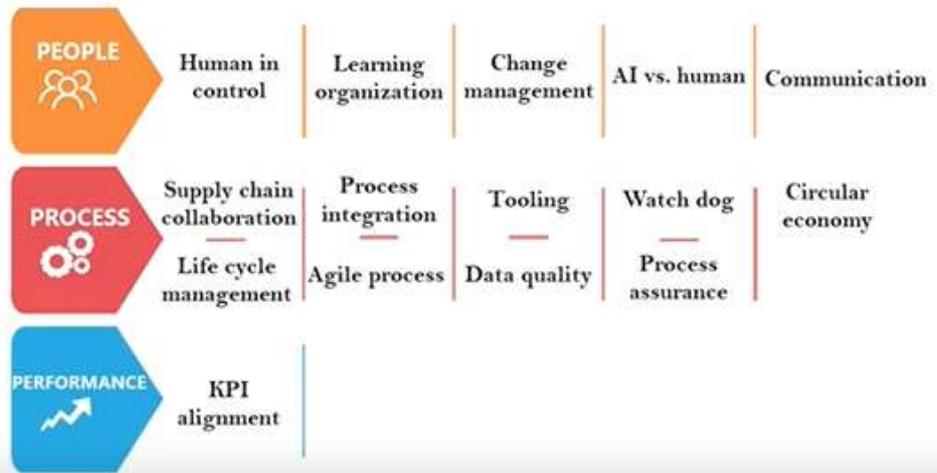# EHTC: High Tech Supply Chain Roadmap – 20-4-2021

First, the roadmap which was created in 2018 is presented. The roadmap includes subjects which are important for the ESCF members. The roadmap is visible in the presented figure.

Projects on the following topics are completed to address the most important subjects on the roadmap:

- Forecasting and predicting (with Machine Learning)
- Online planning (with Artificial Intelligence)
- Data quality
- Change Management
- Risk management
- Digital platforms

The workshop started with young professionals who graduated at the TUe. They presented their work during the past three years.

Amber van Oort did a project at Thermo Fisher Scientific. There she proved that traditional forecasting models made by business experts outperform the machine learning models on the near future. On the far future however, machine learning models can outperform business experts. Important note is to not blindly trust machine learning models.

Bram Cals used deep reinforcement learning at Vanderlande to determine a strategy for finding the optimal routing of order picking. He did this successfully and therefore proved that reinforcement learning is very suitable for finding the optimal strategy in complex systems with lots of processes, combinations and constraints.

Jeroen Vermeulen conducted his thesis at NXP. He researched how machine learning techniques can help to improve the demand prediction. Machine learning models can include external data while statistical models only use historical data. Overall he found that machine learning models are better predictors than the statistical models. The accuracy improves which leads to cost reductions.

Mark van der Pas used traceability graphs to analyse quality incidents at NXP. He found that production lots that were most connected to each other also showed the same root cause for the quality incident that was related to it. The results motivated NXP to further expand and improve their traceability graph, but also look at new opportunities.

Wouter Peters conducted his research at a major retail e-commerce player to identify the main influential factors of product returns in the e-commerce market. His final model was able to predict 20% of actual returns with a precision of 90%. It opens the possibility to target customers based on their historic return behaviour. They could be targeted by certain intervention strategies.

Youri Soons investigated how to accurately predict the remaining useful life of filters at Chemelot. Therefore he used a certain pressure measure and combined two techniques. He used a similarity based approach and a degradation based approach. Overall, his model outperformed the two individual techniques.

Remco Dijkman presented a roadmap for 2025, which is created in collaboration with the ESCF members. A provisional vision for the future is also presented. An interesting discussion regarding this vision followed. The final vision for the future will be presented after improving and elaborating the provisional vision.

Projects on the following topics will be executed during the following years:

- Real-time information visibility (with Machine Learning)
- Real-time planning (with Artificial Intelligence)
- Integrated planning over horizons
- Integrated planning with partners
- Lifecycle and configuration management
- Circular supply chain
- Resilient supply chain

Possible projects on these topics are discussed. Furthermore, suggestions for projects are given by the ESCF members.

Ahmadreza Marandi elaborated on the importance of supply chain resilience. He researches on how to deal with uncertainties in the supply chain. COVID is a big disruptor for a lot of supply chains. Supply chain resilience means that the systems in the supply chain are somehow robust to withstand some level of stress. There are two ways to deal with

disruptions. One is to mitigate the impact. Second is to respond to the event. The following graphs present what the cost will be when combining these two methods.
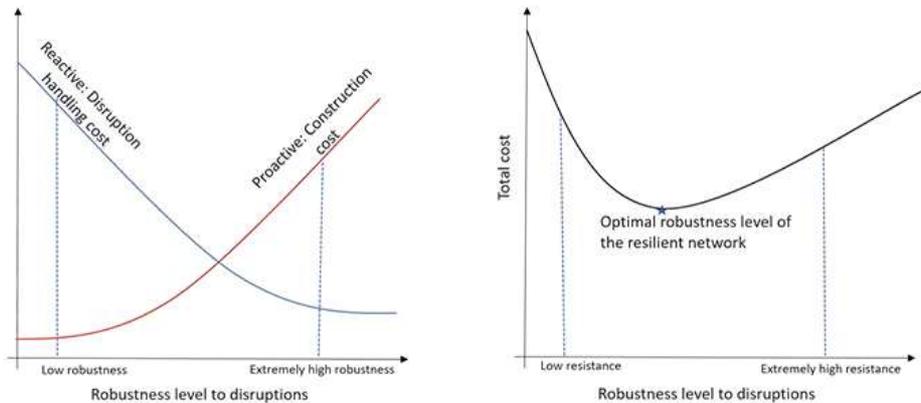
Disruptions can happen on nodes. For example, suppliers who cannot deliver or customers who lower their demand. Another example of disruption on a node is the decrease in production capacity due to COVID restrictions. Disruption can also happen on arrows. This is caused by fluctuating shipment capacity. Ahmadreza Marandi introduces the Location-Transportation problem with uncertain demand quantity. The goal of this problem is to decide where to place your warehouses, what the inventory level will be and how demand will be satisfied. Simulation results say that a robust supply chain performs better on long term when the uncertainty of demand is high. To conclude the workshop, future research on this topic is introduced.