EUROPEAN POLICYBRIEF

Measuring Sustainable Lifestyles and Green Economy Trends to 2050

Finalised project

SUMMARY

Objectives of the research	For the past three years, the EU-InnovatE project has investigated the prospects and obstacles for Europe to achieve sustainable lifestyles and a green economy by 2050. This Policy Brief focuses on one of its major empirical research themes, namely: to measure the impact of trends to 2050 with a focus on how behaviour (and behavioural change) at the user-innovator level affects change in the overall system.
Scientific approach / methodology	EU-InnovatE has been delivered through an innovative mixed-methodology research design. The research findings presented here draw from a combination of qualitative and quantitative data collection, including a systematic review of measurement markers, synthesis of other WP findings against the "Multi-Level Perspective (MLP)", scenario evaluation, and development of a computational model.
New knowledge and/or European added value	Our evidence suggests that sustainability should be defined as a continual state of dynamic transition, within which policies and societal change that support and encourage sustainable user innovation can lead to beneficial system outcomes. It also underlines the value of assessing impacts at the level of European households, and defining the interdependencies of different domains in choosing transition pathways.
Key messages for policy-makers, businesses, trade unions and civil society actors	Public policies and societal interventions which accelerate the adoption of sustainable innovations have a quantifiable effect on carbon emissions and resource consumption. Systemic scenarios are key tools to define options for meeting sustainable consumption targets. Our simulation model allows stakeholders to assess the future impacts of user innovations in transition processes.

SOCIO-ECONOMIC SCIENCES AND HUMANITIES RESEARCH

SEVENTH FRAMEWORK PROGRAMME

Objectives of the research

In the fifth of our six empirical work packages (WP5), the central objective was to investigate and measure the impact of trends in sustainable lifestyles and green economy to 2050, with a focus on how behaviour (and by extension behaviour change) at the user-innovator level affects change in the overall system. This was framed by three key questions:

- ❑ Are there scenarios of domestic consumption behaviours which achieve sustainable lifestyles?
- ❑ Can the transition from contemporary lifestyles to sustainable lifestyles be achieved via user innovations in domestic consumption behaviours?
- ❑ How can this transition be achieved?

To explore these questions, the WP5 research team built on several parallel strands of work developed in the project, primarily the studies undertaken in WP1-4. This was combined with a detailed look at relevant measurements, particularly quantitative work, in the wider sustainability domain.

The main focus of the research was to conduct measurement on the augmented scenarios created in WP2, through the design of simulation models which could then be applied in each of the four domains of investigation in EU-InnovatE: food, energy, living, and mobility. The following outline the specific steps taken:

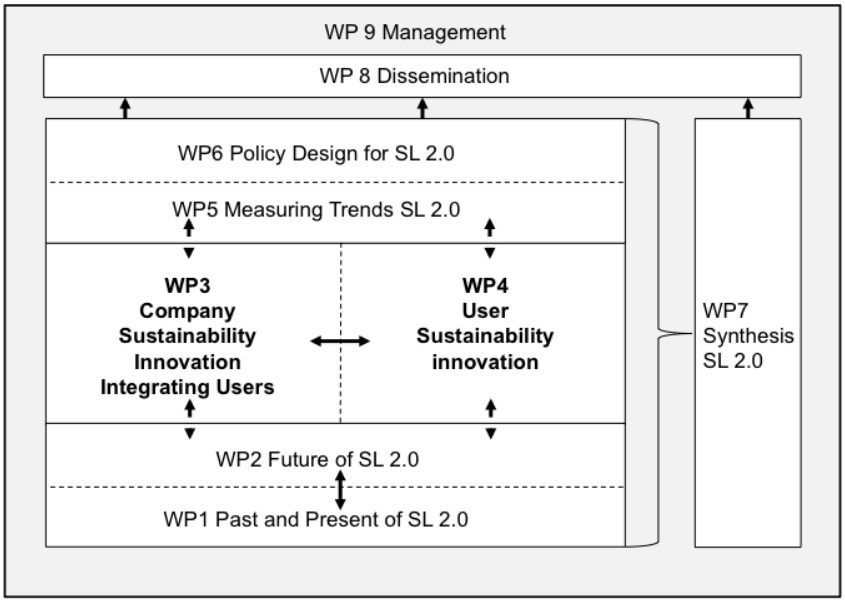
- ✓ Creating artificial societies representative of any scale of community;
- ✓ Measuring the sustainability performance of a society's consumption (contemporary and / or some future desirable society);
- ✓ Evaluating, by domain. the impact of adoption of user innovations upon sustainability performance;
- ✓ Accelerating transition toward sustainable lifestyles (by increasing the speed of sustainable innovation adoption via new policies or societal changes);
- ✓ Analysing transition pathways to sustainable domestic lifestyles;
- ✓ Identifying user innovation types from detailed case studies;
- ✓ Examining adoption rates that have the greatest potential to achieve sustainable lifestyles.

