



Opportunity Now: Europe's Mission to Innovate

European Political
Strategy Centre

Europe has always been a world-leading inventor. We retain the core skills and deep science culture that have made this possible. In this century too, Europe can contribute a great share of the world's new tools: in genomics and biotech, in data and materials, in energy and nutrition, in propulsion and cognition, in health and well-being, both physical and mental.

Will Europe continue its innovation mission? This is not a theoretical or empirical question but one of intent and principle. Do we choose politically to be innovators?

If Europe dropped its mission to innovate, the blame would lie not with the world but with ourselves. But if we choose to hold to the innovator's path, we can succeed: and in doing so, we shall innovate our way to social inclusion and sustainability as well as to productivity, growth and jobs.

This note's purpose is to clarify what is at stake and make the case for a renewed commitment to innovative Europe.

It's Complicated...

Innovation happens in complex ecosystems. Too often, we imagine innovation in a linear way, as a pipe-line with inputs and outputs. But where we focus only on the pipeline, we miss the real needs of Europe's more diverse and demand-driven innovators. We need more open collaboration, both globally and between citizens, governments and inventors at home.

Everyone Must Own their Share in the Revolution

The world faces pervasive disruption. Europe can own, not merely experience, this Revolution. Europe can catch the wave because we are a mature community of values and an open society. Europe has what it takes to design and deliver an innovation-founded better future of our own: social inclusion and sustainability, as well as growth and jobs, are at stake.

Focus on People, Places and Processes

Europe needs better assets as well as a broader vision. We have to get back to basics. The three key foundation actions for innovation are: upskilling Europe's people, using local strengths to underpin local innovation, and transforming public processes. The Commission can and must become a beacon for embedded innovation, and Europe's public sector must change faster. EU 1.0 cannot deliver Europe 2.0.

Seize the Opportunity

Now is the time for a fresh start. Feasible initiatives in the year ahead, joined up at local, national and EU level and pursued at scale, will bear fruit by the end of the decade.

EPSC Strategic Notes are analytical papers on topics chosen by the President of the European Commission. They are produced by the European Political Strategy Centre (EPSC), the European Commission's in-house think tank. This review has been conducted by Robert Madelin. Full notes and references, insight articles and bibliography are included in the e-book version of this note, available on line at: <http://bookshop.europa.eu/uri?target=EUB:NOTICE:KK0216475:EN>.

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1. Innovation: It's Complicated... and Complex

While a new idea is a thought about something new or unique, and making that idea real is an invention, innovation is an invention that has a socioeconomic effect. Innovation changes the way people live.

Wiebe Bijker

Innovation is anything new that changes the society adopting it.

Innovation and creativity have always been intrinsic to being human. Certainly innovation is essential to the ascent of man: wondering what would happen if we did things a bit differently, seeking easier solutions to life's challenges.

In the last two years, humanity has embraced innovation more fully than ever before. Innovation is acknowledged as intrinsic to the achievement of the UN Global Goals, just as it is essential to the ten priorities of the current European Commission mandate.

1.1 What is Innovation?

Innovation is often thought of as the adoption by everyone else of the inventions of scientists and technologists, whether in a disruptive 'entrepreneurial' context, by firm-led incremental improvement or in an integrated technocratic effort of the 'Entrepreneurial State'.

None of these models are outdated, and the State-led model has particular relevance in a century of long-term and massive challenges. But innovation has always been even broader than that, and included new business models (Florentine banking) or social innovation (British Friendly Societies). Today, as the 'friendly spin-offs' of open innovation and the makers' movements make a come-back, the sources and sauces of innovation have never been more varied: innovation is really complicated.

Innovation is also more complex than ever. Complexity, chaos and non-linearity have been seen since the 1970s as the defining features of our age. But still our advanced societies find it hard to make robust policy for a complex innovation system.

Figure 1: Innovation Flavours

Creativity & Design-Driven	Workplace & Employee Innovation	Public Sector Innovation	Social Innovation
Data-Driven Innovation	Technological R&D	Disruptive Innovation	Organisational Business Model Innovation
Open Innovation 2.0	Frugal Innovation	Responsible Innovation	Digital Innovation
Regulatory Innovation	Marketing Driven Innovation	Knowledge Base (non R&D) Innovation	?

Source: European Commission

A complex system is a place where:

- no one can have a complete map of the actors and forces at play,
- the system's behaviour is not simply the sum of the behaviour of those parts,
- feedback loops surprise us and change the behaviour of the system,
- the system is "autopoietic", behaving in a self-driven way and not just in ways we have yet to understand.
- EU innovation policy acknowledges this complexity. As the Innovation Union strategy already made clear, sound policy for innovation will look at organic and porous systems, and fluid activities within them, rather than at a closed network.

But policy is theory. EU and EU Member States actors acknowledge that their practice mostly side-steps the complex reality. We tend too much to work as if innovation were supplied through a pipeline, where upstream research delivers innovation in the market-place.

The pipeline theory is too simple and leads to policy over-simplification: we look at measurable supply inputs, with little accounting for demand, adoption or outcomes. This is not a solely European dilemma. But if Europe can begin to correct it, we shall do better in the innovation stakes.

In reality, our innovation economy is not a Roman aqueduct but a "muddy pond". Rich but obscure. Innovation requires of all actors, corporate, academic, civic and political, the instinct of the hunter-gatherer,

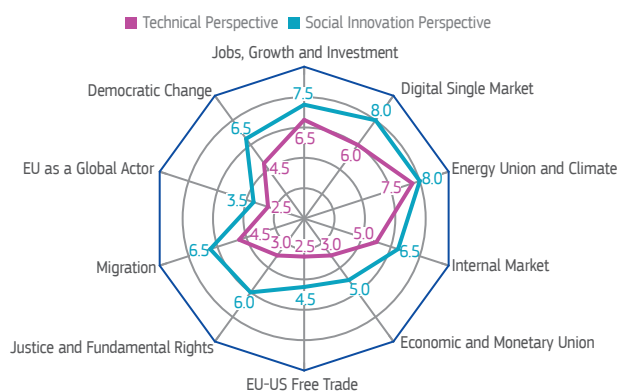
not the farmer; a longer and broader view of needs and opportunities; an enterprising portfolio of risk-taking in place of fixed plans; a culture encouraging the rebellious over the blindly loyal.

None of this means that Europe could discount established innovation pathways. Almost two-thirds of US innovation, for example, comes from companies employing over 500 employees. Europe still needs a share of that: strong EU-based and EU-invested corporates moving from new to big ideas, and from big to global scale.

Big public science projects, such as the Flagship on the Human Brain, remain essential. Europe needs increased, not diminished support in schools for Science and Technology, but also for the Arts. We need big spending, public as well as private, on science and data infrastructure, also on skills in the tertiary and business sectors.

So Europe needs a distinct innovation mission, separate from but not instead of its research policy.

Figure 2: Innovation and the Ten Priorities of the Juncker Commission



Source: European Commission

1.2 Defining an Innovation Mission for Europe

An EU Innovation Mission, will best succeed if it has four key planks:

- Broad political and societal ownership of an innovation mission designed to deliver for productivity, growth, jobs, social inclusion and sustainability.
- Concerted cooperation, with full mutual accountability, rather than an innovation theatre of well-meaning discourse followed by institutionally weak, slow and variable follow-up.

- A foundation of priority investment in our core assets: individual people, local centres of excellence, European public administration.
- More focus on cross-continental scaling by and between innovators, who themselves work off more granular local plans, rooted in local strengths and needs.

And what are the essential parameters that the innovation mission must respect?

Everyone has their own take. Here are twelve key ideas, found in the writings of many of the leading observers:

- Innovation is more than science and technology. Social, demand- and needs-driven innovation matter more than ever. Organisational, service and business models are innovative, too.
- Innovation spirit cannot be faked. Innovators have a right to expect authentically innovative public institutions.
- Public effort must cover the full range of innovation preconditions facing market failure in Europe: human capital formation, science, entrepreneurial environment, patient public capital, intermediary enablers.
- Europe's response to this opportunity must intentionally target outcomes that help everyone; and must confidently reach across constitutional hurdles in order to create pragmatic alliances for action that link up the different layers of responsibility from local to trans-continental.
- Innovation requires, at EU and lower levels, both places for "contamination" and more widespread "pollinators", "enablers" or intermediary actors: to make sure that potential partners find each other and learn more promptly and often from each other's successes and failures.
- Everyone is an innovator now, and needs the chance to join the system. Science and responsible innovation start from open-ness and engagement with everyone. People and organisations with a stake in all sorts of innovation must be systematically involved in policy-making.
- Everyone needs the skills to play: entrepreneurial creativity and positive risk-taking, broad arts and science learning, hands-on experimentation with real-life problems.
- Future opportunities will come in the space between the product and the consumer: "prosumers" will co-design services based on new data insights.
- Digital tools change all previous assumptions about the thresholds and perimeters for successful new endeavours. So we underperform if we focus only on incremental change: Europe must make a portfolio of higher-risk bets in support of speculative and

even disruptive insights. We need to watch the radar screen for innovation promise emerging out of more academic work.

