



Changing gear in R&I: green growth for jobs and prosperity in the EU

Report of the European Commission Expert
Group "R&I policy framework for Green
Growth & jobs"



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Contact: Christian BALLARÒ, Renzo TOMELLINI

E-mail: RTD-ENV-GREENGROWTH-EG@ec.europa.eu,
RTD-PUBLICATIONS@ec.europa.eu

*European Commission
B-1049 Brussels*

Changing gear in R&I: green growth for jobs and prosperity in the EU

***Report of the European Commission Expert Group
"R&I policy framework for Green Growth & jobs"***

Carlota Perez (Chair)
Pier Vellinga (Vice Chair)
Philippe de Buck
Martin Faulstich
Nathalie Girouard
Giulia Gregori
Christian Hudson (Rapporteur)
Paweł Kawalec
Carmen Marchiori
Steven Stone
Reinhilde Veugelers

with the contribution of Marianne Fay

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EXECUTIVE SUMMARY

So-called 'green' living, once promoted for the sake of environmental quality and safety, is becoming a core value in reaching for a better life as well as an economic driver in itself. At a time when the EU is struggling to come to grips with economic crises, unemployment and rising inequality, while confronting global 'megatrends', including environmental threats and geopolitical power shifts, we are also seeing the emergence of new, inspiring and dynamic practices and values, driven by aspirations for healthy living in a clean environment on a safe planet. European citizens and businesses have been among the early adopters of these new lifestyles and production processes, part of a worldwide movement towards a transition to green growth and sustainability.

It is important to define this 'green good life' and 'green growth' in a much broader sense than is usually applied, recognising the potential for innovation in every industry and activity. 'Green' not only includes all the trends in energy conservation, renewables and sustainable products, but innovation in the productivity of resources; the shift from products to services and tangibles to intangibles; an increase in the use of bio-materials and bio-chemistry; healthy eating, exercise and preventative medicine; reuse and recycling; and so on. The result to be expected is a proliferation of innovation in all industries and activities, resulting in the growth of GDP (however measured) accompanied by a significant reduction of its material content.

We are at the onset of a historically recurring transformation. Changes of lifestyle like this one (such as the adoption of Victorian Living, the cosmopolitan Belle Époque and the American Way of Life) have resulted from every major technological upheaval. Today, the transformative potential of the information revolution beyond the ICT industry itself is only just beginning to be recognised in every arena of society. A lesson to be learned from the patterns of technology and lifestyle diffusion in previous transitional periods can help policy-makers to understand and navigate the present moment.

The other lesson to take from the historical record is that the concern for unemployment at such times of transition, although a recurring fear, is misguided. We are currently in a situation comparable to the 1930s, with prolonged unemployment and low or no growth, which then, as now, led to xenophobia, to the rise of extremist leaders and movements and to predictions of secular stagnation from economists. And yet, after that long and deep slump, ending in a terrible war, the Western countries experienced the greatest full-employment boom in history.

The EU is low in material resources but high in skills and salaries, both components of what could be a high-tech, high creativity, service-intensive economy, characterised by low materials and high durability. The competitive edge for such a region in a globalised world is the production of innovative and premium products and services to cater to this new lifestyle, both in the EU and for the growing middle classes of the world, in addition to the development of sustainable equipment and infrastructure adapted to the needs of the rising developing world.

The EU is already well positioned to play a major role in the development of these new markets. International data illustrate that the number of young and rapidly growing companies in this field in the EU is larger than in the USA and elsewhere in the world. Yet, all regions are defining the specific space they will occupy in these trends that prefigure the future. For cultural and historical reasons, European lifestyles are moving faster towards 'green living' and, if clearly targeted, can become the early testing ground for EU companies.

The current technological potential, if intelligently and appropriately supported by **shifting the playing field towards favouring 'green' economic growth, could accelerate that path and result in the creation of a 'European Way of Life'**, a new, sustainable and profitable ideal for middle class aspirations.

The emerging technological possibilities are ripe to be unleashed by policies that entice them in a fruitful direction. Increased productivity and resource efficiency can create highly skilled jobs and generate new financial resources. These, in turn, can enable massive jobs to be generated to cater to the new healthy living and care systems, the recycling and reuse economy, the rental and maintenance economy of durable products, and so on.

The UN Sustainable Development Goals and the Paris Accords on climate change have shaped a favourable context for setting the green growth direction and staying the course. Through this transformative 'green agenda' and its radical transition policy the EU can reduce the pressure on global resources and climate and develop products and services that will not only support the sustainability goals, but also potentially contribute to the reduction of migratory processes.

Whatever the path, lasting success in all markets depends on innovation. To reap the benefits of the economy of the future, policy reforms in the EU are urgently required at all levels, stimulating sustainable innovation and investment both in the public and in the private sector.

There are **four main obstacles** for success in this emerging set of opportunities: **Obsolescence** of the regulatory framework; **unattractiveness** of the context for inviting investment; **contradictory policies** and **lack of experience-sharing mechanisms** for accelerating mutual and cumulative learning.

Those obstacles require an urgent and consistent effort aimed at a full alignment, especially within the EU itself. Innovations are not isolated but interact in systems with many actors and capabilities involved. The systemic nature of new innovation systems calls for a systemically convergent institutional framework that facilitates their interactions and favours a coherent direction. The new competitive strategy would aim at **aligning all policies to favour a 'green' trend across all industries and services**.

The alignment required for an EU transformative green R&I agenda for growth and jobs is particularly urgent in the following fields:

- *Policy formulation processes*: Less top down, more participatory, responsive, and consensual, involving all stake-holders, including all agencies across the EU;
- *Regulation and fiscal policies*: **Coherent and convergent in all those aspects that influence the direction of innovation and market introduction**, regarding both public and private finance and funding;
- *Devolution and subsidiarity*: Making the best of local differences by **empowering cities and regions for increased synergistic investments** (smart regions policies) **in a green direction**;
- *Investment and innovation, public and private*: **Commitment of public funds to R&D and 'green-related' infrastructure projects by the EU and at national, regional and local levels**. This, together with the alignment measures above, will provide strong signals to private investors as to the clarity and stability of the direction taken, as well as the advantages and synergies provided, thus enticing convergent investment and innovation;
- *Updating skills policy*: This will be required **to quickly match the supply of skills and knowledge to increase the synergies in the direction being promoted**. Evaluation of present education and training will reveal that major parts are geared towards past skills or skills that will soon be obsolete.

This understanding of the present challenges and opportunities currently facing Europe provides a new and specific perspective to the upcoming revision of the Europe 2020 priorities of 'smart, sustainable and inclusive growth'.

Realigning all EU policies towards 'green' would provide a driver for growth and jobs and unleash a wave of investment that cannot be achieved with isolated policies on top of the old framework.

INTRODUCTION

The independent Expert Group on “R&I policy framework for green growth and jobs” (hereby referred to as the Expert Group) was established by the European Commission (EC) with the purpose of engaging in a forward looking reflection, contributing to define the EU reference policy framework for research and innovation related to green growth and job creation.

This Report presents the conclusions of the Expert Group and its suggestions and recommendations for future actions. The members of the Expert Group are presented in Annex II.

The aim of the Report was not to carry out an in-depth analysis of the current European Commission’s policies, neither was it to provide recommendations on all aspects of existing programmes, but, according to the mandate received, to

“...assess the challenges of 'going green' ... within the context of growth and job creation ... A clear orientation for how EU R&I policy and programmes can help delivering green growth and jobs will be derived and could also inspire future initiatives within Horizon 2020 aimed to maximise the positive impacts.”

In particular, the Group has been asked to:

- Investigate how R&I can transform green growth into a driver for a faster recovery from the crisis and for long lasting growth;
- Provide strategic guidance and advice on EU research and innovation policy and priorities, stimulating a ‘green’ approach to economic growth and job creation;
- Provide advice and recommendations to help define an innovative perspective to look at green growth from the EU R&I policy and agenda.

Following those guidelines, this report presents the notion of a generalised transition from the old mass production activities and consumption and production patterns (one in which the emerging world has essentially taken over) to a new sustainable direction pre-figuring the future, which would be more adequate and profitable to the European conditions and advantages.

Agreeing on this direction, and aligning policies to clearly favour it, would allow the European countries to take a pioneering position, and would entice both foreign and European companies to take advantage of that tilted playing field to decide which activities to locate in Europe, knowing the profitable areas in which to invest and innovate.

This Report benefited from comments received from various services of the European Commission.

1. THE 'GREEN TRAJECTORY' FOR GROWTH AND JOBS IN EUROPE

This chapter describes an emerging and powerful trend in the EU economy. While jobs and profitability of traditional mass production activities are declining, there is rapid growth of jobs and profitability in businesses that provide products and services to support healthy lifestyles and sustainability.

Data indicate that the world is turning green in the broadest sense of the word. Data also illustrate that European businesses and citizens are well positioned to reinforce and exploit a transition towards a resource efficient economy that meets growing aspirations for a new green 'good life'.

1.1 The evidence: Broadly defined "green" sectors outperform

At a time of slow aggregate growth in Europe and of widespread high unemployment, there are areas of the economy that consistently out-perform others. The eco-industries have globally delivered an average annual growth of around 15% in an otherwise slow world market.

Different definitions and categorisations provide varying estimates of growth in these activities, globally and in the EU. Yet each figure shows the same trend: high growth, out-performing average economic growth growing markets and growing employment.

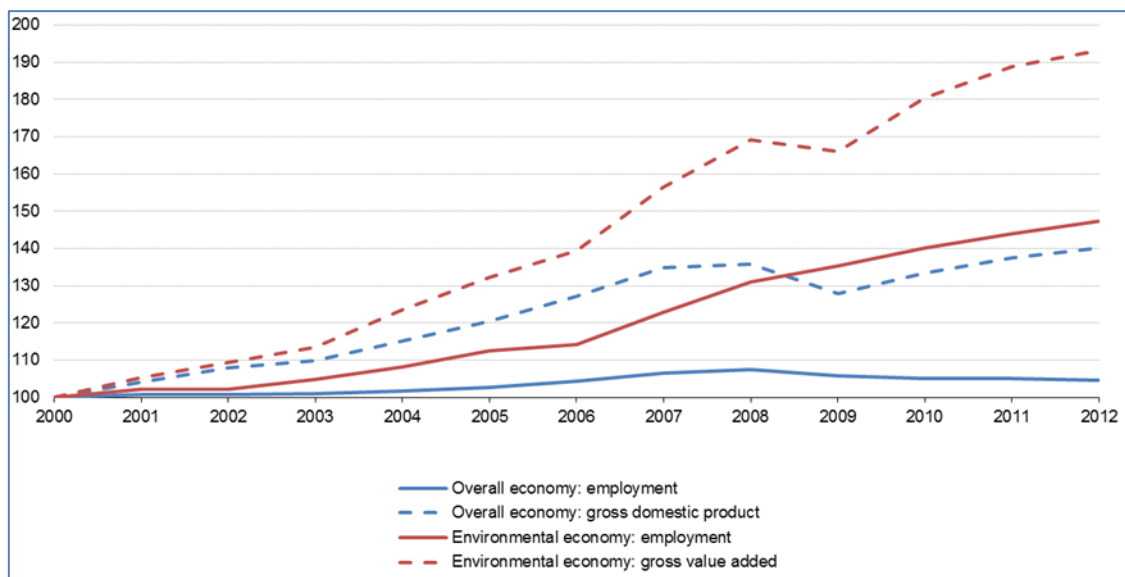


Figure 1 Development of key indicators for the environmental economy¹ and the overall economy, EU-28, 2000–12 (2000=100), Eurostat estimates

Source: Eurostat (online data codes: env_ac_egss1, env_ac_egss3, nama_10_pe and nama_gdp_c)

Though originally driven primarily by ethical environmental concerns, the 'green' sector has gained an international economic imperative due to finite resources and the excessive cost of unsustainable practices. And this shift is occurring in lifestyle choices as well as in business strategies (from SMEs to big corporations, in stock markets, central banks, insurance companies, etc.).

Notable trends can be observed in the market for food and energy. Demand and supply for organic and locally grown food and for renewable energies are rapidly growing, while traditional markets are stagnating or declining. Similar trends can be observed in products and services that support a healthy lifestyle: e.g. the number and variety of fitness centres, of apps and sensors for health observation and of other products and services for self-care. This shift in demand is part of a new

¹ The environmental economy, as defined in Eurostat, encompasses all activities related to preventing, reducing and eliminating pollution and any other degradation of the environment ('environmental protection'); and preserving and maintaining the stock of natural resources and hence safeguarding against depletion ('resource management'). These categories comprise technologies and products that have an environmental protection or resource management purpose as the prime objective.

aspirational lifestyle, which also includes an increasing preference for creativity, collaboration and experience over passive mass consumption for entertainment.

Following such market demand trends, businesses are increasingly applying eco-technologies and techniques to deliver greater efficiency and enhanced consumer value in the emerging context. A survey by Eurobarometer (Figure 2) found that the offer of green products was mainly –and increasingly– moved by demand.

