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Technology management

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Technology management is a set of management disciplines that allows organizations to manage their technological fundamentals to create competitive advantage. Typical concepts used in technology management are:

- Technology strategy (a logic or role of technology in organization),
- Technology forecasting (identification of possible relevant technologies for the organization, possibly through technology scouting),
- Technology roadmap (mapping technologies to business and market needs), and
- Technology project portfolio (a set of projects under development) and technology portfolio (a set of technologies in use).

The role of the technology management function in an organization is to understand the value of certain technology for the organization. Continuous development of technology is valuable as long as there is a value for the customer and therefore the technology management function in an organization should be able to argue when to invest on technology development and when to withdraw.

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Overview [edit]

Technology management can also be defined as the integrated planning, design, optimization, operation and control of technological products, processes and services, a better definition would be the management of the use of technology for human advantage.

Technology Management was deemed an emerging field of study by the Department of Education and received a new Classification of Instructional Program (CIP) code in 2020. Technology Management education is defined as a program that prepares individuals to develop science, technical, and business skills required for management of people and systems in technology-based industries, government agencies, and non-profit organizations. Includes instruction in computer applications, general management principles, production and operations management, project management, quality control, safety and health issues, and statistics. 52.0216 2020 CIP Code

Perhaps the most authoritative input to our understanding of technology is the diffusion of innovations theory developed in the first half of the twentieth century. It suggests that all innovations follow a similar diffusion pattern – best known today in the form of an "s" curve though originally based upon the concept of a standard

Four Functions of Management Technology

- Small Business | • Managing Employees | • Managers

By Anam Ahmed Updated August 29, 2020

There are many different types of management technologies available to help businesses effectively reach their goals. With customer relationship management software, scheduling software and budgeting tools, managers have a number of options available to optimize their planning and execution. It's vital for businesses to properly train their managers on the technology solutions they have available so they can optimize their use.

Managing Resources Effectively

Part of a manager's role is to see that the company's monetary and human resources are used effectively. Budgeting software can help managers allocate funds to different departments, track spending and expenses, and ensure bills are paid on time. With financial software, managers can prepare financial statements such as balance sheets, cash flow statements and income statements. When managers understand the actual financial situation of the company, they have a deeper understanding of whether their resources are being used effectively.

In addition to managing money, managers and business owners need to know their employees are working efficiently. Mitrefinch notes that time and attendance management technology ensures businesses can keep track of their employees. Plus, task management software helps managers monitor project completion and productivity to ensure the company is on its way to meeting its goals. Getting an overhead view using this management technology is a quick way for business leaders to review performance.

Communicating With All Stakeholders

Management technology is critical for maintaining open communication channels with employees, partners, customers and prospects. Simple communication tools like email keep managers up to date on daily activities, while they can get instant updates using messaging and collaboration tools. Teleconferencing and videoconferencing are great ways to build a solid connection when employees or partners work remotely.

To communicate with customers, managers can use several technology options, including email marketing, social media, blogs and websites. These technologies aren't solely for management, but the way they are used is based on communication strategies developed by company leadership. Managers need to create messaging for employees to use when communicating with customers so that they stay on track and provide helpful information customers are looking for.

Developing Customer Relationships

Industry Today suggests that businesses can develop strong customer relationships by using tools like customer relationship management (CRM) software. This management technology oversees all the interactions your company has with each customer. For example, you can integrate CRM software with your website and other systems to track resources the customer downloaded from the website or learn who they spoke to in customer service.

Having all this insight on your customers and prospects in one place provides management with a deeper understanding of their audience. This way, businesses can learn more details about the kinds of challenges their customers face, what types of questions they ask most frequently, and the level of service they expect. This helps managers develop new products and services as well as customer service policies.

Making Decisions With Management Technology

One of the essential functions of management technology in business is that it helps organizations make data-driven decisions. Every day, business leaders are called upon to make operations, marketing, product and customer relations decisions as employees need to know which direction they should go. By having access to important data such as finances, market trends and customer satisfaction scores, managers can figure out strategies and plans for implementation.

Without having access to this insight and knowledge, businesses risk making decisions that are detrimental to their success. However, with tracking metrics that showcase performance and trends, managers can understand which direction the business is headed and what needs to be done to reach the company goals.

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About the Author

Anam Ahmed is a Toronto-based writer and editor with over a decade of experience helping small businesses and entrepreneurs reach new heights. She has experience ghostwriting and editing business books, especially those in the "For Dummies" series, in addition to writing and editing web content for the brand. Anam works as a marketing strategist and copywriter, collaborating with everyone from Fortune 500 companies to start-ups, lifestyle bloggers to professional athletes. As a small business owner herself, she is well-versed in what it takes to run and market a small business. Anam earned an M.A. from the University of Toronto and a B.A.H. from Queen's University. Learn more at www.anamahmed.ca.

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Implications of Technology on Business

By: Adi Pandit
Updated September 26, 2017

technology computer image by Andrey Kiselev from Fotolia.com

The Importance of Modern Management Theories in Managing People

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The technology revolution is considered the next big shift that has occurred in our society since the manufacturing revolution. Technology has far-reaching implications on business. It can make or break a business in today's fast-paced business environment. Businesses should carefully evaluate the implications of adopting or ignoring shifts that occur in the technological landscape.

Efficiency and Productivity

bar chart image by Paul Moore from Fotolia.com

Technological innovations improve the efficiency of a business and hence increase its productivity. Bill Gates had once quipped, "The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is that automation applied to an inefficient operation will magnify the inefficiency."

Technology is improving the execution of various operations such as sales, accounting and customer self-service. Until recently, most productivity gains have been led by manufacturing, but other businesses are now exploiting technology to improve their productivity.

Customer Interaction

wireless internet connection devices clipping path image by Radu Razvan from Fotolia.com

Today's customers interact with businesses using ever more sophisticated technical devices and mediums such as Internet-enabled smartphones. This imposes the need on business to adapt their processes and support these technologies.

Adaptive business

A business built using the right technology the right way is able to respond to changes in market environment and policy in a much more nimble way. Any business depending on inflexible technological choices will find it difficult to adapt to rapidly changing business environments.

Compliance and Policy changes

business report image by Christopher Hall from Fotolia.com

The financial scams and meltdowns of the 1990s and 2000s have brought businesses under the radar of new rules and compliance policies such as the Sarbanes-Oxley Act, the intent of which was to help expose malpractices earlier. This requires businesses to adopt their processes to comply with stricter reporting rules. Technology plays a key role to smooth out such reporting requirements without affecting the day-to-day business.

Impact on workplace

Office manager behind the workplace (PTI) image by Ryszard Stelmachowicz from Fotolia.com

The proliferation of technology in business causes a shift in workplace culture and working conditions. Geographically distributed teams, telecommuting and flexible work timings are a few of many impacts that technology is having on work culture.

Investment

investment image by Kit Wai Chan from Fotolia.com

Every business has to carefully allocate resources for maintaining and improving its technology. Businesses that are predominantly technology driven are proving to be more efficient and lean than non-technology based businesses. Substantial investment in technology plays a big role in keeping a business competitive.

Challenging pace of change

The technology industry is known to change at a faster rate than the businesses it serves. Businesses have to deal with keeping up with technology upgrades and product refresh cycles. Coping with rapid advances in technology poses a unique challenge. Businesses have to decide whether to get on the latest technology bandwagon to reap its potential rewards, which may or may not appear, or stick with the older technology that meets its current needs but may result in losing a technology edge to its competitors.

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MANAGEMENT

The Importance of Modern Management Theories in Managing People

By: Chuck Robert
Reviewed by: Michelle Seidel, B.Sc., LL.B., MBA
Updated March 03, 2019

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Implications of Technology on Business

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Academics and business owners periodically come up with theories for increasing worker output while keeping the same number of workers through modern management theories. According to political science professor Dr. Yasin Olum, modern management is the era of management that began in the 1880s and 1890s with Frederick Taylor, who argued for the abandonment of old management practices for empirically backed best practices. To maximize productivity, managers must understand the latest best practices.

Maximize Employee Productivity

Modern management theories help businesses maximize production by using human resources to their maximum potential. Businesses do whatever possible to develop workers towards their maximum efficiency and potential.

Fredrick Taylor's theory of scientific management held that businesses could maximize the productivity of unskilled workers by first observing work processes and then developing best practices. Taylor's theory builds on Adam Smith's theory of the division of labor, which ensures that each worker becomes increasingly more skilled at a particular task, allowing each worker to become as productive as possible.

Simplify Decision Making

Max Weber theorized that hierarchical systems encourage informed decision making. In the 1950s, the theory of hierarchy delayering emerged. A report for the Institute for Employment Studies argues that flattening the hierarchy would shorten communication paths, stimulate local innovation, speed up decision making and create an environment where managers were more closely involved in production. Flattening out hierarchy means removing overhead and reducing bureaucracy.

Increase Staff Participation

Management theories of the 1930s focused on interpersonal relationships in the workplace, called the human relations approach. Businesses gave the staff more influence over decisions within the workplace. The human relations theory focused more on the psychological and sociological aspects of management, using Abraham Maslow's theories of motivation and Chris Argyris' ideas on how organizational structure interferes with satisfaction.

Think Objectively and Use Scientific Processes

Taylor's scientific management theories leave executives accountable to scientific processes, instead of simply relying on their judgment. When management strategies are implemented, others in the company can test the effectiveness of these strategies and determine if they are truly effective. This discourages management from making decisions purely on whim and instead encourages management to make scientifically proven changes that increase worker productivity.

Adapt to Global Changes

Globalization theories take into account changes occurring throughout the world and how these changes influence business. The globalization theories hold that the business world is becoming increasingly more interconnected and many enterprises are engaging in business with other international companies, investing, hiring overseas workers and handling overseas distribution chains. Globalization is partially driven by the development of informational technologies such as the Internet.

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Technological change

From Wikipedia, the free encyclopedia

> This article includes a list of general references, but it remains largely unverified because **it lacks sufficient corresponding inline citations**. Please help to improve this article by introducing more precise citations. *(September 2020)* *(Learn how and when to remove this template message)*

Technological change (**TC**) or **technological development**, is the overall process of invention, innovation and diffusion of technology or processes.[1][2] In essence, technological change covers the invention of technologies (including processes) and their commercialization or release as open source via research and development (producing emerging technologies), the continual improvement of technologies (in which they often become less expensive), and the diffusion of technologies throughout industry or society (which sometimes involves disruption and convergence). In short, technological change is based on both better and more technology.

Original model of three phases of the process of Technological Change

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Modeling technological change [edit]

In its earlier days, technological change was illustrated with the 'Linear Model of Innovation', which has now been largely discarded to be replaced with a model of technological change that involves innovation at all stages of research, development, diffusion, and use. When speaking about "modeling technological change," this often means the process of innovation. This process of continuous improvement is often modeled as a curve depicting decreasing costs over time (for instance fuel cell which have become cheaper every year). TC is also often modelled using a learning curve, ex.: Ct=C0 * Xt^-b

Technological change itself is often included in other models (e.g. climate change models) and was often taken as an exogenous factor. These days TC is more often included as an endogenous factor. This means that it is taken as something you can influence. Today, there are sectors that maintain the policy which can influence the speed and direction of technological change. For example, proponents of the Induced Technological Change hypothesis state that policymakers can steer the direction of technological advances by influencing relative factor prices and this can be demonstrated in the way climate policies impact the use of fossil fuel energy, specifically how it becomes relatively more expensive.[3] Until now, the empirical evidence about the existence of policy-induced innovation effects is still lacking and this may be attributed to a variety of reasons outside the sparsity of models (e.g. long-term policy uncertainty and exogenous drivers of (directed) innovation).[4] A related concept is the notion of Directed Technical Change with more emphasis on price induced directional rather than policy induced scale effects.[5]

Invention [edit]

The creation of something new, or a "breakthrough" technology. This is often included in the process of product development and relies on research. This can be demonstrated in the invention of the spreadsheet software. Newly invented technologies are conventionally patented.

Diffusion [edit]

Diffusion pertains to the spread of a technology through a society or industry.[6] The diffusion of a technology theory generally follows an S-shaped curve as early versions of technology are rather unsuccessful, followed by a period of successful innovation with high levels of adoption, and finally a dropping off in adoption as a technology reaches its maximum potential in a market. In the case of a personal computer, it has made way beyond homes and into business settings, such as office workstations and server machines to host websites.

For mathematical treatment of diffusion see: Logistic function

For examples of diffusion of technologies see: Diffusion of innovations#International Institute for Applied Systems Analysis (IIASA)

For assorted diffusion curves such as appliances, household electrification and communications see: Diffusion of innovations#Diffusion data

Technological change as a social process [edit]

Underpinning the idea of a technological change as a social process is a general agreement on the importance of social context and communication. According to this model, technological change is seen as a social process involving producers and adopters and others (such as government) who are profoundly affected by cultural setting, political institutions, and marketing strategies.

In free market economies, the maximization of profits is a powerful driver of technological change. Generally, only those technologies that promise to maximize profits for the owners of incoming producing capital are developed and reach the market. Any technological product that fails to meet this criterion - even though they may satisfy important societal needs - are eliminated. Therefore, technological change is a social process strongly biased in favor of the financial interests of capital. There are currently no well established democratic processes, such as voting on the social or environmental desirability of a new technology prior to development and marketing, that would allow average citizens to direct the course of technological change.[7]

Elements of diffusion [edit]

Emphasis has been on four key elements of the technological change process: (1) an innovative technology (2) communicated through certain channels (3) to members of a social system (4) who adopt it over a period of time. These elements are derived from Everett M. Rogers Diffusion of innovations theory using a communications-type approach.

Innovation [edit]

Rogers proposed that there are five main attributes of innovative technologies that influence acceptance. He called these criteria ACCTO, which stands for Advantage, Compatibility, Complexity, Trialability, and Observability. *Relative advantage* may be economic or non-economic, and is the degree to which an innovation is seen as superior to prior innovations fulfilling the same needs. It is positively related to acceptance (e.g. the higher the relative advantage, the higher the adoption level, and vice versa). *Compatibility* is the degree to which an innovation appears consistent with existing values, past experiences, habits and needs to the potential adopter; a low level of compatibility will slow acceptance. *Complexity* is the degree to which an innovation appears difficult to understand and use; the more complex an innovation, the slower its acceptance. *Trialability* is the perceived degree to which an innovation may be tried on a limited basis, and is positively related to acceptance. Trialability can accelerate acceptance because small-scale testing reduces risk. *Observability* is the perceived degree to which results of innovating are visible to others and is positively related to acceptance.

