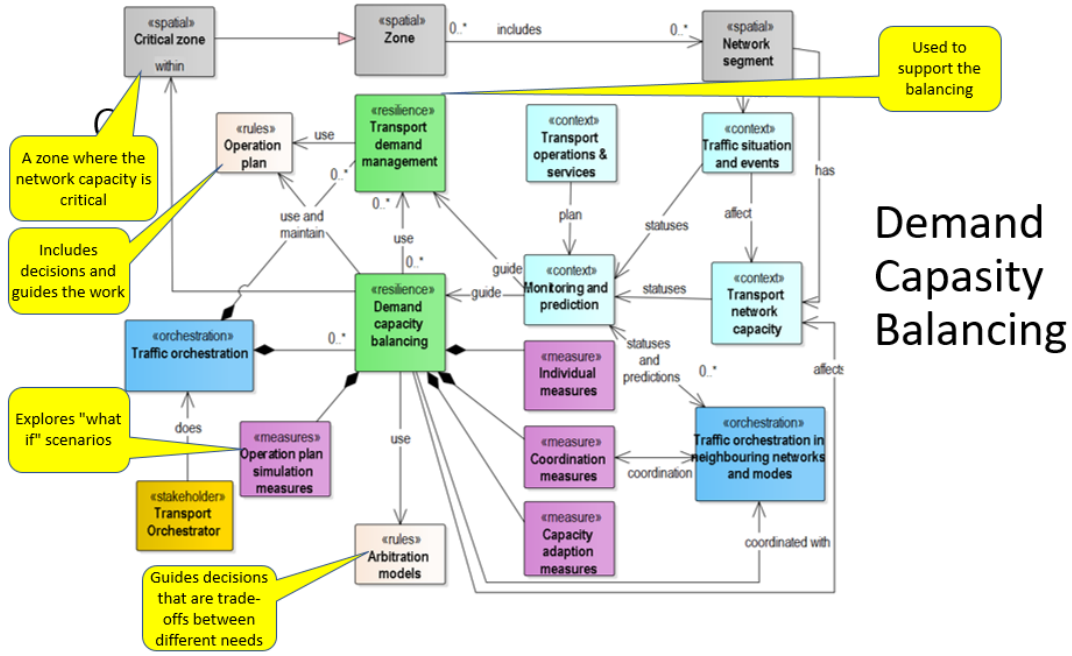

Figure 3: Traffic orchestration using Demand Capacity Balancing (Natvig et al, 2024).

These concepts and measures are the fundamental conditions for the content for the traffic orchestration training and must be understood and continuously rehearsed.

4.2 Training Strategy for Multimodal Traffic Management

The purpose of the TO training program is to educate future TOs on how to manage traffic effectively, i.e. improving resilience of highly automated coordination systems (in normal, disrupted or disaster mode of operation) through better connection and cooperation with the infrastructure and surrounding vehicles. The TO Training Program constitutes three *main parts* (Table 1).

I. *Basic and fundamental competence* includes systems, in addition to practical, operational competencies needed for future traffic orchestration, i.e. performance and skills as a basis for doing traffic orchestration. These may include practical skills, knowledge and/or attitudes.
II. *Resilience competence and traffic orchestration* includes competences to ensure resilience in MTM according to PMA. It is recommended to specify training related to three scenarios: (a) Normal operation, (b) Foreseen events and (c) Unforeseen events.
III. *Specific competencies and refreshment/updating* studies include supplementary competencies, refreshment studies, and specific studies (e.g. specific to contexts and/or local geography).

Table 1: Traffic Orchestrator Training Program.

III. Specific Competencies - Refreshment and updating studies		
I. Resilience Competence - Traffic orchestration Scenarios		
Normal operation	Foreseen events	Unforeseen events
I. Basic and fundamental competencies • Rules, standards, and regulations • Multimodal Traffic Management • Technical tools and equipment (For operation and decision support) • Technology – Traffic flow and data exchange		

The main *participant* to be trained is the TO, who aims to arrange for the most optimal flow of traffic in accordance with policy and in compliance with regulations.