Uniquely, the WP5 models analysed the potential impact of domain innovations **at the level of European households.** It also sought to define interdependencies (inputs and outputs) between different domains. By assessing potential impacts at different points to 2050, the WP5 team was able to iterate around evaluation and re-design of these models, fully leveraging the internal and external project network, and finally prescribing ideal state user behaviour which then fed into the policy innovation work of WP6.

Scientific approach / methodology	As a reflection of the interdisciplinary and transdisciplinary complexity of our central theme and key objectives, the EU-InnovatE project featured an innovative mixed-methodology design applied across all work packages (WPs). The full project framework is shown below. In WP5, the foundational work built on the identification of key indicators in WP2, in order to advance our understanding of existing measurement and models in the sustainability domain – including work on climate change, urban mobility, and demographic patterns – focusing on quantitative results. We considered the three principal modelling fields of systems dynamics, agent-based models, and discrete event simulations. A focused synthesis on project results was carried out around the mid-point of the project, combining the past and present patterns of WP1 with a macro-level view of the future in WP2 to serve as a basis for constructing detailed future models. WPs 3 & 4 provided "best practice" cases on the company and user level to inspire future cases in the detailed scenarios. The role of the user entrepreneur in each of these cases was investigated to the extent of which they act as key 'system changer' with specific focus on how their behaviour (and by extension behaviour change) affects the dynamics of the overall system. This activity was completed by a 2-day internal workshop, which explored the potential to simulate user behaviour through technology platforms associated with the 'Quantified Self' movement. The above activities fed into a detailed design of future scenarios to 2050 in the four domains of food, living, mobility and energy. These future scenarios became the static contexts for runs of a quantitative, dynamic model in each domain. The measurement markers connected agent/micro behaviour with macro measurable outcomes (and feedback from the macro to micro), creating a dynamic picture of co-invention, co-designers, co-production and co-marketing. In each of these models, the research team focused on how behaviour of the user innovator/user entrepreneur affected the overall impacts of innovations on two time horizons: the short term (next 10 years, 2024) and long term (to 2050). Models were run interactively allowing two domains to co-evolve, ensuring that the connections between these highly related areas were also considered. The impact of liberating or constraining various policy indicators allowed for an assessment of the impact of change. The population of actors (initial conditions) could be set as required, allowing for impact to be assessed for different countries or regions.

As a final step, the results of the models were presented to a panel of relevant experts in the field. The focus on user-entrepreneur behaviour as a potential system changer was validated by re-visiting a selection of cases in WP3 and WP4 and presenting the conclusions to case owners. As one of the key deliverables of the project, the research team reiterated the design and evaluation phase 2-3 times. Further internal validation came through the use of published algorithms, which defined the behaviour of various actors.

