

## From Transition Towns to Smart Cities: Opportunities and Challenges

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### Global problems and local impacts

Global problems related to the natural environment, society and economy have local impacts on communities across Scotland. The responsibility for mitigating the causes of those problems and applying adaptive interventions required on a national level lies with local and national planning and governance structures.

However, as planning and delivery of nationally-led interventions can take a considerable time, the population often adapts to the changing context by modifying personal behaviour when information on global and local problems is presented.

An example of a personal adaptive measure in the context of the financial crisis in 2007-2008 and the growing public debt in the United Kingdom from 30% of GDP in 2002 to 80% of GDP in 2014 is the sharp rise of gross household saving in the United Kingdom from less than £1 billion at the start of 2008 to over £20 billion in 2012 [1]. Individuals and community groups can act faster than political and governance structures if they have access to data and decision-making tools needed for local action.

The most notable effects of climate change in Scotland are the increase of winter rainfall over the past 50 years, with a rise of almost 70% in the north of the country, and the rise of rainfall intensity by over 7% since 1961 [2]. Around one in 22 of all residential properties, and one in 13 of all non-residential or business properties in Scotland are at risk from flooding [2]. The Scottish Climate Change Adaptation Programme was laid before the Scottish Parliament in 2014 under Section 53 of the Climate Change (Scotland) Act 2009, i.e. five years later after the Act was passed. It recognises that 'communities have immense potential for developing innovative, grass-root responses to the challenges of climate change' [3]. Species extinction is another global environmental risk, with some estimates that by the end of the century half of all species will be extinct [4]. The Convention of Biological Diversity was signed by 168 countries in 1992-1993 [5], while a strategy for the conservation and enhancement of biodiversity in Scotland was published in 2004 [6] and supplemented in 2013 [7]. The strategy recognises the need to facilitate action by local people to identify and protect important species and habitats.

Regarding social issues, the global population increase, with the current net growth of over 77m per year [8], requires a more equitable use of natural resources, including those for food production. Scotland's use of resources in terms of global footprint is more than twice the amount considered to be sustainable globally [2].

The growing interest in local food production in Scotland addresses the need to reduce carbon emissions related to food transportation and disruption risks. The capacities of many countries to provide food and shelter for growing population are extremely low – more than billion people across the world live in conditions which endanger their very existence and prevent fulfilment of their human potential [9].

One fifth of Scottish population (around 1 million) lives in relative poverty [10] and almost the same number of people (940,000) are in fuel poverty as they spend more than 10% of their income on heating [11]. The ageing population in developed countries is an additional problem. There are now more than 10 million people aged over 65 in the UK, and this figure will almost double by 2050 [12]. The number of pensioners in Scotland follows the trend and will require decentralisation and transformation of health and care services to meet their needs [13].

Global economic problems include the decline of oil reserves [14] and energy security, highlighted by the Ukraine-Russia gas dispute in January 2009. As the threats to energy security are addressed by decentralisation of energy generation, Scotland aims to generate 500 MW of energy through community-owned facilities by 2020 [15]. Disruptions in globalised economy, such as the financial crisis in 2007-08, trigger a wide-spread economic recession. However, economic recovery in the UK

in 2009-2012 has not been evenly spread - London and South East experienced the largest growth [16]. The decentralisation of economic development can ensure a more balanced and resilient economy. Engagement with political structures and communities as well as access to data and decision-making tools are necessary to adapt to the changing environmental, social and economic context.

### **Engagement with political structures and communities**

Two successful approaches in engaging with political structures and communities to address global problems have been developed and widely adopted. While the approach proposed by the American economist Jeremy Rifkin focused on how to influence governments to make a transition to low carbon economy [17], the approach proposed by the independent British activist Rob Hopkins, turned to communities and individuals with the aim of initiating social innovation which will lead to more sustainable living [18]. Jeremy Rifkin's vision of 'the third industrial revolution' has been endorsed by the European Parliament in 2007, the UK Government's White Paper on Energy in 2007, and United Nations Industrial Development Organization (UNIDO) in 2011.