The program includes potential measures, tools, and simulations for traffic orchestration within and between GA. *Resilience* is a significant aspect, and the modules are designed to give necessary competencies about traffic orchestration management principles and measures, in addition to support competencies regarding management in actual (future) scenarios under normal, changed, and disaster conditions.

4.3 TO Training Trials

This section first describes the intended training purposes and learning outcomes of the TO Program, and then the didactical elements in the training trial modules. The section mainly describes the Norwegian training trials because the digital Italian version is mainly a shortened blueprint of this.

The *training purpose* is to prepare, teach and enable future traffic managers (TOs) in an MTME. TO training should enable traffic managers to understand how to orchestrate traffic in their own governance area (GA), using different measures, and cooperate and negotiate with surrounding GAs. In Norway, the purpose was to access the training in the local context, get insights from participants in the actual on-site environment, provide targeted feedback and identify areas for improvement. The intended *learning outcomes* (for the participants) are: (a) *Effects* of completing the program; To increase traffic orchestration performance and skills in future traffic management, handle measures and tools in a resilient manner, and (b) understand *Impacts* of these changes; To improve the resilience.

Framework elements: Three basic training modules were selected, in addition to two resilience modules. Table 2 presents the module names and the duration in the two countries. Most didactical elements (see 2.3) are specified for each module. However, *learning qualifications* are the same for all modules; all participants should have experience with traffic management. Regarding *evaluation*, the participants gave a general evaluation at the end of the last module, in addition to pre- and post-evaluation of each module.

Table 2: Training trials – Modules in Norway and Italy

Time	Modules in Norway	Time	Modules in Italy
Day 1 (8 hours)	A: Introduction B: Traffic orchestration across governance areas C: Simulations, measures and examples of tools	Day 1 (3 hours)	A: General MTM Concept and Traffic Orchestration B: How to effectively use the ORCHESTRA tools and simulations C: Practical use case for tools and simulations for MTM
Day 2 (6 hours)	D: Traffic orchestration according to plan E: Traffic orchestration when incidents occur		

4.3.1 Module A

Learning objectives: After the module participants should have (a) An overview of all training modules and (b) An insight into the ecosystem (MTME), MTM (Multimodal Traffic Management), Roles and responsibilities of MTM, and Possible future scenarios. *Content* and *Learning process:* (a) Introduction to the TO Training Program – Participants presented themselves; TO program and learning objectives for Module A; Pre-evaluation by the participants. (b) MTM Model and concepts (See Natvig et al, 2024) – The facilitators presented the ORCHESTRA project vision, objectives, MTME, and future multimodal traffic scenarios (See Vaillant et al, 2022). The participants commented and asked questions. (c) Future scenarios and the need for MTM – Dialogue and reflections based on illustrations and figures from Vaillant et al, (2023), video of the exploitation project in Arendal (https://www.linkedin.com/company/orchestra2020/), followed by reflections on challenges related to building new industry areas in Arendal illustrated by maps of future transport chains and stakeholders, (d) Reflections and dialogue regarding main topics in Module A, (e) Closing (summing up and post-evaluation).

While facilitators were most active in the beginning by presenting and asking questions, (c) – (e) emphasized involvement, reflection and dialogue.