EU-InnovatE Research Design



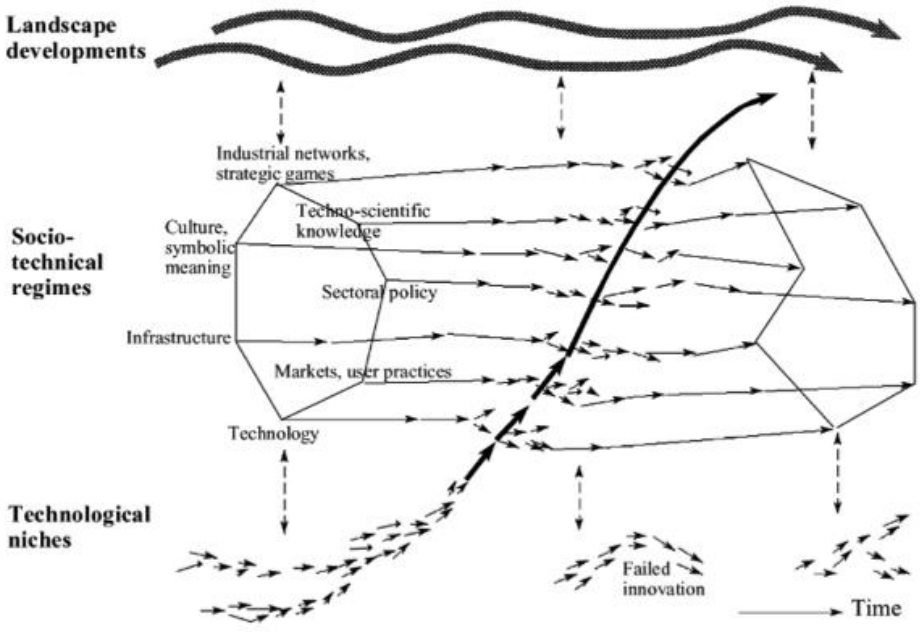
New knowledge and European added value

Understanding sustainability as a dynamic state of continual transition

Within the framework of WP5's research into sustainable futures, detail design and simulation, two important conclusions emerge:

1. Achieving and sustaining dramatic resource efficiencies have the potential to transform capitalism as we understand it today;
2. Sustainability is a dynamic state of continual transition that is best described by the social conditions in society.

These fit comfortably with the central concepts of the "Multi-Level Perspective (MLP)" – as shown below – which has been employed throughout EU-InnovatE to assess the potential impact of sustainable entrepreneurship and user innovation on systems change for more sustainable lifestyles and green economy by 2050.



Source: Geels, F. (2002)

Accordingly, we conclude from our research that sustainable lifestyles are interdependent, nested systems within a sustainable society, and are dynamic by extension. It is also clear that systemic change takes place at an uneven pace along scenario pathways to 2050.

Identifying user innovation types through simulation models

Sustainability is a key consideration for society and the future, and the consequences of our lifestyles in terms of avoidable consumption and emissions is critical. Policies and societal change which support and encourage the adoption of sustainable user innovation can lead to beneficial system outcomes.

Through our modelling, we have been able to measure the amount of carbon dioxide in the atmosphere and the amount of resources being consumed before and after specific user innovations across the four domains of food, energy, mobility and living, with or without policy (or societal) change. The quantitative outputs allow us to apply a degree of prioritization to these innovations, identifying the ones which are likely to have the greatest impact over time. These are represented in the table below:

User innovation types (based on empirical study)