- Digital is far from being everything. For bio-innovation, timescales, infrastructure and cash needs are still orders of magnitude greater than for IT. Social innovators have another different set of needs. So policies cannot be optimised for just one sort of innovation.
- Young, often immaterial, high-growth companies are here to stay. They need public support and attention in their own right, not as part of the too-diverse category of “SMEs”. The success of Europe in high-growth startups will also depend on established firms learning to partner with them. This is VERY hard for incumbents.
- Innovation is a global opportunity: ideas, capital and individuals have choices and will exit or by-pass hostile, as well as enter supportive, jurisdictions.

The remainder of this chapter elaborates on the last point: open approaches to innovation.

1.3 Open Governance

In the century of complex systems, competitive advantage will accrue to communities and jurisdictions able to adapt to unpredictable developments. Mechanistic, predict-and-control logic will systematically fail in a complex system: it will omit new actors, fail to account for feedback loops and overestimate linear returns to effort. Such approaches already impose increasing opportunity costs and increasing downside risks on European society and enterprise: their under-performance erodes both economic opportunity and government legitimacy.

A systems approach will help administrations to map more subtly what is going on. Then we will be more modest in action, will favour the experimental, but also be more attentive to change, faster in response and readier for repeated fine-tuning. Modesty is the key. Where power and knowledge are evolving and widely distributed, governments who want to succeed must operate in a more cooperative and open manner. And the choice of tools must favour participation in place of control, self-organisation rather than centralisation.

The systems approach is no recipe for *laissez faire*: Europe still needs detailed and clear definitions of which authorities are in charge where, and how they cooperate across frontiers. A systems approach typically requires more attention to the maintenance of a strong and open network between all actors. Systems also depend on the long-established fundamental duties of government: to be coherent and to respect legal deadlines for action.

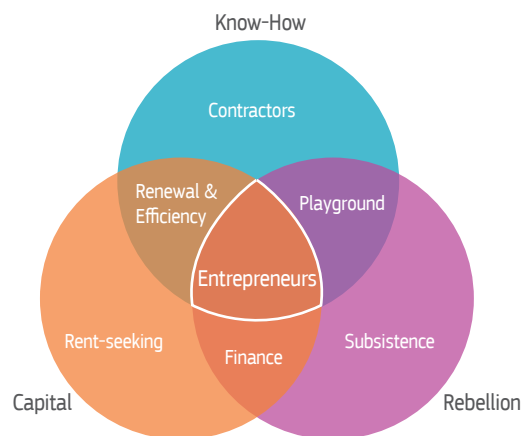
1.4 Open Innovation

A more open approach matters for innovators as much as for government.

Traditionally, innovation has taken place in centralised, closed and inward-looking elite circles.

Now, Open Innovation 2.0 (OI2.0) is more and more outwardly focussed and collaborative. Innovation can be open but still hierarchically owned and managed (an innovation “mall”) or open and flat (an innovation “community”). Central to success is a shared search for shared value. The OI model may not work in all cases, since to hit the shared value target requires quite challenging changes in hitherto top-down and elitist practices in technology and innovation.

Figure 3: What Makes an Entrepreneurial Ecosystem



Source: [N. Colin – The Family](#)

Europe is lucky in having OI2.0 communities of practice within which game-changing experiments continue to multiply, at EU and at national level, as well as in cities and regions. In Luxembourg, for example, various public and private partners cooperate on a focussed set of initiatives: a lean startup support program, the use of design and user experience methodologies in the public sector, and the launch of a policy innovation lab for the Ministry of Public Affairs. And Europe is probably leading the world in social innovation: in private experimentation, in civic cooperative approaches and in public funding for Digital Social Innovation.

1.5 Open Global Cooperation

Innovation in the Internet age is planetary. Value chains are becoming steadily more inter-regional. Protectionist or restrictive walls can be built only at disproportionate economic - and moral - cost. In an open world economy where every country and every ‘sector’ inter-connects,

poor policy on one issue drags down EU competitiveness in everything else, just as a set of mutually reinforcing positive policies can multiply the overall impact of each small breakthrough. No issue is an island.

To innovate, Europe must nurture home-grown talent but also welcome all possible ideas, entrepreneurial know-how and capital, whatever their origin and whatever their affiliation. The basic conditions of doing business (product regulation, employment law, corporate tax) are key determinants of the location of high-value investment.

Innovative open-ness is a European value, because Europe is arguably THE planetary continent. We have suffered periods of patchy introversion: but (so far) nothing as deep or lasting as in Asia or America. Created by historically international nation states, the European Union is, by design and practice, the indispensable partner of global interdependence and cooperation. Europe preserves its ways of life by sustained participation in global cooperation and global institutions.

Seen in this light, Europeans have a huge stake as innovators in preserving sound shared rules. Rules for trade, investment, IPR, but also for taxation, sustainable development and the regulation of the new. European companies and investors world-wide want more, and more positive, regulatory cooperation between governments and global innovation leaders. Europe's innovative bankers dream of a G20 for FinTech regulators to allow faster and more secure global-scale rollout of innovation. Europe is, with China, a cheer-leader for the reconfiguration of financial accounting. Indeed, this is just one point on which the China chair of G20 offers an opening to broaden communication with Beijing across the whole set of global economic policy themes.

Immigration policy itself, however contentious, has a strong innovation impact.

New people are overwhelmingly the source of new ideas. More than one-third of innovators in the US were "born elsewhere" (a group that accounts for only 13% of the population!). Similar figures are reported by European campus incubators. But if the internationally mobile are an asset, too many go to the US, Canada and Australia rather than come to Europe. The European Research Council has played a sterling role in attracting and retaining top researchers. But more generally, EU fears and a fortress mentality can only increase our handicap in attracting and retaining global innovators. This requires just as much attention as the development of fresh employment opportunities at home.

Europe must also attract fresh foreign companies and capital. On the startup scene, Europe has 4 of the top 20 world ecosystems, they are among the fastest growing, and (as in US and Asia) they increasingly attract foreign capital to investment rounds and global citizens to the startups funded. Recent initiatives, by Startup Europe as well as national networks, to hold road-shows in other continents seem promising ways to learn globally and attract back both talent and cash. Global economic diplomacy has never been so important.

2. Owing the Revolution

Europe's innovation mission coincides with a momentous global cycle of disruption. Whether we call this the Fourth Industrial Revolution or the Fifth Human Revolution, that makes for challenging times.

Figure 4: Triple Bottom Line Approach



Source: European Commission

2.1 A Shared Vision of Our Innovative Future

To navigate the challenges and create our own opportunity, we need clear, high-level EU goals for the outcomes we want from the Revolution: outcomes in productivity, growth and jobs, but also in social inclusion and sustainability. We need to look at these big issues together because they success depends on our ability to innovate: innovation changes trade-offs and allows sustainable development where business as usual cannot.

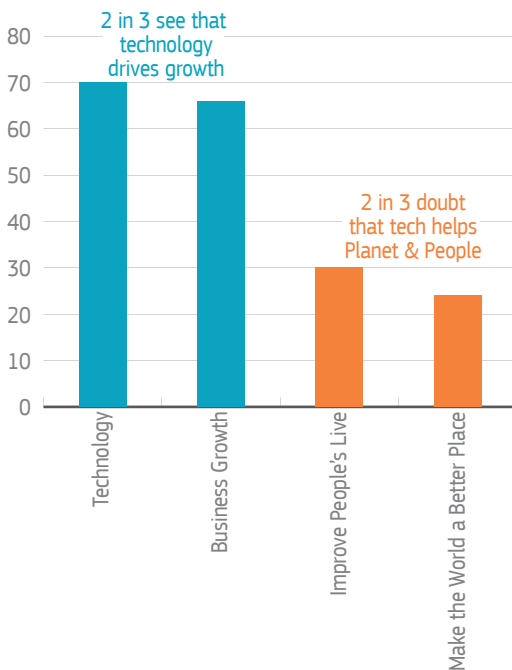
This common frame of vision is essential if Europe is to embrace innovation and if member states and citizens are to be both willing and able to innovate. This holds good:

- for political legitimacy reasons: it is only if all citizens and workers, in all regions, social situations and sectors, have good reasons to believe that they are actively involved in the shaping of an innovation policy, and that its risks, benefits and costs are fairly shared, that they will support it
- for efficiency reasons: innovation increasingly relies on cooperation. It is only if all partners in the cooperation have good reasons to believe that (again) its risks, benefits and costs are fairly shared, that they will engage in this cooperation.