Rifkin's vision includes five pillars that will reduce carbon emissions from energy generation and use: renewable energy, buildings that contribute to energy generation from renewables, energy storage, ICT energy distribution systems and electric vehicles. Rifkin has also explored how the 'Internet of Things' and 'collaborative commons' might lead to a more democratic organisation of social and economic life [19]. The Internet of Things serves as an enabler in this process of change by continually feeding 'Big Data' in real time to all potential users to support better informed and timely decision-making.

Hopkins' focus was on communities and bottom-up actions which can address global problems and meet local needs such as local generation of energy and food production, different organisation of healthcare, use of local building materials, reduction and reuse of waste, and other activities that communities might initiate according to their social, economic and environmental context. Hopkins' book has inspired establishment of community groups known as Transition Towns worldwide [20]. In Scotland, there are 11 'official groups', over 35 'active communities' and over 25 communities that 'show interest in this area' [21]. One of the Transition Towns is Linlithgow, a town of 15,000 people located between Glasgow and Edinburgh.

### **Data portal development for Transition Linlithgow**

A consortium of nine Scottish universities collaborated with the Transition Linlithgow through the project Mainstreaming Innovation, funded by Scottish Government in 2013-2014 [22]. The premise of the project was that by using a systems approach, it should be possible to identify how the interaction between different infrastructure systems can increase the performance of each one and enable a more comprehensive and effective planning of low carbon infrastructure systems. The systems within the project scope were the natural environment; technologies for improving energy efficiency, energy generation from renewables, energy storage and local distribution; low carbon transport; water harvesting, saving and reuse; waste reduction, reuse and to-energy; and information communication technologies for managing of the above systems.

The Transition Linlithgow web site indicates that community has initiated and planned a range of actions for more sustainable living such as local food production, energy efficiency interventions, energy generation from renewables, regeneration and reuse of some old buildings and improvements to walking and cycling routes [23]. A workshop on other potential low carbon infrastructure projects that could be developed in Linlithgow was organised in November 2013. A list of the desired outcomes of the current and future actions was one of the workshop outputs. The list starts with the need to provide information to citizens and data users as the prerequisite for engaging local population in decision-making and social innovation. The list of aims also includes: to produce energy from renewables locally, reduce cost of energy, use public assets more efficiently, optimise land use, increase local food production, and improve local economy, transport, and air and water quality. The discussion defined the aims of the portal development and a model with key functions of interest to

the community now, with a possibility for adding new functions in the future. The key functions of the portal would be to provide: (a) sharing and visualisation of data required for decision-making on sustainable living; (b) decision-making tools and (c) opportunities for citizen interaction.

The proposed framework of the Linlithgow portal defines who the intended users are, who will provide data, the community objectives, desired outcomes and local priorities. The community has highlighted priorities that are aligned with the goals of the local authority. As one of the key functions is data visualisation, the University of Abertay Dundee, a member of the Mainstreaming Innovation consortium, developed a digital 3D model of Linlithgow that provides an overview of Linlithgow region demonstrating the scope, scale and topography. The feasibility study on a district heating scheme in the centre of Linlithgow, undertaken by the University of Aberdeen (another consortium member), included several maps with data on energy consumption with colour coding related to the level of consumption. This and other maps with information about the local built and natural environment can be integrated into a 3D digital model of Linlithgow.

### **Conclusions**

The collaboration with Transition Linlithgow shows the need for making 'big data' available not only to cities, but also to small towns. The availability of data required for decision-making and social innovation will enable tapping into intellectual and voluntary capacities of local population to plan actions which will support local socio-economic development and care for the natural environment. Access to 'big data' by local communities empowers them to become more self-reliant and identify solutions that are suitable for their social, economic and environmental context. Rifkin's Internet of Things and Hopkins' social innovation are both required to build resilience of communities against external threats and enable a more balanced development across the country. Smaller communities, due to easier social interaction and, often, closer and longer social relationships than in large cities, might engage in social innovation faster and more efficiently. It is possible that the solutions developed on a small scale could be replicated on a larger scale. Easy access to 'big data' by small communities should be planned in parallel with providing 'big data' to large cities to avoid creating a potential divide between 'data rich' and 'data poor' communities.

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