

**DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INNOVATION  
COMMITTEE FOR SCIENTIFIC AND TECHNOLOGICAL POLICY**

**Working Party on Innovation and Technology Policy**

**REVISED TERMS OF REFERENCE FOR THE TIP PROJECT ON SYSTEMS TRANSFORMATION  
THROUGH INNOVATION**

**16-17 December 2014**  
**OECD Conference Centre, 2 rue André-Pascal, 75016 Paris**

*Delegates will find attached the revised terms of reference of the future CSTP activity "System Transformation Through Innovation" under the CSTP's PWB 2015-16. Delegates are invited to comment on these discuss and suggest ways forward.*

*Delegates are also invited to indicate their interest in joining the TIP Steering Group for the project.*

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## NOTE BY THE SECRETARIAT

This document scopes the issues for the future terms of reference for the CSTEP activity on “System Transformation through Innovation” which will be led by the TIP in 2015-2016.

TIP Delegates are invited to:

- **discuss** and **approve** the terms of reference;
- **provide feed-back** regarding possible methodologies to be used in the various modules or overall;
- **identify potential partners** outside the OECD with whom collaboration should be sought;
- **indicate interest** (by 15 January 2015) in joining a steering group to carry out the project.

## **TERMS OF REFERENCE FOR THE TIP ACTIVITY ON SYSTEM TRANSFORMATION THROUGH INNOVATION: ROADMAPPING EMERGENT INDUSTRIES AND SYSTEM INNOVATIONS FOR SUSTAINABILITY**

### **Background and context**

1. Modern societies face a range of inter-related challenges ranging from boosting productivity to addressing energy provision and climate change and to the establishment of healthy ageing regimes. For governments, meeting these grand challenges while achieving green growth and generating employment will require policy action to facilitate systems changes on an economy wide scale. These changes amount to no less than the transformation of distribution, production and innovation systems underpinning key economic sectors such as energy, transport and communications. However, effective system transformation raises formidable policy challenges. Achieving green growth requires considerable investment in infrastructure, skills and innovation. Strengthening employment growth following the crisis will require stronger efforts to achieve structural change, including, among others, the revitalisation of industry.
2. Effective management of the transition will require intensified coordination between policy areas (innovation, education, tax, regulation etc.), between levels of governance (national, regional, clusters, cities), between stakeholders (public, private and voluntary organisations). Effective policy design will hinge on improved understanding of the process of transition, of barriers and facilitators. It will likely require new ways to link research to innovation, the deployment of dedicated policy instruments a (e.g. public-private partnerships and cluster accelerators/demonstrators) and new approaches to governance (e.g. performance contracts).
3. The proposed project will build on the 2013-2014 work on system innovation. It will extend our understanding by applying the policy lessons learned thus far to concrete cases of transitions in the field of knowledge based industrial production (i.e. the new production revolution<sup>1</sup>) and in the area of sustainability (e.g. renewable energy, sustainable transport, e-health, etc.).

### **Objective**

4. The goal of the project is to study advanced practices in policy support for the promotion of emerging industries and sustainable (green) innovations in OECD economies. This study will focus on the use of ‘roadmapping’ and ‘demonstration’ in policy development for enabling the emergence of value networks<sup>2</sup> in a set of specific cases (defined in terms of production characteristics or in terms of societal needs such as green innovations). While the goals of structural change in industry and sustainability are not incompatible – indeed new applications and services arising from new production systems can advance system innovation in mobility, health and energy, they follow a different logic, business models and starting points (e.g. resistance by consumers to extensive data linking of information). Therefore it is

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<sup>1</sup> The new production system integrates disruptive technologies and the accompanying new business models for sourcing complementary assets for value creation.

<sup>2</sup> Value networks goes beyond the value chain perspective and the nodes in a value network represent people (or roles).

proposed the study will in the first instance look at the two dimensions of emerging industries and system innovations for sustainability separately but using a common approach as follows:

- a. Specific emerging industries/sectors which are important for the new production revolution.
- b. Mission and transition-oriented approaches to innovation policy that focus on sustainability such as renewable energy systems, sustainable transport systems, e-health, etc.

5. In order to cope with complexity and uncertainty in the transition of production systems and system innovations, roadmapping and demonstration projects are acknowledged to be strategic instruments to manage co-creation processes of new markets in a decentralised decision making space. The study will explore good practices in these domains and further implications for policies regarding industry/technology standards, public research agendas, and cluster policies. This will allow for organising system innovation input in other TIP projects, notably the knowledge triangle.