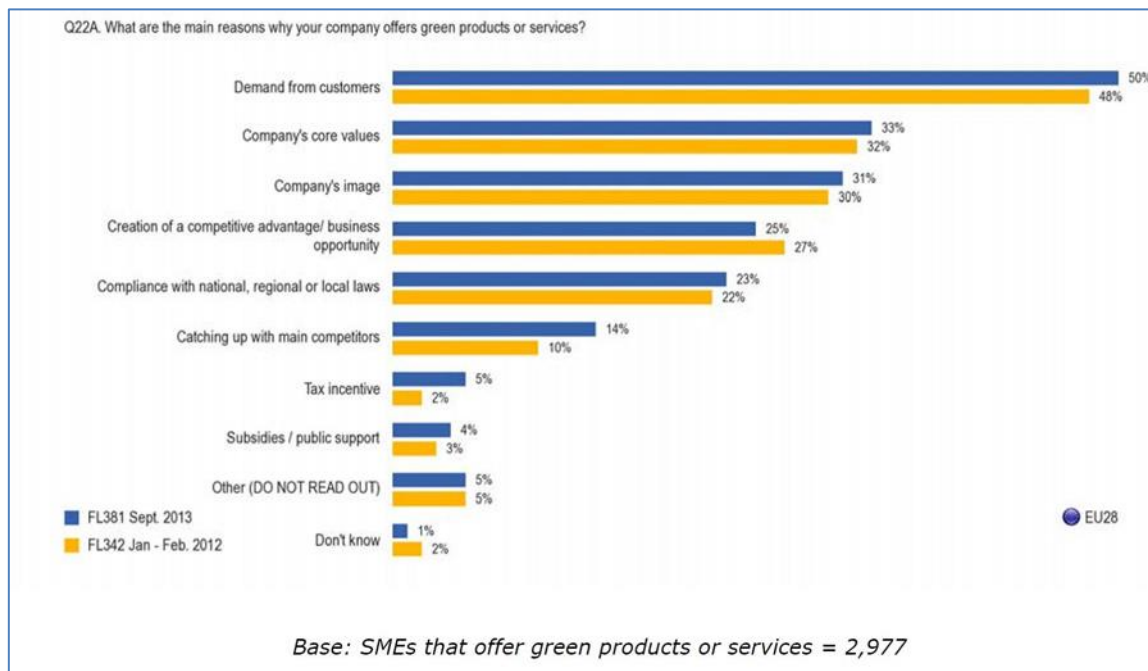


Figure 2 What are the main reasons why your company offers green products or services?, Base: EU28, 2012-2013, SMEs that offer green products or services = 2,977

Source: Eurobarometer SMEs, Resource Efficiency and Green Markets, 2013

It is difficult to capture the nature of these diverse changes with traditional statistics, which were developed in the 1930s and 40s. The new phenomena are either hidden in a broad category or not measured at all, as is the case with the many free intangible services provided on Internet. For instance, consultants PWC estimate the current sharing economy to be worth \$250bn (€225bn), with estimated growth to \$670bn (€600bn) in the next 12 years². Such 'invisible' growth reflects a combination of a move to quality over quantity, the efficient use of resources and the delivery of intangible value, elements not easily captured by current GDP metrics.

BOX Example - E.ON, an international energy company with €112bn of sales (2014) responded in late 2015 to what it called "dramatically altered global energy markets, technical innovation, and more diverse customer expectations" by transforming its business model to focus on renewables, distribution and customer services, stating that their past broad business model could no longer address the new challenges. Competitor RWE (€48 bn) has now taken a similar step.

² <http://www.pwc.co.uk/issues/megatrends/collisions/sharingeconomy.html>

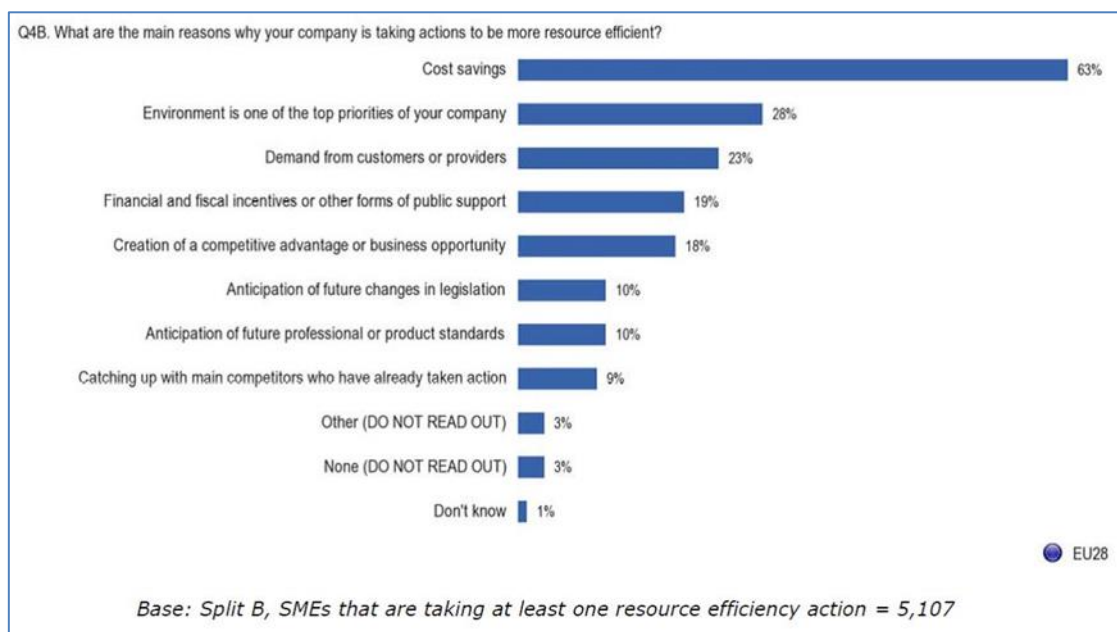


Figure 3 What are the main reasons why your company is taking actions to be more resource efficient? Results for EU28, SMEs that are taking at least one resource efficiency action, n=5,107

Source: Eurobarometer SMEs, Resource Efficiency and Green Markets, 2013

1.2 Key global trends

In September 2015, world leaders at the UN General Assembly adopted 17 'Sustainable Development Goals', a set of universal, integrated and transformative targets, which represent a shared commitment by all countries to a sustainable future. They implicitly include the role of lifestyles and consumer preferences and behaviour in making global development possible in the context of finite resources and environmental risks.

The agreement and the consensus at COP 21 in Paris, in December 2015, implied not only a radical and major shift in energy provision, but equally so in land use and agriculture, food production and consumption. In fact COP 21 has confirmed the analysis presented in this paper: major and far reaching shifts are emerging, and could and should be fostered, in the way that we produce and consume – energy, food, water, transportation, urban infrastructure, homes and commercial buildings.

In May 2015, the Pope's remarkable Encyclical highlighting the need for action on climate change rippled debate through Catholic countries and circles and beyond.

Policy frameworks are shaping markets in response to citizens' changing priorities, and also for economic reasons. Roughly 500 additional Environment, Health and Safety regulations were adopted globally, between 2009 and 2013. Today, as shown in Figure 4, 65 nations have embarked on green economy and related strategies, with 48 of them developing national green economy plans as the centrepiece of these strategies³.

BOX Example - Global corporations such as Unilever are working to increase efficiency all along their global value chains to deliver greater market growth with reduced absolute resource and environmental impact. This 'Partner to Win' programme is based on joint business development plans with its suppliers.

³ UNEP Green economy Toolkit, London September 2014

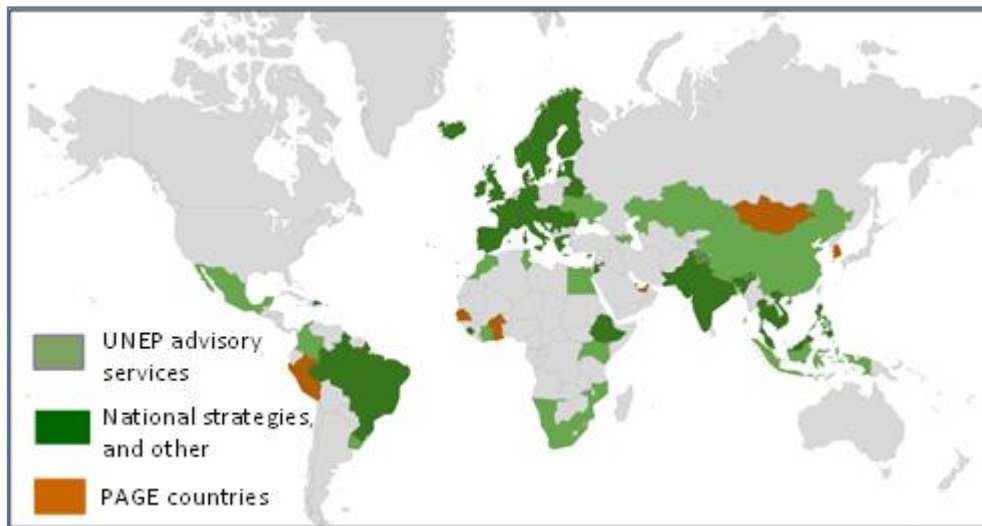


Figure 4 Countries developing national green economy plans, including those with UNEP assistance

Source: UNEP

Various studies have identified the main 'megatrends' likely to determine the directions of future demand as well as future challenges. Recognising these trends is important for business in deciding on innovation and investment, and also for governments in determining the most successful direction in which to shape the context to favour future growth and jobs. The European Strategy and Policy Analysis System (ESPAS)⁴ categorises five megatrends, one of which is the **increasingly disruptive and pervasive impact of the current 'industrial and technological revolution'**.⁵ The other 'megatrends' identified are:

Growth of the global middle class: The increase is expected to be from 1.8 billion in 2009 to 3.2 billion by 2020 and 4.9 billion by 2030. The bulk of this growth is likely to come from Asia (OECD, 2012).

Increasing and converging environmental pressures: Resource scarcity, environmental degradation and climate change are creating ever-greater costs. For example, the stock of 'Natural Capital' is declining in 114 out of 140 countries. At current rates these trends are expected to erode global natural wealth by 10% by 2030, threatening economic development models.⁶ At the same time, 84% of the world's population is exposed to air quality that does not meet World Health Organization (WHO) guidelines, resulting in an annual cost of over US \$3.5trillion.⁷

Globalisation with insufficient global governance: The interdependence of countries, now a fact of global life, has not been matched by strengthening global institutions.

Power shifts: Economic weight and political power are shifting to Asia.

The ESPAS report also highlights the 'challenge to Europe' of inequality in a digitally-connected age, while they also note that digitally connected individuals are both more empowered and also critical of society, exposed at the click of a button to the lifestyles of others. Both aspects represent a challenge for democracy.

These ESPAS megatrends broadly fit with wider opinion. For example, the McKinsey Global Institute categorises megatrends into four disruptive forces: accelerating technological change; demographic shifts, greater globalisation (without explicitly mentioning the shift to Asia); and increasing urbanisation. Price Waterhouse Coopers (PWC) adds rapid urban growth to this list.⁸

1.3 The huge competitive opportunity

These global trends provide strong indications of the future direction of growth: changing social demands and lifestyles, linked to a vast and deep economic and technological transition.

⁴ A joint initiative between the European Commission, Parliament and Council and External Action Service

⁵ ESPAS, 2015 'Global Trends to 2030: Can the EU meet the challenges ahead'

⁶ UNEP Inquiry into Sustainable Financial System

⁷ Source: World Bank (2015) The Little Green Data Book

⁸ <http://www.pwc.co.uk/issues/megatrends/megatrends-overview.html>

There is a huge competitive opportunity for Europe to ride this 'green' trajectory and turn environmental problems into solutions for promoting investment and jobs. Such a green direction implies the use of technological capacities (which the EU has) in order to drastically increase the productivity of energy and material resources (which the EU only has in limited quantities). The markets of the future are bound to grow in that direction. The new 'green' lifestyles are creating new markets domestically and are likely to gradually entice the new millions joining the middle classes across the world. Globalisation will increasingly demand sustainable equipment goods, engineering and related services.

This can also be recognised in the strategic goals formulated by an increasing number of small and large-scale companies: the notion of 'value creation' for society rather than a focus on the physical product that they provide. Their goals reflect the on-going trend away from delivering products towards delivering services.

Indeed, when looking at the potential for employment and economic prosperity, it is important to define 'green growth' and the 'green good life' in a very broad sense, recognising the potential for innovation across every industry and activity. 'Green' not only includes all the trends in energy conservation, renewables and sustainable goods, but innovation in the productivity of resources; the shift from products to services and tangibles to intangibles; an increase in the use of bio-materials and bio-chemistry; a reorientation towards reuse and recycling; and so on.

Such a 'green' direction struggles for an easy label or definition within our current perspectives. It seems closely related to the goals of 2015's globally agreed Sustainable Development Goals, which map the world's citizens' desires and economic routes for their achievement⁹. It has a very strong correlation with the 'Green Growth' trajectory that forms the over-arching strategic direction of the OECD since 2011 – growth, which contains a green trajectory. At the same time, it is a more overarching aim, recognising the convergence of ICT technologies and the sustainability imperative, and acknowledging the driving force that lifestyle choices provide for the economy.

For cultural and historical reasons, Europe has the opportunity to respond to these megatrends and be the dynamic pioneer in the development of a sustainable and creative 'European Way of Life' that can influence the direction of global development while rejuvenating the European production system.

BOX Example - The worldwide introduction of locally generated renewable energies enables rapid local economic development without the need for large-scale energy infrastructures such as ports, rail, pipelines and electricity grids. In turn the availability of low-cost, locally generated, electricity enables the production and re-use of water and the processing of foods and materials.

BOX Example - The creation of additional consumer value through customisation to individual wishes facilitated by 3D printing, which could also eventually transform productivity through improving inventory and maintenance practices, and which could use bio-based materials currently wasted (e.g. MIT's work on Bio-based, biodegradable, hydrogel composites for 3D printing).

The EU has sufficient scientific knowledge, technological know-how, and innovation capabilities to transform its products, services and production systems.¹⁰ Europe is a fertile ground for technical and governance innovation, and has a culture that enables its introduction and widespread use. The region is home to many of the world's most innovative companies, and holds a leading position in many fields of knowledge and key future technologies such as health, food, renewable energies, biotechnologies, environmental technologies and transport.¹¹

⁹ <https://sustainabledevelopment.un.org/?menu=1300>

¹⁰ More accurately, this implies that the EU has the means (and requirements) to transform its socio-technical system. This is a concept which understands the close relationship between society, technology and the interactions these have with the nature of production and consumption of goods and services.

