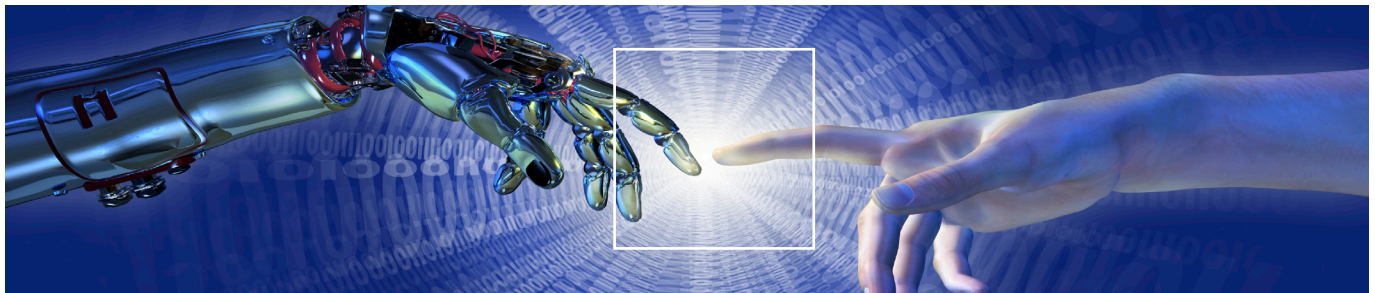


Managing Technological Discontinuities

How Information & Communication Technologies Can Change Your Business



“The winners are found among those who can capture, protect and internalize ‘new to industry’ and ‘new to world’ technologies.” The increasing importance of information and communication technologies (ICT) for innovation in many industry sectors comes with new opportunities for competitive advantage. A systematic approach to dealing with the potential impact of ICT is crucial for future success.

Introduction

Information and communication technologies (ICT) are now an integral part of our environment and are among the most important drivers for innovation in many industry sectors. Whether complex control technologies in the field of machine tools, fly-by-wire systems in the aircraft industry or intelligent components in modern cars, everyday life without ICT is no longer conceivable. Moreover, the contribution of ICT to value creation in the production of consumer and industrial goods will continue to grow.

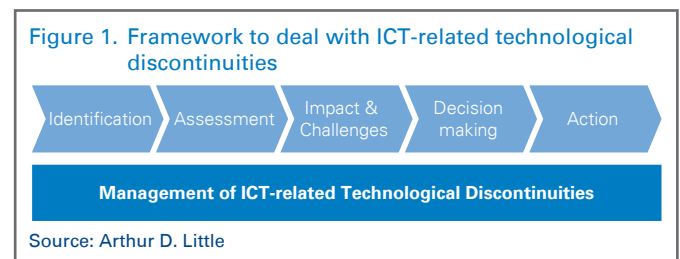
One of the consequences of the digitalization of the economy is a complete or partial replacement of established technologies. ICT solutions can, for example, take on functions that have been provided for by other technologies and replace them completely. A second possibility, one that is less radical but equally significant, is the addition of new functions to products through the integration of ICT components, with older technologies becoming less important as a result.

Such changes are known as technological discontinuities or leaps. The jump to a new technological path is attended by a range of opportunities for business, but poses significant challenges as well.

However, despite their undoubted importance, ICT are not the universal solution to every innovation challenge, and should not be overrated, especially given the speed at which they are developing. Many experts still see a huge need for further research in the field of ICT to realize the manifold visions of a digital world.