## Scope

6. 'Industry 4.0' is a system innovation agenda for the convergence of emergent technologies such as smart robotics, 3D printing, nano-materials with Internet of Things and cloud computing (big data). This industrial revolution promises huge productivity gains while contributing to the solution of societal challenges of different nature. But this is a transition in the production system (coupled with other important socio-technical transitions) of extreme complexity because it requires simultaneous changes on supply and demand sides of emerging markets. What role can/should innovation policy play confronted with such promises but also with this complexity?

7. Innovation policy has broadened its scope to all factors that affect the creation of new products, services and processes, including non-technological factors at the supply-side and also non-innovation policy drivers (societal challenges) at the demand side. This demand-supply articulation is a core element in the innovation system approach and its institutional translation (governance through partnerships). But now the 'innovation of innovation systems' is on the agenda: to enable systemic change also government agencies have to implement radical changes because of the nature of market and systemic failures in a period a fast transition. New instruments and new capabilities are required to match demand and supply conditions in a dynamic context that is characterized by uncertainties at different levels.

8. Roadmapping is an approach that is not only used for technology development but can be extended to all system requirements (e.g. changes in regulation). It is the way that actors in an eco-system can align their actions towards a common vision and converge in agreed transition paths. The archetype of a roadmapping process with great strategic impact on the development of an industry (and on the world economy itself) is the International Technology Roadmap of the Semiconductor industry (ITRS). This industry has already established for more than thirty years a community that collectively 'predicts' how 'Moore's Law' will be implemented by arranging a collective effort of the whole industry to reap the opportunities of exponential growth. In Industry 4.0 this exponential development might also be possible if data management in IT systems can be coupled with physical systems.

9. The 'demonstration' (of technological, industrial, commercial viability) is therefore a stage in the innovation and industrialization process that becomes of more and more strategic importance to make demand and supply conditions meet, therefore reduce uncertainties and improve confidence, from all stakeholders. At EU level, large-scale demonstrators are now envisaged as a decisive element in covering the innovation gap. Such demonstrators include regional and cross-regional initiatives that link services and new emerging industries (e.g. renewable energy, additive manufacturing).

10. Roadmapping and demonstration therefore are two instruments that are part of an agenda for co-creation of the conditions of emergence of new industries in a complex environment with many players and distributed decision making. Governments have a role to play because these instruments make use of and generate public goods: sharing information and experiences is not evident in a competitive environment under short-term pressures that erode trust in long-term mutual commitments. But in a knowledge economy the spillover dynamics of knowledge production and usage are the main engine of growth. The two instruments seek to internalize these interaction effects.

11. Faced with uncertainties, information asymmetries, lock-in and other barriers to reap the benefits from disruptive technologies there is a need of instruments to support coordination mechanisms to integrate new value chains by influencing strategy making of the entrepreneurial actors in the direction of co-investments that will co-create new markets. The roadmapping (or similar interactive strategy building) and the demonstration (living labs, pilot-lines, but also user environments) are therefore hot items for policy development in many countries.

12. Emerging industries are innovation driven value chains that typically emerge from radically new ideas/technologies or combination of ideas/technologies to respond to strong needs (e.g creative industries, eco-industries, experience industries, maritime industries, mobile services industries, mobility industries, and personalised medicine industries).

13. The project will focus on good practices of roadmapping and demonstration in the context of adequate governance of complex systemic changes. The role of policy in ‘giving direction’ and ‘co-ordinating’ the actors needs to be adapted to the new reality that there exist other forces that can foster co-ordination, including market forces as well as interdependency. These approaches may be effective compared to purely top-down or bottom-up approaches towards transitions.

### **Proposed approach**

14. This project builds on the results of the system innovation project but also on the ‘innovation system’ thinking of the TIP in general, in the context of rapid societal and technological changes. The system innovation thinking is used to understand and articulate what is new in the emerging practices of innovation agencies and policy makers to deal with complexity for emerging industries.

- The first step is to define the scope for policy to promote emerging industries through self-organisation, i.e the role of stimulating new linkages, of standard setting, adequate business models for exponential growth (open source vs. IPR). What are the ‘good policy practices’ for promoting emerging industries from a system innovation and sustainability point of view? How can policy stimulate and accompany technology and market forces while ensuring sustainability goals are not lost?
- A conceptual framework for ‘emerging industry roadmapping’ will be offered as a starting point (see for example, <http://www.ifm.eng.cam.ac.uk/research/eip/transitions/>). In addition, analytical data based tools, for example, patent statistics could be used to map trajectories of emerging industries as they have been used to map green technologies.
- The participating countries will contribute cases on roadmapping and demonstrations to extend this academic framework with policy learning. A common case might be to analyse policies to support of 3D-printing in new production systems for customized needs
- The additional feature of this project is to connect the insights from these cases with policy issues in related domains in other OECD projects, regarding the next production revolution or the

knowledge triangle. The interventions will be focused on systemic factors that policies can impact.