With shared goals, Europe can look beyond the fires close to hand, and embrace the future without needing to predict and control it, precisely because we have made a self-confident commitment to a future that we want and believe to be feasible.

World-wide, and not particularly in Europe, we have some way to go before public opinion has this confidence and enthusiasm. Most global influential citizens agree that innovation will boost growth. But at the same time, most feel that the world is moving uncomfortably fast, and only 1 in 3 expect systematic alignment between innovation and their individual and family needs, or between innovation and a sustainable planetary future.

Figure 5: Perception of Innovation



Source: [2015 Edelman Trust Barometer](#)

EU-specific surveys as well as national data largely disprove the myth of overwhelming innovation scepticism in European public opinion. People still love

to understand and to try out the new, as long as they do not suspect it is foisted upon them without upstream engagement. The same surveys show that EU public opinion positively wants innovation to contribute: on health, education, energy, transport, growth and inter-generational equity.

So an innovation mission that delivers on these broader challenges will be well aligned with the EU vision of its future. And there is good recent evidence that this alignment is achievable:

- The UN Global Goals are rooted in the realisation that sustainable and inclusive futures for the planet depend on innovation-driven change,
- The UNEP Inquiry points the way to re-integrate in our financial system the long-term needs of the global economy,
- The OECD beyond GDP and Integrated Reporting movements offer holistic metrics,
- There is in Europe wide social support for a positive innovation, defined by industrial labour unions – “innovation by all and for all” – and supported by management,
- The corporate social contribution is increasingly recognised, both in global surveys and in EU policy,
- The concepts of Open Science and Responsible Innovation offer a blueprint for improving public science.

2.2 Taking Part in Our Future

To build and maintain a more holistic and positive innovation vision will require the greater involvement of everyone. But where do we involve them? Participation is a foundation for trust, and we know how to do it. For example, there is a proven tool-box for science-to-citizen engagement, although it is not yet widely enough deployed.

Open structures to prioritise innovation can be created within each political institution:

- All Parliaments (like Poland’s...) need a standing innovation committee,
- All executives (like Sweden’s, or Switzerland’s), need a top-level council for innovation to map and voice the evolving to-do list,
- All would benefit from something like Denmark’s Board of Technology, which both socialises science and brings society’s needs into focus for investigators and tool-makers.
- Participative policy-making, as piloted with great success by Dialogik or UK Open Policy Making, will link these institutions to broader networks, including “museums of the future”, such as those hosted by ArsElectronica in Linz or at La Villette.

- At EU level, an initiative to pilot, as widely discussed, a European Innovation Council can be designed to involve everyone with a stake in innovation: today, there is an innovation void in EU policy debate, even if more established players enjoy plenty of voice and access.
- It is important that innovators be present in assessing rule-making, from the Regulatory Scrutiny Board down.

Within public administrations, too, a more participative and coherent network of actors is badly needed. Innovation is too much addressed through parallel instrument-led activities. In some administrations, such as that of New Zealand, broader policy commands draw under one lead the range of innovation-driving policies, from innovation and science as such to markets, housing and labour law.

In Europe, we need equivalent coherence within a different and larger structure. One initiative would be to create innovation task forces driving greater innovation across departments of the Commission, and in the parallel structures of the Parliament, Council, Economic and Social Committee and Committee of Regions. Already, the ad hoc network that underpinned the writing of this report revealed lots of energy and ideas, buried behind vertical siloes and under excessive top-down control. As one core mission, such networks could share insights and build synergy both within and between institutions. They would also offer a better knowledge network for similar national and local actors.

Across all institutions, the most urgent need is to break down barriers between and within programmes and institutions, to de-silo. To take a single example, EIT networks, the H2020 Policy Support Framework for national research, Joint Research Centre expert analysis and the Smart Specialisation process are all useful, but proceed too often on parallel tracks. Bringing them together would significantly improve policy impact and financial efficiency. In this area, the recently launched INPACT gives a great new platform on which not only volunteer actors but also the EU institutions should now come together. And closer to the Council, the High Level Group on Innovation Policy continues since the Polish Presidency to do good work.

2.3 Planning Together for Future Challenges

The creation of a more coherent vision and of a more coherent conversation does not imply that the impact of innovation can be all good and smooth. Innovation provides tools and it is the way they are used that produces good or bad outcomes. Change itself means effort for all and at least short-term losses for some.

So shared ownership of the innovation revolution does not require the EU to swallow whole all that is new. But it requires us to resist zero-risk goals or the avoidance of all hazard. It requires instead a deeper and earlier effort to master the trickier aspects of technology-driven societal change. We cannot simply predict that the robots or the gig economy will eat our jobs, and then make rules about that alleged danger. We need to set ourselves the harder task of planning to benefit from the best of new manufacturing and service technologies, while maintaining decent income for decent employment and a life-long funded social safety net.

The reconciliation of the current revolution with our values and goals will often depend on a reframing of the debate to look more widely and further ahead. It may well also require regulatory innovation.

For example:

- Distributed Ledger Technology can enable the frictionless management of contract, payment, tax and social security settlement for as little as an hour's work in the gig economy,
- Household or individual basic income, and life-time social budgets for the education, health and skills of each citizen, mediated through similar technology networks, may then be feasible as the key to a welfare society in the Internet age,

This broader policy debate will not just respond to public concerns as to the future of the European way of life. It is an agenda that is essential to preserve Europe's productive potential. Social inequality in Europe needs attention not just because it avoidably shortens the healthy lives of innocent fellow citizens. Inequality also, in fresh OECD analysis, seriously hampers economic growth: with a modest increase in inequality over two decades costing a range of European economies between 2 and 3 points of cumulative GDP.

On this assessment, Europe can best own the innovation revolution by reaffirming the social pillar of Europe's priorities as part and parcel of the open market economy. That broad vision is the key enabler for trust. Because Europeans have nothing in principle against innovation, and flock to its excitement and its benefits, but seek increased clarity that innovation is part of a good future for their families and themselves.

3. People, Place and Process

If Europeans want to share and win the broader benefits of innovation, what should be the new policy mix?

Too much innovation discourse focuses on the volume of research, the quality of funding processes, or the

substance of IPR. Such factors matter hugely. They are the heart of public science and are rightly still core business. They are subject to rich ongoing discussion and action, and remain key drivers for breakthrough science and high-tech business.

Even so, meeting the science and funding challenges is not a sufficient condition today for sustained innovation success. This section makes the case for additional parallel action, elsewhere: and in particular for dramatically more ambitious, European-level attention to three underweight fields: human capital, geography and public institutions. Better regulation, research design and finance are also covered.

3.1 It's About People

For Europe to flourish in the present age, we must focus more attention on all those individuals who make their lives in the EU. Europe no longer enjoys the old monopolies of know-how and technology or dominates the ownership of planetary resources. Europeans have yet to fully internalize what this means for Europe's choices. In the decades ahead, like South Korea 60 years ago, Europe will flourish and thrive only by the relentless development of creative people. Europe has no other asset.

Most EU citizens are complacent about the state of Europe's human assets. Our collective health, education and skills all deserve higher investment, greater public policy attention and effort. To be resourceful and effective in the 21st century, every individual must be nurtured, in mind and body, in know-how and creativity.

3.1.1 Health

We focus on curing the sick but do not do enough to support good mental as well as physical health. In cognitive and emotional wellness, the European Brain Council's Year of the Brain remade the positive case for investing in brain well-being. This is a goal that covers the full gamut of innovation, from genomics and high-throughput neurological databases to web-based virtual reality support for psychotherapy. Yet these issues of stigma are woefully underfunded.

Physically, too, we can feel proud about average overall longevity, but we should not ignore the stagnation and in many places marginal decline in the share of our lives spent in good health (Healthy Life Years). This state of affairs implies both avoidable illness for fellow-citizens and a work-force shrunken by impaired physical mobility and an unduly early end of productive activity.