A framework for dealing with discontinuities

Due to the uncertainty and challenges surrounding future technological paths it is crucial for affected enterprises to deal with them in a well-structured manner. A promising approach to the successful strategic management of technological discontinuities includes five steps (see figure 1):

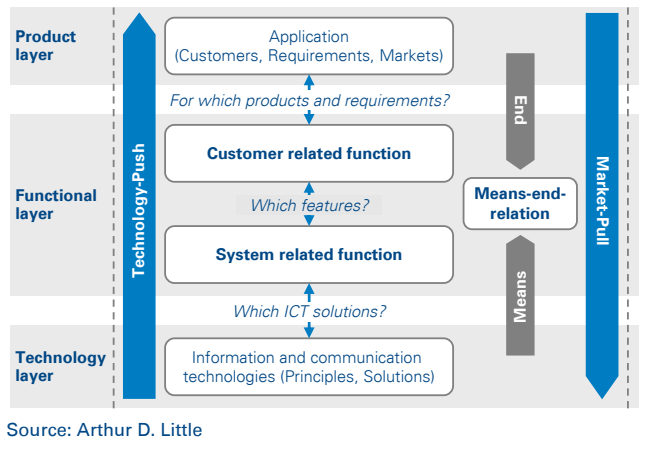


- identify potential discontinuities
- assess potential discontinuities
- analyze specific impact and challenges
- make strategic decisions
- take action

Identification of potential discontinuities

The two key triggers for technological discontinuities are new technological possibilities (technology-push) and social needs and market requirements (market-pull). However, in a dynamic environment, considering each aspect in isolation limits an enterprise’s response to these triggers. Functions can serve as a gateway between these two perspectives and can bring together the spheres of technology and markets (see figure 2 overleaf).

Figure 2. Combining the spheres of technology-push and market-pull through functions



For this reason, any effort to identify potential ICT-related discontinuities must include an analysis of a company's functions:

- system-related functions (general principles of ICT solutions based on past substitution patterns or technological trends)
- customer-related functions (future needs of customers and markets based on general market or social trends)

Such functions that can be combined to means-end relations show possible field for discontinuities and have to be assessed in a more detailed manner subsequently.

Assessment of potential discontinuities

To estimate the likelihood of technological discontinuities, established and potential substitute technologies must be assessed and compared, with explicit reference to the relevant markets. The attractiveness of a technology for specific functions arises from its potential to deliver competitive advantage and this is set by determinants in four areas: market, technological, competitive and other parameters.

These determinants can be aggregated using a two-step approach.

- Scan relevant fields for discontinuities, making a rough estimate of benefit and priority of the identified customer-related functions and compliance with required system-related functions, to produce a short list.
- Conduct a detailed analysis of the short-listed fields, assessing for discontinuities on the basis of the parameters outlined above.

Both steps can be supported by scoring models and portfolios (see figure 3).

Analysis of specific impact and challenges

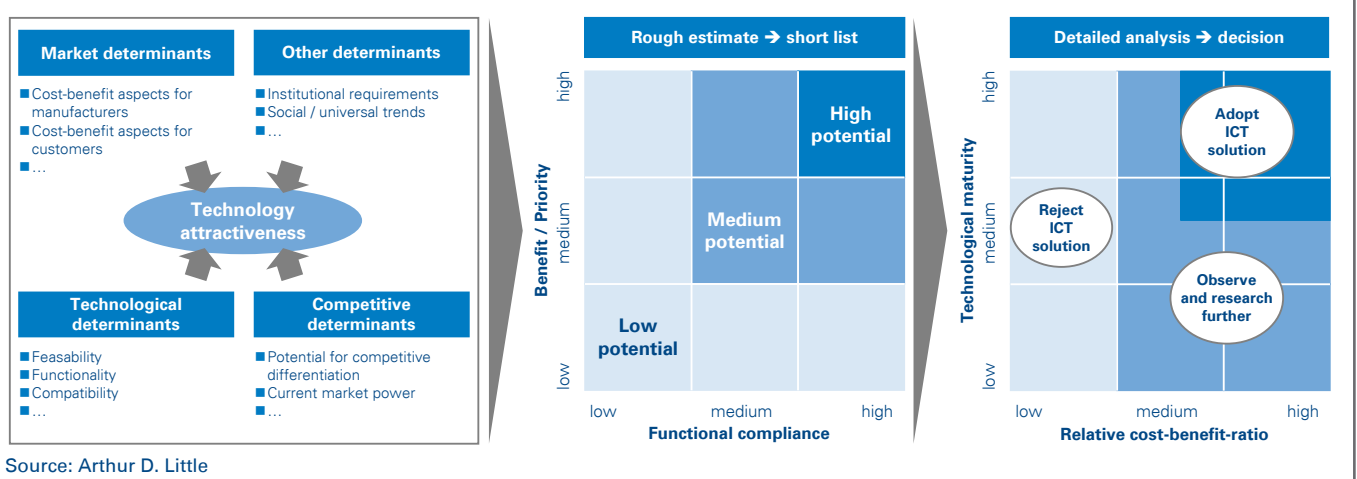
Extensive change accompanies technological discontinuities. Established industry structures may shift and boundaries between sectors may dissolve, with both having a significant impact on companies.