- Regarding work by CSTP on new industrial revolution. The knowledge-based capital (KBC) approach can be enriched with a strategic analysis of the role of business models in emerging industries that capitalize on increasing returns on the basis of exponential growth. Policies regarding openness in general and IPR policies can influence the industry roadmaps. Standards are developed in new ways.
- Regarding work by TIP on the governance of KT and HEIs. The role of academic research programming in matching industry roadmaps: what incentive mechanisms can increase structural (mutual) linkages. What is the role of governmental mission-driven research and innovation policies to promote common ‘missions’ for universities, PROs and industry?
- Regarding work on place-based innovation. The role of regional clusters in co-creating the industry roadmaps in specific segments (smart specialisations) cannot be underestimated at the uptake stage of emerging industries.

### **Proposed methodology for the activity**

15. As regards the methodology for the project, several options could be explored and combined depending on the scope and resources of Members states and the Secretariat.

- 1) **Data-based analytical tools.** A preliminary survey of indicators, methods and datasets that exist and which could be used to measure transitions towards knowledge-based industrial production and green innovations. Analytical data based tools, for example, patent statistics could be used to map trajectories of emerging industries as they have been used to map green technologies. Text and data mining of information contained in scientific publications that shed light on technological trajectories but also science linkages could be studied drawing on new work by the OECD’s Working Party on Industry Analysis (WPIA).
- 2) **Case study approach.** Using the above data analysis, a selection of in-depth case studies on emerging industry and system innovation platforms being promoted in OECD countries (e.g. new materials). Interviews should be included in case studies, in particular, interviews of decision makers. Case study design will be crucial and countries may wish to contract the studies to experienced case study researchers. Quantitative metrics and qualitative data could both be mobilised.
- 3) **Workshop and conferences** to gather expert views and ideas. Project workshop and discussion within the TIP plenary could be used to generate ideas as well as to monitor project progress.

### **Deliverables**

16. The project will deliver a report on innovation policies for fostering emerging industries and system innovations for sustainability.

### **Participants**

17. TIP Delegates and experts will work through a steering group” combining a diversity of Delegates from large and small economies; from member and non-member economies, etc., that will be managed by the Secretariat. Delegates may be the official TIP delegate or nominated experts. Participation

will be open to members of civil society, BIAC and TUAC as well as stakeholders from the higher education and research.

## **Resources**

18. The project will be funded by Part I and voluntary contributions, both cash and in-kind (e.g. organisation of steering group meetings/workshops).

## **Collaboration inside OECD and outside the Organisation**

19. The project will be carried out in collaboration with the CSTP project on “The Next Production Revolution” (Intermediate Output Result 5.3), which is led by the new Working Party on Biotechnology, Nanotechnology and Converging Technologies (BNCT); with a related project in the CIIE PWB 2015-16; and in conjunction with the project on “The Impact of Key Enabling, Emerging and Converging Technologies” (Intermediate Output Result 2.3) which involves a co-operation between NESTI and BNCT on metrics and indicators. It will draw on the work of the Working Party on Industry Analysis regarding IPRs and innovation, in particular patent analyses of innovation trajectories. Finally it will also be co-ordinated with the OECD’s Green Growth and Sustainable Development (GGSD) Forum who will devote the topic of its 2015 Forum to the issue of “Enabling the next industrial revolution: the role of systems thinking and innovation policy in promoting green growth”.

20. Contacts and co-operation will also be established with the IEA and GOV, regarding work on the energy transformation and system innovation in government, respectively.

Provisional time schedule for the TIP project		
Phase	Calendar	Activity
TIP meeting	December 2014	Revised draft terms of reference Identifying additional research questions; Agreeing on methodology
Secretariat	15 January 2015	Deadline for nominations for the steering group
Secretariat	January/February 2015	Setup of a Community of Practice (CoP) on the Innovation Policy Platform (IPP)
Secretariat/Volunteer Country	First Quarter 2015	Workshop on statistical tools for roadmapping for emerging industries and system innovations.
CSTP	March 2015	Progress report
BCNT/TIP	April/May 2015	Possible event
TIP meeting	June 2015	Progress report Selection of Case studies
CSTP meeting/CSTP Ministerial	October 2015	progress report
TIP meeting	December 2015	progress report; possible workshop
CSTP	March 2016	interim report
TIP meeting	June 2016	Interim report
CSTP Meeting	October 2016	draft final report
TIP meeting	December 2016	final report



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