Fortunately for labour competitiveness, there is new scope for innovative answers to public health. The new opportunity comes from sticky and fun mobile health

applications for health promotion, as well as from online systems for diagnosis, treatment and support of patients. The new age of health-promoting innovation is driven by the over-the-counter demand of individuals, by health systems, but also by enlightened employers such as BASF. To make sense, the new tools need to be managed for shared benefits across the existing public, private, health and social service siloes, and not only by curative health professionals and state payers. This public health and over-the-counter innovation boom is in full synergy with the digital transformation of curative health services, the data-driven boom in medical discovery and testing, and the coming age of genomic medicine, with for example the deployment of genomic discovery to accelerate both diagnosis and cure of rare and hitherto intractable disease, or the timely and cost-effective creation of made-to-measure, genuinely personal immuno-oncology solutions. We need an approach to health innovation that links all these opportunities together. We need big bets in public-private partnership on innovative medicines. But we should not leave it all to the curative blockbusters. The Health Community coming together under the European Institute of Innovation and Technology (EIT) is well placed to develop the missing relationships.

Figure 6: Cracking the Tech Literacy Challenge



Source: [BT plc](#)

3.1.2 Education and Skills

In an age of innovation, and an age of ageing, we need every resident, every citizen, to get the best chance in life and to receive special help if they face special difficulty, not only at school but over their whole life. This is good for individuals but also essential for society. With increasing evidence and certainty, we know that we must nurture both mind and body. We know that

individual nurturing from conception to kindergarten matters more than anything and from kindergarten to the teens more than the rest of life.

Again, our results are poor. While Korea, for example, keeps functional innumeracy down to 5% of its adult population, EU Member State numbers range from 15 to 25%. EU skills too often improve neither between generations nor (unlike US) over working life. Some Asian and Nordic school-leavers are more skilled than the university graduates of other EU countries. This state of affairs is not only morally dubious in an inclusive knowledge society but strategically self-harming. Erasmus+, and Europe 2020 targets to reduce early school-leaving and boost tertiary education are all very well, but miss the deeper drivers of this sad state of affairs.

Without imagining any top-down or one-size solution, Europe does need a serious, shared policy push in this field. We already have, within the OECD, clear good practice recommendations. We have, within the EU, world-class early years teaching, which Asian or African countries are picking up, but which neighbouring Member States resist as being impossible to transplant between cultures. We should join and share.

Our collective push has to start young: 5 million children begin primary school this year in the EU. We have a long decade within which to improve their life chances beyond the mixed experience of the school-leavers of 2016.

Life-long learning and the skills agenda is an acknowledged Top Ten priority. There is an emerging cluster of specifications for a no-regrets skills policy:

- As artificial intelligence and robotics help with ever more tasks, the impact on each individual's work will clearly be big, but precise patterns and timetables for change remain unclear.
- We must all use all of our talents throughout life: both sides of the brain and also our hands: this is not 'unacademic' but human, and essential to create innovators. It requires the re-weighting of life towards life-long arts and creativity as well as technical thinking, adaptive learning skills, emotional as well as cognitive intelligence.
- The young need local heroes, from whom they can grasp the ethical as well as practical realities of a fast-changing world. Teachers cannot alone or in a closed class-room convey the excitement of the revolution outside, or the ethical values that will help Europe succeed.
- Adolescents must have school-years and young professional exposure that gets them closer to the real world: this is about experience and not only apprenticeships.

- We must work harder on inclusion, so that double-digit shortfalls in functional skills are no longer acceptable.

We can build this broader campaign on foundations already laid with the Grand Coalition for Digital Jobs, and that is indeed the message of the New Skills Agenda for Europe. But we need to expand this strategy into a wider and more coherent set of actions from early childhood to adult education.

Launched with top-level support in 2013, the Coalition is grass roots in intent. It offers a distributed model for matching individual skills portfolios with employer needs, across specific locations, with learning opportunities, EU-supported but locally made. The coalition is a going concern with national networks in half the Member States. It has broken old siloes between skills actors, especially between government, education and business. It has proved that there is huge unmet demand for such training, that at least 40% of that demand is from girls and women, and that the employment opportunities following training are real. Now is a good time to go to scale. The coalition can grow faster if we create Internet-age support tools, using real-time labour market data and data analytics to better map needs and gaps. But broader cooperation and sustained impetus will be key to success.

But coalitions alone may not be enough to redesign an educational system for Europe that creates innovative potential as the core asset on which future prosperity depends.

Dedicated approaches to early childhood innovation thinking, earlier and more consistent exposure to experimental and creative problem solving, as well as measures to prepare an aging workforce to adapt, are widely acknowledged but have proven difficult to scale.

A renewed commitment to an impact agenda for innovation-oriented education is a no-regrets investment for Europe – the opportunity cost is likely unaffordable.

3.2 Location

Internationalist and globaphobe alike too often think that Global Value Chains have reduced the world economy to homogenised soup. They are wrong. Not even the EU Single Market always responds to a one-size-fits-all policy. Indeed, with a Union of 28 and rising, the range of our diversity has hugely increased. Europe needs deeper reflection as to how to combine loyalty to local reality with strong bridges to carry local success to continental and global scale.

Innovation very much still depends on location. There is plenty of scope for place-based public policy. Evidence from Europe confirms that Druckerian clusters remain a source of advantage, and that distance between assets or actors is often still a relative handicap. It is rare to see effective cooperation span 50 kilometres. Indeed, in the UK, Switzerland and elsewhere, we see world class innovators moving their teams over distances as little as 10 kilometres to be on-site, so great is the premium of absolute colocation over mere proximity.

3.2.1 Smart Specialisation

This is why the insights of Smart Specialisation are crucial, and why it makes sense to define innovation goals at regional level. Smart Specialisation's open and multi-stakeholder discovery process changes mind-sets. Instead of every region going silicon, trying to match global excellence in disciplines in which they have no track record, each region can identify home-grown strengths, talents and needs, then buy in new-to-region innovations, boost local growth, meet local challenges, and only maybe thereafter seek to home-grow new talents.

Identifying smarter goals for a given region is only a beginning. Once we have better goals and a wider group of stakeholders focussed on them, there remains the non-trivial task of using the broadened network to deliver the plan and to reshape the key local innovation institutions, be that the university or something else.

Progress so far in smart specialisation suggests that most regions apply the new approach too gently: they find it hard to create a risk-taking culture on the public side, hard to involve users and business, hard to give space for social innovation. Regions that embrace smart specialisation as a transformational opportunity and not just a transactional game, can overcome these challenges over a few cycles. Persistence is the key.

There can be no one-size blueprint for this sustained local change agenda. But smart specialisation across the EU does require some key new actions:

- A clear policy of support for Regional Technology Organisations (RTOs) as key enablers within and between local ecosystems, and a clearer permission for each RTO to operate across all Member States,
- A stronger commitment by managers of EU structural and investment funds to use the 15% spending allowed "out of area" in order to bring in expertise, for example from leading RTOs or from excellent universities elsewhere in EU,
- A systematic search by innovative cities for cross-border cooperation with innovators elsewhere, exemplified by the Pact of Amsterdam and its overdue EU Urban agenda,

- The multiplication of multi-regional partnerships on the lines of the excellent Vanguard Initiative so that success to date in joint cross-region piloting of innovation can be expanded to pre-commercial procurement and scaling.

The European Institute of Innovation and Technology (EIT) is an as yet under-valued asset. Its business-education-research networks have begun a pioneering journey on unknown paths of cooperation. The journey has not all been easy, but the next steps are fairly clear: EIT can cut a lot of red tape by using to the full the derogations available under its current legal framework. New Knowledge and Innovation Communities (KICs) can accelerate progress by learning from the pioneers. If EIT can also maintain independence from old incumbent actors and centralising politics, stretch its currently too selective networks across the whole of the EU and become more joined up with research and society, it will offer a really effective intermediary for innovators across all Member States. EIT also deserves to be more fully integrated in EU policy debate, invited into Public-Private Partnerships and other technology networks under Horizon 2020 (H2020) and used as a privileged source of evaluation for innovative research and investment.

3.2.2 Extension

Smart Specialisation and smarter institutional architecture will both favour greater innovation. But perhaps surprisingly, the biggest and fastest returns to effort will come from introducing innovation that is not new to the world, but is new to the region, city or firm.

Europe needs to do more for the systematic 'extension' of each given innovative solution to every region and sector where it can bear fruit. The roots of public intervention in support of innovation lie in nineteenth-century Europe, as well as in the American mid-West, where agricultural extension schemes brought best practice to the farm faster than would otherwise have been the case. US advanced manufacturing still benefits from this sort of public-private partnership: granular, painstaking and effective.