- Externally, affected companies face new competitors, new value chain structures and new market participants in upstream and downstream markets. Technological discontinuities bring about new strategic excellence positions (SEP), resulting in greater rivalry.
- Internally, companies face a changing technological base and this brings about a requirement for new organizational structures, processes and human resources.

As a result, the fundamental challenges for enterprises addressing technological discontinuities are identifying and occupying new SEPs, and handling external and internal barriers related to the development of new competences and structural changes.

A further challenge arise from the uncertainty that occurs while new technological paths are tested. Before a new path is locked in, it may change direction rapidly or even lead to a dead-end. Technology superiority is not a guarantee for the lock-in of a chosen path; there are many other determinants and levers that influence lock-in.

Figure 3. Assessing the potential of ICT solutions for causing discontinuities

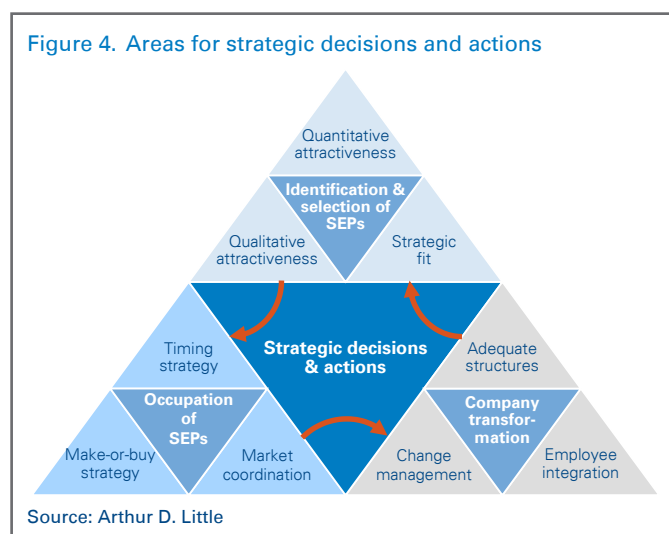


Source: Arthur D. Little

Against this background, companies must manage a balancing act; they must be flexible enough to react to possible shifts, yet simultaneously able to influence path development and enforce lock-in of a favorable technological path. An in-depth understanding of influencing variables helps to ensure effective transition between technological paths.

Deduction of strategic decisions and actions

There are three main areas for strategic decisions and actions relating to technological discontinuities (see figure 4).



1. Identification and selection of new SEPs

Identifying new SEPs and applicable business models requires a detailed picture of the future value chain. This should include relevant value-added levels and sectors, possible customer groups and different market roles. Furthermore, an in-depth analysis of possible path developments can minimize the risk of being stuck on the wrong track.

Once the SEP is selected, a company will be evaluated in three areas:

- quantitative attractiveness (volume, growth, return, financial risk)
- qualitative attractiveness (competitive intensity, entry barriers, risk-reward ratio)
- strategic fit (access, competences, fit with core business)

2. Occupation of selected SEP

Once a promising SEP is identified, the challenge is to occupy it. To discourage potential competitors and enforce lock-in of a specific technological path, a company must achieve rapid and high market penetration and build barriers to market entry barriers, such as economies of scale, a strong competence position or exclusive access to distribution channels and customers.