¹¹ Innovation Union Competitiveness Report 2013, SWD(2013) 505.

For example, in the development of environmental technologies, the EU is currently the world leader, with the potential to profit from growth in global markets (see Figure 5).

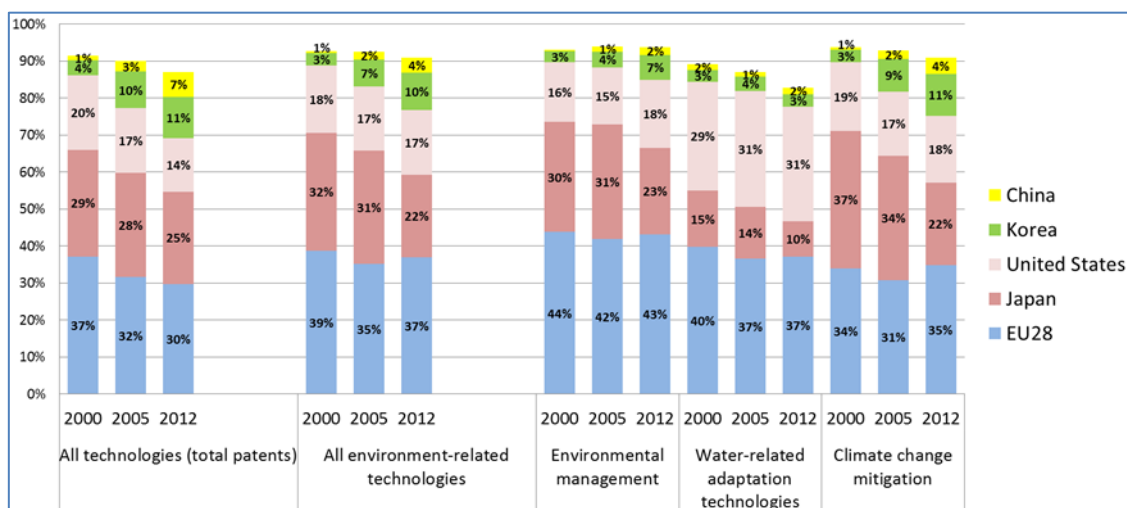


Figure 5 Evolution of World's share in technology development, total and environment-related technologies, 2000, 2005 and 2012, patent family size ≥ 2, fractional counts by country of residence of the inventor(s)

Source: OECD data treated by EC, DG RTD

This relative advantage in environmental technologies can be seen as comparable to the EU's position in high-end vehicles, where years of investment in innovation in response to consumer and regulatory demands have given the EU a 70% share of the global luxury car market, including strong demand in China (Accenture 2013).

1.4 Targeting the high growth markets of the future

However, for the EU to seize the opportunities of fast-changing global markets in the green trajectory of growth, much greater investment will be required in turning inventiveness into bold commercial innovation. A lack of investment in high-growth areas is currently holding back the EU's path to competitiveness, full employment and prosperity.

The OECD long-term economic scenarios emphasise the crucial role of investment in increasing what economists term 'Multi-Factor Productivity', which acknowledges the contribution of technical change as well as other factors beyond labour and capital, such as the intelligent use of resources.

The money goes where the music is – and over the last two decades the 'investment music' was mainly playing in the emerging economies. Investments within the EU will have to become more attractive. Augmenting the productivity of energy and natural resources and targeting the 'healthy life style' aspirations of the middle class worldwide can become a powerful attractor into the future for both foreign and domestic investment– but what is needed are the right framework conditions to stimulate business to engage with this trajectory.

The future competitiveness of the EU, depends on its ability to tilt the playing field towards the future. This requires three things: 1) shared goals; 2) a dynamic home market; and 3) clearly directed public investment in innovation and market introduction support. Above all, what is required is determination and bold institutional and policy innovation. And this implies creative thinking in policy making, preferably with the participation of the business and social stakeholders.

2. LEARNING TO ACCELERATE INNOVATION FOR SUSTAINABLE GROWTH AND REWARDING JOBS

Given the strain on public finances and the high levels of unemployment in some of the EU countries, economic reform options have to create conditions for leveraging private investment at an unprecedented scale and pace of time.

To accelerate investment, innovation and growth in the EU, it is important to understand the multiple causes of current low growth and investment and to identify policies and instruments that will work. It is equally necessary to understand the notion of systemic change and the synergistic effects of new technologies and behaviour/social changes, including shifting lifestyles.

In this endeavour, there are lessons to be learned from innovation theory, from equivalent periods in history, from the modernisation of global corporations, from recent experience in promoting green change and also from the lack of success in moving finance away from short-termism and towards investing long-term in the real economy.

2.1 Lessons from innovation studies: systemic policies for systemic change

It is now widely accepted that, as Schumpeter held, innovation is the key driver of economic growth and development and that it provides the foundation for new businesses, new jobs and greater productivity. Innovation can also help to address pressing social and global challenges. Strengthening innovation is a fundamental challenge for countries in their quest for greater prosperity and better lives.¹² But isolated innovations do not go very far, and neither do groups of disconnected innovations.

Success in stimulating investment in innovation requires an understanding of its systemic nature in two main aspects: that innovations flourish in favourable contexts in interactive innovation systems and that transitions occur through many inter-related advances that are, in fact, system innovations, rather than individual ones.

Even if each innovation can be seen in isolation, there are many contributors that make it more likely for each one to occur and for successive ones to appear. That is because innovation is a collective process taking place within innovation systems,¹³ which are tacit social networks, where synergies are created between the various actors (universities, policymakers, users, intermediary organisations and various interacting firms) and where the context, defined by the policy framework, is crucial. 'Innovation' cannot be successfully promoted for its own sake, without at the same time creating a favourable context for whole innovation systems to flourish.

Silicon Valley is an example of a type of system of innovation that grew originally within government funded laboratories, receiving soft public credit for new firms and government procurement, until it was strong enough to be market driven.¹⁴ The system around the Internet was wholly government developed and funded until it was handed over to the market, which then enabled it to flourish as a veritable revolution in ways that were not originally envisaged by the State. The growth of systems such as the Industrial Districts in Northern Italy¹⁵ or the wind energy industry in Denmark (see Section 2.5) depend on government providing strong and intelligent support to build on an existing potential in traditional skills. There are yet other cases, such as the growth of the Norwegian offshore oil industry cluster, that are explicitly promoted by the State in a clear direction and then become powerful export industries.¹⁶

All these cases strengthen the argument made by Mariana Mazzucato¹⁷ about the entrepreneurial role of government, which is typically hidden behind private sector market successes. Until this is fully recognised it will be difficult to create the consensus relationship for a converging direction that will tilt the playing field in a systemically profitable direction.

In the case of promoting green growth, it is particularly important to understand the other aspect of innovation, which is their inter-relatedness when considering new sustainable transport, energy, waste, building, and agro-food systems. Just as the information revolution required whole range of new services and involved investment and innovation across a range of inter-related products, so will each of these systems. The literature on system innovation¹⁸ notes that many green innovations are initially deployed in relatively small technological or market niches¹⁹ and then face uphill struggles against deeply embedded systems that have been around for decades. This is a

¹² OECD (2015), *The Innovation Imperative: Contributing to Productivity, Growth and Well-Being*; OECD (2015) *System Innovation: Synthesis Report*

https://www.innovationpolicyplatform.org/sites/default/files/general/SYSTEMINNOVATION_FINALREPORT.pdf

See also Freeman, C. (2008) *Systems of Innovation*. Cheltenham: Elgar

¹³ Lundvall, B-Å. (ed.) (1992) *National Innovation Systems: Towards a theory of innovation and interactive learning*. London: Pinter Publishers

¹⁴ Adams S. (2005) 'Stanford and Silicon Valley: Lessons on Becoming a High Tech Region.' *California Management Review* 48,1: 29-51

¹⁵ Boari, C. (2001) 'Industrial Clusters, Focal Firms, and Economic Dynamism: A Perspective from Italy'. World Bank Institute

¹⁶ Leskinen, O. et al. (2012) *Norway Oil and Gas Cluster: A story of achieving success through supplier development*. Harvard Business School

¹⁷ Mazzucato, M. (2013) *The Entrepreneurial State*, London: Anthem

¹⁸ Elzen, B., Geels, F.W., and Green, K. (eds.), 2004, *System Innovation and the Transition to Sustainability: Theory, Evidence and Policy*, Cheltenham: Edward Elgar; Geels, F.W., 2005, *Technological Transitions and System Innovations: A Co-evolutionary and Socio-Technical Analysis*, Cheltenham: Edward Elgar

¹⁹ Schot, J.W. and Geels, F.W., 2008, 'Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda and policy', *Technology Analysis & Strategic Management*, 20(5), 537-554

common problem in transitions. As shall be discussed below, history teaches us that after a shift in technologies, not only does the existing economic system not automatically grasp the potential for a transition, but it is unconsciously oriented to favour the old (now obsolete) direction of development.²⁰

An understanding of both innovation systems and system innovation provides criteria for effective policy-making to enable a successful transition. It teaches us the need for systemic institutional innovations to create a coherent context for convergent actions. Next to policies that nurture innovations directly (e.g. R&D funding, demonstration projects, knowledge sharing, vision articulation), it is necessary to adjust the selection environments (e.g. taxes, subsidies, regulations, standards, infrastructure investments, skills). The policy mix needs to provide clarity about future directions and adjust incentives accordingly.

Markets are effective when there is a clear potential to exploit and develop profitably. This implies that the current lack of investment must be understood as unattractiveness. Indeed, as shall be discussed below, history teaches us that to take advantage of a major shift in technologies, significant and systemic institutional innovations are required.

2.2 Lessons from history: systemic policies for successful growth

This is not the first time that a massive lifestyle change has occurred driven by new technologies. 'Victorian Living' emerged with the rise of urban industry and railways; it was replaced by the Cosmopolitan Belle Époque in the global Age of Steel and Steamships and then by the American Way of Life in the era of mass production and the automobile. It is not the first time, either, when an enormous technological potential has lain dormant or deployed very slowly. Economic history provides other examples of blocked progress where there is no powerful profit and demand incentive to unleash available technological change.

In fact, this was the case of the technologies for mass production, electricity and synthetic materials in the 1930s –prior to the explosion of the biggest economic boom in history. The potential for wide-ranging innovation from these new technologies already existed in the pre-war economic slump. However, it took a combination of the massive war effort (which also taught business the advantages of working with government) and the subsequent policies of the Welfare State, which fostered the consumerist 'American way of life', to release that potential in all its diversity and life-transforming power²¹²².

Adopted in Europe with corresponding cultural and political variants, this was a major lifestyle shift into the world of suburban homes, universal electricity, disposable plastics, refrigerated and frozen foods and home entertainment, and from horse driven carriages, bicycles and tramways to the individually-owned automobile, which redefined the territory, making all land available for development.

Institutional innovations included the credit system, unemployment and mortgage insurance, labour union secured salaries, free or subsidised education and health care, and a progressive tax-system. All of these allowed consumers to spend, without great risk of default, in ways that rewarded investments in mass production. Domestic policies were bolstered by innovative international institutions such as the World Bank, the IMF, the role of the US Dollar and the Marshall Plan, supporting orderly global market expansion, investment and trade. Next to suburbanisation, the Cold War and the Space Race gave the other direction for technological innovation.

The resulting boom in growth, jobs and wellbeing –called by the French 'Les trente glorieuses'– was due to this synergistic combination of institutional changes and technological potential and investment, which facilitated a mutually supportive upswing in demand, quality of life and economic expansion. It was indeed a positive-sum game between business and society, and led to the greatest economic boom in history. It was a golden age in the advanced countries of 'the West', facilitated by the designed growth of the mass market for mass production, and enabled by policies of income distribution.

Europe today is in a situation similar to that experienced in the US in the 1930s. A huge technological potential, capable of a great transformation in production and lifestyles, is being held

²⁰ See for example Pierson, P. (2000) 'Increasing Returns, Path Dependence and the Study of Politics', The American Political Science Review, Vol. 94, No. 2 (June 2000), 251-267

²¹ See further Perez (2002) Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages, Cheltenham: Edward Elgar

²² It should be noted here that one the experts did not agree with all aspects of the parallel with the 1930s

back by obsolete market frameworks and an ideology that resists State intervention. The ICT revolution is fully installed and continues to intensify, but it needs a policy environment that tilts the playing field in a clear direction to create technology-relevant synergies and externalities.

Yet every technological revolution is different, and every set of policies for unleashing its transformative and innovative power must also be different and appropriate for its potential. On this occasion, when taking advantage of the potential of the ICT revolution, we are dealing with a globalising set of technologies that have divided markets into multiple segments, from the great volumes of low-cost, narrow margin standardised products, to a proliferation of medium and small specialised niches (the so-called 'long tail'²³). And this is occurring in all sectors, from natural resources, through manufactured products, to low and high tech services.

This implies the need for companies, countries and regions to recognise the most appropriate sources of demand-pull that can be identified (or shaped) in order to make the best use of pre-existing dynamic comparative advantages or to create the conditions for new ones to flourish. The fact that the EU comprises a variety of countries could result in a particularly powerful combination if they were all to agree on the broad direction of sustainability and of producing goods and services towards the 'Green European Way of Life', for themselves and for export.