Communication channels [edit]

Communication channels are the means by which a source conveys a message to a receiver. Information may be exchanged through two fundamentally different, yet complementary, channels of communication. Awareness is more often obtained through the *mass media*, while uncertainty reduction that leads to acceptance mostly results from *face-to-face communication*.

Social system [edit]

The social system provides a medium through which and boundaries within which, innovation is adopted. The structure of the social system affects technological change in several ways. Social norms, opinion leaders, change agents, government and the consequences of innovations are all involved. Also involved are cultural setting, nature of political institutions, laws, policies and administrative structures.

Time [edit]

Time enters into the acceptance process in many ways. The time dimension relates to the innovativeness of an individual or other adopter, which is the relative earliness or lateness with which an innovation is adopted.

Economics [edit]

See also: Technical progress

In economics, technological change is a change in the set of feasible production possibilities.

A technological innovation is Hicks neutral, following John Hicks (1932), if a change in technology does not change the ratio of capital's marginal product to labour's marginal product for a given capital-to-labour ratio. A technological innovation is Harrod neutral (following Roy Harrod) if the technology is labour-augmenting (i.e. helps labor); it is Solow neutral if the technology is capital-augmenting (i.e. helps capital).[2][8]

Technological change can cause the production-possibility frontier to shift outward, allowing economic growth.

See also [edit]

- Accelerating change
- Cultural lag
- Innovation
- Investment specific technological progress
- Posthumanization
- Productivity
- Productivity improving technologies (historical)
- Second industrial revolution
- Technical change
- Technical progress function
- Technological innovation system
- Technological revolution
- Technological transitions
- Technological unemployment
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100%
Number or percentage of adopters
S-shaped
diffusion
curve
Time

Instructor: ***Kimberly Winston***

Kimberly has a MBA in Logistics & Supply Chain Management

Cite this lesson

How has technology changed your life in the last 5, 10, or 20 years? In this lesson, you will learn the definition of technological change as well as its advantages, impacts, and several examples.

What Is Technological Change

In economics, a **technological change** is an increase in the efficiency of a product or process that results in an increase in output, without an increase in input. In other words, someone invents or improves a product or process, which is then used to get a bigger reward for the same amount of work.

The telephone is an example of a product that has undergone a technological change. It has undergone many different changes over the years that have made it more efficient. Processes or products, such as the telephone, move through technological change in three stages:

- **Invention** - the creation of a new product or process
- **Innovation** - the application of the invention for the first time
- **Diffusion** - how fast others begin to adopt the innovation

Impacts of Technological Change

We have all likely experienced the impact of technology. Let's take a look at the ways, both good and bad, technological change has impacted our world:

- Creates new products and processes

When telephones were first invented, the object was to be able to verbally communicate with someone. Due to technological changes, we have multiple ways to communicate using our phones, such as text, email, or talk.

- Increases efficiency, lower costs

Technology makes it possible to perform everyday tasks faster and with less energy on our part. For instance, some people have a vacuum cleaning robot. Instead of spending 30 minutes vacuuming, they push a button and go do something else. That's efficiency.

- Helps economies evolve

People are able to increase the ways in which they create wealth. It also has a ripple effect. When one technological change occurs, it changes how we live. With the integration of technology, societies evolved from traditional hunting and gathering to industrialized. So that fewer people are growing crops and more are moving into other industries.

Almost every industry, such as aviation, education, or the medical field, have been improved by technological change. Think about how you are learning this very lesson today. How would students have obtained this information 50 years ago?

- Decreases self reliance

Support

The Technology Learning Cycle

MAY 2, 2012

by Chris Clark

tags: teaching

The Technology Learning Cycle is a tool that faculty can use to reflect on their own learning about technology. It provides a way to think about how we learn to use new tools and incorporate them into our teaching. The Cycle was developed in the late 1990s at the University of Missouri to help faculty members who were training pre-service teachers in the use of technology. A central premise of this model is that faculty must be lifelong learners with regard to technology.

Phases of the technology learning cycle

1. **Awareness** – becoming aware of technologies through media, friends, family, colleagues, or students.
2. **Exploration and Filtration** – examining various technologies and selecting a tool that shows potential for personal and classroom use.
3. **Learning**– developing a comfort level with the technology
   - Technical – learning the mechanics of working with the technology.
   - Pedagogical – preparation, planning, and practice using the tool to enhance learning.
4. **Application** – implementing a project that uses the technology to fulfill a need.
5. **Sharing and Reflection** – thinking critically about what you have learned, passing the knowledge on to others, and personally applying it to restart the cycle.

The cycle repeats each time you become aware of a new technology and choose to implement it in the classroom. Each cycle is typically more sophisticated than the previous one. The cycle propagates as others pick up on the knowledge you share.

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Diffusion of innovations

From Wikipedia, the free encyclopedia

Diffusion of innovations is a theory that seeks to explain how, why, and at what rate new ideas and technology spread. Everett Rogers, a professor of communication studies, popularized the theory in his book *Diffusion of Innovations*; the book was first published in 1962, and is now in its fifth edition (2003).[1] Rogers argues that diffusion is the process by which an innovation is communicated over time among the participants in a social system. The origins of the diffusion of innovations theory are varied and span multiple disciplines.

Rogers proposes that four main elements influence the spread of a new idea: the innovation itself, communication channels, time, and a social system. This process relies heavily on human capital. The innovation must be widely adopted in order to self-sustain. Within the rate of adoption, there is a point at which an innovation reaches critical mass.

The categories of adopters are innovators, early adopters, early majority, late majority, and laggards.[2] Diffusion manifests itself in different ways and is highly subject to the type of adopters and innovation-decision process. The criterion for the adopter categorization is innovativeness, defined as the degree to which an individual adopts a new idea.

The diffusion of innovations according to Rogers. With successive groups of consumers adopting the new technology (shown in blue), its market share (yellow) will eventually reach the saturation level. The blue curve is broken into sections of adopters.

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What is digital transformation?

Digital transformation is the integration of digital technology into all areas of a business, fundamentally changing how you operate and deliver value to customers. It's also a cultural change that requires organizations to continually challenge the status quo, experiment, and get comfortable with failure.

What is digital transformation?

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Leaders need to be fully aware of this reality as they frame conversations around digital transformation. For advice from Swift on how to speak to this topic without getting burned, read our related article, Why people love to hate digital transformation.

[How has the CIO role evolved in the digital age? How has the skill set changed? What's coming next? Read also: CIO role: Everything you need to know about today's Chief Information Officers.]

Why does digital transformation matter?

A business may take on digital transformation for several reasons. But by far, the most likely reason is that they have to: It's a survival issue. In the wake of the pandemic, an organization's ability to adapt quickly to supply chain disruptions, time to market pressures, and rapidly changing customer expectations has become critical.

And spending priorities reflect this reality. According to the May, 2020 International Data Corporation (IDC) Worldwide Digital Transformation Spending Guide, spending on the digital transformation (DX) of business practices, products, and organizations continues "at a solid pace despite the challenges presented by the COVID-19 pandemic." IDC forecasts that global spending on DX technologies and services will grow 10.4 percent in 2020 to $1.3 trillion. That compares to 17.9 percent growth in 2019, "but remains one of the few bright spots in a year characterized by dramatic reductions in overall technology spending," IDC notes.

At a recent MIT Sloan CIO Symposium series event, IT leaders agreed that consumer behavior has quickly shifted in many ways since the start of the pandemic. Sandy Pentland, a professor at the MIT Media Lab, described how optimized automated systems in areas like supply chain management broke down when faced with rapid shifts in both demand and supply – a reality that just about everyone has faced on a personal level during the pandemic.

It's early to guess which long-term consumer behavior changes will stick. However, Rodney Zemmel, global leader, McKinsey Digital of McKinsey & Company, says that on the consumer side "digital has been accelerating in just about all categories." An important factor to watch will be the degree to which forced change – three out of four Americans tried a new shopping behavior, for example – will revert when possible, post today's

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TUESDAY, DECEMBER 1, 2009

TECHNOLOGY POLICY AND PLANNING

TECHNOLOGY POLICY AND INSTRUMENTS

The need for technology policy springs from an explicit commitment to a national goal and the acceptance of technology as an important strategic variable in the development process. Technology policy formulation would naturally follow the establishment of a development vision or a national goal. The goal or the development vision would then be used as the yardstick by which to be produced and services to be provided in the country in the coming one or two decades. The formulation of a technology policy begins with the **establishment of a vision for the country and the corresponding scenario of the mix of goods and services to be produced and provided.** The policy formulation process is a logical and flexible enough, yet rigorous enough to formulate the strategy.

A **technology policy is a comprehensive statement by the highest policy making body (Cabinet/ Parliament) in the Government to guide, promote and regulate the generation, acquisition, development and deployment of technology in the country in the pursuit of the attainment of achieving national objectives set forth in the development vision or perspective plan.** [1]

The principal aims and objectives of a technology policy are to acquire the appropriate technological capabilities for the production of goods and services in a competitive manner and for both domestic and export markets. A policy statement includes the expression of a desire to develop a national capacity for innovation and adaptation in technological matters. The policy document includes the principles on which the envisaged technological development is to be based. Such principles include, among others, environmental protection, health and safety, conservation of environment, sufficiency of basic needs, promotion of self reliance, creating mass involvement, etc.

The technology policy declaration usually contains several commitments on behalf of the Government and several categorical assurances. The policy, among other things, commits the authority to ensure:

- Establishment of institutional facilities for relevant research, development and skill development for extensive absorption of imported technology;
- Establishment of institutional facilities for promotion of research results and promotion of indigenous technology;
- Development of support facilities like information and documentation services, standardization and quality control;
- Adequate support to emerging technologies with an eye on future utilisation in production sector;
- Optimal level of indigenous and imported technology.

The Indian Government had announced a comprehensive Technology Policy Statement in 1983.

Policy Instruments

Policy instruments are the links between the expressed purpose and the results that are sought in practice. There are a variety of policy instruments available to the state to refer explicitly to technology functions and activities. The indirect mass, although primarily referring to policies, functions or activities other than technology, have an important indirect effect on S&T activities. A policy instrument may have direct or indirect effect on, or may affect activities or influence the results of resource deployment. Different policy instruments are listed below:

- Policy instruments to build up S&T infrastructure; a Policy instruments to support technology transfer;
- Policy instruments to define the pattern of demand for technology;
- Policy instruments to promote the performance of S&T activities in the enterprises;
- Policy instruments to support the performance of S&T activities.

Technology policy influences the activities of different segments, agencies and departments of the government and has a direct bearing on various sectors of the economy. The **technology policy** is a part of the overall national policy and the necessity of its integration with the national development policy. **The policy formulation mechanism would vary from country to country depending on the social structure, political system and prevailing economic conditions.** Technology policy formulation largely depends on the political will of the government to take the initiative. The government may also seek the advice of a technological council. In the S&T policy which has been adopted by an S&T Plan for integration into a national socioeconomic plan. In India the Science Advisory Council to the Prime Minister and the Cabinet are the S&T policy-making bodies. The policies are implemented through the various departments in the Ministry of Science & Technology and other S&T and Technical Departments.

TECHNOLOGY PLANNING

With the emerging role of technology as a master key for development, 'integration of technological considerations in the national socio-economic development' [2] is the need and strengthening of national capabilities for effective importation, generation and utilisation of technology has become imperative. There are no unified technology planning methodologies and the objectives of technology plans are usually expressed in one of:

a) Importation, adaptation and modification of technologies produced elsewhere;

b) Advancement of technology development capability in the country;

c) Creation of a climate for the acceptance of the need for technological change.

Figure 1 : Changes in the structure of the economy with technological advancement.
Source: Technology Management Handbook UK-CRAP, 1984.

Common procedures followed include **macro level** planning, **micro level** planning and **project level** planning. Several problems were reported in technology planning. The problems were concerned with the lack of commitment regarding the **development aspects of technology planning.** It is important to realise that all processes of modernisation and change result in some structural unemployment. The structural adjustment and structural transformation with the advancement of technology (Figure-1). Therefore, it is essential to exploit opportunities for achieving desirable changes and expansion of the base of production facilities.

Some of the important goals for technology planning and planning at the national level are as under:

a) It is essential that the planning for technology should be kept as a dynamic process.

b) It is essential that optimisation of consumer goods to capital goods then output substitution of technology goods for which a difficult one and requires careful planning.

c) The dimension of belief in the potentially critical for technology development; development of technological capabilities requires a long gestation period.

d) In the early stages of development, protection of local technological efforts is essential, but this should gradually be withdrawn.

e) Strong competition and market orientation is very important for technology development.

f) The will to solve one's own political and administrative problems and financial commitments at the highest political level is a necessary precondition for the preparation of any useful technology plan.

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Technology strategy

From Wikipedia, the free encyclopedia

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- This article **is in list format, but may read better as prose**. *(November 2016)*
- This article's **tone or style may not reflect the encyclopedic tone used on Wikipedia**. *(June 2017)*

Technology strategy (**information technology strategy** or **IT strategy**) is the overall plan which consists of objectives, principles and tactics relating to use of technologies within a particular organization.[1] Such strategies primarily focus on the technologies themselves and in some cases the people who directly manage those technologies. The strategy can be implied from the organization's behaviors towards technology decisions, and may be written down in a document. The strategy includes the formal vision that guide the acquisition, allocation, and management of IT resources so it can help fulfill the organizational objectives.[2]

Other generations of technology-related strategies primarily focus on: the efficiency of the company's spending on technology; how people, for example the organization's customers and employees, exploit technologies in ways that create value for the organization; on the full integration of technology-related decisions with the company's strategies and operating plans, such that no separate technology strategy exists other than the de facto strategic principle that the organization does not need or have a discrete 'technology strategy'.