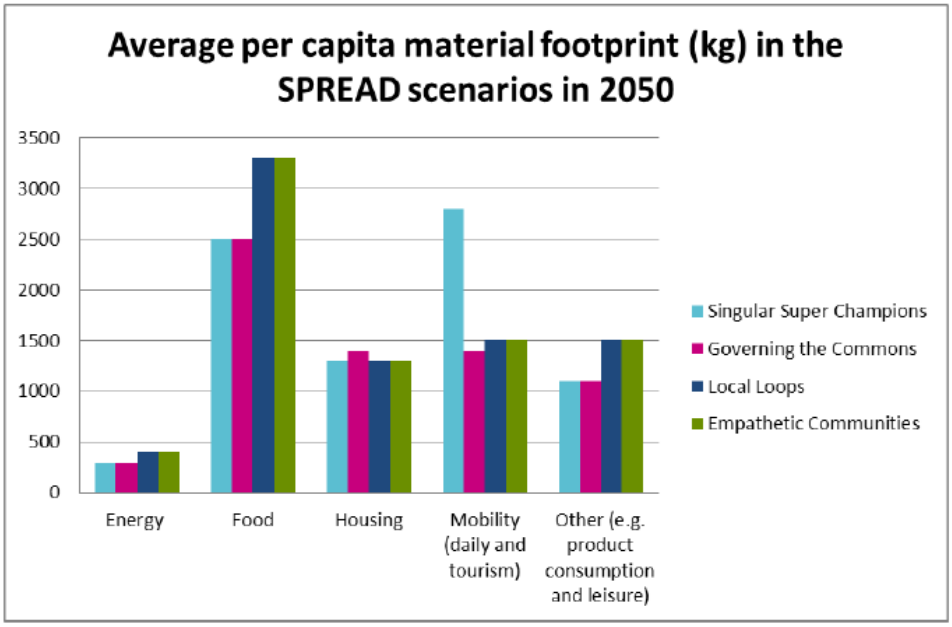
Domain	Primary innovation	Domain	Primary innovation
Living	change type improve construction reduce space reduce household waste	Food	reduce consumption change source preparation reduce waste
Mobility	reduce km change mode change fuel	Energy	change source reduce consumption

A new focus on household behaviours and footprints

At the heart of WP5's investigation were the outputs from WP2, led by Forum for the Future in the UK. The WP2 team sought to augment the four diverse futures created by the EU-funded SPREAD 2050 initiative (2011-2012), in which European lifestyles are sustainable in 2050. The SPREAD scenarios focused on the same four domains as EU-InnovatE (energy, food, living and mobility).

These futures are normative, and thus desirable, but are all defined by a measure of sustainability where the mass of annual *per capita* resource consumption is on average under 8,000Kg (versus a 28,000-40,000Kg level in 2010). The related challenge is to understand how the transition to any one of these futures may occur.

Considering the diversity and complexity of the study, the WP5 team designed a computational model to show household consumption using sustainable performance metrics of carbon emissions and kilograms of resource consumption. This was then applied to the new qualitative scenarios from WP2 to assess material footprints by individual domain in 2050, while keeping under the defined limits set out in the original SPREAD initiative – see below for results:



The key to the model design has been to recognize the integrated nature of households. The model is only a simplification of reality, but nevertheless it is very powerful because it shows total consumption from the behaviours of integrated domains in each household, how each contributes to carbon dioxide emissions and resource consumption. This is important if we want to know how different innovation can lead or transition to sustainable lifestyles.

From the application and reiterations of this model, three headline insights emerge:

- Augmented scenarios deliver target resource consumption;
- Transitions to sustainable lifestyles though sustainable user innovation require innovation in every domain;
- Policy interventions can have negative or inconsequential impacts depending on the scenario.

Key messages for policy-makers, businesses, trade unions and civil society actors

Headlines around transitions to sustainable lifestyles in Europe

The results of the work undertaken in WP5 point to three main messages to policy-makers and other key stakeholders in sustainable lifestyle transitions:

1) For each domain investigated (food, energy, living and mobility), representing household consumption, the sum of all innovation types has the potential to transition contemporary European societies to sustainable future levels of consumption.
2) Public policies and societal interventions which have the potential to accelerate the adoption of sustainable innovations have a quantifiable effect on carbon emissions and kilograms of resource consumption.
3) Systemic innovations which represent changes to a contemporary scenario, or describe a potential future – such as the augmented SPREAD 2050 scenarios developed in WP2 – demonstrate alternative possible ways of meeting sustainable consumption targets.