It is worth noting that history also teaches us that the absence of such a direction keeps finance away from innovation in the real economy. Policies grounded in previous technologies restrain innovation.²⁴

2.3 Lessons from history: technology and jobs

Evidently, the available technological potential associated with ICT does carry with it the threat of technological unemployment through robotics, artificial intelligence (AI) and so forth. The concern for existing – and future – jobs, skilled and unskilled, manual and intellectual, is regularly brought up for discussion.²⁵

Such fears of technological and structural unemployment were also prevalent in the 1930s, a time when the assembly line was drastically increasing labour productivity and the mechanisation of agriculture was doing the same in the countryside, expelling the labour force to the cities. This pattern too is a recurrent phenomenon, recognisable in the worries of the Luddites during the Industrial Revolution in England as it is in the future forecasting of the present.

However, each time these fears have been allayed once the technological revolution is fully unleashed across the economy. Productivity is then increased sufficiently in both new and old industries to make a quantum jump in wealth creation, using relatively less labour per unit. At the same time, lifestyles and production processes are transformed in such ways that they create new demands, which induce innovation and investment to use the labour force in other activities.

As shown in Figure 6, on the long term trends in US employment numbers, this is indeed what happened in the post-war period with the boom in home-ownership and suburbanisation. The Welfare State became itself an employer of many, but also stimulated infrastructural investment (roads, electricity, telephones, water) to facilitate home development, as well as the education and health systems.

The retail sector multiplied across the territory to service the new consumption-oriented, suburban lifestyles; the construction industry – itself a consumer of manufactured products – grew rapidly, generating further jobs in the developing insurance and real estate sectors. Both creator and beneficiary of the new mass produced lifestyle, the advertising sector boomed, supporting the growth of the television, film, music and other entertainment industries. These new service industries all were labour intensive, with a productivity lower than that of manufacturing, but they counted on the demand generated by taxes (as procurement and welfare) and by high salaries across the economy. The result was that while the manufacturing sector led in volume and productivity growth throughout the 1950s, its employment numbers barely grew. As shown in Figure 6, full employment was achieved not in the industries directly related to the new technologies, but through job creation in lifestyle-related services and in government. While in the 23 years from 1947 to 1970 manufacturing production almost tripled in real terms, its employment

²³ Anderson, C (2006) *The Long Tail*. New York: Hyperion

²⁴ An extreme case of this is the law passed in the UK in 1865 to restrict the speed of early steam-driven automobiles, demanding that a person run in front of each car waving a red flag in order not to scare horses and livestock.

²⁵ See Cowen, Tyler (2011) *The Great Stagnation: How America Ate All the Low-Hanging Fruit of Modern History, Got Sick, and Will (Eventually) Feel Better*. New York: Dutton; and Brynjolfsson, Erik and McAfee, Andrew (2014) *The Second Machine Age*. London: W. W. Norton & Co

increased only 30%. In the same period employment in government, trade and services more than doubled.

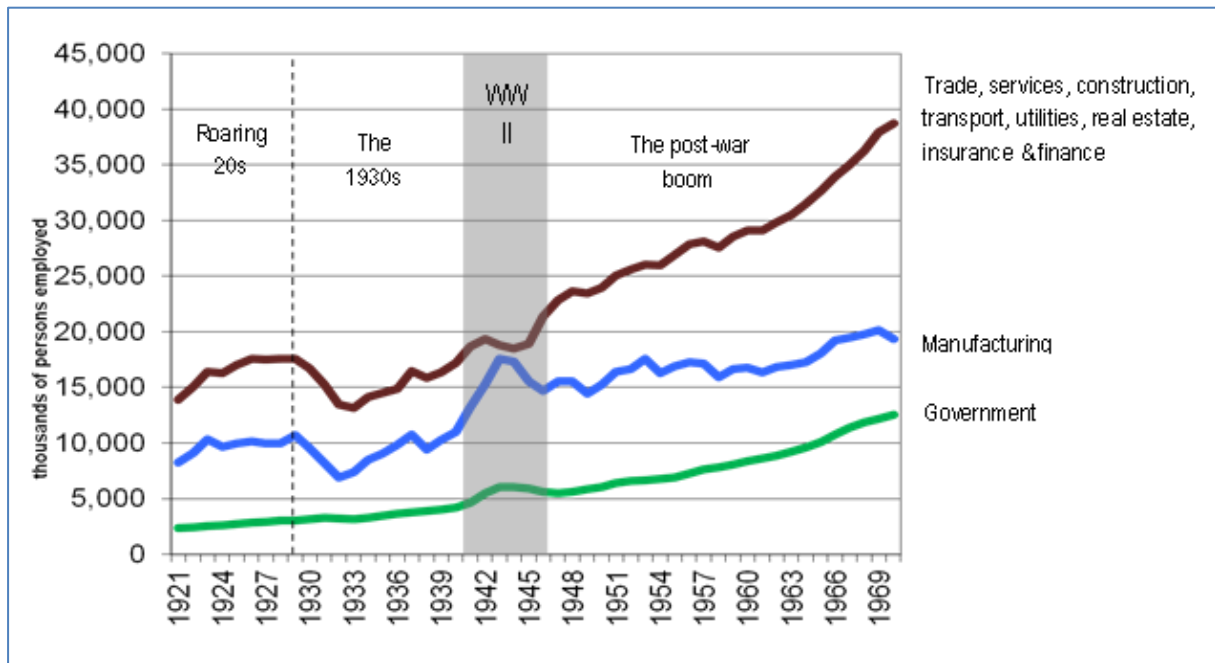


Figure 6: Evolution of non-agricultural employment by sector – US 1921-1970

Source: US Dept. of Commerce

It is true that many of those very jobs, both in manufacturing and services, are now threatened by ICT, which has enormous potential for increasing productivity. This encompasses both labour productivity and the productivity of resources. Old industries and services will be affected, and the information industries may spawn relatively few jobs compared with equivalent investments in the past²⁶. The question is then whether the transformation in lifestyles and approach to resource use will produce enough jobs to counteract these losses.

This report believes in the affirmative. We are witnessing the emergence of a whole range of new positions in personal services, health, education, training, coaching, 'quality of life' goods and services, creative industries, information intermediation, maintenance, rental services, energy conservation, recycling and other climate and resource related activities in the 'green' direction. Just one specific example is the burgeoning demand for locally- produced and organic food, traditionally-made cheeses, artisanal bread, and other similar products that are generating a whole new layer of production and distribution associated with health, nutrition and – up to a point – community values, which have the potential to multiply geographically. Equally, many quality of life activities are flourishing through collaborative action and the sharing economy, which could be strengthened by enabling policy measures.

Evidence on so-called green collar jobs²⁷ is already indicating employment creation.

- Globally, jobs in renewable energy increased by 6.5 million (or 18%) during 2013. Estimates suggest that by 2030, 12 million people could be employed in the biofuels sector, 2.1 million in the wind sector and 6.3 million in the solar PV sector.
- The implementation of energy efficiency measures in the EU have the potential to create or maintain 2 million green jobs by 2020 and the development of renewable energy sources could generate 3 million jobs during the same period.²⁸
- The Bio-based sector is expected to create 1 million workplaces between 2010 and 2030, (mostly in rural areas)²⁹.

²⁶ Brynjofsson, E. and MacAfee, A. (2015) The Second Machine Age. New York: WW Norton & Co

²⁷ see for example the 'Green Collar Nation' report, TUC 2015, www.tuc.org.uk

²⁸ Source: Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions green employment initiative: tapping into the job creation potential of the green economy, Brussels, 2.7.2014COM(2014) 446 final

²⁹ Next generation ethanol and bio-chemicals: what's in it for Europe?, Bloomberg New Energy Finance, 2010

- Green Alliance estimates that in the UK the circular economy currently 'has the potential to create over 200,000 gross jobs and reduce unemployment by about 54,000 by 2030. It could also offset around seven per cent of the expected decline in skilled employment to the year 2022. But, a more rapid development of circular economy activity could create around half a million jobs (gross) and reduce unemployment by around 102,000. It may also offset up to 18 per cent of the expected loss in skilled employment over the next decade'.³⁰
- A study of 5135 firms, from the PITEC survey in Spain, found more stability and greater growth in employment in those firms that engaged in green innovation that in those that did not. (see Figure 7).

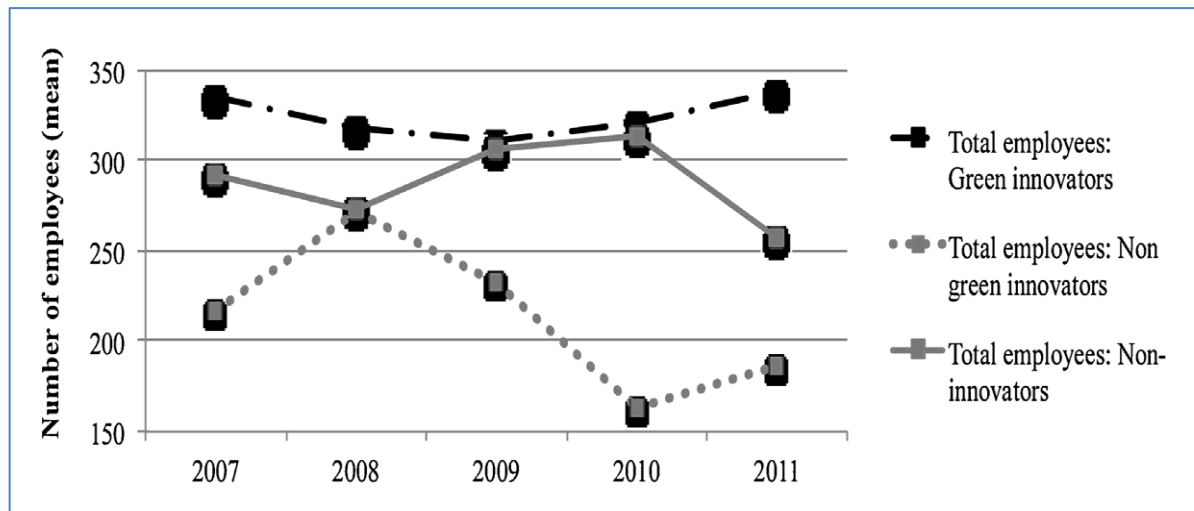


Figure 7: Average number of total employees and R&D personnel by type of firm

Source: Kunapatarawong, R. and Martínez-Ros, E, (2016)³¹

If the move from possession to access or service for (truly) durable goods were to be adopted as business model and rewarded by policy, a flourishing rental economy has the potential to become a massive employer of maintenance, distribution and installation workers. Electronic tags would record the history of each appliance and help determine the rental price, while 3D printers could produce replacement parts without the need for costly inventories. Producers would concentrate on luxury products incorporating the latest technologies, the best and most durable materials, the most advanced designs, the lowest energy consumption, and so on, in order to provide the top end of the rental market at the highest price, for the highest profit. From there down the rental economy would take over and maintain products at a variety of prices for their several-decades-long lifetimes, until they are finally disassembled and recycled. The whole process would accelerate the growth of middle class consumers by reducing the cost of access to the basic durable goods, while reducing the amount of materials required for doing so and increasing the quality and environmental friendliness of the products, upgrading them along their lifespan.

Whether that business model is adopted or not is dependent on many circumstances, including the price of materials and the policy framework, but it is worth presenting as an example of how job creation depends far less on how new technologies affect the old ways of doing things, but more on the manner in which technological opportunities and lifestyle shifts, together with entrepreneurial inventiveness, can create the broad spectrum of complementary businesses and jobs necessary to make an economy prosper.

This is the reason why it can be said that 'green growth' as a direction can do as much for innovation and job creation now as the direction of suburbanisation did at a similar moment in the past. When the playing field is clearly tilted, markets can be infinitely creative.

In addition to the jobs question, the concerns about reversing increasing inequality can also find lessons to learn from what happened in the same period in history. The long term USA income data, gathered by Piketty and Saez, covers the 1930s, which is the period we are comparing with the current one. Figure 8 shows how then, as now, the top 1% of taxpayers receive as much as

³⁰ <http://www.green-alliance.org.uk/resources/Employment%20and%20the%20circular%20economy.pdf>

³¹ Kunapatarawong, R. and Martínez-Ros, E (2016) "Towards green growth: How does green innovation affect employment?", *Research Policy* 45 pp 1218-1232, p. 1222

24% of income, whereas, once policies are established to guarantee dynamic demand and implicitly indicate the direction for innovation, inequality is reduced in relative terms. The top 1% receives 10% of taxpayer income. That does not imply that business is not prosperous and investors are not being rewarded. There is simply a bigger cake, distributed in a more inclusive way.