A technology strategy has traditionally been expressed in a document that explains how technology should be utilized as part of an organization's overall corporate strategy and each business strategy. In the case of IT, the strategy is usually formulated by a group of representatives from both the business and from IT.[3] Often the Information Technology Strategy is led by an organization's Chief Technology Officer (CTO) or equivalent.[4] Accountability varies for an organization's strategies for other classes of technology. Although many companies write an overall business plan each year, a technology strategy may cover developments somewhere between 3 and 5 years into the future.

The United States identified the need to implement a technology strategy in order to restore the country's competitive edge. In 1983 Project Socrates, a US Defense Intelligence Agency program, was established to develop a national technology strategy policy.[5]

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3 Framework of (IT) technology strategy
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Socioeconomics

From Wikipedia, the free encyclopedia

Not to be confused with Social economy.

Socioeconomics (also known as **social economics**) is the social science that studies how economic activity affects and is shaped by social processes. In general it analyzes how modern societies progress, stagnate, or regress because of their local or regional economy, or the global economy. Societies are divided into three groups: social, cultural and economic. It also refers to the ways that social and economic factors influence the environment.

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Overview [edit]

"Socioeconomics" is sometimes used as an umbrella term for various areas of inquiry. The term "social economics" may refer broadly to the "use of economics in the study of society".[1] More narrowly, contemporary practice considers behavioral interactions of individuals and groups through social capital and social "markets" (not excluding, for example, sorting by marriage) and the formation of social norms.[2] In the relation of economics to social values.[3]

A distinct supplemental usage describes social economics as "a discipline studying the reciprocal relationship between economic science on the one hand and social philosophy, ethics, and human dignity on the other" toward social reconstruction and improvement[4] or as also emphasizing multidisciplinary methods from such fields as sociology, history, and political science.[5] In criticizing mainstream economics for its alleged faulty philosophical premises (for example the pursuit of self-interest) and neglect of dysfunctional economic relationships, such advocates tend to classify social economics as heterodox.[6]

Socioeconomic Factors of Environmental Change [edit]

Socioeconomic system at the regional level refers to the way social and economic factors influence one another in local communities and households. These systems have a significant impact on the environment through deforestation, pollution, natural disasters, and energy production and use. Through telecoupled

Related Terms

- Cobb-Douglas Production Function
- Cost Analysis
- Fixed Proportion Production Function
- Private Cost
- Linear Homogeneous Production Function
- Marginal Cost
- Constant Elasticity of Substitution Production Function
- Types of Iso-quant Curves
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Production Function

Definition: The **Production Function** shows the relationship between the quantity of output and the different quantities of inputs used in the production process. In other words, it means, the total output produced from the chosen quantity of various inputs.

Generally, production is the transformation of raw material into the finished goods. These raw materials are classified as land, labor, capital or natural resources. These may be fixed or variable depending upon the nature of the business.

This function establishes the physical relationship between these inputs and the output. The efficiency of this relationship depends on the different quantities used in the production process, the quantities of output and the productivity at each point. It can be shown algebraically:

$$O = f(I_1, I_2, I_3, I_4 \ldots\ldots Z_n)$$

Where, O = quantity of output

I_1, I_2, I_3 = Quantity of different inputs

It can be classified on the basis of the substitutability of the inputs by other inputs:

1. Fixed Proportion Production Function
2. Variable Proportion Production Function
3. Linear Homogeneous Production Function
4. Cobb. Douglas Production Function
5. Constant Elasticity of Substitution

Thus, it is a comprehensive function that involves different activities ranging from the production of output from the given inputs and its distribution by the marketing division of the organization.

Related Terms:

1. **Fixed Proportion Production Function**
2. **Variable Proportion Production Function**
3. **Linear Homogeneous Production Function**
4. **Cobb-Douglas Production Function**
5. **Constant Elasticity of Substitution Production Function**

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In economics, a **technological change** is an increase in the efficiency of a product or process that results in an increase in output, without an increase in input. In other words, someone invents or improves a product or process, which is then used to get a bigger reward for the same amount of work. Dec 28, 2015

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Macro Environment

By JIM CHAPPELOW | Updated Jan 30, 2020

What Is a Macro Environment?

A macro environment is the condition that exists in the economy as a whole, rather than in a particular sector or region. In general, the macro environment includes trends in the gross domestic product (GDP), inflation, employment, spending, and monetary and fiscal policy. The macro-environment is closely linked to the general business cycle as opposed to the performance of an individual business sector.

KEY TAKEAWAYS

- The macro-environment refers to the broader condition of an economy as opposed to specific markets.
- The macro-environment can be affected by GDP, fiscal policy, monetary policy, inflation, employment rates, and consumer spending.
- The state of the macro environment affects business decisions on things such as spending, borrowing, and investing.

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Impacts of Technology on Society, Economy and Plants

Article Shared by Sanket Suman

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The following three points highlight the top three impacts of technology on environment.

Impact # 1. Technology and Society:

The most dramatic influence of technology has been felt on society. Technological development affects life of every human being.

The effects of technology on society can be studied as under:

a. Consumers' Expectations:

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High expectations of consumers pose a challenge to business community. It provides opportunity to the business houses. Consumers expect that new varieties of products, superior in quality, free from pollution, more safe, more comfortable should be produced and supplied to them at a short notice of time.

b. Relationship between Business and Technology:

Technology's effect can be felt through business. Scientific discoveries have little or no meaning unless there are competent business units to produce for people what science has discovered. Society depends on business to keep the stream of discovery flowing into useful goods and services for mankind.

If there are no business institutions, new discoveries would, remain mere ideas in mind, sketches on paper or models in laboratories. Therefore a business and technology are closely related to each other.

c. Social Changes:

The role of technology on social change can be examined in the following ways:

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(i) Technological change sometimes socially uprset the population and people drift about in search of new centres of employment. Sometimes, this drafting may result in a new geographical distribution of population.

(ii) Technology directly changes the pattern of the social life. Technological advancement tends to remove social differences, the differences between sexes and between parents and children.

(iii) Technology flows to less developed countries mainly through MNC's. With vast resources at their common. MNCs have carved places and images for themselves distinct from local companies. People who are associated with the MNCs are better paid than the people working with the local companies. These people behave like a class apart by themselves.

(iv) In the last, our day to day life is affected by the technology. Even the language we use is changing. New terms continue to emerge. It is correctly said that words are the budges of social change. When our language changes, behaviour will not be far behind.

d. Complexity of System:

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Technology has made the system more complex. Though the modern machines work faster and better. But they fail often because of their complexity. Eventually technology might lead to simplicity and small independent operational units, who work to fulfill of dreams of a common man.

Impact # 2. Technology and Economy:

The impact of technology on economy can be reviewed as stated below:

a. Qualitative and Quantitative Increase in Productivity:

The most significant impact of technology is greater productivity. The example of quantitative increase in more production at less cost. In a hospital, the effect may be qualitative such as maintaining electronic monitoring equipment regardless of its cost.

As a result of increase in productivity, real wages of employees increase and prices of some products decline. Thus the benefit of technology spreads throughout the whole social system. This results in the demand for more technological advancement.

b. Need to Encourage Research and Development:

Instead of importing and buying technology, the Governments in the developing countries should favour research and development regarding science and technology. The institutions and researchers should be encouraged to find our innovation technologies which could make the country self relevant and reduce vulnerability making the maximum use of indigenous resources.

It should arrange for modernisation of both equipment and technology.

At the same time, the Govt., should sponsor the researchers, students and managerial staff to visit abroad and get training because it will help in bringing foreign technology at home. It should ensure availability of technology to all segments of the society.

The R&D wing should be established by the government as it could provide vital inputs to both large and small scale industries. This wing could help according to the nation's specific conditions. There is a strong case for developing labour intensive technologies in all labour surplus backward economies.

c. More Intellectual and Upgraded Jobs:

A job which was earlier handled by an unskilled worker, now requires the services of an educated and competent worker. Office jobs now demand the services of computer experts. Thus the technological development has made the jobs more intellectual and upgraded.

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Some workers will be dislocated unless they are well equipped to work on new machines. This makes it the duty of the businessman to retain the employees. For those, who pickup and acquaint themselves with new technology, the job opportunity should be given in priority basis.

d. Need for Highly Professionalised and Knowledgeable Personnel:

Not only jobs become more intellectual, even the employees tend to become more professional. The organisation shall need scientists, engineers and highly skilled workers on its payroll. The organisation can boast of a progressive and modern personnel.

But motivation of such jobs is a difficult task. They will need attractive remuneration, job security and just treatment. Job retention of such employees is another difficult job. The company has to make several efforts to discourage shifting of jobs by professionalised employees.

e. Need for Bio-Professional and Multi-Professional Managers:

Persons who assume charge of the administration are required to be qualified in management education in addition to the proficiency in chosen fields of specialisation. Today's business needs bio-professional and multi-professional managers.

f. Government Regulations and Public Opposition:

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Another impact of technological development is the ever-increasing regulations imposed on business by the Government and stiff opposition form the public. Government has the power to investigate and ban the products which are harmful for a section of society.

Sometimes these developments invite stiff opposition from public who fear that new innovations are a threat to ecology, privacy, simplicity and even the human race. But the public must be enlightened that the technology is not always harmful. It can be corrective as well as curative also.

g. Insatiable Demand for Capital:

Today's technology is characterised by its insatiable demand for capital. Huge investment of money is required for:

(i) Acquisition or discovery of new ideas & their adoption.

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(ii) Education and training of the managers and other related employees.

(iii) Several other related areas.

Business organisation should not only raise huge amounts of capital, but proper utilisation of the funds for gainful purposes is also a must. This calls for an efficient and effective financial management along-with qualified and competent financial managers.

h. Impact of Changes on Products and Organizations:

Technology refers to change and more change. This poses another threat to business community. A new technology may develop a new industry but destroy an existing one.

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In this changing world, every product is like a mortal human being, subject to a life cycle as shown in the diagram:

Even the organisation which is associated with a particular technology will have the same life pattern as that of the technology.

The use of such an organisation will have the following stages:

In this eight step sequence an organisation takes birth, dies and has its last rites. Thus a new technology have two side of coin which is creative as will destructive.

Fig. LIFE CYCLE OF A PRODUCT

i. Redefinition of Business Boundaries:

(i) Technological change may broaden or narrow generally accepted industry boundaries.

(ii) Technological changes affect the individual companies also in the industry. Due to these changes, the companies may find themselves in different business.

(iii) Technological changes also give rise to product substitution and product differentiation.

(iv) For multiproduct companies, technological change may have multiple impacts. Technological changes can create new things and obsolete the existing ones. Thus technological change influences industry boundaries and structure, product substitution and differentiation, price and quality relationship between products.

Impact # 3. Technology and Plant Level Changes:

a. Impact on Organisational Structure:

Technology in an organisation will have significant impact on the organisation structure, length of the line of command and span of control of the chief executive. No doubt, other factors also influence the organisational structure but the impact of technology is most considerable.

b. Import of Technology:

For the business houses who wish to import technology, there are additional problems. They will have to provide for the training of technicians and supervisors, testing and replacement of raw materials and parts, which are not available locally.

Moreover, the developed countries may not be willing to lend the technology. They will never pass on the key technology such as design know-how, which will help the importing country.

The technology which the developed countries are willing to lend is limited in scope and is mainly aimed at exploiting the markets in which they are interested. Let us assume that there are foreign companies who are willing to transfer the technology, there is still the problem relating to choosing a right collaboration and obtaining clearance from Government.

c. Total Quality Management (TQM):

TQM has been introduced in almost all the organisations. TQM means total commitment of an organisation to quality.

It has the following principles:

(i) Meet the consumers' requirements on time, the first time and 100% of the time.

(ii) The work should be error free.

(iii) To follow the policy that prevention is better than corrections.

(iv) To measure the cost of quality.

d. Business Process Reengineering (BPRE):

Michael Hammer is the father of this process named BPRE which essentially involves considering how things would be done if the organisation were to start all over from the scratch. BPRE helps the organisation in cutting down its costs, eliminating wastes and in improving its quality.

This concept is considered essential in modern competitive world. BPRE will affect the employees considerably because now the jobs will require wider range of skills, more interaction with customers and suppliers, greater challenge, increased responsibilities; but we should remember that its price is very higher.

e. Flexible Manufacturing System:

Under FMS machines are designed to produce batches of different products with flexible manufacturing.

When management wants to produce a new part, it does not change machines, it needs to change only the computer programming because a unique feature of FMS is the integration of computers aided designs, engineering and manufacturing with this they on product low volume products for consumers at a cost comparable to what had been previously possible through mass production.

Under FMS, workers and employees will need more training and higher skills. Moreover, it will need the total restricting of the organisation so that the authority could be decentralised into the hands of the operating teams.

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industry, with security already proving to be a hot area.

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Here are the biggest technology acqusitions of 2020 so far, in reverse chronological order:

13 September: Nvidia to acquire Arm for $40B

Chipmaker Nvidia confirmed the planned acquisition of UK-based chip designer Arm in September for $40 billion in a combined stock-and-cash deal. The purchase sees the Japanese telco Softbank part with an asset it only acquired in 2016.

"Simon Segars and his team at Arm have built an extraordinary company that is contributing to nearly every technology market in the world. Uniting NVIDIA's AI computing capabilities with the vast ecosystem of Arm's CPU, we can advance computing from the cloud, smartphones, PCs, self-driving cars and robotics, to edge IoT, and expand AI computing to every corner of the globe," Jensen Huang, founder and CEO of NVIDIA said in a statement.

Based in Cambridge, England, Arm designs chips for companies such as Nvidia and its rivals to manufacture. "As part of NVIDIA, Arm will continue to operate its open-licensing model while maintaining the global customer neutrality that has been foundational to its success, with 180 billion chips shipped to-date by its licensees," the company said.

In terms of Nvidia's commitment to the UK, it outlined in the announcement that "Arm will remain headquartered in Cambridge," and the company will continue to "attract researchers and scientists from the UK and around the world."

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customers navigate this new world. By aligning our efforts as a single team, we are able to democratise security intelligence for all."

Google acquires Fitbit for $2.1 billion

Google has announced it is acquiring Fitbit for $2.1 billion. The deal is expected to go through in early 2020 following all of the relevant approvals. A company statement also promised that Fitbit will continue to work across Android and iOS.