Similar efforts in Europe have had startlingly big and rapid pay-offs. Irish small firms received a grant of up to 2500€ or 50% of costs for a change project to 'get on-line'. This small bet inspired companies who may previously have been under-informed or under-confident to try new tools. Within a year, 60% of beneficiaries had ventured for the first time into export sales, turn-over was up 20% and new jobs had been created.

There are many needs in many sectors for the sort of help that Ireland has piloted. In advanced manufacturing

technology, where the US has a government-led extension partnership, EU suffers an uptake gap between large firms (75+% using best-in-class kit) and medium firms (65% not using the kit). Digital Innovation Hubs under the Digital Single Market can be part of the answer to this sort of under-performance. Impact Hubs already help social enterprises scale in Europe. Foundations such as Access or Bertelsmann help to ready charities and social startups for capital investment and scaling. But as for the Grand Coalition, a joined up effort between all countries and regions is needed to meet EU-wide need effectively on these fronts.

3.2.3 Universities as Entrepreneurial Ecosystems

The university must do more than teach and investigate. Today's innovative university is the key to regional innovative success.

Those responsible for Europe's tertiary assets strive to improve under difficult circumstances. But too often, universities behave as if they were "communities of inertia". Very few European academic institutions are yet committed to radical change. With deep change, Europeans can win top place among the Young Universities of the World. Without deeper change soon, academia as a whole will fail to offer the artificial reefs of inter-disciplinary knowledge creation around which lagging countries and regions can become globally viable growth economies. It is probable that only a strong political shove will shift the governance and mind-set of universities to pro-innovation risk-taking and effort.

The transformation needed here is lateral and disruptive. A move beyond the generation, dissemination and curation of knowledge to the civic and entrepreneurial university: a place that is good for society and innovation as well as good at research and teaching.

As Philip Nolan, President of the National University of Ireland, has put it:

The university in the future will not be an isolated institution, but a vital node in a fluid network of interdependent knowledge organisations, which together create an innovation system. This requires universities to rethink their structures and processes, enterprise to re-evaluate their conceptions of value, risk and return, and governments, through regulation and funding, to promote an intimate and mutually beneficial interaction between public universities and private knowledge enterprises.

This is a vision much discussed around Europe, fully consistent with Open Innovation 2.0, with civic involvement in innovation, with Smart Specialisation. The idea of urgent university transformation is somewhat left to one side in EU debate, perhaps for reasons of deference to national prerogative and to academic elites. But the changes needed are so closely connected to innovation success that we must assess together how fast Europe can shift and ensure that we learn more securely and faster from each other how best to make the change.

This is not virgin territory. On the basis of a brief survey, it is clear that there are some proven, generally feasible and often ignored starting steps on this journey.

Nor does it imply any "sell-out" of the integrity of academic life. The key is to have strong checks and balances to preserve university autonomy, and then to permit very deep co-existence. Netherlands' Eindhoven University of Technology, for example, produces a very high proportion of papers co-authored by industry. Of its 300 professors, half work full-time and are employed by the university. The other half are part-time, and about 80 per cent of staff in this group are employed by industry, splitting their time between working at the university and working in business. The university funds half the cost of long-term research programmes with industry, as long as the academics involved can secure the rest of the funding from business, but refuses to conduct research with industry that cannot be published.

A blueprint for entrepreneurial universities would include the following:

- As talent managers, universities should move decisively to recruit for, incentivise and reward academics for entrepreneurial endeavour. Evidence shows that this is not dumbing down the academic side. On the contrary, entrepreneurial stars are also star professors. Entrepreneurial universities can only be created by academics for whom entrepreneurship and innovation matter and who can spread that message.
- Students need help to become successful investigator entrepreneurs: they need more responsibility and resources as academics at an earlier stage; they need entrepreneurial academic role models; they need to be well taught business as part of their core curriculum; they need access to digital engineers resourced to help all other disciplines; they need easy and above all fast access to follow-on financial support, so that they can go from workbench to prototype and even spin out their ideas without being forced off the campus.

- Universities should create not just science parks, but build, within the academic setting, cross-disciplinary and open meeting places, where fresh opportunity and ideas can thrive. These should be open to enterprise, so that they become a recognised local source of innovative solutions for their partners, and to civil society, so that Open Innovation can flourish. In this way, universities will become the meeting place for practitioners dealing with real problems in a real-world context. Companies will be able to scout for ideas, source talent and share. Professors in residence with companies and entrepreneurs in residence on-campus can both help to seed good practice in universities developing this approach for the first time.
- Matching this effort, universities need to bring onto governing body more challenging outside voices from civil society, venture capital and business. This will help the comfortable university to feel more keenly the pressure to perform while helping the less well-endowed to think lean and ambitious. It will consolidate the commitment to persistent improvement. And it can bring these benefits without any politicising or dumbing down.
- Real inter-disciplinarity in teaching needs more than the familiar mix-and-match modular menus. Success depends on the painstaking development of integrated programmes. It may take, to quote the example of Digital EIT Masters, 4 or 5 years to bring a 2-year course from inception to cruising speed. But the pay-off is a pipeline of ambidextrous winners, brilliant at tech AND business, able both to win thesis prizes against all-comers and to get value-added ideas to market almost before graduation.
- Last but not most crucial, the role of technology transfer offices (TTOs) must shift decisively from creating value for the university up-front to supporting the downstream creation of value by students and faculty. TTOs tend to seek too great a piece of the action, deterring many investigators from attempting to go to market and weighing down the prospects of the rest. Evidence from Asia, Europe and America is clear: small shares on founding (3-5% max) and big support is the way to success. Well-supported successful founders come back and support the *alma mater* out of all proportion to the meagre returns earned by leonine TTO contracts.

In some parts of Europe, the tertiary ecosystem faces other challenges, whether in the form of academies of science that take too much of the money for too little innovation, or zero-sum competition, instead of porous and fluid cooperation, between university, institute and contract research. The Commission's Policy Support Framework allows EU-wide peer review of the resulting under-performance, but bolder steps at national level alone can bring solutions.

The universities' road to future-proof relevance and excellence everywhere will not be comfortable, but it is essential work if Europe is to get a full return on its innovation spending. Combined with more effort in early years and inclusive education to increase the talent pipeline, a rebuilding of the tertiary asset of Europe is the essence of excellence in the new age of discovery. The EU institutions can help, both by convening the debate, and by including innovation in ongoing Commission evaluation of Higher Education, as well as in the mid-term reviews of Horizon 2020 and the structural funds.

3.3 Modernising Governance

The open governance ideal was first set out in EU thinking in 2001. It marked a step beyond Weberian conceptions of public service. In turbulent times, it was clear that professionalism and efficiency were no longer enough. Open, participative, transparent, coherent and accountable institutions hold the road better.

The 2001 policy has since been refined by a rapidly growing body of more recent evidence and practice.

The emerging consensus recipe for 21st century public administrations covers four key areas:

- Attitudes: governments need to embrace change. To import an entrepreneurial mind-set. To dare to be creative in the face of crisis, to experiment across a range of risk-taking ideas, not picking winners but letting losers go. To favour outcomes over rules, response to changing reality over following the plan.
- Engagement inside: to get there, public service managers must make the engagement and development of people their top priority. Engagement requires a sense of purpose, of mastery and of autonomy. With this, public service can be filled with passionate, self-starting creatives rather than merely obedient and diligent experts. They in turn will be credible convenors of participative policy-making. There are always blockers to confront on such a change journey, but a quick and low-cost culture audit can help to use the positive culture-shapers, to win the trust of the majority and to circumvent opposition.
- Engagement outside: allowing outside parties in is the most crucial and challenging step. To make data easy to understand and explore. To share in problem analysis, to co-design possible initiatives, to test prototypes.
- Tools: Tools to connect civil servants among themselves, citizens among themselves and both groups with each other. Tools to offer everyone horizon-scanning, foresight and data-driven knowledge, and to enable future scenarios to be

explored iteratively in credible models and in Policy Laboratories. Most radically, public tools to help communities find solutions for themselves, without waiting for top-down prescription.

Reform on these lines is key to innovation success for Europe. Any institution can and indeed must play: at EU or national or local level, in administration, manufacturing, services and academia.

3.3.1 Commission 2.0

The European Commission has advanced more in this area than is usually acknowledged, no doubt because most of the experiments have yet to go corporate. But the foundation is there.

