Assessing the impact of Science and Technology Drivers in Regions

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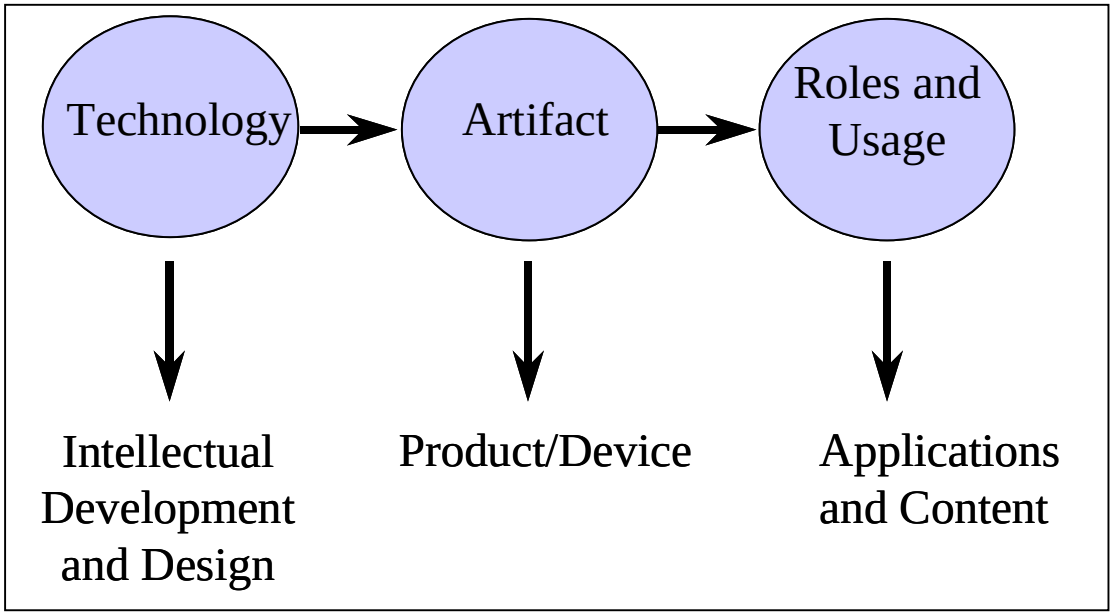
In attempting to understand the continuing role of technology and its potential differential effects on various countries, regions and cultures it is important to understand general technology trends and the various dimensions of technology that provide opportunity for participation. The RAND Corporation in its landmark study of the Information Revolution[1] developed a useful model of technology elements to apply against social, political and economic factors to understand regional significances.

The model consists of two elements: technology components and participation measures. Technologies can be described using three broad factors: the technology, the artifact or device and usage and associated services. Countries and regions respond to and shape technology implementations through a number of both causative and reactive factors such as culture, capacity, capital and control. It is the intersection of these participation measures with technology elements that provides a roadmap for understanding future participation and success.

Technology Components

The RAND study was able to clearly differentiate country and regional participation in the information revolution through the consideration of technology components.



Technology Technology is the idea or the intellectual property based on scientific properties that allows creation of a product that embodies it: for example, the design of masks for semiconductors is necessary before fabrication and assemble into a physical device is possible. This stage of technology is critical to control of the direction the technology takes; maintain leadership in continued development; and positioning for spin-off technologies and benefits.

[1] *"The Global Course of the Information Revolution: Recurring Themes and Regional Variations,"* by Richard O. Hundley, Robert H. Anderson, Tora K. Bikson and C. Richard Neu, National Defense Research Institute MR-1680, RAND, Santa Monica, California, 2003, 174p.

Artifact The artifact or physical device may involve hardware of software and embodies one or more technologies. This component is clearly associated with products. How such products are fabricated, assembled and packaged are all elements of the artifact.

Usage Applications and content determine how artifacts and technology are used, both in the form of device applications as well as services associated with the artifact and technology. For example, a compact disk (CD) can be used for storing all kinds of information implemented in countless ways from entertainment to secure data storage. In addition to developing and providing such applications, services such as marketing, digital recording and copying as well as support services are all included in Usage.

Participation Measures

Many factors shape and characterize a nation or region's approach to technological introduction and development. Some of these factors are causative; they are the underlying factors shaping the ability to adapt or adopt technology. Other measures are resultant; they help characterize a nation or region's posture but are effects, not causes. Together these factors distinguish and differentiate regional and national responses to technological introduction and change.

The Four "Cs"

- Culture
  - Language, nationalism, stratification, legal systems authority, trust and the concept of information
- Competence
  - Education, training, and sophistication
- Capital
  - Internal capital sources, external capital sources and physical infrastructures
- Control
  - Agency of control and form of control

Capacity The presence of well-developed physical infrastructures (e.g. electric power grids, telecommunications networks) indicating historical comfort with technology and change. This particularly includes the presence of well-educated populations with high literacy rates, providing the human capital required to exploit technology.