See larger image Rob Schultz/IDG

The San Francisco-based Fitbit designs and manufactures popular digital fitness trackers and has also branched into smartwatches to keep pace with rivals Apple and Samsung. It also provides corporate wellness programmes for businesses and a set of applications for users to track their fitness.

James Park, cofounder and CEO of Fitbit, said in a statement: "Google is an ideal partner to advance our mission. With Google's resources and global platform, Fitbit will be able to accelerate innovation in the wearables category, scale faster, and make health even more accessible to everyone. I could not be more excited for what lies ahead."

Google has its own wearable software platform – Wear OS – which Rick Osterloh, senior vice president for devices and services at Google, committed to in a blog post.

"By working closely with Fitbit's team of experts, and bringing together the best AI, software and

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technology acquisition

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Technology acquisitions involve bringing in new **technologies** from external sources rather than using the firm's own internal research and development activities. ... By its nature, a **technology acquisition** is a **technology** transfer, with transaction costs associated with the various stages of the **acquisition** process.

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A review of the stages proposed in the literature indicates that there are a number of steps in the process of **technology acquisition** and implementation.

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Technology forecasting

From Wikipedia, the free encyclopedia

Technology forecasting attempts to predict the future characteristics of useful technological machines, procedures or techniques. Researchers create technology forecasts based on past experience and current technological developments. Like other forecasts, technology forecasting can be helpful for both public and private organizations to make smart decisions. By analyzing future opportunities and threats, the forecaster can improve decisions in order to achieve maximum benefits.[1] Today, most countries are experiencing huge social and economic changes, which heavily rely on technology development. By analyzing these changes, government and economic institutions could make plans for future developments. However, not all of historical data can be used for technology forecasting, forecasters also need to adopt advanced technology and quantitative modeling from experts' researches and conclusions.[2]

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2 Important aspects
3 Methods
3.1 Combining forecasts
4 Relative researches and Applications
4.1 Forecasting institutes
4.2 Scientific Journals
4.3 Uses in manufacturing
4.4 Technology forecasting with technology radar
5 See also
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History [edit]

Technology forecasting has existed more than a century, but it developed to an established subject until World War II, because American government started to detect the technology development trend related to military area after the war. In 1945, the U.S. Army Air Forces created a report called *Toward New Horizons*, which surveyed the technology development and discussed the importance for future studies. The report is an indication for the beginning of modern technology forecasting.[3] In the 1950s and 1960s, RAND Corporation developed the Delphi Technique and were widely accepted and used to make smart evaluation for the future.[4] The applications of Delphi Technique are a turning point in the history of technology forecasting, because it became an efficient tool for knowledge building and decision-making, especially for social policy and public health issues.[5] In the 1970s, private sector and government agencies out of military area widely adopted technology forecasting and helped to diversify the users and applications. As the developments of computing technology, advanced computer hardware and software facilitates the process of data sorting and data analysis.The development of Internet and networking is also beneficial for the data access and data transfer.[6] Technology opportunities analysis started since 1990. Improved software can help analysts search and retrieve data information from large complicated database and then graphically represents interrelations.[7] From 2000, more and more new requirements and challenges lead to the modern development of technology forecasting, such as prediction markets, alternate reality games, online forecasting communities and obsolescence forecasting.[3]

Important aspects [edit]

> "**I think we have a cultural affinity for technology that reflects optimism, but we all make poor forecasts.**" — *Jim Moore, director of the Transportation Engineering Program at the University of Southern California*[8]

Primarily, a technological forecast deals with the characteristics of technology, such as levels of technical performance, like speed of a military aircraft, the power in watts of a particular future engine, the accuracy or precision of a measuring instrument, the number of transistors in a chip in the year 2015, etc. The forecast does not have to state how these characteristics will be achieved.

Secondly, technological forecasting usually deals with only useful machines, procedures or techniques. This is to exclude from the domain of technological forecasting those commodities, services or techniques intended for luxury or amusement.

Thirdly, feasibility is a key element in technology forecasting. Forecasters should consider the cost and the level of difficulty of materialization of desires. For example, a computer-based approach "Pattern" is an expensive forecasting method which is not recommended to been used in cases of restricted funds.[2]

Methods [edit]

Commonly adopted methods of technology forecasting include the Delphi method, forecast by analogy, growth curves and extrapolation. Normative methods of technology forecasting—like the relevance trees, morphological models, and mission flow diagrams—are also commonly used. Delphi method is widely used in technology forecasts because of its flexibility and convenience. However, requirement on reaching consensus is a possible disadvantage of Delphi method. Extrapolation can work well with enough effective historical data. By analyzing the past data, forecaster extend the past development tendency in order to extrapolate meaningful outcomes in the future.[9]

Combining forecasts [edit]

Studies of past forecasts have shown that one of the most frequent reasons why a forecast goes wrong is that the forecaster ignores related fields.[9] A given technical approach may fail to achieve the level of capability forecast for it, because it is superseded by another technical approach which the forecaster ignored. Another problem is that of inconsistency between forecasts. The inconsistency between forecasts reflects on the different locations and time used on controlled experiment. It usually produces inaccurate and unreliable data which leads to incorrect insight and faulty predictions.[11] Because of these problems, it is often necessary to combine forecasts of different technologies. In addition, the use of more than one forecasting method often gives the forecaster more insight into the processes at work which are responsible for the growth of the technology being forecast. Combining forecasts can reduce errors compare with a singular forecast. In the case when researches face troubles to pick a typical forecast method, combining forecasts are always the best solution.[12]

Relative researches and Applications [edit]

Forecasting institutes [edit]

- TechCast Project
- Singularity Institute for Artificial Intelligence
- Future of Humanity Institute
- The Millennium Project
- Institute for the Future

Scientific Journals [edit]

- Technological Forecasting and Social Change
- Futures
- Futures & Foresight Science
- Foresight
- Journal of Futures Studies

Uses in manufacturing [edit]

Technology forecasting heavily relies on data and data makes contributions to manufacturing and Industry 4.0. IoT System provides a strong platform to make predictive analysis in the post-Industry 4.0. The advanced technologies will increase forecasting accuracy as well as reliability. As the rapid development of IoT technology, more and more industries will be equipped with sensors and monitors. The emergence of modern manufacturing changes the appearances of factories. IoT system helps managers to monitor and control the production process by collecting, tracking and transferring data. Data is powerful. Managers also can do business analysis based on marketing data. Information such as customer buying preference and market demanding could be collected and used for production estimation.[13]

Trend analysis based on current growth assumption could be used in manufacturing. The analysis strongly helps the cycle time reduction of manufacturing process and energy consumption. In this case, modern technology increases production efficiency as well as economic efficiency.[14]

Technology forecasting with technology radar [edit]

Companies often use technology forecasting to prioritize R&D activities, plan new product development and make strategic decisions on technology licensing, and formation of joint ventures.[15] One of the instruments enabling technology forecasting in a company is a technology radar. Technology radar serves to identify technologies, trends and shocks early on and to raise attention to the threats and opportunities of technological development as well as to stimulate innovation. [16]

Technology radars have successfully been implemented for the purpose of identifying, selecting, assessing and disseminating a company-wide technology intelligence. [17] [18] These Technology Radars follow a certain radar process which itself brings significant value for a company. [19]

- Identification: employees acting as technology scouts from all over the world submit novel technologies to the platform.
- Selection: based on the technology, its potential impact and novelty, a radar team revises submitted technologies and selects the most valid ones.
- Assessment: selected technologies are then assessed on the basis of market opportunity and implementation risk.
- Dissemination: radar displays assessed technologies according to maturity, position in the value chain, and relevance.

See also [edit]

- Accelerating change
- Delphi method
- Forecasting
- Futurology
- List of emerging technologies
- Optimism bias
- Reference class forecasting
- Strategic foresight
- Technology scouting
- Technology roadmap

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External links [edit]

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- TSTC Forecasting The emerging technology & forecasting office at Texas State Technical College
- [1] Unido Technology Foresight Manual.

Wikimedia Commons has media related to *Technology forecasting*.

V · T · E **Emerging technologies** [hide]

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Fourth Industrial Revolution

From Wikipedia, the free encyclopedia

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The **Fourth Industrial Revolution** (or **Industry 4.0**) is the ongoing automation of traditional manufacturing and industrial practices, using modern smart technology. Large-scale machine-to-machine communication (M2M) and the internet of things (IoT) are integrated for increased automation, improved communication and self-monitoring, and production of smart machines that can analyze and diagnose issues without the need for human intervention.[1]

History of technology

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History [edit]

Delphi Method

By ALEXANDRA TWIN | Reviewed By GORDON SCOTT | Updated Mar 6, 2020

What Is the Delphi Method?

The Delphi method is a forecasting process framework based on the results of multiple rounds of questionnaires sent to a panel of experts. Several rounds of questionnaires are sent out to the group of experts, and the anonymous responses are aggregated and shared with the group after each round. The experts are allowed to adjust their answers in subsequent rounds, based on how they interpret the "group response" that has been provided to them. Since multiple rounds of questions are asked and the panel is told what the group thinks as a whole, the Delphi method seeks to reach the correct response through consensus.[1]

KEY TAKEAWAYS

- The Delphi method is a process used to arrive at a group opinion or decision by surveying a panel of experts.
- Experts respond to several rounds of questionnaires, and the responses are aggregated and shared with the group after each round.
- The experts can adjust their answer each round, based on how they interpret the "group response" provided to them.
- The ultimate result is meant to be a true consensus of what the group thinks.

Feedback

Understanding the Delphi Method

idea generation or diffusion—they often further debilitate the weakest parts of the chain, compromising their innovation capabilities overall.

Think Innovation Value Chain

To improve innovation, executives need to view the process of transforming ideas into commercial outputs as an integrated flow—rather like Michael Porter's value chain for transforming raw materials into finished goods. The first of the three phases in the chain is to *generate* ideas; this can happen inside a unit, across units in a company, or outside the firm. The second phase is to *convert* ideas, or, more specifically, select ideas for funding and developing them into products or practices. The third is to *diffuse* those products and practices. Let's examine the activities and challenges associated with each.

Idea generation.
Executives understand that innovation starts with good ideas—but where do these concepts come from? Managers naturally look first inside their own functional groups or business units for creative sparks; they usually find they have a pretty good sense of what's close at hand. The bigger sparks, they discover, are ignited when fragments of ideas come together—specifically, when individuals across units brainstorm or when companies tap external partners for ideas.

Cross-unit collaboration—combining insights and knowledge from different parts of the same company in order to develop new products and businesses—is not easily achieved. Decentralized organizational

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Value chain

From Wikipedia, the free encyclopedia

It has been suggested that *Virtual value chain* be merged into this article. (Discuss) *Proposed since September 2020.*

A **value chain** is a set of activities that a firm operating in a specific industry performs in order to deliver a valuable product (i.e., good and/or service) for the market. The concept comes through business management and was first described by Michael Porter in his 1985 best-seller, *Competitive Advantage: Creating and Sustaining Superior Performance*.[1]

> The idea of the value chain is based on the process view of organizations, the idea of seeing a manufacturing (or service) organization as a system, made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes, and outputs involve the acquisition and consumption of resources – money, labour, materials, equipment, buildings, land, administration and management. How value chain activities are carried out determines costs and affects profits.
>
> — IfM, Cambridge[2]

The concept of value chains as decision support tools, was added onto the competitive strategies paradigm developed by Porter as early as 1979.[dubious – discuss][3] In Porter's value chains, Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service are categorized as primary activities. Secondary activities include Procurement, Human Resource management, Technological Development and Infrastructure (Porter 1985, pp. 11–15).[1][2]

According to the OECD Secretary-General (Gurría 2012)[4] the emergence of global value chains (GVCs) in the late 1990s provided a catalyst for accelerated change in the landscape of international investment and trade, with major, far-reaching consequences on governments as well as enterprises (Gurría 2012).[4]

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What is an **S-curve**? An **S-curve** is defined as: "A display of cumulative costs, labor hours or other quantities plotted against time. The name derives from the **S**-like shape of the **curve**, flatter at the beginning and end and steeper in the middle, which is typical of most projects.

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A **relevance tree** is an analytic technique that subdivides a broad topic into increasingly smaller subtopics thereby showing 'all' possible paths to the objective, and provides a forecast of associated costs, durations and probabilities for each element.

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What is **trend Extrapolation** ? A simple forecasting technique is **trend extrapolation**. This technique simply takes a historical **trend** over time and extrapolates where the **trend** line will be if extended into the future. The general assumption is that whatever happened in the past will continue in the future.

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Interpolation refers to using the data in order to predict data within the dataset. **Extrapolation** is the use of the data set to predict beyond the data set.

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Technological forecasting

Technological forecasting

Technological Forecasting (TF) is concerned with the investigation of new trends, radically new technologies, and new forces which could arise from the interplay of factors such as new public concerns, national policies and scientific discoveries. Many of these forces are beyond the control, influence and knowledge of individual companies.

Technology Foresight is a combination of creative thinking, expert views and alternative scenarios to make a contribution to strategic planning.

The future is almost by definition unknown, but in both forecasting and foresight activities the judgements or opinions of experts are used. Experts can be used singly, or in numbers. Different techniques can be applied to provide either a consensus view, a range of opinions, or maverick views. The kinds of exercises that can be carried out vary enormously in their complexity and structure and in the ease with which they can be managed.

The simple expedient of subscribing to a technical journal, or belonging to a network or collaborative R&D project, or finding out what research is being done by a relevant research organisation, can all be the first stage towards setting up a more structured approach.

Planning the exercise and getting started

When planning to start either forecasting or foresighting it is useful to consider:

- The reasons for doing it.
- What resources will be needed and what resources can be made available.
- How long will it take?.
- How to learn the techniques and improve the overall process.

Establish the need

In order to assess if a more systematic approach will be useful the following factors can be considered:

- The criticality of technologies used by the company.
- The maturity and rate of change of critical technologies.
- The nature of the R&D strategy, (eg whether offensive or defensive).
- The complexity and flexibility of markets and the overall business environment.

The magnitude and direction of technological progress in general is driven by financial investment and by market forces and needs; these must also be watched and monitored as part of any forecasting activity.