The Commission should now set the pace:

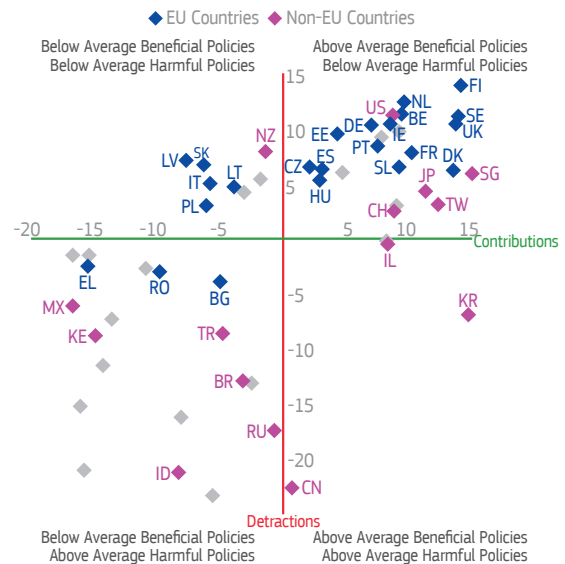
- joining the Open Government Partnership, a platform built on the principles of 2001, and recently opened to non-state public entities.
- sharing, through this and other networks, Commission-built open source tools such as Futurium, just as other Digital Leader governments (EU or not) are sharing their own software and skills around the world.
- Leading an EU-wide increase in effort around the implementation of the G8 Open Data Charter, to which Commission and G8 members are committed but on which progress is uneven.
- Moving fast on digital-by-default services and Once-Only data requirements, which together can save Europe 15 billion Euros of overhead.
- Mainstreaming Internet-ready regulation, in search of similar big wins. This means moving from (for example) a requirement to label a product to recognition in law that on-line provision of such information can be better for the customer (who now often chooses the energy efficient fridge on-line not by examining it in a show-room), and better for market efficiency.
- On internal engagement, to re-visit internal working culture, on the basis of some simple rules,
- On tools, to accelerate the roll-out of the cutting edge knowledge tools currently piloted under the label CONNECTED platform, and already endorsed in principle for corporate use,
- To use ESPAS and the EU Policy Lab not only for continental but for global knowledge management and data science, where Europe can lead the world on issues ranging from bee health to financial stability and oceans.
- To devote more effort to deeply rethinking what evidence for policy needs to be if policy is to remain legitimate and effective: the Chief Science

Adviser experiment and the current Science Advice Mechanism both point in the right general direction, but we still lack designated senior scientists embedded in each policy pillar and networked across the public administration, as well as globally.

None of this is trivial. The implied cultural change starts with fast and easy promulgation. It requires sustained and persistent senior management example to modernise prevailing mind-sets. But: all these steps, and there are more, promise decisive and immediate impact on the standing of public service as well as on its overall morale and efficiency. With such an agenda, Europe could move faster towards becoming a pro-innovation space.

3.3.2 Regulations For, Not Against, Innovators

Figure 7: Assessment of How Some Countries' Policies Impact Innovation Globally



Source: [ITIF – Information Technology & Innovation Foundation](#)

How good is Europe at creating a pro-innovation rule-book? This breaks down into two questions: what do we do to help innovators? And how far do we do things that are a hindrance?

It is true that over recent years some specific hard cases grab and hold the headlines. They greatly damage the reputation Europe needs as a reliable place for innovators, and predictability matters more in many sectors than the fine detail of the rule-book.

The picture is not all black, however:

- recent US-based expert assessment suggests that, on both scores, at least a plurality of EU national environments for innovation are broadly fit-for-purpose;

- the most important issues for tech innovators may not be tech regulation: EU-based digital platforms complain as much if not more about discontinuities in the Single Market in insurance, property and consumer law.

So if we could move the whole of Europe towards our own existing best-in-class models, innovators across the EU would certainly feel the benefit.

Such a shift implies that governments in Europe decide to change.

We can begin by making clear that Europe wants to host companies with new ideas and global ambitions; that we offer functional, liveable and exciting cityscapes for innovative folk; that we are open as a matter of principle and not only in theory to new business models, even if they disrupt incumbent business and require hard work by regulators (another class of incumbent!).

Such a shift also requires a smarter default response to something new. Too often, regulatory policy debate around new technology comes down to a false stand-off between “wait and see” or “do something now”. Europe can instead offer to “look AND wait”: the recent European Parliament report on Blockchain shows how this might work.

The key is greater agility: to act more promptly as a new “thing” emerges (in this case Bitcoin), to gather people with insights as well as interested but less informed parties, to gather evidence of both facts and hopes or fears, to accelerate society’s collective learning.

Prompt, collective enquiry of this sort is too often opposed, for fear that looking will tempt us, like toddlers, to touch and hurt what we have not yet understood. So the condition for more prompt and energetic looking would be a stronger collective acceptance that we should touch only when we have some understanding of what is going on, and should then touch to learn more before we even begin to assess what must be done (so, as conversation evolves, we understood that the issue is not Bitcoin, or even crypto-currencies or Blockchain, but distributed ledger technologies and how to maximise their beneficial use across society and not just in financial services).

The new Better Regulation package offers the best-ever foundation for making this kind of shift. A detailed box of tools with which to refine *ex ante* checks, to see and avoid regulatory double jeopardy, to weigh more fully the benefits of innovation as well as the risks of intervention, and vice versa.

The package is notable, too, for a first-ever EU political definition of the benchmark for effective and trustable self- or co-regulation. Building on long administrative experience at both EU and national level, this promises faster and more easily adjustable rules to frame activities that may not be easy targets for full legal rule-making. It is excellent that the latest literature gives added support for such approaches and additional evidence of what constitutes good practice. And also important that the implementation of such novel instruments will be supported by a commission-convened Community of Practice, since here Europe operates both as pathfinder and as a learning organisation.

The *ex post* evaluation of rules for continuing regulatory fitness (REFIT) can also be expected to harvest much low-hanging fruit: bearing in mind, for example, that today it takes 26 steps for a mobile telecommunications operator to get access to harmonised radio spectrum. But the execution of the Better Regulation philosophy calls for brave and expert judgment.

Innovation needs Goldilocks regulation. An unregulated free-for-all creates operator uncertainty. Heavy rules offer only the certainty of excess costs. Somewhere in the middle is just right, but defining the middle is the art.

Stretch goals in eco-matters, for example, can seem just right, and often in fact are a promising driver for change. But it is too easy for regulators to get it wrong:

- To under-stretch, to the benefit of incumbents, by allowing the mere dilution of harmful refrigerants where much safer products are available, or a marginal adjustment in energy efficiency where greater gains are achieved already, if not from the same firms in the same places.
- To overreach, by setting standards for components and also for assemblies, with the result that Europe’s installed technology innovation capacity is dragged towards the rule-driven pursuit of unfeasible or disproportionate goals.
- To set arbitrary if well-meaning constraints, such as the prohibition on low-calorie sweeteners unless they cut calories by minimum 30%.

Such unintended deleterious impacts can only multiply where technology and markets move faster than our grasp of the trends:

- How can we keep track of the heterogeneous uses of myriad substances in complex value chains worldwide? Can new simulation techniques, for example high-throughput *in silico* modelling of ecotoxicity, both reduce development costs for business and better target regulatory focus on the most

risky substances? If so, then this could be a good candidate for a major flagship investment in public science support for Better Regulation.

- How can we assess whether a new societal goal, such as reparability or recyclability, is a suitable client for regulatory or standards-making “support”? We cannot assume it is so, although such a hypothesis always deserves due diligence to show that it is likely so, or an experimental approach at small scale to test the real-world impact.
- How do we reduce the burden of up-stream laboratory testing, where real-time data enables adequate oversight to keep markets safe? Of compulsory and micro-defined physical labelling where consumers can access on-line data? Of regulatory checks, where thanks to the Internet the reputation mechanism is more effective than regulation? It is perfectly possible today for governments to let anyone who wants to begin operations in what has been hitherto a sector run by *ex ante* licencing, on the sole condition that they become accountable by opening for real-time oversight the large data sets they use to run their business. We should pilot such experiments soon in Europe.
- How do we use Internet and data tools to improve monitoring and enforcement? The certainty of detection and penalty should be easier to create in the 21st century, and that can be crucial for consumer confidence in an innovation-rich market: from “Mad Cow” to Madoff to Dieselgate, horsemeat to implants, it is the failure of enforcement that undermines trust, both in public administration and in the market. Where the consumer accounts for 55% of GDP, against under 20% for public expenditure, that matters.

One response to the increased uncertainty should be increased clarity in our regulatory principles around innovation. The Council of Ministers has agreed to take into account the impact on innovation in the process of developing and reviewing regulation in all policy domains. So the principle is clear. How can we best implement it?