Encouragingly, our findings underline that there is considerable scope for transitioning to more sustainable systems in the decades to come, and that the European Union can take a central role in accelerating this movement.

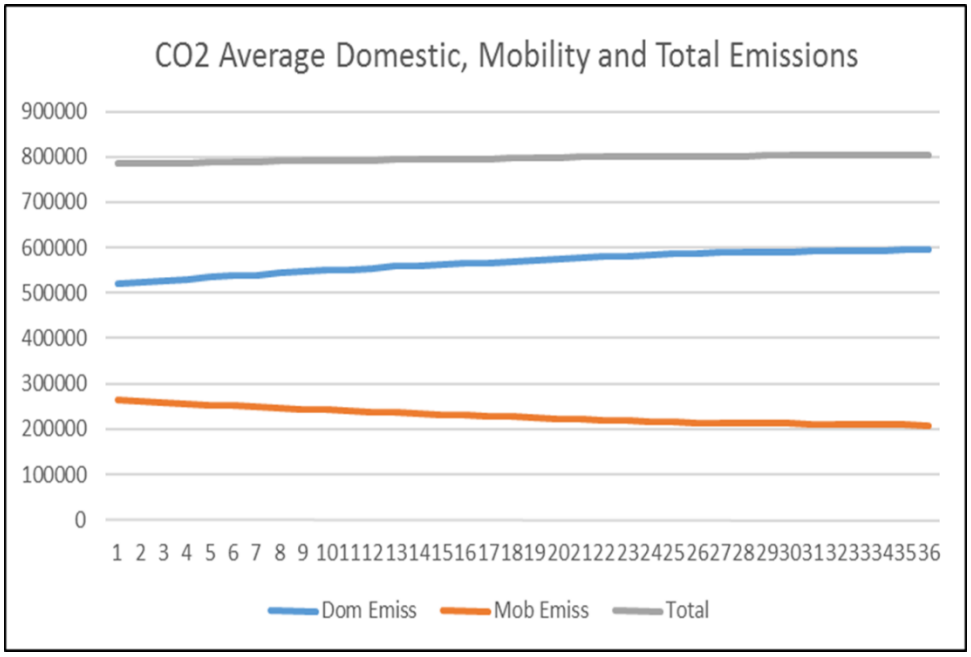
That said, by extrapolating from the outputs from our simulation work, we believe that more attention should be put on **sociological, institutional, economic and managerial aspects of the transitions to sustainable lifestyles, and less on technology itself**. Human behaviour (attitudes to innovation, acceptance and adoption of new solutions) will play a central role in driving change; the likely advent of an age of digital transformation and new industrial systems will not resolve unsustainable lifestyle challenges by itself.

Another valuable finding from our work is the fact that individuals who lead the process of becoming user innovators, raise the issue of their lack of support not only from public institutions, but also from the point of view of collective action. This is in line with the reality that the view and perception of what constitutes an innovator has been changing in recent years, as innovations are democratized and the traditional hierarchical way in which goods and services are developed is shifting towards a less centralized perspective.

New insights into the interdependencies of domains and innovation impacts

The unique approach taken in the WP5 modelling work has highlighted the importance – to policy and industry in particular – of understanding the wider context and impacts of user innovation, and the interconnectedness of domains.

As an illustration, the graph below presents our simulation of the impact on CO2 emissions in the eventuality of a 45% adoption rate of electric vehicles in the UK over the next 20 years – which many would consider to be a positive development.