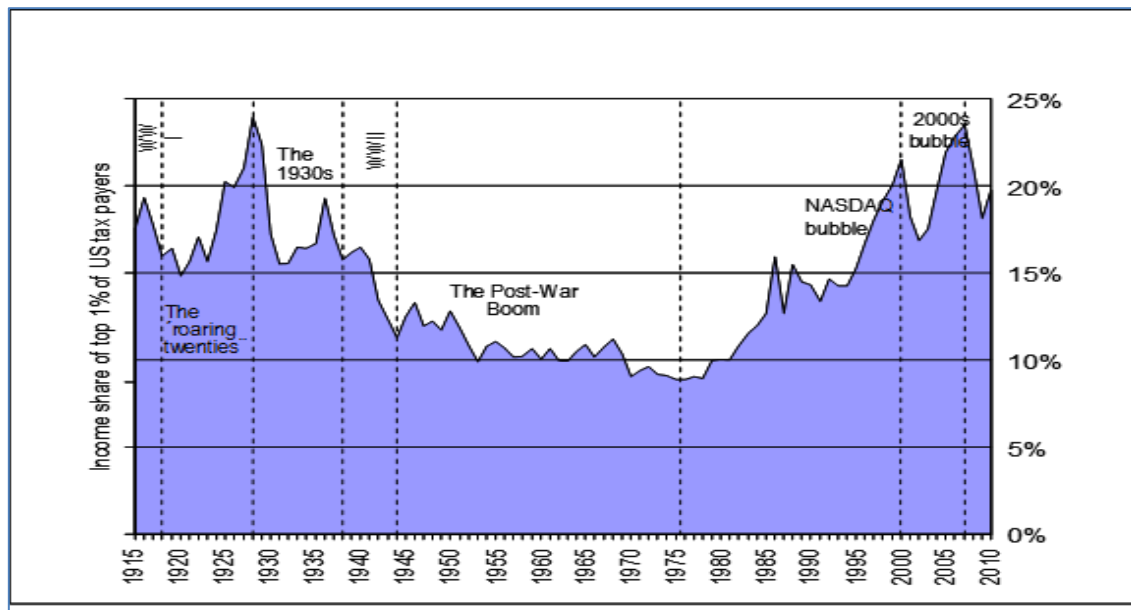


Figure 8. Percentage of income earned by top 1% of tax payers (including capital gains)

Source: Data from Piketty and Saez 2010

2.4 Lessons from industry: Flexibility, networking, empowerment

Technological revolutions do not only transform production technologies and consumption goods and services, they also provide – and require – organisational change to take best advantage of the new potential. Since the 1980s, management literature has been full of teachings about the flattening of the old pyramidal structures, about empowerment of lower managers and workers, about decentralization and the formation of agile networks, about ways of fostering innovation within the company and of the many other deep transformations that constitute a new organizational paradigm for best practice. Such a process also happened during the mass production revolution, which created the then highly efficient, centralised, pyramidal structures of command and control, which shaped both companies and governments and enabled the post-war boom. Today while all the corporations that have succeeded in the global economy have transformed themselves from that now inappropriate model, most governments remain attached to the structures of the old paradigm.

It is not enough to outsource some functions to the private sector, as has been attempted in recent years. At a time of such major transformations, it could be argued that such practices only delay the internal upgrading of the organisation of the public sector³².

To make government capable of unleashing the transformative power of technology, it has to modernise itself into an agile and empowered network that has intense interaction with the areas it serves. That is likely to imply the devolution of power from the national centre to the cities, regions and municipalities. The post-war model of centralised national governments with homogeneous policies across regions was very effective at the time, but is now being challenged by the desire for autonomy in order to cater to and take advantage of local specificity and dynamism. This can be seen as a threat or as an opportunity. Information technologies favour diversity, interconnections, networks and platforms for innovation. And the changes that have made companies agile and fostered successful network structures to deal with an increasingly complex and varied context can serve to make the public sector more successful too.

At the same time, the proliferation of global corporations in both production and finance also suggests the need for supranational coordination and information sharing, if not outright

³² See Drechsler, W. and Randma-Liiv, T. (2014), 'The New Public Management Then and Now: Lessons from the Transition in Central and Eastern Europe', in de Vries, M. and Nemec, J. eds., *Implementation of New Public Management Tools. Experiences from transition and emerging countries*, Brussels: Bruylant, pp. 33-49.

organisations with enforcing power. Current issues with corporate tax avoidance clearly exemplify the limitations of the national space – as does the limited impact of supposedly national policies which can often ricochet to global financial markets. In this respect, the EU can take advantage of its supranational character to reinforce and help align the national frameworks.

2.5 Lessons from recent experience: Local, regional and national

Local, regional and national examples illustrate how transformation towards green growth and new jobs can be facilitated by public policies such as pilots, procurement, targeted funds, and co-investment in green infrastructure.

The European Innovation Partnership on Smart Cities and Communities has recognised over 370 city commitments to use ICT to improve urban efficiency in energy, transport, emissions, water and resource use.

Many countries have explicit strategies to support transition within parts of their economies, which exhibit characteristics of systemic innovation. In the US there exist –and for a long time have existed– agencies and programmes that clearly promote, procure and fund innovation in clear directions, such as DARPA, for military equipment, DARPA-E, more recently, for the new energy area, the NNI for nanotechnology, the NIH for pharma and other health areas and so on³³. Equivalent programmes and agencies could contribute to focus the various EU countries on convergent innovation efforts towards individual competitiveness in the context of a European powerhouse.

In the EU, green banks or funds are being set up in countries, regions and cities. One example is the UK Green Investment Bank, meant to accelerate the UK's transition to a greener, stronger economy. The Government committed to the provision of an initial £3.8bn of capital. The bank's investments help to fund the creation of new, modern, green infrastructure across the UK and with that, new jobs in construction and operations. By the end of 2015 (less than three years after creation), the bank had backed projects with a total value of more than £10bn and partnered with almost 100 co-investors. Its projected portfolio return is now over 10%.

At the city level, there are cases such as the Amsterdam Climate and Energy fund. In 2011, the city set up the Amsterdam Investment Fund, with €45 million aimed at supporting projects in the fields of climate, sustainability and air quality, thus accelerating the energy transition of Amsterdam. The fund invests in financially-sustainable and profitable projects implemented by local businesses, residents, housing associations, and knowledge and community organisations. It provides them with soft loans, not subsidies. The fund is revolving, on the basis of an agreed return of 7.5 %.

Beyond funding, various EU countries also have programmes and regulations either to support the green economy or as part of energy and new industrial strategy policies. The experience of such examples can provide guidance for policy action.

Upgrading by consensus in the automobile industry

Constant innovation is central to EU vehicle manufacturer's success in competitive global markets. That is what has resulted in the European dominance in the luxury market; yet 80% of vehicle market growth is now outside the EU. Correspondingly, their industry has established a strong mechanism of private-public co-operation to progressively change the EU policy and market framework to support technological innovation. The EU CARS 21 and CARS 2020 processes have brought the highest-level European Policy makers together with industry leaders to create a shared compelling long-term direction for the future, and an action plan based around 4 pillars:

- Developing and Financing technological innovation
- Improving domestic market conditions for profitability of innovations
- Improving international market conditions for profitability – the progressive adoption of higher EU technological standards; and
- Facilitating transition, in skills and redundancy

The long-term direction has been based on a combination of technological possibility and the implications of global megatrends – notably the climate constraint.

³³ See Block, Fred L. and Keller, Matthew R., *State of Innovation: the U.S. Government's Role in Technology Development*, Boulder CO: Paradigm

Consensus for a leap to the future

The Pas de Calais region is tackling long-term structural economic problems by means of a masterplan to drive the 'Third Industrial Revolution'. This plan, drawn up between the North-France Chamber of Industry and Commerce and the regional authority, aims to boost short and long-term investment by stimulating the transition to integrated, distributed renewable energy generation, storage and efficiency, merging ICT with mobility and renewable technologies. The President of the Chamber of Commerce and Industry has said 'We were kings of the first industrial revolution; we suffered in the second industrial revolution. We will not miss the third.'³⁴

From early adopter to industry leader

From the invention of the wind power turbine in 1890, through the installation of power stations in the 1920s and the creation of the modern turbine in 1960, the Danish have a historical identity as pioneers of wind power. Thus the country's response to the oil crisis of the 1970s and the Chernobyl nuclear disaster of 1986 can be understood in that historical context: renewables were not merely a pie-in-the-sky option for energy independence, but a tried and tested alternative, promoted across the spectrum from government appointed experts to grassroots NGOs. A national system of innovation was developed, including investors, manufacturers, utility companies and the community. R&D included multiple experimentations with different turbines and other renewable technologies and a stringent testing and certification programme for successful innovation. The state funded development costs (including wind maps to establish locations with the most energy potential), initially subsidised production, and both promoted and legislated for landscape considerations, including an enforced distance of turbines from homes, while public support was built with a systemic approach that included public education, the establishment of local energy offices and private ownership via community cooperatives. This systematic approach has seen a rapid growth in capacity in just two decades; by 2010, renewable sources supplied 42.1% of Danish power needs³⁵.

The intertwining of civil society, markets and government policy

The UK has been experimenting with legislation for zero carbon architecture. The BRE (Building Research Establishment group) was originally government funded; privatised in 1997 and now a registered charity, it runs the voluntary BREEAM certification scheme to help developers move in the direction of the zero carbon policy. Developing from the opposite direction, the non-profit Bioregional (www.bioregional.com) was founded in 1994 to promote 'green and sustainable businesses'. In partnership with the architectural firm Zed Factory (www.zedfactory.com), they developed the UK's first 'zero carbon' 'eco village', BedZed, which opened in 2002. Although it only delivered on some of its ambitious aims, the lessons learnt have led to future, more successful 'One Planet Living' buildings – including the One Brighton development, which is currently achieving a 60% carbon reduction over existing housing stock while delivering an almost 50% reduction in energy costs to residents and using water at 27% below the national average. Bed Zed informed the 2007 government policy to make all new homes zero carbon by 2016, through progressive tightening of Building Regulations (Part L), in line with the European Energy Performance of Buildings Directive (2010/31/EU; recast), and in 2010 the UK government introduced a voluntary Code for Sustainable Homes to provide a single national standard. Similar projects across the UK attempting to meet these regulations and voluntary codes have been instrumental in encouraging innovation that has seen sustainable materials and practices drop in cost to near parity with traditional ones³⁶.

Adopting sustainability policy as standard

Since the 1990s, German waste policy has been moving towards a model that supports the circular economy: phasing out untreated waste on landfill, introducing a waste and circular economy law and entering negotiations with producers on voluntary agreements for waste streams. Many of these activities preceded and inspired EU waste legislation, brought in both in response to popular opposition to landfilling and to the recognition that businesses needed to be reassured of the economic benefits that resource efficiency could bring. Today 63 % of municipal waste is collected for recycling, and the recovery rates of waste from building materials are high. Activities are funded by municipal waste fees and application of the 'polluter pays' principle. During this period, the secondary raw materials market has grown five-fold – up to 10 billion euros between 1995 and

³⁴ <http://www.managenergy.net/article/82>

³⁵ Low Carbon Green Growth Roadmap for Asia and the Pacific: Denmark's Renewable Energy Policies (CASE STUDY). UNESCAP, 2012; Saidur, R., M. R. Islam, N. A. Rahim, and K. H. Solangi. 'A Review on Global Wind Energy Policy.' Renewable and Sustainable Energy Reviews 14, no. 7 (September 2010): 1744–62

³⁶ <https://www.gov.uk/government/publications/2010-to-2015-government-policy-energy-efficiency-in-buildings/2010-to-2015-government-policy-energy-efficiency-in-buildings>

2009. Jobs in the sector total 250,000, with a substantial growth rate expected. With the national Resource Efficiency Programmes (ProgRess I and II) Germany enters into the 2nd generation of a Circular Economy Agenda, moving from waste treatment to product design and product use phases. The focus of the new agenda is currently on 'soft policy' instruments such as capacity and network building, research and innovation transfer.

Strategic sequencing of transition policies

The *Clean Vehicles in Stockholm* programme has been run by the Environment and Health Administration in the City of Stockholm since 1994, with the aim of speeding up the transition to clean vehicles and renewable fuels (e.g. biogas). It was recognised from the start that, as they exist in a symbiotic relationship to each other, both needed to be introduced concurrently. Thus a three-phase systems approach was taken, using a plethora of instruments designed to foster cooperation between actors from different networks. The first challenge was to remove barriers and pave the way for users of clean vehicles. A whole range of *EU-funded projects* (e.g. ZEUS and CIDIS) gave the City of Stockholm scope to carry out such vital measures as replacing its own vehicles with cleaner hybrids (*public procurement*), and its *collaboration* with fuel companies to introduce pumps for upgraded biogas and ethanol at city gas stations. Broadening the market was the goal of the second phase. A purchase *subsidy for transport companies* was introduced³⁷, along with other incentive measures including *free parking* for clean vehicles, extra mileage allowances for special transport services carried out in taxis contracted by the council, and preferential queues at the Stockholm-Arlanda airport. Once the market started taking shape and more clean vehicles became available, the direction changed towards external information and communication, such as the 2003 campaign 'Clean vehicles are better than normal cars', carried in collaboration with major car dealers. This campaign was extremely successful: media coverage of clean vehicles increased by 700 per cent. With the public interest piqued, exemption from congestion charges for clean vehicles and reduced tax on the use of company cars for private purposes were then introduced. Statistical analysis indicates that congestion charge exemption in Stockholm has been the single most important incentive³⁸. Today, clean cars are perceived as 'normal', representing approximately 40 per cent of new car sales in 2010 – just 14 years after the start of the initiative.

Lifestyle change, legislation and product innovation

In January 2011 a law was passed in Italy aimed at reducing the environmental contamination caused by traditional plastic carrier bags, building on a series of legislative measures introduced in response to order to the Waste Framework Directive and the Landfill Directive. Consumers now have a choice of long-life reusable carrier bags or biodegradable, compostable single-use carrier bags (conforming to the harmonised CEN Standard 13432), a two-step model that has accommodated the existing industry while acting as a primer for new investments, growth and innovation in the market for bio-based products. This single law has seen a 50% reduction of the use of disposable carrier bags in mass retail, improved the quality of organic recycling (50% of the bags for organic waste collection are carrier bags), and a 30% decrease of GHG emission (connected with disposal actions). It slots into an EU-wide shift that sees regional capacity for biodegradable polymers at more than 200,000 tonnes, job creations along the value chain (from agriculture and green chemistry to waste management). Perhaps most crucially, it has tapped into prevailing public sentiments and supported lifestyle change by providing an easily-adoptable, transitional product choice: 94% of the Italians support the law, demonstrating that consumers are ready to change their habits quickly in order to adopt more sustainable behaviours when they know that they have a positive impact on the environment and it is easy for them to do so.

The need to share experiences

An important lesson that finding out about all these cases (and many others) teaches us is the urgent need for effective information and experience-sharing mechanisms across the EU, among national regional, city and local governments.

