

Peter W.B. Phillips:
Governing Transformative Technological Innovation: Who's in Charge?
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Industrialized economies, and so-called 'post-industrial' economies, are uniformly committed to science and technology driven innovation. Innovation is looked upon as the major determinant of competitiveness, comparative advantage, wealth creation and direct connections are made between levels of innovativeness, productivity, and socio-economic well-being of citizens. Governments make major investments, as a proportion of *per capita* gross domestic product, in science and technology research and development, with constant pressure to increase the percentage expended grounded in the belief that more investment will create more innovation, greater prosperity, and to complete the cycle, more resources to invest through taxation. With so much of society aligned in the name of innovation, what is the outcome?

According to Peter Phillips, an international political economist, the answer is change. By creating the context for innovation to occur, social arrangements become oriented toward scientific, technological, and implicitly, social change. Two questions arise, the first being whether institutions implicated in innovation are responsive to change, or whether they become obstructions, and the second is whether institutions tasked with generating innovation are structured for the change they are to bring about. One of the central claims of

Governing Transformative Technological Innovation is that much analysis of innovation focuses on incremental change, often of the sort envisioned as resulting from linear conceptions of technology development and transfer. More revealing are situations in which transformative innovation, the kind which might actually accrue the greatest social and economic gains (or potential losses in rare situations) for society, reveal the bottlenecks and gateways in the innovation system. This structural approach to the institutions and actors involved in innovation is coupled with the second central theme of the book which is an inquiry about the system of governance, or lack thereof as the case may be, that is supposed to be at the helm of innovation: who's in charge?

To answer these questions, Phillips develops an account of transformative technological change in innovation systems in which the system is not governed by single actors or institutions but for which control is a networked and complex systems-level phenomenon. The scope and impact of change wrought by transformative technologies, contrasted with incremental technological change, is attributed to the complexity of the system. This in turn stimulates Phillips' discussion about the roles of different institutions, actors and sectors, which inform much the tools of analysis used to attribute functions and responsibility to

markets, states, and civil authorities. Once these structural and dynamic aspects of innovation systems are characterized, the analysis of the governance question begins. The analysis first locates the authorities that define knowledge, then identifies the institutions and actors behind the management of knowledge and responsible for coordinating its mobilization between different sectors, and finally, reflects on the social structures that enable the creation and addition of value that, when added to inventions, makes innovations what they are. In the final part of the governance analysis, Phillips turns to the distributed governance networks responsible for innovative products and services to reach markets.

We learn from Phillip's analysis that the uncertainty created by transformative technological change intricate challenges for governance. Any analysis must confront the complexity of the system, which makes decomposition of even single sectors of the economy—sometimes down to the level of a single technology—extraordinarily difficult. The governance question is therefore complex to describe, let alone prescribe. With technological intensification, increasingly complex international networks of research, development and exchange, and with the proliferation of convergent technologies that cross formerly distinct scientific and technological domains, the governance question deepens. Although technological transformation might sound erudite and restricted to privileged classes in industrialized countries, some technologies, for example in agricultural biotechnology, have sweeping impacts on production, consumption and trade whose effects are present in industrialized countries and around the world.

How should systems of governance respond? Here Phillips presents some challenges for governance that can guide a considered response. The first task is to find proportionality in governance of transformative technology so that beneficial technological innovation can flourish. To some extent, this involves being able to distinguish and act appropriately, hopefully in advance, to situations in which a technology can be knowingly rejected because it is harmful, from technologies that are rejected but without evidence of their being harmful. This distinction is important, because some governance structures are designed to tolerate occasional type 1 errors, whereas others are not. An overlay of proportionality in governance, such that the extent and speed of governance responsiveness takes into account systems uncertainties, tolerances and intolerances, as well as potential losses and gains, remains a significant challenge that needs to be tackled. Here Phillips' message is that in a networked and distributed world of governance, one might reasonably expect to see local independence of institutions and actors. For example, self-regulation by industry can be a nimble, speedy, and effective governance mechanism far preferable to cumbersome, slow and loop-hole filled legislative approaches. Sometimes governments prefer to rely on industry to self-regulate for that reason.

A second governance challenge lies in the fact that just as technological development is frequently characterized as path-dependent, or in patently undesirable situations, 'locked-in,' so too are governance structures. This explains why transformative technological innovation is truly mold-breaking with respect to governance, and moreover suggests how it is possible to make

use of different governance structures, each with their unique characteristics, to achieve specific governance outcomes. The third challenge involves setting standards for accountability, responsibility and transparency in a constantly shifting innovative landscape. What one thinks of as a sign for standards one day in this landscape may not be the same tomorrow. An appeal is made to making sure that whatever else happens, legitimacy of authorities entrusted with governing well is sustained by a reflexive engagement on what has worked, what needs to be retained in the governance system, and what needs to be changed in governance of new technologies. Each

of these three challenges reflects analysis in earlier parts of the book, and at the same time it is evident that taking up these challenges will be part of Phillips' future research. Based on this lucid exposition and sustained analysis of the complex problem nexus presented by transformative technological innovation and its governance, there is much to look forward to.

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