Never waste a good crisis

Researchers
Geerten Hengeveld, George van Voorn, Hubert Fonteijn, Luisa Trindade, Esther Koopmanschap, Paulien Harmsen, Jeroen Sluijsmans, Sinéad O'Keeffe, Els Weinans, Natalie Davis

Focus
With most technological solutions available, transformation towards a biobased (textile) economy will require major changes in existing – and often conservative - behavioural patterns. Can modelling provide insight into how externally induced crises can open up windows of opportunity for such behavioural changes to establish and consolidate?

Innovative idea and objective

The current demand for resources requires a transition to a more sustainable economy. Transitions may effectively be triggered by slow background change in combination with disruptions that cause the system to cross a 'tipping point', so that the change becomes permanent. Rather than viewing disruptions as 'bad', the key proposal here is to consider disruptions as possible drivers for desired change, i.e., "don't waste a crisis". For instance, the energy use reduction and increased investments in alternative energy sources have probably been triggered by a combination of the steeply increased energy prices and the awareness around climate change. Similarly, we aim to identify options for policy makers to trigger a transition to a more sustainable textile economy.

Relevance to the materials transition in textiles and/or building materials?

Two key aspects for transforming are technological development and social acceptance for uptake of the new technology. Currently more sustainable textiles exist, and the focus here is to consider the adoption of these new textiles. Can disruptions like price shocks combined with longer-term policy provide opportunities to force a transition to a more sustainable clothing-based economy?

What did you do?

In this research we have developed an agent based model (see Appendix A: Draft of paper). The model simulates time series of monthly textile purchases by consumers. The textiles are produced by producer agents, and are distinguished based on three binary traits, namely is or is not sustainably produced, has or has no longevity, and is or is not a high-valued brand, giving eight classes of textiles. Each trait translates to a price premium. Consumer diversity is based on differences in available monthly budget for textiles and preference ranking for the three traits; not all consumers can afford all textile classes, and consumers may end up not buying in a particular month or having to choose between traits based on their preference. Producer agents adapt prices and produced volume based on sales in previous months. Importantly, consumers are linked via different networks in which preferences are shared and possibly updated after contact with peers.

The model allows for experimentation with different factors. This may be helpful in identifying policy options for making a transition, by considering the changes in model output after changing inputs and introducing disruptions, and by using the model to stimulate discussion about the important processes in the textile economy.

Main result, achievement and highlight

We can experiment with different factors, like the distribution in available monthly budgets, rates of updating in price and produced volume by producers, and preference exchange and updating rates by consumers. Different network types are considered. The base model displays temporal variation in prices, produced volumes, and bought textiles of different classes (including buying nothing); in longer-running simulations certain classes of textiles can eventually disappear.

The experiments include a simulated social awareness campaign, in which a percentage of the consumers simultaneously reset their preferences such that they prioritize sustainable products. The results show that such *a campaign alone is insufficient to trigger a tipping point* towards a state that is systematically sustained by positive feedback between an increasing percentage of people who buy sustainable and producers who offer sustainable products at costs that are affordable for a large part of the consumer population. A systematic improvement is only achieved in the model when an awareness campaign is combined with a mechanism for social opinion diffusion, particular networking between consumers, and a decreasing marginal production cost mechanism (i.e. prices per item decrease as volume increases) – which are all real-life system properties.

Key message

Social awareness about sustainability alone is insufficient to drive the materials transition. Instead, awareness campaigns – or sudden disruptions, for that matter – should occur in combination with social opinion diffusion in particular network structures and decreasing marginal production cost mechanisms to achieve a transition.

Visual abstract

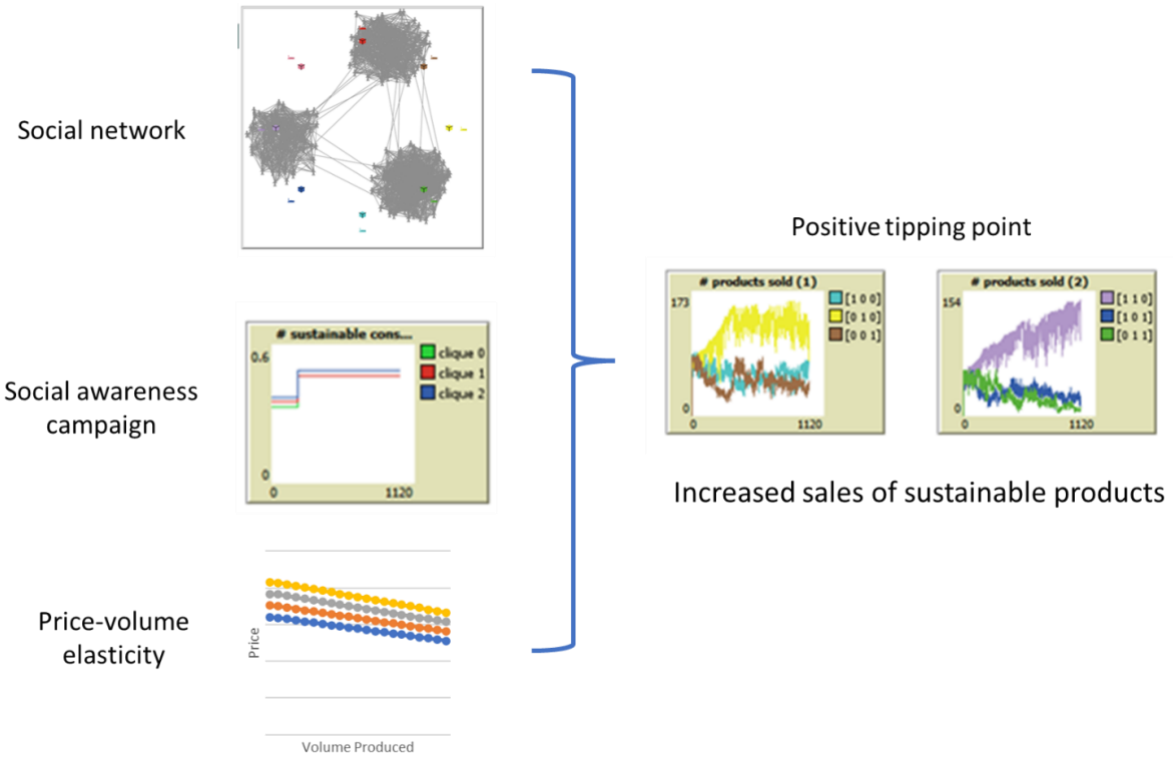

Figure 1: In this project we constructed an agent based model to simulate the effects of a social awareness campaign in an environment with diffusion of preferences for products between consumers and price-volume elasticity. The combination of these mechanisms and the campaign can trigger a transition to a state in which a considerable percentage of the consumers systematically buys sustainable products at an affordable price.