The OECD report on the innovation imperative notes the great potential of the local level for experimenting with novel policy instruments for exploiting green growth trajectories. The evidence in Figure 9 indicates that in the majority of countries the accumulated investment in environmental protection is, in most countries, made more by local governments than at the regional or national levels. An effective and efficient way of communicating the results of such experiences could intensify the pace at which success and competitiveness are achieved across the EU.

³⁷ Around 800 clean vehicles were subsidised through the national climate investment programme KLIMP. Within the framework of the EU project Biogasmax, the City subsidised a further 100 vehicles, most of them external.

³⁸ Its impact increased sales of alternatively fuelled vehicles by about 23% in Stockholm County in 2008.

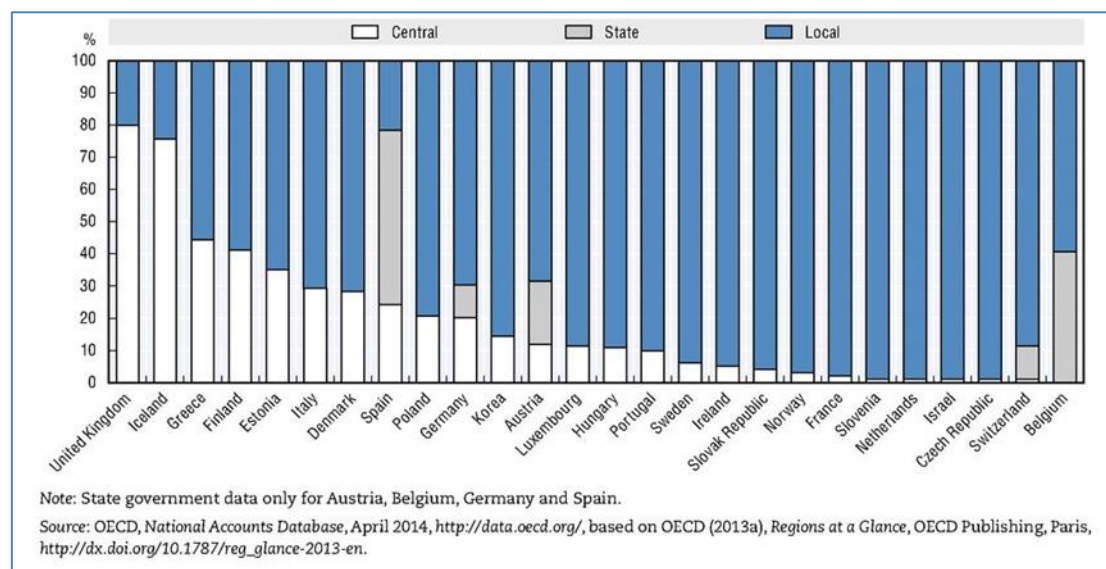


Figure 9. Gross capital formation in environmental protection by level of government, 2012

2.6 Lessons from the unsuccessful and risky financial framework

Attracting private finance is as much at the core of the green growth transition as is public funding of relevant R&D and infrastructures. As stated by the OECD Report on Systemic Innovation: 'Access to and cost of capital is a central determinant for the initiation of systems innovation. Beyond incentivising investments through tax policies or subsidies, financial innovations will be needed to help to cut the cost of funds raised for investment and to raise funds more securely and quickly.'³⁹

Unfortunately, even with the collapse of the bubble in 2008, the financial world (in particular investment banks and hedge funds) has been reluctant to fund the real economy and has instead remained focused on financial instruments within the 'paper' or cyber-economy. ICT has provided the conditions for the easy creation of synthetic opaque financial instruments that can readily be traded and mobilised across the globe, along with various forms of obtaining short-term gains, beginning with the extreme case of so-called high frequency trading.

This short-termist tendency has been emphasised as a crucial problem to overcome by Andy Haldane, the Chief Economist of the Bank of England:

- '... there have been concerns about the rising share of investors with excessively high discount rates and low holding periods – in other words, about 'short-termism'
- 'There is clear evidence of the investor scales having rebalanced in this direction over time. Average holding periods of shares have been in secular decline in a large number of countries for a number of decades. In the UK and US, they have fallen from around 6 years in 1950 to less than 6 months today.'
- 'The macro-economic consequences of this behaviour are likely to be far from benign. The other side of the coin to high pay-out ratios from internal funds is low investment. There is both direct and indirect evidence of investment having been adversely affected by short-termism on the part of either investors or managers or both.' (A. Haldane, Edinburgh Corporate Finance Conference, May 2015)⁴⁰

Indicating that current financial and corporate governance frameworks are one of the causes of low-investment, this speech was widely commented upon and won widespread support. Haldane's observations imply that under present conditions both managers and financiers are not only preferring stock buybacks to investment in R&D or skills or innovation, but are also lobbying for maintaining or deepening the current frameworks and against changes that would favour returns on innovation and long-term growth.

Policies for one or the other bias are oppositional and, without disincentives to short term returns (through taxes or other means), the shift towards investing in riskier innovations with long-term benefits – indispensable for guaranteeing growth and jobs in the EU economies – will not occur.

³⁹ OECD (2015), *The Innovation Imperative*, op. cit.

⁴⁰ <http://www.bankofengland.co.uk/publications/Pages/speeches/2015/833.aspx>

The often-presented argument that there are no innovation opportunities available for investment in the real economy is only true inasmuch as finance sees them as risky and not profitable. But such perceived risk is rarely of a technological nature. Most of the many opportunities are clearly technically feasible. The primary barrier to investment lies in doubts over future profitability and market growth, due to unsupportive (misaligned) policy frameworks shaping markets.

There is little evidence that quantitative easing has increased productive lending and regulatory constraints are not likely to change short-termism or the tendency to stay within the financial world speculating with synthetic instruments, derivatives or the like. Only a strong shift in the playing field in favour of longer term investment in the real (in this case, sustainable) economy can do the job. A possibility would be charging higher taxes on short-term than on long-term capital gains and/or higher taxes on capital gains than on dividends.

Recently, both *The Economist* and the *Financial Times* have recognised that central banks have reached the limits of their possibilities in inducing growth and avoiding the tendency towards deflation, and recommend investment stimulus or even 'helicopter money' – i.e. direct introduction into the economy to create demand. *The Economist* blames the lack of boldness among politicians fearing 'that they are not up to the job'.⁴¹

In the public sector, there are a growing number of local and regional green investment funds focused on CO₂ emissions reduction, renewable energies, sustainable agriculture, biodiversity management, landscape management, social care and culture. Usually they are funds with some benefits: low interest rates and some strings attached such as enhancing the quality of public goods.

The creation of a much wider availability and access to such low interest / long term financing will definitely reinforce the scale of investment in resource efficient and healthy products and infrastructure. Simultaneously new jobs will be created in the real economy. Adjustment of the present system of quantitative easing by the ECB, by more direct investments in the real green economy will increase resource productivity and create jobs in a direct way. It is crucial that new financial instruments be developed and linked to growth markets.

A major UNEP enquiry on the financing of the Green Economy produced a detailed report on potential policy measures arguing that "there is now a historic opportunity to shape a financial system that can more effectively finance the development of an inclusive, green economy"⁴². Their findings coincide with those of this report in recognising that change is already happening in that field too with interesting cases of success, and that it can be accelerated by public choice with systemic policies and coalition building.

3. A TRANSFORMATIVE GREEN AGENDA FOR EU GROWTH

This report has put forward the case that the current technological potential, if intelligently and appropriately supported by shifting the playing field towards 'green' economic growth, could lead to the creation of a 'European Way of Life', a new, sustainable and profitable ideal for middle class aspirations.

To achieve this, however, requires an urgent and consistent effort aimed at a full alignment. As discussed above, it is well established that innovations are not isolated but interact in systems with many actors and capabilities involved: producers, suppliers, researchers, financiers, consultants, distributors, and so on.

The resulting synergies between all these elements enable and encourage further innovations in the same system. For example, when the Norwegian off-shore oil industry began, government policy systemically encouraged and supported the development of high tech suppliers, leading to a proliferation of services, the creation of specialists in various aspects of the complex processes, parts producers, water and air transport services, underwater technology, safety products, appropriate materials, consultants, and so on. The new knowledge, processes and suppliers that emerged across this spectrum lowered the cost and time of further development of the under-sea fields, generated numerous jobs of various skill levels and created a wide ranging export industry ready to help off-shore producers the world over⁴³. Thus the systemic nature of new innovation

⁴¹ 'Out of ammo? Central bankers are running down their arsenal. But other options exist to stimulate the economy'. *The Economist*, Feb 20th 2016; 'Helicopter money' on the horizon, says Ray Dalio" Friday 19 Febr, 2016. <http://www.ft.com/cms/s/0/5bc2c2be-d666-11e5-829b8564e7528e54.html?ftcamp=crm/email//nbe/FirstFTEurope/product#axzz40ZSw4s3N>

⁴² UNEP (2015) *The Financial System We Need*. <http://web.unep.org/inquiry/publications>

⁴³ Leskinen, O. et al. (2012) op.cit.

systems calls for a systemically aligned institutional framework that facilitates their interactions and favours a coherent direction and eliminates the obstacles to following it.

In the proposal presented in this report, rather than aiming narrowly at a particular industry, the policies would aim at aligning all policies to favour a 'green' trend across all industries and services. It means providing significant and enduring advantages for following that broad trend, while leaving ample space for unhindered creativity and innovation across the whole economy

This understanding of the present challenges and new opportunities facing Europe suggests a specific perspective for the upcoming revision of the Europe 2020 priorities of 'smart, sustainable and inclusive growth'. Realigning all EU policies towards 'green' would provide a driver for growth and jobs and unleash a wave of investment that cannot be achieved with isolated policies on top of the old framework.

3.1 Current obstacles to EU growth

Whatever the path, lasting success in all markets is going to depend on innovation. Recent OECD analysis points to certain structural causes for the low investment in innovation in the EU. They describe how one of the key requirements for innovation and growth is: *'the creation of a business environment which promotes new ideas and lets them come to scale.'*⁴⁴

The Expert Group believes that the way to achieve this is to provide a systemically coherent policy framework in a 'green' direction, broadly understood as one that leads to a circular low-waste economy, encourages a move from possession to access, focuses on preventive care and healthy lives, increases the productivity of energy and resources, multiplies the creative industries and, in general, increases the proportion of intangibles in lifestyles and in what we now measure as GDP.

There are four main obstacles for promoting and accelerating innovation in this emerging set of opportunities:

- *Obsolescence*: The existing regulatory framework was designed and set up for the opportunities (and the winners) of the past and must be re-examined and modernised;
- *Unattractiveness*: The current context is not conducive to favouring investment (by local or foreign companies) or to entice finance to invest in the real economy rather than in bonds, derivatives or other instruments;
- *Misalignment*: Even the policies that are clearly aimed at fostering green behaviours in industry are contradicted by various other policies within the EU itself;
- *Isolation*: There is no effective experience-sharing mechanism among policy makers within the EU or across the countries in order to accelerate mutual cumulative learning, multiply the successes and avoid repeating mistakes.

These obstacles can be jointly confronted through an urgent and consistent effort aimed at a full alignment in the direction of 'green' growth, especially within the EU itself.

3.2 Re-alignment of the institutional framework

An EU transformative green research and innovation agenda for green growth and jobs requires realignment in several fields:

- *Policy formulation processes*: Less top down, more participatory, responsive, and consensual, involving all stakeholders, including all agencies across the EU.
- *Regulation and fiscal policies*: Coherent and convergent in all those aspects that influence the direction of innovation and market introduction, regarding both public and private finance and funding. Competition policy may need to be revised to allow innovations to overcome the advantages of incumbency and market power. Taxation is an important determinant of economic choices and fiscal policy a key element of a country's economic strategy, including social equity. As such it is a crucial instrument in changing direction towards green growth.
- *Devolution and subsidiarity*: Making the best of local differences by empowering cities and regions for increased synergistic investments (smart regions policies) in a green direction.
- *Investment and innovation, public and private*: Commitment of public funds to R&D and 'green-related' infrastructure projects by the EU and at national, regional and local levels.

⁴⁴ OECD (2015), The Innovation Imperative, op. cit.

Provide public funding to match private financing for innovation; remove market barriers. Reform financial regulation to wean finance away from financing finance and towards funding the green wave of innovation in products, services and production methods. Encourage co-innovation and co-production by public and private institutions, in particular with regard to products and services of a collective nature such as the energy infrastructures. This, together with the alignment measures above, will provide strong signals to private investors as to the clarity and stability of the direction taken, as well as the advantages and synergies provided, thus enticing green investment and innovation.

- *Updating skills policy:* This will be required to quickly match the supply of skills and knowledge to increase the synergies in the direction being promoted, even whilst learning infrastructures are not yet updated. Immediate skilling is crucial in helping workers adjust to new roles facing accelerated change, while the established education and training institutions engage in their complex and longer term modernisation processes.

Such a re-alignment of the institutional framework will require EU leadership in policy formulation and consensus building. It is up to governments at all levels, national, regional and local to lead and give shape to the future by explicitly recognising the directions of future growth, together with the huge innovation potential both in business and in lifestyles.

Stimulating a green direction for investment and innovation provides a converging context for the better, faster and deeper implementation of many of the sectorial initiatives currently attempted by the EU: the Energy Union, the Circular Economy, the Digital Single Market, improvements to the Single Market, the Bio-economy, the Innovation strategy⁴⁵, and the general aim of increasing democratic participation.

3.3 Transform institutions from regulators to systemic facilitators

As indicated above, policies need to be made less top down, more participatory, responsive, and consensual, involving all stakeholders across the EU.