4.3.2 Module B

Learning objectives: (a) Understand TO methods: TDM (Transport Demand Management, Figure 2), DCB (Demand Capacity Balancing, Figure 3), (b) Understand MTME and PMA: TO (key functions) between GAs, How traffic orchestration can be conducted with the use of local/relevant examples, Key stakeholders and roles, (c) Introduction to traffic orchestration measures and examples of tools. *Content* and *Learning process:* (a) Opening session with a recap of Module A and objectives of Module B, (b) Board Game - Basic traffic orchestration concepts and measures (https://orchestra2020.eu/the-orchestra-board-game/). Two situations were played (Normal traffic; Dry port transport), followed by a post-lecture on main orchestrator concepts and principles. (c) Traffic orchestration – Examples from the Living Labs and exploitation project. Maps were used to reflect on the Living Lab at Herøya (stakeholders, GAs), in addition to how the project is applied in a local context in Arendal. (d) Reflections and dialogue regarding main topics in Module A, (e) Closing.

4.3.3 Module C

Learning objectives: Insight into (a) Potential tools for traffic orchestration and (b) Benefits of simulations (of traffic flow and changes): Decision support, Understanding multiple measures for handling complex situations, Simulation of historical situations and incidents, "What Ifs", and documentation for historical events and potential causes, (c) Connectivity and automation (digital and manual operations of CAV, coordination and data sharing between GA). *Content* and *Learning process*: (a) Opening session, (b) Simulations and tools (See Søråsen, 2024), (c) Simulations and tools in HIP Living Lab, (d) Connectivity and automation in the future, (e) Closing.

4.3.4 Module D

Learning objectives: (a) In-depth understanding of usual cases and everyday operations within MTM using TDM (future normal variations in traffic flow and changes with increased automation, coordination across modalities etc.), (b) In-depth understanding of different TO measures, tools and simulations supporting decisions and actions, (c) Understanding of roles and responsibilities of TOs in GAs – and to be able to translate general roles to actual actors and places. *Content and Learning Process:* In this module, most of the time was used for

discussions and reflections. (a) Opening, (b) Repetition of examples from Module B, (c) Future scenarios for the Herøya and Arendal cases (d) Closing.

4.3.5 Module E

Learning objectives: (a) In-depth understanding of operations within MTM using DCB when incidents occur, (b) In-depth understanding of different TO measures, tools and simulations supporting decisions and actions, (c) Understanding of roles and responsibilities of TOs and GA – and to be able to translate general roles to actual actors and places (d) Insight in how to handle the foreseen incidents (possible incidents that have been thought of). *Content and Learning process:* Discussion of tools and orchestration measures when incidents occur, and how to re-plan and return to operation. (a) Opening, (b) Repetition of examples from Module D, (c) Future scenarios when incidents occur, (d) Closing.

5. Discussion

5.1 What Knowledge and Competencies do Future Traffic Managers Need?

The TO training needs are based on ORCHESTRA's anticipated future traffic scenarios. In addition to understanding general *future* trends, knowledge of *past* and *current* challenges is critical for specifying, updating and determining significant competencies.

5.1.1 Traffic Orchestration – Collaboration and Synchronisation of Plural Managers

Multimodal management will be needed, enabling negotiation for optimal use of capacity across networks during planned operations and when incidents occur to foresee and prepare for capacity problems. TO's role and responsibility is to orchestrate according to policy. That will imply a responsibility to orchestrate the traffic within a GA in a way that will prevent negative consequences in surrounding GAs and across networks. When incidents occur that will affect neighboring GAs, traffic orchestrators must be trained in regulated procedures for cooperation and collaboration, being able to evaluate automated decision support and understand the consequences measures will create for themself and other TOs. This will be practiced best when TOs from neighboring GAs train together. Using coordination measures will enable simulations to indicate the effect of traffic flows, emissions, and other important effects on policy goals.

5.1.2 Simulations of Scenarios – Practicing of Explicit and Tacit Knowledge

Resilience depends on the ability of pro-active measures, and the flexibility in the use of different measures, combinations of measures and an understanding of the immediate effects and chain effects in own, and neighboring GAs.

