



4TU. Resilience Engineering

TU Delft Delft University of Technology

TU/e Technische Universiteit Eindhoven University of Technology

UNIVERSITY OF TWENTE.

WAGENINGEN UNIVERSITY & RESEARCH

4TU.

ACCOMPLISHMENTS



TOWARDS RESILIENT SUPPLY CHAINS

Busy shopping periods such as Black Friday and Christmas are easy to predict in advance. However, stocked shelves are no longer a given. The international economy is feeling the effects of problems in the consumer products' supply chain, such as cars and telephones, now and in the coming years.

In the past 24 months we have seen exceptional problems such as the blockade of the Ever Given in the Suez Canal, but also deeper pre-existing inter-dependencies have come to light. Therefore, investing in the development of shock-absorbing, resilient supply-chain models seems obvious.

A concrete example of the development of such a new supply-chain model is the collaboration with ASML. 4TU.RE researchers are working with ASML to contribute to improved customer service for spare parts and maintenance. When an ASML customer's chip machine stops for an hour for part replacement, it has a rippling effect on the production for another month. Downtime is therefore very expensive. The new service-supply concept helps to avoid very expensive long-term downtime and thus contributes to a more sustainable supply chain.

Read more about the collaboration with ASML and watch a video with Ahmadreza Marandi:



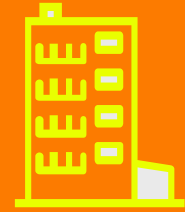
CASCADING EFFECTS CAN ONLY BE MANAGED TOGETHER

Often, it is hard to understand the cascading effects that happen in a city. Too many dependencies and complex interaction. Imagine you can instead explore how to cope with shocks and stresses on a city-level in a game. Rather than to wait for extreme events to happen, you could play out different scenarios on how to manage floods, droughts or extreme temperatures, etc. The game, RElastiCity, developed by 4TU.RE scientists, provides players insights into the consequences of policy choices.

The players each represent specific systems within a city: energy, transport, water and built environment. With different measures, the players can decide how to prevent, mitigate or recover from the shocks and stressors that life throws upon them, in this way players can increase the urban resilience of their city, which is the goal of the game.

Carissa Champlin: "RElastiCity shows policy makers interdependencies among urban systems and teaches the importance of coordinating measures in dealing with stresses on these systems."

Read more about this game and other open educational resources:



THE BRIDGE KEEPS AN EYE ON THINGS

We want to be safe on the street, but we don't want monitoring technology to invade our privacy. A creative answer to this dilemma is the 3D printed bridge on the Oudezijds Achterburgwal in Amsterdam. The bridge, designed by Joris Laarman Lab, is unique in the world and combines several innovations: new ways of large-scale 3D printing with steel, sensors that measure all kinds of data related to maintenance, crowds and traffic flows and the possibility for citizens to contribute to science.

In this large project with more than ten different partners, 4TU.Resilience Engineering researchers were involved in the design, planning and installation of the sensor network in the bridge.

Roland Kromanis: "The data that we collect enables us to gain new insights in the use of the bridge. With this knowledge we can improve future designs and help shape a resilient urban environment."

The MX3D bridge in Amsterdam was opened in July 2021 by Her Majesty Queen Máxima, watch the video and read more:



ACCOMPLISHMENTS



DRY FEET IN THE LIMBURG HILLS

Climate change brings about more floods. The low-lying delta of the Netherlands is particularly vulnerable. Therefore, good water management is essential to improve our resilience. The case of the extremely high water in Limburg in July 2021 has once again highlighted this.

Bas Jonkman: 'This flood has broken records in terms of precipitation, drainage and damage. We must learn from this to make our system future-proof and more resilient.'

The way we learn is by sharing experience and expertise from different angles. Different perspectives contribute to making the water management system resilient to a changing climate. We bring together civil engineers devising technical improvements, with experts in spatial planning and design, coordination, health, and public policy.

Watch the video of the High Water 2021 symposium and read more about the analysis of the flooding in July 2021:



RESILIENCE IN FARMING AND FOOD SYSTEMS

Resilience in farming and food security are at the top of the agenda since we are confronted with heatwaves, droughts, and conflict. Crops have been failing due to extreme weather conditions, but also logistics of food supplies are not robust, as the war in Ukraine shows.

4TU.RE scientists contribute resilient farming and food systems by proactively entering into discussions with policymakers and making scientific knowledge available. These conversations have led to the development of the ABCD model, which translates resilience into concrete properties of food systems. At the same time, the model serves as a steppingstone to better explain resilience. Precisely because of an early collaboration with policymakers from the Ministry of Agriculture, Nature and Food Quality in the development of the ABCD model, this model has quickly become a successful, communicative tool.

Hubert Fonteijn: "Now that the resilience of food systems is in the spotlight, it is time to make the theoretical insights into resilience as concrete as possible."

What does ABCD stand for? Read more:



A DIGITAL RESILIENT POWER GRID

The transition to renewable energy sources goes hand in hand with digitalisation. Sensors and algorithms make it possible to coordinate the supply of energy from local solar cells and wind turbines with local consumption. Digitalisation thus brings a new dynamic of accessibility: there are more actors using the power grid for supply and demand of energy. Will the power grid hold when we connect a new large wind farm to an aged local electrical network? What happens if the number of electrical cars grows exponentially? How do we handle cyber-threats?

Developing a digital resilient power grid requires excellent cooperation between various parties, such as the government, network operators and energy suppliers, but also end users such as industry and citizens. To support this cooperation the DeSIRE research programme helped to establish the 'Control Room of the Future' (CRoF). Here researchers and companies can jointly explore the effects of disruptions, including cyber-threats, in a safe, virtual environment.

June 1, 2022 CRoF signed a collaboration with Technolution, a technical consultancy firm from Gouda, the Netherlands, and their subsidiary Phase to Phase, whom will invests € 525.000 in both hardware and software.

Watch a video with Alex Stefanov and read more:



4TU. Resilience Engineering

4TU Centre for Resilience Engineering (4TU.RE) is the knowledge centre in Resilience Engineering of the four universities of technology in the Netherlands (Delft University of Technology, Eindhoven University of Technology, University of Twente and Wageningen University and Research).

The knowledge centre wants to develop, apply and disseminate knowledge, methods and tools for making societies more resilient. Within this area 4TU.RE focuses on engineering solutions (technical solutions and system designs) in interaction with social-ecological systems.

Established in 2018, the centre can boast on several accomplishments. Tina Comes, scientific director: "The best result we have accomplished is our collaborative spirit that brings the researchers across different disciplines together. We know how to build common ground, both within our community as outside with our national and international external partners."

Tatiana Filatova, scientific leader of the DeSIRE research programme, adds to that: "We are rooted and embedded in the Netherlands, but have a truly international outlook. Our community consists of international scientists with an appointment at one of the four technical universities in the Netherlands. We have the ambition to be of global relevance, which is why we have a growing community of fellows and ambassadors world-wide."

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