Co-ordinating resources

Decisions must be made about who should manage the forecasting process. It is not a task for a junior member of staff. It may need a multidisciplinary team or a single individual with adequate authority to co-ordinate across several departments. In all cases the exercise should first seek to use the knowledge and expertise of individuals within the company. Their specific knowledge of company activities and processes will be useful; much additional information can also be gleaned from their contacts and networks and from their appreciation of the general business environment.

Establish and improve the process: forecasting

The process has two primary activities: information gathering and analysis. The value of the overall process to each company depends on how the two main activities are carried out, how the techniques are customised, and the extent to which the process is followed through to recommendations and actions. They are often applied in iterative or parallel processes. It is not necessary to complete the whole process to appreciate the potential benefits so the process reinforces itself and encourages further iterations.

Activity 1: collection of relevant information

The major issues to be addressed are:

- What information and what kind of data are relevant?
- What sources of information are to be used?
- How accurate is it?.
- What systems need to be set up to provide information and data on technological developments and trends?

Practical decisions arising from consideration of these issues include:

- Which journals to monitor, and how.
- Which conferences and trade fairs to attend.
- How to share information.
- Who should participate in which networks.
- How can an individual's relevant expertise best be used?
- What internal data to collect and external data to acquire.
- How to track performance parameters of competitors' products?

Activity 2: analysis of the data by individuals and by various methods and techniques

The major issues to be addressed are:

- Whose expertise should be used?.
- Which methodologies or techniques are appropriate?.
- Against what criteria or objectives are the analyses to be judged?.
- What data should be used or is relevant?.
- Who are the relevant people to apply the techniques to the data?.

Decisions following from considerations of these issues could result in a greater understanding of the potential contribution and judgement of different experts, within and without the company; more tightly formulated objectives; and a greater understanding of the value of forecasting in general.

Establish and improve the process: foresight

Foresight activity seeks the subjective or intuitive opinions of a number of people with varying degrees of expertise. Opinions need to be collected without bias or misinterpretation. Using different techniques, some more structured than others, experts are asked to project their present knowledge towards how events and trends might develop in the future. They also need to consider what alternatives might be possible within the projected time frame. When setting up a foresight programme it is important to consider:

- What kind of expertise is relevant and how can it be obtained.
- What boundaries to the creativity of the process have to be imposed.
- How can the exercise be aligned to the needs of the organisation that is commissioning the study.

Specific techniques

Forecasting techniques

The formal forecasting techniques are standard components that are described in many textbooks on forecasting techniques (see specific techniques). Specific techniques for forecasting fall into two main categories, exploratory and normative. Information about each technique is available in various references.

- **Exploratory** techniques are primarily concerned with the analysis of historical data. Selected attributes such as functional performance, technical parameters, economic performance etc. are plotted against time. Since it is usually assumed that progress is evolutionary and that technological progress is not random, it is possible to generate characteristic curves or patterns from the data and from these patterns forecasts can be made with varying degrees of certainty. However, changes do occur and the influence and impact of new or surprise factors must not be disregarded. Examples of relevant exploratory techniques are:
  - S-curves
  - cycles
  - trend extrapolation
  - technology substitution

— all of which rely on a large amount of statistical data, which may or may not be available freely.

- **Normative** techniques start by proposing a desired or possible state, such as the satisfaction of a market need or the achievement of a technological development, and work backwards from this to determine the steps necessary to reach the required outcome. The number of foreseeable paths of development from the present position to the objective could range from 'none', implying a completely new technology, to 'several'. Each feasible path to the objective is analysed for its relevance and difficulty. Examples of relevant normative techniques are:
  - relevance trees
  - morphological analysis
  - technology watch and technology monitoring
  - Delphi analysis
  - trend impact analysis
  - technology substitution.

Information needed for these techniques is likely to be more firm-specific than that needed for exploratory techniques. Technology-watch in particular needs a proactive role to help the organisation identify and establish links with the most useful sources of information and opinion; typically these will be at the forefront of innovative activity.

Foresight techniques

The methods and systems used in foresight programmes are drawn from the forecasting field, particularly technology forecasting (see above).

Intuitive thinking is used more in technology foresight than in technology forecasting and is used in a comprehensive and structured form. All intuitive thinking methods are relevant to foresight activities, but only a few of the exploratory and normative methods used in forecasting are applicable to foresight. Which exploratory or normative method to use, under different circumstances, will depend on the requirements of each specific study.

The use of 'vision' is a form of intuitive thinking. When companies formulate a business strategy the vision of key individuals can play an important part. The value of this kind of input is increasingly acknowledged.

It is unlikely that any single method on its own will meet the needs of a foresight programme.

Other methods and techniques that can be used for foresighting include:

- The general classes of **cross-impact simulation**, which try to develop a qualitative understanding of the structure and interrelationships of the situation.
- **Relevance trees**, which investigate the dependence of technologies at one level to technologies at adjacent levels.

Both of these classes of methods provide some elements of semi-quantitative or judgmental analysis.

Patent analysis can be regarded as a specific foresight technique if the implications of the analysis are followed through.

Intuitive thinking is used in technology foresight in a comprehensive and structured form. All intuitive thinking methods are relevant to foresight activities, but only a few of the exploratory and normative methods are applicable. Which exploratory or normative method to use, under different circumstances, will depend on the requirements of each specific study.

Relevance tree

Once an objective has been defined, a *relevance tree* technique can be used to investigate the relevance and feasibility of different ways of achieving it. It provides a means of exploring all the contributing technologies and approaches in a systematic way and highlights the alternative routes and choices that are available, and their consequences. If there is a critical gap which cannot be bridged with existing technology, it could signal an opportunity for a major technological innovation. Each route can then be assessed on criteria such as development cost, probability of success and lead time, and a decision taken relevant to company policy at that time. Expert opinion has to be employed to quantify the consequences and relevance of many of the steps, and there is no 'best' approach, because criteria will be company specific. A methodology using 'relevance numbers', which assigns to each path a proportional relevance with respect to other alternatives at the same level, is a useful tool for reaching a consensus, and for quantitatively comparing relative importance.

Delphi exercises

The *Delphi* technique is used where a consensus of expert opinion is required on the timing, probability and identification of future technological goals or consumer needs and the factors likely to affect their achievement. It is best used in making long-term forecasts and revealing how new technologies and other factors could trigger discontinuities in technological trajectories. The choice of experts and the identification of their level and area of expertise are important; the structuring of the questions is even more important. Experts in non-technological fields can be included to ensure that trends in economic, social and environmental fields are not overlooked.

The exercise usually consists of an iterative process of questionnaire and feedback among the respondents; this process finally yields a Delphi forecast of the range of experts' opinions on the probabilities of certain events occurring by a quoted time. The method seeks to nullify the disadvantage of face-to-face meetings at which there could be deference to authority or reputation, a reluctance to admit error, a desire to conform, or differences in persuasive ability. All of these could lead to an inaccurate consensus of opinion. The quality of the forecast is highly dependent on the expertise and calibre of the experts; how the experts are selected and how many should be consulted are important questions to be answered. If international experts are used, the exercise can take a considerable length of time, or the number of iterations may have to be curtailed. Although seeking a consensus may be important, adequate attention should be paid to views that differ radically 'from the norm' there may be important underlying reasons to justify such maverick views. With sufficient design, understanding and resources, most of the shortcomings of the Delphi technique can be overcome and it is a popular technique, particularly for national foresight programmes.

Benefits

Technology cannot be considered in isolation from environmental, social, economic and political factors and all these factors can affect a company's performance and outlook. The quality of decision-making in strategic planning can be improved by information on these factors and by the knowledge and experience learned from obtaining such information.

Forecasting and foresight extend and expand the benefits of near-term market intelligence and simultaneously stimulate learning and improvement practices.

Forecasting and foresight studies try to shed light upon the nature, magnitude, probability and timing of relevant scientific and technological developments. These can be opportunities or threats and might have a potential impact either on a single enterprise or on several or many enterprises collectively. They might have an impact on supply-chains, industry sectors or consumer markets.

It is sometimes important that national governments and international organisations, such as health and environmental agencies, should set up forecasting and foresight activities. These activities can complement the formal or informal planning, marketing or forecasting and foresight activities set up by business associations and/or individual companies. A co-incidental benefit of national or international studies that are conducted in a participative way is that they can facilitate networking between companies.

Much of the value of engaging in foresight activities at a company level lies in working through the processes themselves rather than just reading the results and formal reports arising from the exercise.

Foresight information can give greater legitimacy to vision statements. A common reason for a company to change its Chief Executive Officer is to inject a new vision into the organisation. Foresighting exercises can provide an alternative way to inject new vision; they are less dependent on the talent or inspiration of a few key individuals. A wide representation of employees can be involved in foresighting, or can learn about its impact and results; this has direct benefits since the vision is already communicated and better understood across the organisation. There are also indirect benefits in terms of empowerment, motivation and learning.

Watch out for

Forecasting must be a continuing activity if it is to bring maximum value and utility to a company. Systematic and longer time-span data will give an improved basis for conducting forecasts, and much can be learnt by comparing previous forecasts with what has actually happened in the intervening period. Forecasting need not be carried out continuously or frequently but it should be repeated at appropriate intervals.

Foresight can be an occasional activity but ideally should be continuous and integrated into the operating philosophy and culture of the company.

If forecasting exercises are not clearly understood and structured they can consume considerable resources of effort and expense.

Before beginning any forecasting exercise it is important to review the need for a forward look, and then match this to the resources available. The quality and usefulness of results are very dependent on the quality of information obtained and the expertise with which it is analysed and used. Deploying too many resources in futures studies can be counter-productive.

The results of the first attempts at forecasting or foresighting may be disappointing. For a variety of reasons there may be a lack of conviction in the early stages of establishing the process. For example: information may not be sufficiently comprehensive or relevant; new sources of data may have to be identified; new contacts or networks may have to be established; the relevance and value of different techniques may have to be reviewed. However, the process should not be abandoned too hastily. Further work will lead to better results. The best way to learn the skills and to evaluate the most useful and relevant sources, inputs and methods for each company, is to actually do it.

A vision or mission statement or defined core competence can narrow the focus of futures studies, but care needs to be taken to prevent the focus becoming too narrow. The value of any study would be reduced if mindsets became too narrow or closed: companies would under such circumstances fail to recognise the potential relevance of certain trends and developments.

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technology substitution

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Definition

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Forecasting technique in which (1) a baseline scenario is constructed using trend extrapolation, (2) future events that may affect this scenario are identified and evaluated on the basis of their probability of occurrence and degree of impact, (3) the combined effect of these events is applied to the baseline scenario to create future scenarios.

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Technology strategy

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- This article is in list format, but may read better as prose. (November 2016)
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Technology strategy (**information technology strategy** or **IT strategy**) is the overall plan which consists of objectives, principles and tactics relating to use of technologies within a particular organization.[1] Such strategies primarily focus on the technologies themselves and in some cases the people who directly manage those technologies. The strategy can be implied from the organization's behaviors towards technology decisions, and may be written down in a document. The strategy includes the formal vision that guide the acquisition, allocation, and management of IT resources so it can help fulfill the organizational objectives.[2]

Other generations of technology-related strategies primarily focus on: the efficiency of the company's spending on technology; how people, for example the organization's customers and employees, exploit technologies in ways that create value for the organization; on the full integration of technology-related decisions with the company's strategies and operating plans, such that no separate technology strategy exists other than the de facto strategic principle that the organization does not need or have a discrete 'technology strategy'.

A technology strategy has traditionally been expressed in a document that explains how technology should be utilized as part of an organization's overall corporate strategy and each business strategy. In the case of IT, the strategy is usually formulated by a group of representatives from both the business and from IT.[3] Often the Information Technology Strategy is led by an organization's Chief Technology Officer (CTO) or equivalent.[4] Accountability varies for an organization's strategies for other classes of technology. Although many companies write an overall business plan each year, a technology strategy may cover developments somewhere between 3 and 5 years into the future.

The United States identified the need to implement a technology strategy in order to restore the country's competitive edge. In 1983 Project Socrates, a US Defense Intelligence Agency program, was established to develop a national technology strategy policy.[5]

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1 Effective strategy
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Effective strategy [edit]

A successful technology strategy involves the documentation of planning assumptions and the development of success metrics.[6] These establish a mission-driven strategy, which ensures that initiatives are aligned with the organization's goals and objectives.[6] This aspect underscores that the primary objective of designing technology strategy is to make sure that the business strategy can be realized through technology and that technology investments are aligned with business. Some experts underscore the successful technology strategy is one that is integrated within the organization's overall business strategy not just to contribute to the mission and vision of the company but also get support from it.[7]

There are frameworks (e.g. ASSIMPLER[8]) available that provide insights into the current and future business strategy, assess business-IT alignment on various parameters, identify gaps, and define technology roadmaps and budgets. These highlight key information, which include the following:

- The important components of information tech-strategy is information technology and strategic planning working together.
- The IT strategy alignment is the capability of IT functionality to both shape, and support business strategy.
- The degree to which the IT mission, objectives, and plans support and are supported by the business mission, objective, and plans.

For a strategy to be effective, it should also answer questions of how to create value, deliver value, and capture value. In order to create value one needs to trace back the technology and forecast on how the technology evolves, how the market penetration changes, and how to organize effectively. Capturing value requires knowledge how to gain competitive advantage and sustain it, and how to compete in case that standards of technology is important. The final step is delivering the value, where firms defines how to execute the strategy, make strategic decisions and take decisive actions. The Strategic Alignment Process is a step by step process that helps managers stay focused on specific task in order to execute the task and deliver value.

Meta-model of (IT) technology strategy [edit]

Aligned with Statement Of Applicability (SOA) approach, IT strategy is composed of IT Capability Model (ITCM) and IT Operating Model (IT-OM) as proposed by Haloedscape IT Strategy Model.[9]

Framework of (IT) technology strategy [edit]

Process of IT Strategy is simplified with framework constituted of IT Service Management (ITSM[10]), Enterprise Architecture Development (TOGAF) and Governance (COBIT). IT Strategy is modeled as vertical IT service applied to and supported by each horizontal layers of SOA architecture. For details, refer Haloedscape IT Strategy Framework.