3.3.3 Embedding Innovation in Regulatory Practice

Beyond applying this principle case-by-case, we could deploy as a pilot some omnibus pro-innovation rules offering additional guidance to regulators. The result should be a new social contract, allowing innovators out of the laboratory and into the streets, and giving them the benefit of the doubt, at least if they on their side subscribe to open and responsible innovation norms.

A positive, but not lax, framework for innovation would require a two-way deal with several building blocks:

- “Responsible Innovation”, as defined in Horizon 2020, but including strong citizen engagement with both science and innovation,
- An explicit legal basis for regulatory discretion to allow and control piloting, and to adjust standards in light of technological development and new data,
- Scope for insurance-innovator-regulator conversations to ensure that the market for insurable innovation risk is taking as much of the burden as possible,
- Innovator-regulator cooperation and information sharing,
- A positive duty to remove existing burdens as they prove unnecessary, and to regulate with a view to supporting growth,
- The designation of a single local regulator as the ‘primary authority’ for applying a law, so that operators have a single interpreter of their duties, on whom other regulators can also rely,
- Regulatory sand-boxes, especially for FinTech, allowing regulators and innovators to get to know each other upstream of requests for product approval, and close involvement of startups and venture capitalists in advisory boards of regulatory authorities
- regulator-regulator cooperation,
- a safeguard mechanism,
- periodic evaluation.

It is happily, pretty clear that such a deal is perfectly constitutional¹ and there is a cluster of precedent and good practice, too:

- Vehicle type approval at EU level, where since 2007 any national regulator may licence any novel type, subject to certain simple conditions of substance and procedure.
- Green innovation deals in the Netherlands.
- Council support.

We now need to seed more widespread experiments, well beyond the circular economy, and to gather experience from across Europe.

3.4 Money and Research

Almost every debate on innovation ends up sooner or later focussing on research policy and access to money.

On a systemic view, these two issues are hugely important, and should remain core business: we shall not be an innovation super-power if we scrap the flagships of big science. But that does not mean that

they should be the prime targets for a game-changing fresh start in European innovation. Public budgets relevant to innovation (not by any means only H2020) do not bulk large enough in the overall volume of public and private spending.

A full account of the significance of 'research' for 'innovation' lies beyond the scope of this review.

Research is not the only driver of the system of innovation. It is one of ten or so key success factors identified in innovation literature. And at corporate level, for example, only 17% of innovation spending is on R and D, with the bulk going on other components of Knowledge-Based Capital (design and data, skills and software, organisation and marketing).

Research impact measurement is therefore hard because linkages in a system are not one-to-one. A recent global review by the World Economic Forum Council on the Economics of Innovation identifies similar shortcomings in almost all the impact indicators used worldwide: a bias to technology-intensive sectors, poor granularity and poor predictive power. The Commission's own advisers have suggested an overall re-assessment of the current indicators on research and its innovation impact and in any case more careful use of what is available to draw policy conclusions.

It is not certain that EU policies need to be based on our very own metrics. But to the extent that we do maintain in-house effort, it must be very openly managed and peer-reviewed, to avoid any charge that we rely on less than robust models. And impact measurement should be coherent across our plethora of overlapping but under-connected instruments: across, for example, digital EIT communities, IT-focused H2020 partnerships, and regions with structural fund digital goals. Common self-evaluation and progress reporting will certainly identify both gaps and overlaps, and could create rather rapidly a more robust and coherent network of actors.

3.4.1 Research Strategy

Research policy is essential for some and helpful for innovation, even if it is no "silver bullet".

Fundamental and excellent research is one indispensable driver of innovation. The innovation mission of Europe cannot succeed overall if it is accompanied by a drift away from fundamentals: US fundamental research spending was increased, not reduced, for the Kennedy moon-shot. The success to date of our own big research bets, notably in the Human Brain Project, suggest that, beyond the recently announced Quantum Flagship, future similarly ambitious endeavours should be launched.

In that spirit, it is worthwhile to record, if only for separate implementation, the most promising suggestions for innovation-friendly and no-regrets change to research policy that have emerged in the course of preparing this Note.

The main messages on Research are to:

- Revalidate and rethink research itself as a key driver for the EU's policy priorities, including the societal challenges of inclusion and sustainability as well as knowledge, growth and jobs.
- Protect the budget for public research, covering fundamental discovery on a large scale, long-term road-mapped coalitions of investigation (the so-called Public-Private Partnerships) and focussed research in support of public policy (notably sustainability and climate), as well as small-scale pathfinding of the sort pioneered by the so-called FET Open budget;
- Simplify public research procedures and get closer to fixing the real innovation blockages;
- Build better networks, starting from what exists, such as in the set of European Innovation Partnerships;
- Work harder on rebuilding excellence in lagging regions, but not by distorting H2020;
- Use the Mid-Term Review to ensure that innovators get full and easy access to EU funds, and that innovative opportunities (and innovation experts) are built into all stages of the funding pipeline, from calls to project management to outcomes.
- Increase public funding for the big infrastructures of science;
- Build digital data skills among and at the service of research communities.

3.4.2 Infrastructure and Skills

Research equipment needs a step-jump in public support if we are to keep abreast of the booming opportunities brought by new technology at the intersection of the formerly separate fields of nano-bio-cogno-data science, in fields such as data-driven genomics and immuno-oncology.

The great disciplines (and we must hope their leading European practitioners) are merging. As convergence and data-driven investigation transform every discipline, so excellent and innovative science will depend on world-class kit in plentiful supply at manageable cost. This means a significant increase in the share of available funding that goes to computing and curation tools for science. It also requires greater public incentive for excellent inter-disciplinary work, over the siloing of science.

Even today, to take just a single example, ecological sustainability could be much better assessed and assured if more super-computer capacity were available to exploit the very detailed data map that already exists, thanks to satellites and sensing. Anyone contemplating greenfield or even urban development anywhere in the world can in theory today make use in real time of the very large data sets that map the planet's diversity and highlight what species need careful management. With computing resources too scarce, and default mentality rooted in the old ways, most cases rely instead on crude, ill-validated and dated land use categories.

More generally, since the focus here is on innovation, society will only get the most out of research and innovation to the extent that the very high-speed communications capacity of Europe reaches everyone, however remote from the big urban centres. Broadband is a drag on development for too many towns and for too many people.

With infrastructure, there is a growing need for skills: new tools need fresh training in their use. Data skills must become as widespread as card indexing sheets in all disciplines.

We also need Digital Humanities. This means incentives for systematic companion research by both the hard and the social sciences (including game theory) in the changes that flow from innovation breakthroughs. The launch of such sister projects is already underway in pursuit of Responsible Innovation in digital fields such as Artificial Intelligence or Health. We also need to think about the sociology of networks and to think hard about the very different relations that will exist across a blockchain-enabled network.

Funding processes must get much simpler still. Further simplification is challenging: it will require the exercise of collective courage by budgetary and controlling institutions allowing the fund-holders to adjust the risk map. But it is a must.

3.4.3 Money for Research

Funding rules that are simple for public payers and their controllers are for that very reason too often unfit for the purposes of the entrepreneurial university or innovative private researcher. The conditions for EU funding continue to deter some excellent teams in some excellent institutions from even bothering to read the H2020 calls. For new-born innovators without standard affiliations, emerging from the makers' movement or the distributed ledger world, such barriers are even higher, and public funding is irrelevant, although funding needs can still be a killer.

Budgetary and control authorities need to give permission for funds to flow less tidily if we are to truly support innovation:

- Funders must work harder up-stream to avoid investing too close to what has been done already: repeating known pilots is a real and expensive trap.
- In support of the more systematic translation of research into innovation, we need urgently to roll out across all sectors the Innovation Radar successfully piloted by the Commission in the IT field in 2014-2015 (and supported by Commissioner Moedas in his own policy pronouncements during the last year).
- Funders must have discretion to give greater weight to critical mass bets and less to spreading support thinly across a score of clusters doing much the same thing.
- Promising tools such as for pre-commercial procurement are totally under-used. This needs more political push, more human resource and more of a community of expertise and practice, across the EU.
- Down-stream, where the challenge is scaling, we need to allow expenses in such taboo fields as marketing, which has traditionally been viewed as too far from the lab bench, but which in the still novel concept of Knowledge-Based Capital is very much in-scope.
- Extension schemes to spread new-to-region innovations deserve a lot more emphasis.

More challenging is a change of mind-set from isolated project consortia or even large inward-looking networks running 'their' contractual partnership to porous and organic ecosystems in which even newcomer free-riders are welcome to visit and learn.