Relevant fields of action for achieving these goals are:

- timing: a timing strategy can be a proactive, active or adaptive
- make or buy: relevant ICT competencies can be developed in-house or incorporated through acquisitions or co-operation
- coordination with other market participants: agreements with market participants such as suppliers or producers of complementary products as well as the integration of customers can help to enforce specific standards and designs

Decisions relating to action in these fields should be based on a company's current situation and profile as well as its overall market, competitor and technology characteristics. In addition, the opportunities, risks and streams related to the technology-adoption process and its possible outcomes must be analyzed and considered.

3. Company transformation/change management

In cases where ICT-related discontinuities erode a company's competence dramatically, new organizational structures and a culture shift may be unavoidable. To address ICT-related technological discontinuities successfully, it is therefore important to initiate and support a process of change through suitable methods.

Case study for ICT-related discontinuities – smart buildings

One current development bringing about technological discontinuities is the vision of an intelligent energy supply and usage system, including a smart grid on a macro level and smart buildings on a micro level.

Behind this development lies the rapid growth of a decentralized and fluctuating power supply, brought about by the increase in renewable energy sources. This development requires power generation, allocation and usage to be more closely connected, and demands automated processes to balance supply and demand. ICT solutions will play a key role in meeting these requirements and, in doing so, will devalue the strategic importance of established know-how and capacities.

Where smart buildings are concerned, the main objective is to foster energy efficiency on a micro level by enabling consumers to analyze and control their consumption through user interfaces and automated processes. Possible solutions include the optimized consumption of energy generated by own renewable sources, demand response concepts, the integration of forecasts, and intermediate storage systems.

Analysis by Arthur D. Little shows three particular challenges in this context:

1. Identification of profitable business models

Due to a lack of common communication standards and smart appliances, monetary savings from smart systems are currently low while implementation costs are high. Operating smart systems profitably (and achieving independence from government support) will require either efficient solutions and innovative business models or higher energy costs.

2. Dominant design of smart buildings

Efficient energy generation and usage at building level requires interfaces in all participating systems allowing them to send and receive commands. However, a dominant design for the location of the active management functions that ensure efficient operation has not been found yet. Elements and products that must be considered include smart appliances, smart meters, stand-alone energy management systems, power sockets, inverters and, in the long run, even batteries and plug-in vehicles.

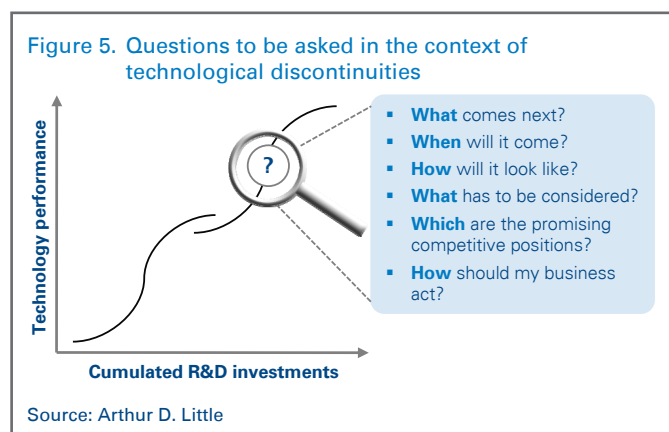
3. Embedding smart buildings into a smart grid

Aiming at energy efficiency on a micro level is controversial since such an autarkic perspective is too narrow from an economy's point of view. Thus, it is important for participating companies to get a broad perspective on the challenges and requirements regarding the future grid.

Conclusion

Our analysis and experience shows that a well-structured approach to identifying, assessing and dealing with the potential of ICT solutions and related technological discontinuities helps companies to be one step ahead of their competitors and thus maintain and extend their competitive position.

Dealing with technological discontinuities requires an in-depth knowledge of technological and market trends as well as the capacity to approach technological change with an open and imaginative mind. At Arthur D. Little we provide answers for your business regarding the relevant questions, whether in the context of our future energy system or in other businesses that are affected by ICT solutions (see figure 5).



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A special thank goes to Holger Seim

Arthur D. Little

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