Typical structure of a (IT) technology strategy [edit]

The following are typically sections of a technology strategy:

- Executive Summary – This is a summary of the IT strategy
  - High level organizational benefits
  - Project objective and scope
  - Approach and methodology of the engagement
  - Relationship to overall business strategy
  - Resource summary
    - Staffing
    - Budgets
    - Summary of key projects
- Internal capabilities
  - **IT project portfolio management** – An inventory of current projects being managed by the information technology department and their status. Note: It is not common to report current project status inside a future-looking strategy document. Show Return on Investment (ROI) and timeline for implementing each application.
  - An catalog of existing applications supported and the level of resources required to support them
  - Architectural directions and methods for implementation of IT solutions
  - Current IT departmental
Includes a SWOT Analysis SWOT analysis
- Strengths
  - Current IT departments strengths
- Weaknesses
  - Current IT department weaknesses
- External Forces
  - Summary of changes driven from outside the organization
  - Rising expectations of users
    - Example: Growth of high-quality web user interfaces driven by Ajax technology
    - Example: Availability of open-source learning management systems
  - List of new IT projects requested by the organization
- Opportunities
  - Description of new cost reduction or efficiency increase opportunities
    - Example: List of available Professional Service contractors for short term projects
  - Description of how Moore's law (faster processors, networks or storage at lower costs) will impact the organization's ROI for technology p
- Threats
  - Description of disruptive forces that could cause the organization to become less profitable or competitive
  - Analysis IT usage by competition
- IT Organization structure and Governance
  - IT organization roles and responsibilities
  - IT role description
  - IT governance
- Milestones
  - List of monthly, quarterly or mid-year milestones and review dates to indicate if the strategy is on track
  - List milestone name, deliverables and metrics

Audience [edit]

A technology strategy document is usually designed to be read by non-technical stakeholders involved in business planning within an organization. It should be free of technical jargon and information technology acronyms.

The IT strategy should also be presented or read by internal IT staff members. Many organizations will circulate prior year versions to internal IT department for feedback. The feedback is used to create new annual IT strategy plans.

One critical integration point is the interface with an organization's marketing plan. The marketing plan frequently requires the support of a web site to create an appropriate on-line presence. Large organizations frequently have complex web site requirements such as web content management.

Implementation [edit]

The implementation of technology strategy will likely follow the conventional procedure taken when implementing a business strategy or an organization's planned changes within the so-called change management framework. Fundamentally, it is directed by a manager who oversees the process, which could include gaining targeted organizational members' commitment to an innovation.[11] There are a number of strategic options available when implementing a technology strategy and one of these involves the structured approach.[12] For instance, in the area of systematic exploration of emerging technologies, this approach help determine the relevance and opportunities offered by new technologies to business through its well-defined assessment mechanisms that can effectively justify adoption.[7]

Relationship between strategy and enterprise technology architecture [edit]

A technology strategy document typically refers to but does not duplicate an overall enterprise architecture. The technology strategy may refer to:

- High-level view of logical architecture of information technology systems
- High-level view of physical architecture of information technology systems
- Technology rationalization plan

See also [edit]

- Business strategy
- Enterprise planning systems
- Project portfolio management
- Second half of the chessboard
- Strategy

Notes [edit]

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Technology transfer

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Technology transfer, also called **transfer of technology** (**TOT**), is the process of transferring (disseminating) technology from the person or organization that owns or holds it to another person or organization. These transfers may occur between universities, businesses (of any size, ranging from small, medium, to large), governments, across geopolitical borders, both formally and informally, and both openly and secretly. Often it occurs by concerted effort to share skills, knowledge, technologies, manufacturing methods, samples, and facilities among the participants. to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials, or services. It is closely related to (and may arguably be considered a subset of) knowledge transfer. Horizontal transfer is the movement of technologies from one area to another. At present[when?] transfer of technology is primarily horizontal. Vertical transfer occurs when technologies are moved from applied research centers to research and development departments.[1]

Technology transfer is promoted at conferences organized by such groups as the Ewing Marion Kauffman Foundation and the Association of University Technology Managers, and at "challenge" competitions by organizations such as the Center for Advancing Innovation in Maryland. Local venture capital organizations such as the Mid-Atlantic Venture Association (MAVA) also sponsor conferences at which investors assess the potential for commercialization of technology.

Technology brokers are people who discovered how to bridge the emergent worlds and apply scientific concepts or processes to new situations or circumstances.[2] A related term, used almost synonymously, especially in Europe, is "technology valorisation". While conceptually the practice has been utilized for many years (in ancient times, Archimedes was notable for applying science to practical problems), the present-day volume of research, combined with high-profile failures at Xerox PARC and elsewhere[citation needed], has led to a focus on the process itself.

Whereas technology transfer can involve the dissemination of highly complex technology from capital-intensive origins to low-capital recipients (and can involve aspects of dependency and fragility of systems), it also can involve appropriate technology, not necessarily high-tech or expensive, that is better disseminated, yielding robustness and independence of systems.

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Transfer process [edit]

Many companies, universities and governmental organizations now have an Office of Technology Transfer (TTO, also known as "Tech Transfer" or "TechXfer") dedicated to identifying research which has potential commercial interest and strategies for how to exploit it. For instance, a research result may be of scientific and commercial interest, but patents are normally only issued for practical processes, and so someone—not necessarily the researchers—must come up with a specific practical process.[3] Another consideration is commercial value; for example, while there are many ways to accomplish nuclear fusion, the ones of commercial value are those that generate more energy than they require to operate.

The process to commercially exploit research varies widely. It can involve licensing agreements or setting up joint ventures and partnerships to share both the risks and rewards of bringing new technologies to market. Other corporate vehicles, e.g. spin-outs, are used where the host organization does not have the necessary will, resources or skills to develop a new technology. Often these approaches are associated with raising of venture capital (VC) as a means of funding the development process, a practice more common in the United States than in the European Union, which has a more conservative approach to VC funding.[4] Research spin-off companies are a popular vehicle of commercialisation in Canada, where the rate of licensing of Canadian university research remains far below that of the US.[5]

Technology transfer offices may work on behalf of research institutions, governments and even large multinationals. Where start-ups and spin-outs are the clients, commercial fees are sometimes waived in lieu of an equity stake in the business. As a result of the potential complexity of the technology transfer process, technology transfer organizations are often multidisciplinary, including economists, engineers, lawyers, marketers and scientists. The dynamics of the technology transfer process has attracted attention in its own right, and there are several dedicated societies and journals.

There has been a marked increase in technology transfer intermediaries specialized in their field since 1980, stimulated in large part by the Bayh-Dole Act and equivalent legislation in other countries, which provided additional incentives for research exploitation.

Partnership intermediaries [edit]

The U.S. government's annual budget funds over $100 billion in research and development activity, which leads to a continuous pipeline of new inventions and technologies from within government laboratories.[6] Through legislation including the Bayh-Dole Act, Congress encourages the private sector to use those technologies with commercial potential through technology transfer mechanisms such as Cooperative Research and Development Agreements, Patent License Agreements, Educational Partnership Agreements, and state/local government partnerships.

The term "partnership intermediary" means an agency of a state or local government—or a nonprofit entity owned, chartered, funded, or operated by or on behalf of a state or local government—that assists, counsels, advises, evaluates, or otherwise cooperates with small business firms; institutions of higher education defined in section 201(a) of the Higher Education Act of 1965 (20 USC § 1141 [a]); or educational institutions within the meaning of section 2194 of Title 10, United States Code, that need or can make demonstrably productive use of technology-related assistance from a federal laboratory, including state programs receiving funds under cooperative agreements entered into under section 5121 of the Omnibus Trade and Competitiveness Act of 1988 (15 USC § 2781).[7]

Drawbacks [edit]

Despite incentives to move research into production, the practical aspects are sometimes difficult to perform in practice. Using DoD technology readiness levels as a criterion (for example), research tends to focus on TRL (technology readiness level) 1–3 while readiness for production tends to focus on TRL 6–7 or higher. Bridging TRL-3 to TRL-6 has proven to be difficult in some organizations. Attempting to rush research (prototypes) into production (fully tested under diverse conditions, reliable, maintainable, etc.) tends to be more costly and time-consuming than expected.[8]

See also [edit]

- Angel investor
- Bayh-Dole Act
- Business incubator
- Commercialization
- Commercialization Reactor
- Diffusion of innovations
- Discovery (observation)
- Innovation
- Intellectual property
- Invention
- Licensing Executives Society International
- Open innovation
- Patent
- Prior art
- Seed money
- Startup company
- Technology assessment
- Technology licensing office (TLO)
- Technological revolution
- Value chain
- Venture capital
- New product development

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TECHNOLOGY TRANSFER

Technology transfer is a fast-growing activity in the U.S. research and development system, and one which has received substantial attention from governments, industry, and universities. The exact nature of this activity is difficult to pin down, partly because the term has many different connotations. Some of the varieties of technology transfer commonly discussed in business periodicals (such as the *Wall Street Journal*) include:

- International technology transfer: the transfer of technologies developed in one country to firms or other organizations in another country. In the U.S., this issue is often associated with the undesired transfer of weapons technology to "hostile" nations.
- North-South technology transfer: activities for the transfer of technologies from industrial nations (the North) to less-developed countries (the South), usually for the purpose of accelerating economic and industrial development in the poor nations of the world.
- Private technology transfer: the sale or other transfer of a technology from one company to another.
- Public-private technology transfer: the transfer of technology from universities or government laboratories to companies.

While all four types of technology transfer are of concern to businesses, this overview will deal mostly with the first two types. International technology transfer and North-South technology transfer these activities tend to be driven directly by foreign policy and national defense concerns, while the other two types are driven by a balance of corporate and policy interests.

WHAT IS TECHNOLOGY TRANSFER?

Technology is information that is put to use in order to accomplish some task. Transfer is the movement of technology via some communication channel from one individual or organization to another. Technology is the useful application of knowledge and expertise into an operation.

Technology transfer usually involves some source of technology, group which possess specialized technical skills, which transfers the technology to a target group of receptors who do not possess those specialized technical skills, and who therefore cannot create the tool themselves (Carayannis et al., 1997). In the United States especially, the technology transfer experience has pointed to multiple transfer strategies, two of which are the most significant: the licensing of intellectual property rights and extending property rights and technical expertise to developing firms.

The major categories of technology transfer and commercialization involve the transfer of:

1. technology codified and embodied in tangible artifacts
2. processes for implementing technology
3. knowledge and skills that provide the basis for technology and process development.

WHY TRANSFER TECHNOLOGY?

Most technology transfer takes place because the organization in which a technology is developed is different from the organization that brings the technology to market. The process of transferring a technology from its place of origin to the marketplace is called technology commercialization. In many cases, technology commercialization is carried out by a single firm. The firm's employees invent the technology, develop it into a commercial product or process, and sell it to customers. In a growing number of cases, however, the organization that creates a technology does not bring it to the market. There are several potential reasons for this:

- If the inventing organization is a private company, it may not have the resources needed to bring the technology to market, such as a distribution network, sales organization, or simply the money and equipment for manufacturing the product. (These resources are called complementary assets). Even if the company has those resources, the technology may not be viewed as a strategic product for that firm, especially if the technology was created as a byproduct of a research project dealing with a different objective.
- If the inventing organization is a government laboratory, that laboratory is forbidden in general by law or policy (in the United States) from competing with the private sector by selling products or processes. Therefore, the technology can only be brought to market by a private firm.
- If the inventing organization is a university, the university usually does not have the resources, expertise to produce and market the products from that technology. Also, if the technology was developed with funding from the federal government, U.S. law strongly encourages the university to transfer the technology to a private firm for commercialization.

From a public policy perspective, technology transfer is important because technology can be utilized as a resource for shared prosperity at home and abroad. As a resource, technology (1) contains a body of knowledge people need to know how; (2) acts as a stimulant to healthy competitive international trade, (3) is linked with other nations' commercial needs, and (4) needs an effective plan for management and entrepreneurship from lab to market.

From a business perspective, companies engage in technology transfer for a number of reasons:

- Companies look to transfer technologies from other organizations because it may be cheaper, faster, and easier to develop products or processes based on a technology someone else has invented rather than to start from scratch. Transferring technology may also be necessary to avoid a patent infringement lawsuit, to make that technology available as an option for future technology development, or to acquire a technology that is necessary for successfully commercializing a technology the company already possesses.
- Companies look to transfer technologies from organizations as a potential source of revenue, to create a new industry standard, or to partner with a firm that has the resources or complementary assets needed to commercialize the technology.

For government laboratories and universities, the motivations for technology transfer are somewhat different:

- Governments or universities may transfer technology from outside organizations if it is needed to accomplish a specific goal or mission (for example, universities may transfer in educational technologies), or if that technology would add value to a technology the government or university is hoping to transfer out to a company.
- Government laboratories and universities commonly transfer technologies to other organizations for economic development reasons (to create jobs and revenues for local firms), as an alternate source of funding, or to establish a relationship with a company that could have benefits in the future.

HOW DO YOU TRANSFER TECHNOLOGY?

The first requirement for an organization to transfer a technology is to establish legal ownership of that technology through intellectual property law. There are four generally recognized forms of intellectual property in industrialized nations:

- patents, dealing with functional and design inventions
- trademarks, dealing with commercial origin and identity
- copyrights, dealing with literary and artistic expressions
- trade secrets, which protect the proprietary capabilities of the firm

Under U.S. law, a patent is granted only by the federal government and lets the patentee exclude others from making, using, selling or offering an invention for a fixed term, currently 20 years from the date the patent application is filed. The number of patents granted by the U.S. government is up by 21 percent in 2003. A trademark, as defined under the Trademark Act of 1946 (The Lanham Act) is "any word, name, symbol, or device, or any combination thereof (1) used by a person, or (2) which a person has a bona fide intention to use in commerce…to identify and distinguish his or her goods, including a unique product, from those manufactured or sold by others, and to indicate the source of the goods, even if that source is unknown."

A copyright seeks to promote literary and artistic creativity by protecting, for a limited time, what the U.S. Constitution broadly calls writings of authors. The general rule in the United States for a work created on or after January 1, 1978, whether or not it is published, is that copyright lasts for the author's life-time plus 50 years after the author's death. The copyright in a work made for hire or in an anonymous work lasts for 75 years from publication or 100 years from creation, whichever is shorter.