Collaborative research is perhaps the defining DNA of EU policy. But more can be done. The European Innovation Partnerships represent a piloting of this sort of culture. The Aho Group report on the first wave of experiment has called for more ambitious design of the next wave of these 'Outriders for European Competitiveness': there does need to be a renewed effort here, rather than the abandonment of the idea. Because EIPs sit well with the logic of broader networks as a key success factor for innovative Europe. But they will need to be open by design to smart Regions, H2020 teams, EIT communities etc.

Finally, and the most delicate point, we must resolve in the next year or so, not just further discuss, the North-South, East-West tensions between Member States. For the sake of excellent research and continent-wide innovation, Europe needs a pact of mutual generosity between Member States, so that on the one hand taxpayers' money can flow to the best clusters in the most promising fields of endeavour, without recourse

to national sharing, but, on the other, newer actors are involved and not left behind. One way to do this would be to use structural specialisation funds to offer grant support for the participation, in successful consortia, of additional investigators from institutions otherwise not so successful in the European Research Area. We also need to deploy funding specifically to integrate so far excluded regions and universities and innovation hubs across the EU in networks such as EIT KICs or H2020 partnerships which have so far failed to reach all 28.

3.4.4 Money for Innovation

Many initiatives are underway at EU level to increase innovators' access to investment finance. The key need now is for speedy action and prompt impact.

Beyond what is underway, evidence gathered in the last months indicates that following areas deserve more serious attention.

The first is risk capital. At household level, 3 million citizens of the EU hold non-real estate assets above a million Euros, so if just 10% of that cohort put 10% of these assets into innovation risk portfolios, 30 billion additional capital would be available.

Such newcomers clearly come into the game first time in response to clear signals such as tax incentives. They also need examples in their immediate vicinity. One way to foster investment is to offer greater support for the Business Angel Communities, so that they can more rapidly seed the Angel Investor culture in Member States where it has been largely unknown, and for venture capitalism. This could be supported direct from EU funds, including the structural funds, as part of current efforts under EFSI (a Fund of Funds for Innovation) and H2020 (capacity-building for Angels in all Member States).

At the same time, there should be a re-assessment within the current agenda of the Capital Markets Union as to the systemic failure of capital markets to reliably provide adequate patient capital for manufacturing (and other) innovators. This market failure has been a subject of constant complaint in at least some parts of Europe for over 50 years. Most recent analysis suggests that cross-Europe coordinated patient capital providers could play a greater intermediary role in plugging the gap. This suggests scope for structural initiatives alongside the recent European Fund for Strategic Investments. The need for pension funds to be brought fully into the risk game also needs attention, not least in managing the risk profiles that the prudential regulator imposes.

We should not ignore this last point simply because of current short-term facts, such as near-zero interest rates, the faltering IPO cycle or the unicorn bubble. These are all fascinating and significant phenomena, but when the cycles move on, Europe will still need a better safety net of patient capital.

And indeed, public funders can legitimately seek permission from budgetary authorities and auditors to share risk with their beneficiaries: we need to define success for innovative investment vehicles as being less than cost recovery case-by-case, and monitor portfolio performance without imposing tight goals even at that level. Entrepreneurs need to see that public funders take risks, and that like Venture Capital veterans they welcome repeat business from leaders of 'failed' projects.

In addition, there seems to be a need to expand the scope of support for 'mission-led business' beyond that allowed by the Regulation on European Social Enterprise Funds. This text seems in its adopted form to have too narrow a scope to produce the desired jump in capital for social innovation. We should be sure to cover all fully profit-distributing businesses that identify their primary purpose as tackling social and environmental goals. New social investment business models in general deserve serious public support.

The last, and maybe heretical, option, even if it is fully compliant with state Aid and other requirements, is a cooperative initiative to roll out across all Member States the best of existing national pro-innovation tax policy:

- Offer substantial tax incentives for household risk finance experimentation (the UK example?)
- Extend tax advantages more systematically to investments wherever engaged across the EEA (the French example?)
- Give grant aid and not only tax credits, so that really young firms can benefit (the German example?)
- Match best-in-Europe incentives for startup funding models, for example in the treatment of stock options.

None of this is to suggest any naive optimism as to the impact of tax incentives. The political economy of tax breaks shows that it is all too easy to create tax credit junkies, whose innovation strategies are distorted by the easy money. It is clear that low and stable corporate (and personal) tax rates have greater impact on innovation outcomes than short-term *ad hoc* shifts in policy. And good tax design is hard: in the field of R and D tax breaks, a single Member State can find its different tax tools placed among both the ten best and the ten worst tools in operation.

Still, if all are doing it, it would be better to do it together. European tax fragmentation means a certain randomness in one driver for innovation; and creates a huge business in tax collection and optimisation. A small package deal on these lines would contribute both an important signal that all Member States want to help all innovators, and a modest experiment in voluntary cooperation over a relatively delicate matter.

4. Opportunity Now

To dare is to lose one's footing momentarily. Not to dare is to lose oneself.

Soren Kierkegaard

The claim of this note is that feasible fresh initiatives in the year ahead, joined up and at scale, will bear fruit for Europe by the end of the decade.

Two final questions:

- What makes it urgent to do any of the sundry things outlined above?
- What comes first: are there small steps, and quick wins?

4.1 The Case for Action

There are five good reasons to act now:

- There is no alternative. The revolution is all around us: we cannot survive on power or on cost, nor can we even count on trickle-down productivity to keep us in touch with the rest of the world if others become the lead geese. Our choice is to be a cork in the flood or masters of our fate. Not a choice.
- Innovation alone gives us a chance to build the future we want: with innovation, we can hit the 10 priority targets, score on the UN Global Goals and respect COP21. We can achieve social inclusion and sustainability as well as growth and jobs.
- Innovation is central to Europe's sustained competitiveness. It increases the value and reduces the cost of European ideas, built in Europe but exported world-wide. Today's accelerating technology cycles enable Europe, like everyone else, to achieve fresh leadership, with breakthrough discoveries made and exploited locally, but can just as easily lose us our current mastery of familiar niches.
- By committing to innovation, we become fitter for the future. A pro-innovation stance helps to make society attentive to its future and resilient in face of crisis. We also move away from the risk of being a 'community of inertia', where we persist in values, beliefs and routines that served in the past but betray us now.

- Finally, the innovation choice is asymmetrical: an innovative society can fine-tune what it does with its discoveries, but a continent that lost innovative capacity would also lose that choice.

4.2 The Paths to Action

A serious change of policy choice in favour of our innovation mission cannot be made in a single step. So this is not an action plan. But it exemplifies with executable ideas the breadth of the agenda. Nor can we succeed by cherry-picking: the systemic challenge of innovation requires broad and sustained commitment. The European Innovation mission needs to be launched on the basis not of a check-list but of a few guiding principles.

1. Innovation will get the sustained top-level attention it deserves: institutions will sustain that conversation, involving everyone with a stake in innovation, not only funders and beneficiaries.
2. We can achieve a lot by extending to all localities and all players the best ideas and tools that we have to hand. Boot-strapping innovative change in firms of all sizes, rooting innovation in the real-world skills and needs of every region, scaling what works.
3. We shall embark on the prompt and persistent re-making of public service: Commission 2.0.
4. We shall direct our regulators to foster invention and the marketing of the new.
5. We each have distinct roles, but we shall be mutually accountable for our progress. We will make together, each at our local level, some bold bets on change in tricky areas: education, health, universities, tax; and some bolder bets on potential breakthrough technologies, notably genomics, the brain, distributed ledgers and quantum.

Conclusion

Europe enjoys an unbroken record of making technology breakthroughs from which all the world now benefits.

Europeans still largely love the new, but want to feel involved in the road to innovation, and to understand the benefits to their own locality and family. We still have needs and remain as inventive as any part of Humanity. But in our adoption of the new as well as in our social structures, we do seem to have lost a sense of urgency, while the innovative capacity of other continents continues to evolve at a pace we do not currently match.

EPSC Strategic Notes

If we want to continue our innovation mission, we must give sustained and serious support to innovators. The political choice is how far we shall continue to be one among the sovereign global purveyors of such innovation, and how far reduce our role to that of a needy user.

The future of innovation in Europe is less a theoretical or empirical question and more one of intent and principle. The key issue is what society we want: innovation is a necessary but not sufficient condition for social inclusion and sustainability as well as productivity, jobs and growth. Shall we seize the innovation opportunity? This note rests on the conviction that Europe will want to remain an innovator in and for the world, and that we Europeans can still do that.



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Notes

1. European Commission. Towards an Innovation Principle Endorsed by Better Regulation, EPSC Legal Note, 2016