Capital National or regional participation in technological change requires access to significant capital resources, both internal capital sources as well as external capital sources. The varying structures of capital markets in different nations represent another important differential

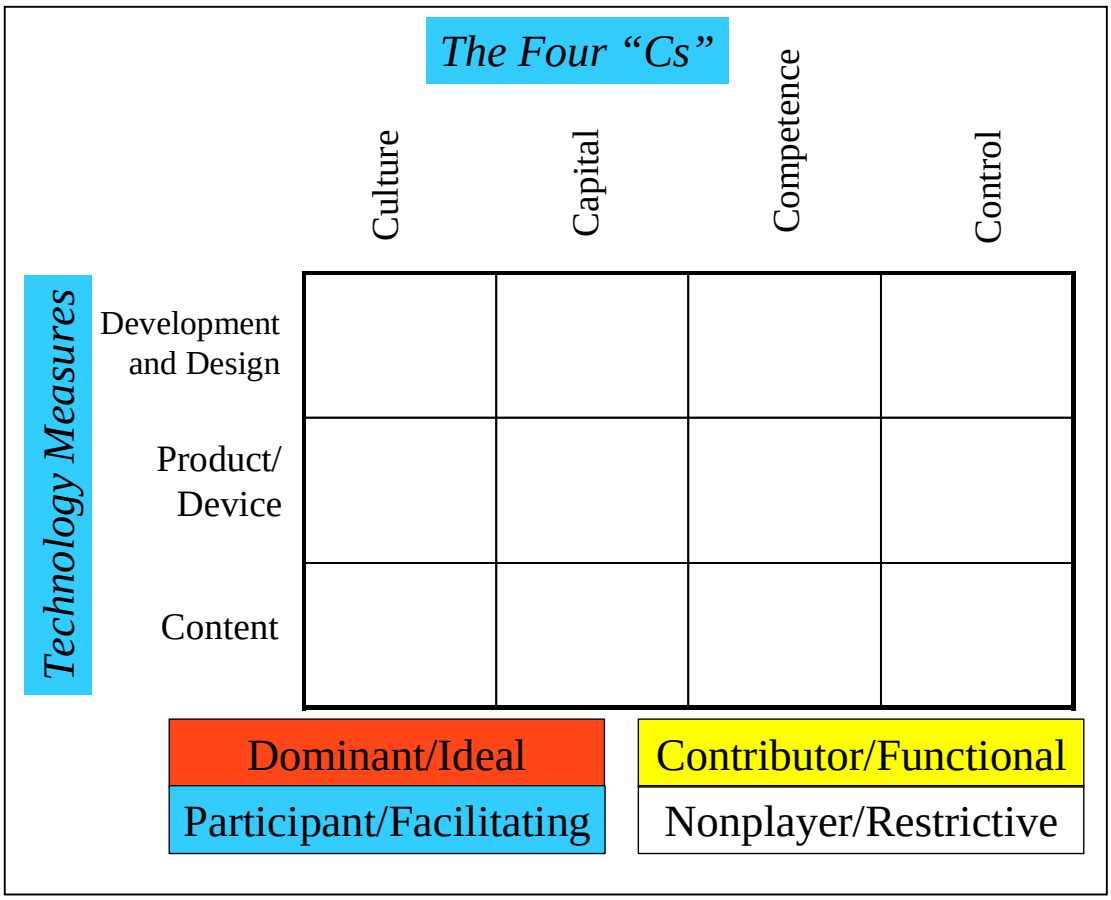
determination of the impact of technology in those countries. The availability of funding for new businesses and concepts and the manner of the funding process directly affect the growth and development of new industries in any given nation. Strong financial and institutional support for research is important for the development of a ready supply of trained technology professionals and ready access to exploitable technology.

Culture Language, nationalism, social stratification are key issues in technology acceptance. For example, the consequences of failure; the willingness to accept and embrace failure as well as success are clear measures of a society's reaction to, and mechanisms for change. Labor mobility; the degree of mobility in the labor force, including the ability to expand and accept non-native labor is linked closely to immigration acceptance and acceptance of other cultures and ideas.

Control The degree and nature of the control that a government exercises over the various segments of a society is another important factor shaping a nation's technology posture. Government control can have both positive and negative effects insofar as a society's propensity to change. For example, issues of governance that are conducive to the acceptance of technology, especially issues related to the structure of commercial property rights, corporate governance, and government-industry ownership. Governance issues that influence class mobility, independent acceptance of change and ability to create individual wealth. The nature of legal regimes is also important. Technology assimilation requires legal structures permitting, protecting and enforcing rights to technology development and ownership.

Integrated Assessment Matrix

The matrix is an interesting tool to describe and compare types of outcomes and responses to the trends we see in technology and science in the future. The degree of technology penetration and the response of nations and regions to technology drivers can play out in many ways and with a great deal of heterogeneity. General characterizations nonetheless will provide insight into the trends and directions pointing to consequences for future relationships.



All nations are not equally strong and conducive in all of the participation measures, in fact, relative strengths and weaknesses lead to advantages and disadvantages in participation in technology adaptation and adoption. Others only participate in a part of the technology cycle. In fact, it is the outliers and countries that do not conform to regional characterizations that are of great interest.

In looking at the differentiation between countries and regions it is clear that some nations or regions will inevitably fall behind in participating in technology benefits and trends because they are too rigid. Others will fall behind because they lack the necessary physical, human, financial and institutional capital. Still others will fall behind for other reasons. The economies, societies and countries that will flourish are those most adept at dealing with change.