A trade secret is information that an inventor chooses not to disclose and to which the inventor also controls access, thus providing enduring protection. Trade secrets remain in force only if the holder takes reasonable precautions to prevent them from being revealed to people outside the firm, except through a legal mechanism such as a license. Trade secrets are governed by state rather than federal law.

The second step in technology transfer is finding a suitable recipient for that technology—one that can use the technology and has something of value to offer in return. Firms are now studying more systematically the process of licensing and technology transfer. There are five information activities needed to support technology transfer:

- technology scouting—searching for specific technologies to buy or license.
- technology marketing—searching for buyers for a technology, the inverse of tech scouting; also searching for collaborators, joint venture or development partners, or investors or venture capital to fund a specific technology.
- technology assessment—evaluating technology, aimed at answering the question "what is this technology worth?" Includes research of any intellectual properties, and market and competitor assessments.
- transfer-related activities—information about the transfer process itself, such as licensing terms and practices, contracts, conducting negotiations, and how to do the transfer successfully.
- finding experts—to assist in any of the above areas. A common saying in the field is, "technology transfer is a contact sport."

These information needs are often supported by service companies, such as licensing consultants, and by electronic media, including databases and online networks. Some new online networks use the Internet to help firms in these information activities.

The information-transfer process is one of the most critical steps in technology transfer. New licensing practices are designed to address this process. For example, many licenses now bundle both the basic technology and the equipment needed to utilize that technology in a single agreement. A license may also include a "know-how" agreement, which exchanges relevant trade secrets (with appropriate protections) to the licensee to help in exploiting technology. In some industries, such as petroleum exploration, firms even practice wet licensing, whereby employees of the licensee are loaned out to the licensee to teach how a technology should be properly used.

The major barrier to the increase in technology transfer among firms is organizational behavior. In the past, cultural blocks such as the "not invented here" syndrome prevented firms from even showing interest in technology transfer. New concepts along the lines of knowledge management are changing behaviors and beliefs, leading firms to examine the resources they have in-house that could be made through the active pursuit of licensing.

Once the organization has at least started to establish ownership of the technology, there are several possible legal and/or contractual mechanisms for transferring technology from one organization to another:

- licensing—the exchange of access to a technology and perhaps associated skills from one company for a regular stream of cash flows from another.
- cross-licensing—an agreement between two firms to allow each other use of or access to specific technologies owned by the firms.
- strategic supply agreement—a long-term supply contract, including guarantees of future purchases and greater integration of activity than a casual market relationship. One prominent example is the second-source agreements signed between semiconductor chip manufacturers.
- contract R&D—an agreement under which one company or organization, which generally specializes in research, conducts research in a specific area on behalf of a sponsoring firm.
- joint or cooperative R&D agreement—an agreement under which two or more companies agree to cooperate in a specific area of R&D or a specific project, coordinating research efforts across the partner firms and with sharing of research results.
- R&D corporation or research joint venture—the establishment of a separate organization, jointly owned by two or more companies, which conducts research on behalf of its owners. A notable example is Bellcore, which originally was established by the seven Regional Bell Holding Companies of the United States and which would conduct research and set standards for the local telephone system.
- research consortium—any organization with multiple members formed to conduct joint research in a broad area, often in its own facilities and using personnel on loan from member firms and/or direct hires. The Microelectronics and Computer Technology Corporation (MCC) and Semiconductor Manufacturing Technology (SEMATECH) are examples of such organizations.

The choice of which mechanism to use in a particular technology transaction depends on many factors, including the stage of development for that technology, what the company receiving the technology is willing or able to pay, what technology or other assets it might be able to offer in place of money, the likely benefits of establishing a longer-lasting partnership between the organizations instead of a onetime transfer, and the exact legal status of ownership over that technology. For example, if a small firm simply wants to sell its technology to a large firm in exchange for money, it will probably choose to license the technology. If the small firm also wants access to the large firm's complementary assets, such as its production facilities and distribution network, it will try to negotiate a more substantial and permanent relationship, such as an R&D contract or a cooperative R&D agreement.

PRIVATE TECHNOLOGY TRANSFER

Technology transfer between private companies is most commonly accomplished through licensing, although other mechanisms such as joint ventures, research consortia, and research partnerships are also quite popular. Licensing is a big business by itself. In 2002 U.S. companies received over $66 billion in payments on technology licenses from other companies, of which $16 billion was from domestic sources. Data from the U.S. Department of Commerce compiled in the mid-1990s indicated that international technology licensing was rising at approximately 18 percent per year, and domestic technology licensing was rising at 10 percent per year.

Another growing mode of private technology transfer is the formation of research joint ventures (RJVs) between companies in the United States. For years, such joint ventures were rare, mostly due to fears among companies that joint ventures would provoke antitrust prosecution from the government. Passage of the National Cooperative Research Act (NCRA) in 1984 and the National Cooperative Research and Production Act in 1993 relaxed antitrust regulation of such partnerships, leading to a substantial increase in RJVs.

Studies of the filings of RJVs registered with the Department of Justice under the NCRA shows some interesting trends:

- Although multi-firm consortia such as SEMATECH and the Microelectronics and Computer Corporation (MCC) attract the most interest, about 85 percent of RJVs involve only two firms.
- Most RJVs focus on developing process technologies rather than product technologies, as processes are viewed as pre-competitive technologies in many industries.
- The largest concentration of RJVs focus on telecommunications, while software and computer hardware are also leading industries for RJV activity. These industries have significant impact on technological advances in other industries, and therefore attract much interest for partnering firms. Not surprisingly, RJVs are less common in the chemical and pharmaceutical industries, probably because process technologies have greater competitive impact in those industries than in others.

Research joint ventures are advantageous means of acquiring high-risk technologies, for several reasons. First, joint ventures enable the risks and costs involved in early research in technology to be shared across multiple firms, reducing the burden on each individual company. Second, the resources and expertise needed to develop new technologies may be distributed across multiple firms, so RJVs are the only way to combine those resources in one effort. Third, in industries where technology advances quickly, RJVs are an effective way to keep up with new developments. Finally, RJVs are often used to develop and set critical technical standards in certain industries, especially telecommunications. These reasons indicate that RJVs will continue to increase in significance as a tool for technology transfer.

TECHNOLOGY TRANSFER FROM GOVERNMENT TO INDUSTRY

In an effort to increase the application of government research results to industry technology problems (and therefore fuel technology-based economic growth), the United States government has passed a series of laws since 1980 to encourage the transfer of technologies from government laboratories to industry. Technology licensing was the earliest focus of activity, based on the notion that government laboratories were like treasure chests of available technologies that could easily be applied to corporate needs. In fact, government technology licensing activity is extremely limited, except in the National Institutes of Health. The NIH has been the source of several groundbreaking therapies and other medical technologies and enjoys close relations with the pharmaceutical industry, enabling the agency to gain large amounts of licensing revenue.

Other agencies face substantial difficulties in licensing technologies. Often, their technologies require substantial development before commercialization, reducing their value to firms. Also, most government laboratories do research in areas where there is no clear, consistent path to commercialization as exists in the pharmaceutical industry. The uncertainty of commercialization also diminishes the willingness of firms to purchase technology licenses from laboratories.

Instead, most agencies have focused on signing Cooperative Research and Development Agreements (CRADAs), a mechanism developed under the 1986 Federal Technology Transfer Act. CRADAs are contracts to conduct joint R&D projects, where the government laboratory contributes personnel and equipment, while the partner contributes these assets as well. The number of CRADAs signed by government agencies has increase steadily in recent years.

There are several potential benefits and potential difficulties involved in CRADA research relationships:

- Transfer of product and process technologies can have a significant impact on recipient firms' business performance. For example, the invention of an improved method for delivering the medication paclitaxel was licensed by the National Institutes of Health to Bristol-Myers-Squibb as the product Taxol, which has since become a leading treatment for breast and ovarian cancer. However, there is no data to show what portion of transfers are successful versus those which are not.
- Technology transfer may or may not result in commercial products. A survey of 229 technology transfer projects at 29 federal laboratories, conducted by the Georgia Institute of Technology, found that 22 percent of the projects resulted in new commercial products, while 36 percent contributed to products under development. Interestingly, in 13 percent of the projects, new product development or product improvement was never a goal.
- Laboratories' views on technology transfer can affect success. Now that most of the legal barriers to technology transfer have apparently been eliminated by congressional legislation, the true barriers are generated by the culture of the laboratories and the attitudes of researchers and laboratory administrators. For example, in several cases firms have complained that laboratory researchers were not used to meeting the strict timetables on project completion that private sector researchers must observe.
- Technology transfer, especially in joint research, can aid the government laboratory as well. A report by the GAO examining ten CRADA projects found that the laboratories can also benefit from technology transfer, for example, through enhanced expertise for researchers, development of technologies that also support the laboratory's mission, acquisition of sophisticated equipment and infrastructure, and increased laboratory revenues from industrial sources.

UNIVERSITY-INDUSTRY TECHNOLOGY TRANSFER

One of the original pieces of U.S. technology-transfer legislation, the Bayh-Dole Act, directed government agencies to encourage universities and other research organizations to license out technologies developed with federal funding. Since 1980, this activity has become a small but growing source of revenue for universities. Technology transfer from academic research institutions to industry continues to grow, according to the annual survey of the Association of University Technology Managers. The 2003 survey shows that increasing numbers of research institutions are forging licensing agreements with commercial entities to bring newly developed technology and products to the market. In 2003, the 165 institutions of higher education responding to the survey reported receiving close to $1 billion in licensing revenue in 2003, a 1 percent increase over 2002.

Commercial institutions pay royalties for the right to put inventions and discoveries from universities to commercial use in products such as computer-imaging technology, medical diagnostic testing, and treatment of disease. Institutions of higher education, in turn, can use the revenue to increase investments in research and development. This technology transfer also leads to sponsored research agreements between firms and universities, often to undertake additional research needed to commercialize technologies. Universities now receive approximately 7 percent of all research funding from industry, compared to about 3 percent in the 1970s. Institutions of higher education also reported spinning off nearly 350 companies and receiving 3,450 U.S. patents for new technologies and inventions. Since fiscal year 1996 when the question was first asked, 178 U.S. survey respondents have reported a total of 2,230 new products introduced to the market place.

For industry, universities offer the best way to acquire basic technological research as those activities are curtailed within firms. Universities also house experts in very focused fields of study that are likely to have benefits to a small number of firms. Finally, joint industry-university research is viewed as an important recruiting tool in today's competition for scientific talent, since industry-funded projects are often carried out by graduate students who later go to work for their former sponsors.

Technology transfer is a valuable mechanism by which industry can accelerate its innovation activities and gain competitive advantage through cooperation. Technology transfer can also boost overall economic growth and regional economic development. While further study is needed to estimate the exact benefits gained from technology transfer and ways to achieve those benefits, it is clear that this is an activity that is becoming a central feature of the U.S. research and development system.

SEE ALSO: Joint Ventures and Strategic Alliances ; Licensing and Licensing Agreements ; Technology Management

Elias G. Carayannis and

Jeffrey Alexander

Revised by Badie N. Farah

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Technology Transfer Methods

by **Denis** on August 17, 2013 in **Business Development**, **Technology Transfer**

The choice of a technology transfer method should be based on technology analysis, future strategy of cooperation with a company's supplier, investment resources and technical capacities of the company to implement the technology.

When choosing a transfer method, it is necessary to understand that the more complex is the technology, the closer should the connections be between the buyer and the supplier. As noted earlier, technology transfer doesn't end with equipment delivery. In itself, equipment doesn't generate new competences. The real changes in the company's work can be introduced by transfer of knowledge, skills, and intellectual property rights.

Let's try to consider main technology transfer methods, their strengths and weaknesses:

Licensing

Licensing is an agreement under which the owner of a patent, trademark or other intellectual property gives permission to another company to use the technology developed by him (her), in a certain area during a certain period of time.

There are two main types of licenses: 1) one who grants an exclusive right to use the technology; 2) another with non-exclusive right, which implies that the patent owner may transfer the right to use the technology to other companies in the same area.

Additionally, the licensing agreement could include a sublicensing clause which permits the licensee to grant to someone else the right to use the technology.

The advantage of buying a license/patent is that it has lower costs, compared with other technology transfer methods. However, the purchase of a license requires sufficient knowledge, experience, relevant expertise and manufacturing base for the further in-house technology implementation.

Support Contract

According to this agreement, the technology owner participates in the technology implementation, providing at each stage of the transfer technical support, as well as personnel training.

The involvement of technology developer in the technology transfer process ensures a closer cooperation between two parties which favors a complete transfer of all knowledge and skills related to the technology. In this way, the support contract may be a part of the licensing agreement, in order to improve the transfer efficiency.

Joint Venture

A joint venture is an agreement concluded between two or more companies in order to execute a particular business. The joint venture implies mutual assets, management, risks, profit sharing, co-production, services and marketing.

Benefits from a joint venture in case of technology transfer are the following: long-term cooperation between the parties, motivation of all participants in the successful transfer, lower costs than if the companies have been working separately.

The disadvantages of a joint venture are often associated with the different vision and goals of both partners, their inability to be independent in management. Also, companies are not always able to determine objectively the value of capital contributed by each of them and, therefore, subsequent profits distribution. (The foreign company provides innovative technology and management competence, while the local company is familiar with the market and regulation. Finally it is difficult to determine the value of each asset).

Franchising

Franchising is an agreement where one company grants to another the right to use its trademark and business model. The buyer of the franchise starts manufacturing and selling the goods according to the seller's specification. Normally, the company owner of a trademark also shares its experience in operating and managing the franchised product/technology.

The main advantage of franchising is the fact that the company gets an already-made brand. With the franchised product, the company acquires a proven business model, knowledge in management and marketing.

The disadvantages are the company's dependence on the technology owner. In most cases, the company has to purchase raw materials, equipment and other products from specific vendors. It must follow internal rules and procedures of the technology owner. Generally, the company cannot bring the product to other markets as well as sale the franchise. In addition, the decline of the franchise owner reputation could have an impact on the company that has bought its franchise.

