

Policy Brief

Innovation for System Transition

Our 2050

This is one of a series of policy briefs to summarize ongoing findings related to the research project, 'Our 2050 – Opportunities for Ireland in a Low Carbon Economy', which is on the economic and societal opportunities arising from the transition to a low carbon economy and the policies needed to achieve this transition.

The Our 2050 project is addressing four key questions:

1. What will Ireland's future energy use look like? In particular, how will we generate electricity? How will we heat our buildings? What modes of travel will we use?
2. What technologies are most likely to play leading roles in Ireland's transition to a low carbon economy?
3. What strengths can Ireland play to, and what opportunities can Irish-based firms avail of?
4. What policies are needed? What do government, firms, universities and individuals need to do, individually and collectively, to achieve the transition?

This policy brief addresses the fourth question.

Changing Models of Innovation:

From National Innovation Systems to System Innovation

Ireland's National Mitigation Plan states that climate change is the global challenge of our generation. It acknowledges that many of our current socio-technical systems, such as our transport, electricity and heating systems are environmentally unsustainable, and that a transformation is needed in these systems to enable us to transition effectively to a low carbon and climate resilient future.

At the same time, new technologies, such as digital technologies and nanotechnologies, are likely to disrupt our current ways of living in ways we cannot yet fully predict. Radical technological disruption is already becoming evident, for example, in the rapid development of autonomous vehicles, and the increasing digitalisation of work through robots and machine intelligence.

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It is important, therefore, that innovation actors, including governments, firms, researchers and citizens, become more informed of ways to successfully navigate the challenges associated with socio-technical transitions. In this regard, System Innovation is emerging as a new policy field to help guide policymakers.

For decades, innovation policy makers have been developing innovation models and policy instruments to target investments in science and technology to maximise the impacts of those investments. This is the so-called linear model of innovation, whereby governments play an active role in financing scientific research on the premise that new scientific discoveries will be taken up by firms to produce new technologies,

new industries, economic growth and jobs. Policy instruments developed under this linear model aim at stimulating R&D, and include support for basic research in universities, and favourable tax treatment and direct subsidies for R&D in firms.

Over time, this linear model was supplemented by the national innovation system (NIS) approach to innovation in which creating linkages between the various actors in the system, along with building their innovative capacities, are critical. The NIS model retains public support for basic research in universities and favourable tax treatment and direct subsidies for R&D in firms, and adds a further range of policy instruments aimed at strengthening the overall innovation system. These include cluster policies to stimulate collaboration between firms, research centres to increase links between firms and higher education institutions, education policies to support the absorptive capacities of firms, support for high growth innovative firms, and policies to support the commercialisation of research carried out in higher education institutions.

Owing to the scale of contemporary grand challenges, the linear model and the NIS model are now being supplemented by a third innovation model, namely the model of System Innovation. While the linear model and NIS both aim to strengthen and enhance the productivity of an existing innovation system, many of our current socio-technical systems are no longer sustainable.

“System Innovation policy is emerging as a new policy field to help guide policymakers.”

The optimization of existing systems is no longer sufficient. Instead a System Innovation approach, aimed at bringing about fundamental change in the systems that provide us with energy, food, and transport, among others, is needed.

10 Key Policy Messages on System Innovation

The following ten key messages have emerged from the OECD's work on system innovation over recent years to help decision-makers, particularly governments, address the transition to more sustainable systems.

Getting started

- 1. The need to understand the challenge at hand and to develop a vision of what future sustainable systems will look like.* A key question is to understand what technologies are likely to play important roles in the future system. What infrastructures will need to be built to support the widespread adoption of those technologies? How will business models need to change e.g. from a centralised utility model for electricity generation to distributed electricity generation? How will patterns of behaviour need to change e.g. new forms of public transport such as shared autonomous vehicles?
- 2. Creating spaces for building system level awareness.* System transitions involve multiple players over extended time periods. The details of the design of the new system, and the pathway to that new system, are not clear at the outset. In fact, multiple new systems and multiple pathways may be possible. A central challenge is to build collective leadership capacity to innovate at the scale of the whole system. Neither simple top-down or bottom-up mechanisms alone will be sufficient.
- 3. Coordinating across government departments and across different levels of government.* System transitions do not fall neatly under the responsibility of a single government department. Mechanisms for coordination across government, which are stable over time, are therefore needed. System transitions also typically involve multiple levels of government, from international, national, and regional, down to urban and local community levels. The community and city levels of governance are proving to be particularly significant in many system transitions.
- 4. Lengthening planning and investment horizons to timescales commensurate with the transition.* Changes in large complex systems, such as transport or electricity systems, can take time. Climate change policy makers envisage timeframes of the order of twenty to thirty years for some sustainability transitions to occur. Governments therefore need to lengthen planning and investment horizons well beyond a single electoral cycle and long term political commitment needs to be maintained spanning multiple changes in government.

Building transformative coalitions

- 5. Establishing and maintaining long-term collaborative partnerships and networks.* System transitions by their very nature are highly-collaborative endeavours, requiring participation, expertise and investment on the part of multiple actors including government, the private sector, and civil society. A key factor for success is achieving effective co-operation among these multiple, diverse participants. Bringing together multiple actors to make complementary investments raises particular challenges.
- 6. Access to and cost of capital is critical to the success of system transitions.* System transitions typically require large infrastructure investments to transform or replace existing infrastructures, e.g. transforming existing electricity grids to smart grids capable of operating with intermittent renewable energy sources, or replacing existing petrol and diesel stations with facilities for charging e-vehicles. This requirement for major capital investment means that financial innovations aimed at financing costly infrastructures are crucial.
- 7. State owned companies may need to play an important role.* While encouraging new entrants and entrepreneurship remains an important aim of policies for system transformation, it is also the case that the private sector might not step in precisely because there is no developed market yet.

Steering the process

8. *Technological innovation is necessary but not sufficient.* Innovation policy has traditionally focused on fostering the invention and take-up of new technologies as a means of boosting economic growth, employment and national competitiveness. In the transition to low carbon systems, however, relevant technologies are often available and diffusion, rather than invention, of technology is the more important issue. This does not mean, of course, that further technological innovation is not needed, but it does mean that policy makers also need to pay attention to non-technological innovations, including barriers to institutional and individual behavioural change.
9. *Managing and overcoming resistance is a key role of policy.* Existing high-carbon systems rely on technologies that use coal, oil and gas. System transitions require the replacement of both the technologies and the fuel sources. Such fundamental change is likely to meet with resistance on the part of incumbent industries and workers whose jobs may be at risk. System transitions will also require changes in behaviour on the part of individuals and society. Such changes can foster resistance in the form of psychological opposition to new technologies and practices. Managing and overcoming such resistance is a key role of policy.
10. *International collaboration is essential.* Contemporary science, technology and innovation policy often emphasises endogenous radical innovation, especially by domestic firms, universities and public research organisations. Policy for system innovation, by contrast, implies a greater focus on harnessing not only local but also global developments. Finally, throughout the process, evaluation will play a crucial role in gauging progress and steering the system towards the goal of system transformation. Stakeholders must be willing to re-evaluate choices previously made, and to reorient technology choices as new information becomes available. The mantra in innovation for system change is “Be flexible, Be adaptive!”

This policy brief has synthesised some of the findings from the OECD on system transition. Some planned next steps are to explore how these findings apply to Ireland and how the Irish governance system as a whole is “system transition ready”. If you have any questions, comments or would like to discuss more with the project researchers, please use the contact details below.

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Further Reading

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