To seize the opportunity identified in this report, European institutions, led by the Commission, need to enhance their role as stimulators and facilitators of consensus for innovation. Internal co-ordination of the wide-range of policies required to stimulate the future high-growth markets, would preferably be coordinated by the President, or one of the Vice-Presidents.

Crucially, the public sector's role changes: from regulator to facilitator. It takes a central role in stimulating change, with a reduced role in prohibition. The OECD (2015) has identified 3 key roles to this end, drawing on Weber and Rohrer (2012): orientation, coordination and programming. Full adoption of these three roles implies significant change for most European administrations, including the European Commission.

Successful creation of the conditions for growth, therefore, depends on institutional innovation in the European administration's own operations, in order to enable them to successfully play these roles in a flexible non-bureaucratic way, involving intense interaction with the agents of change in business and society.

Regulation can steer and help innovation by streamlining the framework conditions, but to stimulate a systemic change a group of stakeholders has proposed to include in the process the so-called "innovation principle". The implementation of such an innovation principle will imply the assessment of the potential impacts of new legislative measures on innovation, whilst ensuring a high standard of protection for citizens and the environment.

The practices and norms of decision-making will also need innovation. An example is the use of the GDP (Gross Domestic Product) metric. Growth is typically assessed by GDP, an aggregate indicator that is a measure of market activity. Although now institutionalised as a basis for decision-making, the choice of this metric is a cultural one, developed in the 1930s in the era of mass production. Yet the technological basis for value and wealth creation has massively changed since that time, due to information technology⁴⁶.

Policy focussed on what can be measured by GDP may then end up being a distortion of present societal goals. Many have pointed out that median disposable income measures are better guides to changes in living standards, and to political and consumer sentiment.⁴⁷ The GDP metric, based on dated market structures, preserves market failures and does not permit an understanding of the

⁴⁵ A Bioeconomy for Europe (COM(2012) 60 final)

⁴⁶ Brynjolfsson and MacAfee, op.cit.

⁴⁷ See, for example, Stiglitz, J. and Sen, A. (2009) Report by the Commission on the Measurement of Economic Performance and Social Progress. Available at: stiglitz-sen-fitoussi.fr/en/index.htm

new phenomena associated with intangible value and the other novel aspects that now strongly influence quality of life.

3.4 Empower cities and regions for smart and local specialisation

Effective convergence that makes the best of local differences requires the empowerment of cities and regions, in order to increase synergistic investments to stimulate and support the spread of the new economy in each location. The transition to new economic arrangements has often been more immediately successful at the regional or urban level, where a regional or city administrations can co-ordinate different strands of policy and infrastructural change.

To facilitate a greater pace of innovation and transition, then, increased flexibility must be given to those regions of the EU that are keen to progress faster in the direction of future growth. To accelerate market change in the EU, supra-national-level policy makers can do more to liberate and support regions and cities to accelerate their own progress in reforming local market conditions. This would allow the commercialisation of innovations within niches, and the progressive scaling of innovations through the co-ordination of growing markets between Europe's cities and regions.

This action would include the removal of existing regulatory blocks, including outdated environmental regulation, to a supportive policy framework for regional government to financially support local industries in innovation and market introduction of niche products and practices e.g. through procurement. This can also be aided by the necessary review of competition policy.

The EU's Smart Specialisation strategy already promotes regional governments' effective use of a range of STI instruments to implement national and European innovation strategies. The evidence gathered by the OECD, mentioned in section 2.4⁴⁸ above, suggests that building Europe's competitive advantage may benefit particularly from further empowering the local level. This implies strategically exploiting the historical and geographic strengths, though fostering inclusive growth, while respecting and enhancing cultural and regional diversity. This is fully consistent with smart specialisation in high-value sustainable niche products

3.5 Make significant infrastructural and R&I investment

There are two reasons for engaging in infrastructural investment now. First is the urgent and immediate need to overcome the recession and avoid the next collapse that many are predicting. Yet it is as important to look ahead and create the conditions necessary to enhance the attractiveness and competitiveness of the European territories for investment and innovation in the growth areas of the future.

If the accent is put on the first reason, then one could believe that any infrastructural investment will act as the stimulating 'helicopter money' Milton Friedman once promoted.⁴⁹ In fact, *The Economist* magazine says it in so many words:

*'... governments can make use of a less risky tool: fiscal policy. Too many countries with room to borrow more, notably Germany, have held back. Such Swabian frugality is deeply harmful. Borrowing has never been cheaper. Yields on more than \$7 trillion of government bonds worldwide are now negative. Bond markets and ratings agencies will look more kindly on the increase in public debt if there are fresh and productive assets on the other side of the balance-sheet. Above all, such assets should involve infrastructure. The case for locking in long-term funding to finance a multi-year programme to rebuild and improve tatty public roads and buildings has never been more powerful.'*⁵⁰

The Economist is correct that such classic Keynesian stimulus is key in order to move the economy away from the risks of stagnation and deflation. Modernising and fixing 'tatty public roads and buildings', whether in a sustainable, energy efficient manner or not, will generate employment and increase solvent demand.

Yet if a systemic effort in a clearly defined technological direction is intended, then it makes a difference *what* you invest in: especially which type of infrastructure, and which areas of RD&I.

⁴⁸ http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/the-innovation-imperative_9789264239814-en#page247

⁴⁹ Friedman, M. (1969) 'The Optimum Quantity of Money'. Essay. London: MacMillan

⁵⁰ 'Out of ammo? Central bankers are running down their arsenal. But other options exist to stimulate the economy'. *The Economist*, Feb 20th 2016

Setting up smart grids or optical fibre to the home (FTTH) or infrastructure for charging electric cars or waste disposal systems and/or high tech public transport can make a difference for both investors and jobs; for both innovators and those who fund them. Additionally, public procurement can be used as a tool for guaranteeing markets for early innovations as the military did for the Silicon Valley firms. This changes the playing field by giving clear signals for a stable long-term green direction.

Public investment also attracts related investment from suppliers or users of the networks being set up or of the new technologies being developed; it can also include new forms of support for private green investment. The national and locally initiated 'green investment' banks or funds described in chapter 2 have demonstrated capacity to trigger private investments. Multipliers of 3 to 10 have become normal in this area.

An increasing network of local, regional and national development banks and special green banks are setting up such financial facilities. They provide a major opportunity for upscaling. This could be achieved by engaging, for example, the European Development Bank. Once there are enough successful green growth projects across the EU, there will be a growing pool of skills at all levels, the existing trends in consumption and production will be accelerated, and it will be clear to investors that the EU is the most advantageous location for green growth investment. Unleashing such a virtuous cycle is the path to a prosperous Europe with prosperous citizens.

4. A SHIFT IN OUTLOOK

- The report provides concrete elements to turn the environmental challenges into a growth opportunity showing that there is no trade-off between environmental policies and economic growth;
- Instead of trying to push investment, it suggests that dynamic demand is what will pull investment and innovation. Calling attention to the change in lifestyles that is already taking place (indicating the direction in which demand is shifting) and how it can be accelerated by policy is a central piece of the argument.
- It does not see global changes as threats that make Europe run desperately to catch up but points out the relative advantage of Europe in the shift to green lifestyles. This is both because its citizens are culturally more likely to adopt such lifestyles and because they are already doing so. Evoking the notion of the previous energy and materials-intensive 'American Way of Life' that evolved in mid-20th Century, it suggests the notion of a new 'European Way of Life' that would be emerging and could shape a viable and sustainable future for the continent and for the emerging middle classes across the world.
- The report sees sustainable production methods as the other side of the 'green lifestyle' coin. Strategic changes that lead to vast increases in the productivity of resources and reductions of their environmental damage will generate innovation in production methods and in final products. Europe is already experimenting in this area, so helping to accelerate the trend would ensure the EU remains on the leading edge. This opens competitive market opportunities for the new technologies, materials and equipment in addition to the final products themselves.
- It indicates the potential advantages for EU companies if EU policies were to clearly favour such a green direction. In that case, European companies would have the right incentives for profitable green innovation and investment as well as the best testing ground for internationally competitive products.
- This means redefining 'green' beyond renewables and environmentally-friendly products and including a much wider range of technologies such as the ICT and products geared towards long-term sustainability. The emphasis needs to be on reducing the material and energy content of what is considered this new 'good life', which in turn will be reflected in reductions in the material and energy content of what we now measure as GDP.
- This reorientation corresponds to the comparative advantages of Europe. A green trajectory can absorb labour-saving technical change in the industries that have to compete with global low-cost labour, while creating labour-using services for the new lifestyles. It will also reduce the cost of importing raw materials and energy, not only by reducing the material content of production, but also by increasing durability and maintenance, recycling and reuse, rental and sharing, all of which are also job creating.
- Another fresh perspective of the report is the importance given to a synergistic set of policies in order to achieve a systemic transition. It promotes a clear tilting of the playing field to make it more profitable to shift towards green production than to continue with business as usual. This shift built upon green research and innovation would reduce uncertainty and indicate long-term stability in order to overcome financial short-termism.

- To underline the feasibility of such a transition and the pivotal role that policy can play in it, the report uses the historical parallel with the government-led boom of the early 1950s. It also signals the similarity of the current post-bubble collapse recession with that of the 1930s. The fundamental similarities identified are:
 - a) High levels of unemployment (different depending on the country and depending on the regions within each country).
 - b) Acute polarisation of income.
 - c) Risk aversion of the financial world in relation to innovation in the real economy (short-termism and the reliance on casino-type financial instruments, while banks remain unstable). The new industries are the ones that continue to innovate – but from their own profits.
 - d) Huge technological potential capable of transforming the whole economy but for the most part unseen and unfunded.
 - e) The socio-political consequences of that context manifested in very similar ways in the 1930s to the present: the emergence of messianic leaders and extremist movements both left and right, the search for scape-goats and explosions of xenophobia; desperate migrations between and within countries; an abundance of anti-technology theorists, politicians and luddites; worried economists predicting secular stagnation, structural unemployment, low or no-growth, etc. into the future.
- The lessons of history should allow us to understand the task and the conditions without a commotion such as war. For that purpose, the report provides an outline of the systemic policies applied by governments after the war, which succeeded in unleashing a demand-driven consumer boom across the advanced nations of the West. The available technology and context suggested then a direction grounded in mass production, and centred on suburbanisation and home ownership. Policies enabling this included:
 - a) Positive-sum game between business and society: the essence of social democracy (Keynesian democracies).
 - b) Mechanisms for continuity of incomes (unemployment insurance, pensions, etc.) and their increase with inflation (official labour unions), to ensure consumption and uninterrupted credit payments.
 - c) Public infrastructural investment for suburban developments plus mortgage insurance, easy loans (for veterans and others), etc.
 - d) High taxes to fund the Welfare State, the new car-based infrastructure and the Cold War (a crucial source of demand for innovation).
 - e) Protection for agriculture (also a source of demand for innovation in mechanised equipment, and petrochemical fertilisers, pesticides, etc).
 - f) Public health and education (in some cases also subsidised energy and transport) creating government demand in those sectors and freeing income for consumption demand.
- This is just one historical illustration of previous periods when state-enabled booms have followed low-growth periods. The report stresses that, while the pattern does recur, the context is always different and thus requires a different response.
- The government policies needed for unleashing a boom with the current transition will be different in many ways; both because of the different nature of the technological potential, including its tendency to differentiate rather than homogenise consumption and because of the context of globalisation.
- For a Europe that moves clearly towards green growth in a globalising world, demand for competitive exports would come from the rising middle classes (following the trends in domestic markets, especially at the top of the range) and from the need for infrastructural investment in the advancing world. This means incentives for innovation in sustainable equipment of all sorts, adapting to the different climatic and geographic conditions in the new developing areas.

Taken together, the new aspects of this report present the notion of a generalised transition from the old mass production activities and consumption/production patterns, where the emerging world has basically taken over, to a new more profitable and environmentally sustainable direction pre-figuring the future.

Acknowledging this 'green trajectory', which goes well beyond the transition to renewable energy, and aligning policies to favour it by building on green research and innovation, would allow the EU to take a leading pioneering position and the European companies a competitive advantages from that tilted playing field. This in turn will positively impact new job creation, investment and innovation, by enticing companies to locate in Europe these new high growth activities.

5. CONCLUDING REMARKS

This report has argued that environmental challenges, rather than being a threat to growth, constitute the best opportunity for reviving wealth and job creation in the EU. Moreover, it has noted that what could be called the 'green good life' has found a culturally fertile ground in the European countries, where it has been spreading faster than in other regions of the globe. This provides a domestic demand context that can entice business to innovate in a green direction, while using it as a test ground for competitive exports. Indeed, European companies have also pioneered the adoption of circular economy practices and other methods for increasing the productivity of resources and reducing environmental damage.

Consequently, the report has suggested promoting consensus around a policy framework, aligned on a green trajectory. Its object would be to accelerate the existing regional trends and to bring the European economies to a leadership position in the lifestyles and production methods that will make the global economy prosperous and viable. This would result in strengthening an emerging 'European Way of Life' that can become the new global aspirational model in the information age, in the way that the 'American Way of Life' became the model in the age of the automobile.

All this implies making a significant directional transition; can such a clear tilting of the playing field be agreed by business, government and society in a group of advanced democracies? That is the question that remains and that is the challenge presented here.

ANNEX I - BACKGROUND DATA

Resource productivity, domestic material consumption and GDP

Since 2008, domestic material consumption has fallen considerably in the EU28, while GDP has grown more moderately, leading to a noticeable increase in resource productivity, indicating a decoupling of material use from economic growth. In other words, since 2008, the EU has been doing more with less.

Decoupling means environmental pressure is stable or decreasing while the economic driving force is growing. However it is very likely that the drop of DMC was strongly influenced by the impacts of the economic crisis, not reflecting a major transformation of the economy and sustainable improvements in resource efficiency. Furthermore, because DMC does not account for upstream 'hidden' material flows embodied in the growing amount of imports of intermediate and final goods from the rest of the world, the progress in resource efficiency of an import-intensive European economy might be overstated.