Training using simulations may facilitate both explicit and tacit knowledge creation. Simulations will be crucial to manage challenges and surprises in actual traffic orchestration. Probable everyday operations and events in local contexts provide the opportunity for discussions and simulations of previously used measures and potential new measures that can be taken to manage incidents and get back to planned operation with minimal negative impact. This gives the traffic orchestrator practice in recognizing the best probable measures and likely consequences. Training and results of simulation may in return give input to automated decision support.

5.2 How Should Knowledge Creation Processes be?

5.2.1 Learning Process

Learning is embedded in practice. The training emphasizes active participants using dialogue and discussions. Learning and development take place when participating in social and culturally shaped contexts. Reflection is regarded as significant in learning and knowledge creation. Experience from practice is significant in both reflection-on-action (past experiences or future intended/unintended acts) and reflection-in-action (experiences when engaged in an activity).

Since context is considered significant for learning, is it central to create good arenas for learning and experience transfer. The training in Norway was physical and in Italy digital. Dialogue face-to-face makes it easier to collaborate and make common reflections by making it possible to notice non-verbal communication and to

make use of tactile collaboration e.g. by using games and the scenarios cases from Herøya and Arendal to create and move signs and symbols on physical maps.

5.3 What Knowledge Strategies may Facilitate MTM?

Knowledge strategies are often linked to organizational outcomes and implemented in one organization. In addition, MTM should include strategies for inter-organisational outcomes of synchronizing management systems, including regulations and plans, stakeholder responsibilities and operations.

5.3.1 How to Cope with a Continuously Changing World?

Digitalization and increased data sharing between vessels, sensors and infrastructure will change the interaction between human and automatic management, requiring dynamic updates of an educational program. Further, knowledge management updates will require rehearsal and repetition of new modules.

Determination of what competencies TOs will need in the future will require continuous updates of documents about e.g. past and current incidents and risks, new digital management tools and measures, and changes of regulations and standards. In addition, foresight science and future trend-analysis may be used to determine resilience competences to handle future normal traffic variations (known-known), and foreseen (known-unknown) and unforeseen events (unknown-unknown).

5.3.2 Knowledge Strategies

Bratianu (2022) presents several organisational strategies, and some perspectives are in accordance with a resilience perspective and may be applicable to create inter-organisational strategies, e.g. integrated knowledge strategies of reactive and proactive components including known and unknown. Resilience should be an important aspect in future TO education, constituting a *reactive* (learning from experiences and historical events) and a *proactive* approach (anticipating potential scenarios to know what to look for). The scenarios and examples used in the training pilots are based on concrete, local cases. Design and updates of scenarios are essential and should aspire to reflect relevant and recognizable cases.

6. Conclusions

The *main conclusion* is that future traffic management requires new knowledge creation due to the shift from reactive traffic management to proactive traffic orchestration (preparation and handling before an incident occurs).

6.1 Piloted TO Training

- The training trials have provided insights into the effectiveness of the modules and their practical application in real-world scenarios.
- The aim of competent traffic orchestration is to find optimal MTM solutions in highly complex situations, foresee most events, execute dynamic measures when needed and thus to ensure the resilience of transport systems.
- Scenarios and exemplification of measures make it possible to discuss and make decisions for various outcomes of historic and foreseen events.
- Artefacts like boardgames, maps, and illustrations are well suited to learning principles and concepts on a general level.
- Contexts may facilitate learning and insight through using scenarios and storytelling related to personal experiences and local context.
- The participants should have traffic management experience.
- The training period for program should be extended, including time between each module, e.g. making room for reflections, exercises or the context related lessons.

6.2 Recommendations for Future TO Training

- Clarify new sets of knowledge, skills, and performance necessary for proactive traffic orchestration.
- A program should clarify both general competence needs, and design context-specific modules related to local challenges.

- It is essential to emphasize cooperation between TOs in neighboring GAs, e.g. roles and responsibilities.
- Develop and use simulations as an active artefact, making TOs able to test measures for optimal management of capacity and handling incidents. Scenarios should include ordinary operations and crisis to prepare TOs for unforeseen situations.

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