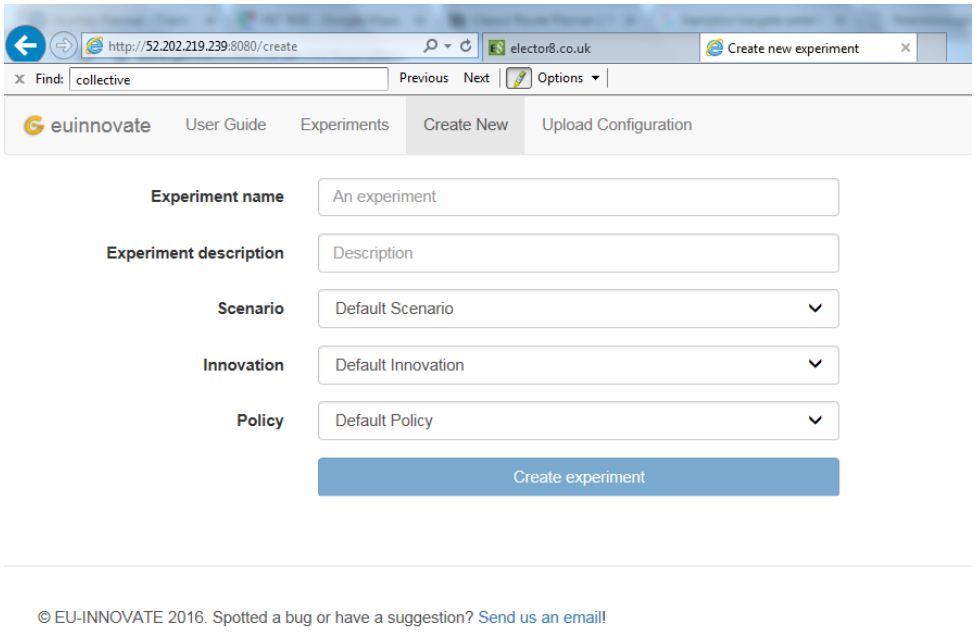
In this scenario, however, our simulation data forecasts that overall CO2 emissions would ***increase*** at this level of user innovation and adoption. This is not due to the vehicle technology itself, which (as the orange line indicates) would considerably reduce emissions over time. Rather, the net increase is explained by the UK's current and anticipated mix of electricity generation systems over the next twenty years, which will remain relatively "dirty" and reliant on fossil fuels. As a consequence, domestic electricity consumption will significantly increase as citizens charge their cars at home, causing domestic emissions to rise by 15-20% - thereby outstripping the reductions delivered through improved engine technology.

This snapshot illustrates how the energy domain has a direct, significant impact on the mobility domain, which may be overlooked in policy and business circles when considering the design of more sustainable transport systems. It also underlines the importance of local or national context. A country with a "cleaner" energy mix and generation systems would be well advised to develop electric vehicle policies and user incentives – but it is essential to look at and understand the bigger picture before prioritizing one or more transition pathways.

Using the EU-InnovatE simulation model to enhance decision-making

In line with the EU's priorities for open access research outputs, and the EU-InnovatE consortium's desire to achieve both scientific and societal impact through its work, the WP5 simulation model can be leveraged by any organization to assess the potential impact of promoting certain scenarios, innovations and / or policies that seek to advance sustainable lifestyles and green economy in Europe.

The screenshot below presents the simple, user-friendly landing page for external users. It allows an organization (public, private or civil society) to experiment with different combinations of approaches and frameworks to assess which will bring the greatest benefits in terms of emissions reduction and resource footprint.



It is also worth highlighting that potential users do not need to own meta or large-scale data to run experiments through the model. Its design is deliberately inclusive, so that any organization interested in mapping out potential sustainable futures can use it to support their internal reflection and decision-making.

To learn more about the simulation model, and to receive guidelines on how to use the online platform, please contact Prof. Liz Varga at Cranfield University directly (liz.varga@cranfield.ac.uk).

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Further reading	• Innovating in Search of Sustainability: Citizens, Companies and Entrepreneurs • Practitioners Cookbook for Innovation with Stakeholders • Company-driven Open Sustainability Innovation (18 case studies) • Sustainable Enterprises (14 case studies) • International Webinar Series (6 presentations and audio recordings) Available on the project website, plus links to all project deliverables.
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