The EU has shown continuous growth in the amount of material extraction and primary production that it outsourced to other countries. So while direct material resource use in Europe seems to have stabilised, the EU citizen's material 'footprint' is likely to be much more substantial at the global level.

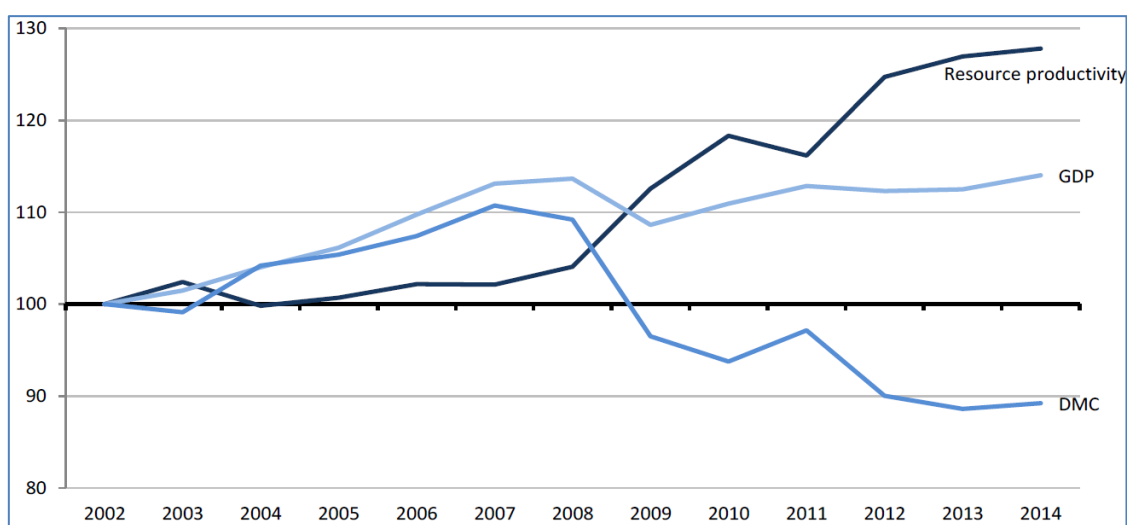


Figure 10 Evolution of resource productivity, domestic material consumption and GDP, EU-28, 2002-14 (index 2002=100)

Source: Eurostat (online data code: (tsdpc100), (tsdpc230) and (nama_10_gdp))

Green market data

- Worldwide, the clean technology market was worth more than €2 trillion a year in 2012 grew at 12% a year from 2007 and it is expected to more than double in size by the mid-2020s⁵¹.
- The full global green business market was estimated at £3.3 trillion in 2011/12⁵²
- By 2020, green technology will have surpassed the car industry as well as the engineering sector in Germany.⁵³
- Clean Energy Investment increased six fold between 2004 and 2011, reaching 279 billion in 2011.⁵⁴
- Globally, the IEA expects renewable power capacity to grow faster than any other source of electricity over the next five years. Around 700GW of renewables will be added by 2020, it

⁵¹ Roland Berger Strategy Consulting

⁵² Department for Business, Innovation and Skills (BIS), Low-Carbon Environmental Goods and Services report, 2012

⁵³ Peter Löscher, Chief Executive of Siemens (until 2013), Europe's largest engineering group

⁵⁴ Overcoming Barriers to International Investment in Clean Energy, OECD 2015

says, most of which will be wind and solar. Some 40% of this growth will come from China.⁵⁵

- Based on past trends, China has identified the 'environment industry' as one of its seven strategic industries, which together should almost double their share of China's growing GDP (from 8% to 15%) between 2015 and 2020.
- The Bio-economy, the branch of green economy that uses renewable biological resources, is estimated as having a turnover of around 2 trillion Euro, with more than 22 million people employed, representing 9% of EU total employment.
- By adopting circular economy principles, across 3 sectors, Europe can take advantage of the impending technology revolution to create a net benefit of €1.8 trillion by 2030, or €0.9 trillion more than in the current linear development path. (GDP could increase as much as an additional 7% by 2030 and 16% by 2050). This would be accompanied by better societal outcomes including an increase of €3,000 in household income (an increase as much as 18% by 2030 and 44% by 2050 in a circular scenario, compared with 7 and 24% in the current development scenario.)⁵⁶
- Such a circular economy approach would also bring a reduction in the cost of time lost to congestion by 16%, and a halving of carbon dioxide emissions compared with current levels (48% reduction of carbon dioxide emissions by 2030) and 83% by 2050⁵⁷
- Economic modelling⁵⁸ results suggest that resource productivity improvements of around 2% to 2.5% pa can be achieved with net positive impacts on EU28 GDP. It is estimated that resource efficiency improvements all along the value chains could reduce material inputs needs by 17%-24% by 2030.⁵⁹
- Using resources more efficiently will bring new job opportunities. The European Commission estimates that 2 million additional jobs could be created by the circular economy.⁶⁰
- The volume growth of EU bio-based chemical products up to 2020, including bio-plastics, bio-lubricants, bio-solvents, bio-surfactants, is estimated at 5.3% p.a., resulting in a market worth € 40 billion and providing over 90,000 jobs within the biochemical industry alone.⁶¹
- The global bio-based market and revenue is estimated at € 250 billion by 2020 by the World Economic Forum⁶²
- Each Euro invested in EU-funded bio-economy research and innovation, if coupled with a coherent and incentivising framework at a national and European level, is estimated to trigger 10 Euro of value added in bio-based sectors by 2025.⁶³
- Currently, in the EU, 60% of total waste is not recycled, composted or reused,⁶⁴ 44% of large companies in the EU sell their scrap material to another company and 24% of SMEs do so too⁶⁵. A better use of resources is calculated to represent an overall savings potential of €630 billion per year for European industry.⁶⁶

⁵⁵ IEA Medium Term Renewable Energy Market Report 2015

⁵⁶ 'Growth Within: A Circular Economy Vision for a Competitive Europe', EMF, SUN, McKinsey Center for Business and Environment, 2015

⁵⁷ <http://www.ellenmacarthurfoundation.org/news/circular-economy-would-increase-european-competitiveness-and-deliver-better-societal-outcomes-new-study-reveals>

⁵⁸ Study on modelling of the economic and environmental impacts of raw material consumption, March 2014, Cambridge Econometrics, Deloitte Bio Intelligence for the European Commission

⁵⁹ Meyer, B. et al (2011) 'Macroeconomic modelling of sustainable development and the links between the economy and the environment'. Study for the European Commission

⁶⁰ Cambridge Econometrics et al. (2014) Modelling the Economic and Environmental Impacts of Change in Raw Material Consumption, cited in 'Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions: Closing the loop - An EU action plan for the Circular Economy'

⁶¹ Europe Innova Report 'Assessment of the Bio-based Products Market Potential for Innovation', 2010

⁶² World Economic Forum, The Future of industrial bio-refineries, 2010

⁶³ 'Innovating for Sustainable Growth: A Bio-economy for Europe' - COM(2012) 60 final

⁶⁴ Eurostat waste statistics (2011)

⁶⁵ Flash Eurobarometer 2013 on 'SMEs, resource efficiency and green markets': ec.europa.eu/public_opinion/flash/fl_381_eapdf

⁶⁶ 'Guide to resource efficiency in manufacturing: Experiences from improving resource efficiency in manufacturing companies'. Europe INNOVA (2012)

- McKinsey have pointed to untapped 50% possibility for energy efficiency saving in production⁶⁷.
- The sharing economy or collaborative consumption is, according to Time magazine (2011), one of 10 ideas that will change the world, by offering improvements in system wide resource productivity. It touches on several sectors such as housing, transport, retail. It is developing and growing despite some resistances.
- An important driver to the green trajectory is related to the unsustainable costs and impacts of the current linear model powered by fossil fuels. This has already been apparent in the rising costs associated with natural disasters. Since 1990, over 4.3 billion people have been affected by natural weather related disasters, with costs estimated at US\$1.5tn (€1.3tn).⁶⁸

Adoption of sustainable transport in cities

The adoption of many kinds of sustainable transport in cities has shown remarkable upward trends in the last decade. See figure 11

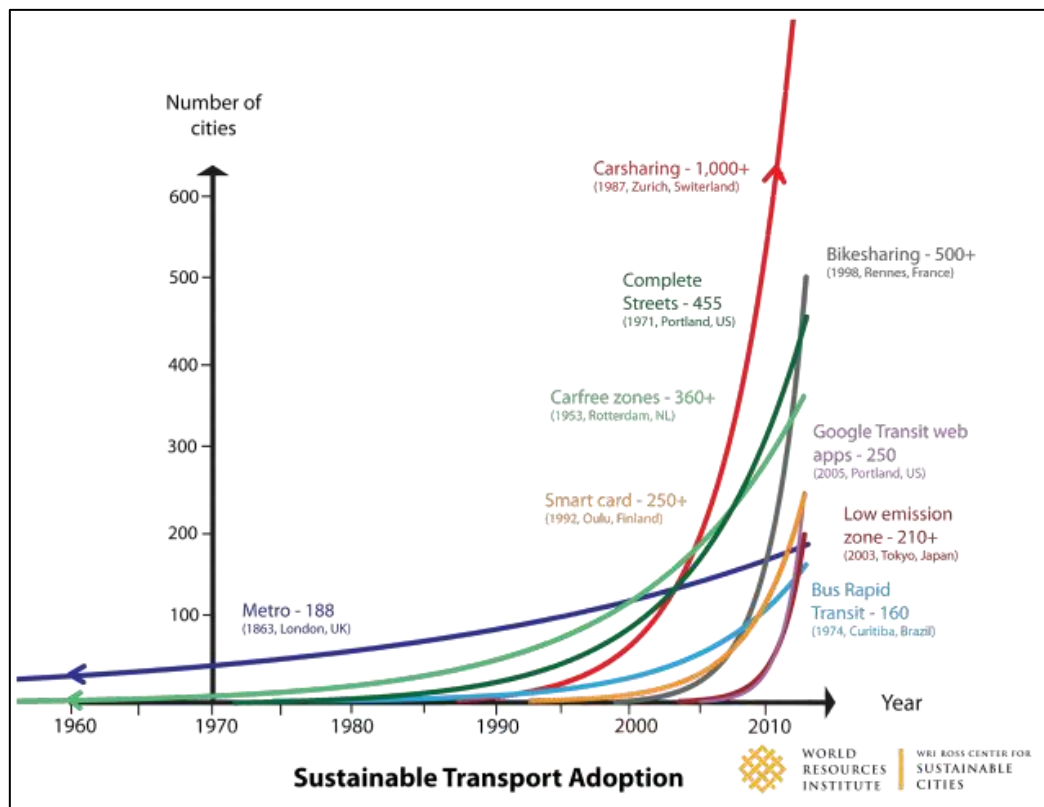


Figure 11 Innovation in sustainable transport – adoption curves in cities

Source: Research by Heshuang Zheng, Dario Hidalgo and Akshay Mani; Design by Benoit Colin and Heshuang Zheng. Source: World Resources Institute

⁶⁷ Choudhry, H., Lauritzen, M., Somers, K. and Van Niel, J. (2015) 'Greening the future: New technologies that could transform how industry uses energy', McKinsey Green Campus Report, August 2015

⁶⁸ <http://www.axa-im.com/en/about-axa-im/-/news/climate-change-is-an-investment-play-for-today-luisa-florez/maximized/I73E>

ANNEX II – THE MEMBERS OF THE EXPERT GROUP

Name	Nationality	Present position
Carlota Perez (<i>Chair</i>)	VE/UK	Centennial Professor, London School of Economics; Professor of Technology and Development at the Nurkse Institute. Technological University of Tallinn, Estonia; Honorary Professor, SPRU, University of Sussex, UK
Pier Vellinga (<i>Vice Chair</i>)	NL	Professor in Climate Change and Societal Implications at Wageningen University and Vrije Universiteit Amsterdam, Co-initiator and early Bureau Member of IPCC.
Christian Hudson (<i>Rapporteur</i>)	UK	Senior Fellow at Ecologic Institute.
Nathalie Girouard	CA	Coordinator for OECD work on green growth and sustainable development
Reinhilde Veugelers	BE	Full professor at the Department of Management, Strategy and Innovation at KU Leuven.
Giulia Gregori	IT	Head of Strategic Planning and Corporate Communication at Novamont SpA
Paweł Kawalec	PL	Director of The Institute of Theoretical Philosophy at KU Lublin
Steven Stone	US/FR	Chief of UNEP's Geneva-based Economics and Trade Branch
Carmen Marchiori	IT	Lecturer in Environmental Policy and Economics. Department of Geography and Environment of London School of Economics
Martin Faulstich	DE	Professor of Environmental and Energy Technology at Clausthal University of Technology and director of the CUTEC Institute of Environmental Technology
Philippe de Buck	BE	Member of the European Economic and Social Committee and former Director General of Business Europe
With the contribution of:		
Marianne Fay	US	Chief Economist of the Climate Change Group at the World Bank

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The independent Expert Group on the “R&I policy framework for green growth and jobs” was established by the European Commission for engaging in a forward looking reflection contributing to define the reference policy framework for green research and innovation. The report presents the notion of a global transition towards an environmentally sustainable future which is more adequate and profitable to the European peculiarities. Such “green trajectory” includes but goes beyond the traditional green sectors and European policymakers are invited to align policies to favour it. This would allow the EU to take a leading pioneering position and competitive advantages from that tilted playing field. This transition built on green research and innovation will positively impact new job creation by enticing companies to locate in Europe new high growth activities.

Studies and reports