Strategic Alliance

A strategic alliance agreement is usually concluded between two or more big companies in order to use specific skills of each of them in the development of new innovative technologies. Strategic alliance could be in form of joint laboratories, research programs, production and promotion of a new product.

Typically mutual efforts of different partners give better results than an independent development of a new technology. During joint operations, each company can get the needed experience in new areas and in different forms of management.

The major weakness of strategic alliances is the complexity in managing companies with different cultures. There will be at least two teams of managers with different approaches. The companies may have different goals and strategies in further business development of the new technology.

Turnkey Agreement

In case of a turnkey agreement, the general contractor is responsible for all the procedures related to technology transfer, such as technology design, financing, equipment supply, construction and commissioning.

The advantages of a turnkey agreement are that the company concludes a contract only with one supplier who takes full responsibility for the project execution, except a force majeure; the project will have a fixed price; the supplier guarantees the performance and the efficiency of technology.

The disadvantages could be the following: company should know in advance all the features and output parameters which the technology should have after its launch; a complex or large-scale technology requires a deep knowledge in the corresponding field (in this case an independent expert organization could be employed to determine the technology's features and output characteristics); transfer price under a turnkey agreement is generally much higher than with any other method (the more risks the supplier takes, the higher the price is); during the transfer implementation, a company doesn't have full control over the progress and quality of each stage of the transfer; contractor's financial problems may lead to the project suspension (it is difficult for company to determine supplier's financial capacity and its ability to self-finance all stages of the transfer).

One of the ways to reduce the risks of the turnkey agreement is to involve the supplier in the capital of the new entity. This will motivate the supplier to ensure the quality of the new technology, as well as it will bring the supplier's experience in the further operational processes.

Equipment Acquisition

Equipment Acquisition is a simple and, therefore, one of the most common methods of technology transfer. The main disadvantage of this method is the fact that the company limits itself to mere technical knowledge incorporated in the equipment and does not get any new competences in the management and production. Moreover, equipment available on the market does not give unique privilege to the buyer, as this equipment may be purchased by any other competitor.

Management Contract

Technology can be transferred through a competent expert, who could be "entice" from another company.

This method of technology transfers involves minimum costs. But, generally, it can be effective only for small projects with relatively simple technology. Furthermore, technology should not be patented.

Foreign Company Acquisition

A company may acquire a foreign startup which is developing a new technology. As a result, the company will not only get the technology, but also a team capable to develop it in the future. Moreover, the acquisition of a foreign firm automatically places the company on the new international market.

Among the main risks of buying an existing firm, is the possible resignation of key employees after the acquisition. Besides, the founders of the successful startup would agree to sell it only for a price significantly higher than the market. This increases the risk of the profitability in the future.

Direct Foreign Investments

Direct foreign investments is one of the main methods of technology transfer at the state level. Generally, a foreign company invests in developing countries in order to create a new market, remove export barriers and get an access to cheap labor.

In this case, a developing country gets all the benefits of technology transfer, particularly the development of its own research environment. Besides, it is a way to create new jobs and raise taxes.

However, to attract foreign investors, the developing country's government, generally, has to make some concessions in its policy. As we can see in practice, without these concessions large international corporations are not motivated in long term investments in developing countries.

Buy-Back Contract

A buy-back contract is a form of agreement between developing countries and large foreign companies. Under this agreement, a foreign company supplies industrial equipment in exchange for profits derived from the sale of raw materials or goods produced on this equipment. This kind of technology transfer is often used in the construction of new plants in the developing countries. In that case the state becomes a shareholder in the created enterprise.

For a developing country this represents a possibility to get a high-tech equipment without direct investment in it. Moreover, the foreign company is responsible for the performance of supplied technologies.

Potential disadvantages of a buy-back contract are the motivation of the foreign company to start production at least costs which, certainly, will affect the execution quality. Typically, under a buy-back agreement the price for a new technology is much higher than in case of direct investments.

Original equipment manufacturer (OEM)

OEM can be considered as a form of subcontracting, where a local firm starts manufacturing according to the foreign company specifications.

A foreign company transfers a part of its technologies and equipment. It conducts training and management reorganization. Afterwards, the foreign company sells produced goods through its own channels and under its own trademark.

OEM agreement enables local companies to absorb new technologies and to reorganize their production. With new equipment and skills, these firms can produce new goods for the domestic market under its own brand.

The main drawback of this agreement is the obligation to supply to the foreign company products at a fixed price which is normally much lower than the market one.

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RAJU DHANANJAY REDDY March 25, 2016 at 3:39 pm #

Sir,
By way of introduction, I'm an associate member of Ravikumar Associates and Ganadadri Infra Pvt Ltd.
We have decide to venture in to the coatings manufacturing line of activity.
We request you to provide us assistance in establishing a resin and paint manufacturing company on turnkey basis.
We require the very best state of art technology and solutions.
We will sincerely appreciate if you can kindly help us in this regard. Please suggest the following:
1) We would like to begin with an initial investment of 1 or 2 crores depending on the viability.
2) We would like to go in to the manufacture of Finished and Under Coatings (Enamels, Distempers. Emulsions, Primer Wall and Wood, Putty Walls and Wood) and Adhesive Resins and Binding Products.
We have an export market and would like to get the best product possible to compete in the market.
Please let us know your terms and conditions, including your fees structure.
Thanks and regards,
RDS Reddy
9866844002

REPLY

sam eno July 3, 2020 at 2:57 pm #

This paper has gainanized our interest in our project. we are interested in the transfer methanol fuel production technology from Israel. which steps should we take and what advise will you give to us to successfully transfer this technology from Israel

REPLY

ELIBARIKI MUNGWE September 8, 2020 at 11:24 pm #

Very excellent understandable explanation

REPLY

ELIBARIKI MUNGWE September 8, 2020 at 11:25 pm #

Good detailed

REPLY

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SUNDAY, JANUARY 30, 2011

Technology Transfer & Routes of Technology Technology Transfer

What is technology transfer ? Briefly discuss various routes of technology transfer. Give an example of specific route of technology transfer as adopted by an organisation.

Ans : Basically there are two ways of acquiring new technology : first is Develop it or purchase it; the second way of acquiring technology is commonly called "Technology Transfer".

The important reasons for purchasing technology are :

a) It involves little or no R & D investment.

b) Technology can be used quickly; and

c) Technological and financial risks are often quite low.

There are also good reasons for selling technology, such as :

a) Increasing return on investment

b) Technology may not have immediate use.

c) Technology has already been utilised up to its limit.

Therefore, technology transfer occurs because of existence of 'Buyers' and 'Sellers'. The sellers are called "tranferers" or "licensors" and buyers are called "transferees" or "licensees". Therefore Technology transfer is simply the acquisition and use of knowledge. There is no transfer of technology unless and until technological knowledge is put to use. Technology transfer is not restricted to scientific and engineering items. The manufacturing, marketing, distribution and customer service are among the factors that are included in the technology transfer.

The key factors in technology transfer include:

1. Transplantation of technology: involves shift from onset of well defined conditions to another set in which at least one key variable may differ. Secondly the recipient may apply the technology to a different purpose from that of the supplier.

2. A sense of opportunitism prevails in technology transfer, whether **justifies or not.**

3. The transfer process embraces a rich variety of mechanisms and relationships between recipient and donor(Supplier of technology). The process can vary from a routine people less passive transfer to turnkey contract where the donor takes the full responsibility for all phases of the contract.

4. The nature of the transferred technology and how it is transferred car critical to the success of the technology transfer process.

Technology transfer may begin as a solution to some one's problem. Adoption of such 'outside solution to solve an inside problems is technology transfer. The advantages lies in avoiding 'reinventing the wheel'.

Dimensions of Technology Transfer :

The time and resources required to transfer a given technology depends upon :

- What is actually transferred
- The mode of transfer.
- The absorption of transfer
- The absorption capabilities of the recipient enterprise.
- The capabilities and motivation of the supplier enterprises.
- Technology gap between supplier and the recipient.

ROUTES OF TECHNOLOGY TRANSFER

The principal routes of enterprise-to-enterprise technology transfer are :

1. **Licensing or Franchise :** Licensing and franchise arrangement vary from a complete package of instructions, technical assistance and training to mere permission for the manufacturer and sale of a product.

2. **Supplier of materials and parts :** Supplier of materials and parts are often willing to provide a jull range of technical support, information and manufacturing know-how and they can be effective in know-how, and they can be as effective in know-how transfer as in industrial licensing arrangement. The manufacturers of colour TV sets in India are a classic example of this type. The manufacturers did not have formal technology transfer agreement but has an understanding with the foreign suppliers of materials and components regarding technical assistance in production.

3. **Equipment supplier :** A variety of technological services are provided by equipment suppliers, including operational and maintenance procedures and even processing know-how (Typical in chemical industry). Some technologies are machine based and therefore the know how is transferred along with supply of plan t and equipment.

4. **Outright purchases** eg of turnkey plants or of complete manufacturing and operational specification drawing know how, performance data and technical assistance.

5. **Acquisition** of the company or business owning the technology

6. **Joint ventures** with the technology owners

7. **Franchising of trademarks** and technical, management and marketing know-how.

8. Combination of variations of any of the above.

Transfer capability and motivation of enterprises supplying the industrial technology have an important bearing upon the effectiveness and efficiency of technology transfer. The competence of the transfer agents, including their ability to design an easily transferable technology package, is an important factor. The supplier enterprises and its transfer package represents a combination of documentation, training and technical assistance. Motivation of technology supplier depends largely on the transfer mode and potential return the supplier hopes to realise from an effective and efficient transplant.

Technology transfer of mushroom spawn production as done by 'Eco-care & Aware' :

Eco-care & Aware is a not for profit support service organisation providing training, support, service / consultancy and agro-allied technical support to development sector. Support service includes project planning and formulation of development project, technical support during implementation, monitoring and evaluation, training and capacity building, study and research, micro planning and PRA (Participatory Rural Appraisal). The organisation also provides agro-allied technology transfer support so as to boost rural and urban livelihood towards wealth creation to the society as a whole. One such agro-allied technical transfer support as provided is the technology of mushroom spawn production.

Unlike agriculture, mushroom seed / spawn production involves sophisticated technology with high investment requiring laboratory and equipments with accessories. The major constraint in the mushroom production is the non-availability of spawn. The technology of spawn production technology as transferred by 'Eco-care & Aware' is through the route of equipment supplier and training. It supplies the necessary equipments and other accessories required as well as provided training for 15 days for one complete cycle of production at laboratory site of recipient. So it can be a form of total manufacturing and operational technology transfer including equipment as required.

To popularise this technology the organisation uses the latest web base awareness and publicity medium. It has created one webpage- http://www.mushroom-spawn.com/ describing its technology, services and the cost norms of transfer.

For universal awareness it uses the Google contextual and search engine ad media so that people can know that a law cost spawn production technology is available in the nearby including the training and know-how transfer for the same.

This webpage http://www.mushroom-spawn.com/ also detailed its objective, requirements and equipments and accessories that are required for setting up on cost effective spawn production unit.

Merit of this route of technology transfer:

1. Equipments along with know-how transfer facilitates the recipient organisations, institutions or individuals for better serving its production or business purpose.

2. Quick dissemination of spawn technology help in easy availability of mushroom spawn facilitating the poor farmers to produce mushroom to earn their livelihood.

3. Web based publicity technology made this technology available for the recipients within the figure tip search in the Internet search- Google, yahoo etc.

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Dictionary of International Trade

Technology Transfer Agreement

This contract is used when a company (Licensor) assigns or licenses to another (Licensee) registered industrial and intellectual property rights (patents, utility models, trademarks, copyright etc.) as well as technical assistance and *know-how*. In the first case, knowledge and exclusive rights are granted, which are recognised and registered in order to manufacture and market products, whilst in the second, knowledge is transferred which has no legal recognition, but that does have a value in itself. As in the Trademark License Agreement, in the technology transfer contract the price for the assignment of industrial and intellectual property rights, as well as the *know how* is initially paid a certain amount of money (fee) and during the term of the contract a percentage (royalties) calculated on the amount of the sales of the products under license, made by the Licensee. The fees for technical assistance services are paid individually for each service rendered. The Technology Transfer Agreement is increasingly being used in technological cooperation strategies through which companies endeavour to enter into competition in certain sectors or markets but without having to develop internally the technology necessary for that purpose and that which is acquired through this type of contract to R&D+ i companies. Model of Technology Transfer Agreement.

SCRIBD 1 of 19 Search document

http://stdev.unctad.org/compendium/documents/totcode%20.html

International Code of Conduct on the Transfer of Technology

[1985 version]*

-

Preamble

The United Nations Conference on an International Code of Conduct on the Transfer of Technology,

1. Recognizing the fundamental role of science and technology in the socio-economic development of all countries, and in particular, in the acceleration of the development of the developing countries;

2. Believing that technology is key to the progress of mankind and that all peoples have the right to benefit from the advances and developments in science and technology in order to improve their standards of living;

3. Bearing in mind relevant decisions of the General Assembly and other bodies of the United Nations, in particular UNCTAD, on the transfer and development of technology;

4. Recognizing the need to facilitate an adequate transfer and development of technology so as to strengthen the scientific and technological capabilities of all countries, particularly the developing countries, and to co-operate with the developing countries in their own efforts in this field as a decisive step in the progress towards the establishment of a new international economic order

3. Bearing in mind relevant decisions of the General Assembly and other bodies of the United Nations, in particular UNCTAD, on the transfer and development of technology;

4. Recognizing the need to facilitate an adequate transfer and development of technology so as to strengthen the scientific and technological capabilities of all countries, particularly the developing countries, and to co-operate with the developing countries in their own efforts in this field as a decisive step in the progress towards the establishment of a new international economic order;

5. Desirous of promoting international scientific and technological co-operation in the interest of peace, security and national independence and for the benefit of all nations;

6. Striving to promote an increase of the international transfer of technology with an equal opportunity for all countries to participate irrespective of their social and economic system and of their level of economic development;

7. Recognizing the need for developed countries to grant special treatment to the developing countries in the field of the transfer of technology;

8. Drawing attention to the need to improve the flow of technological information, and in particular to promote the widest and fullest flow of information on the availability of alternative technologies, and on the selection of appropriate technologies suited to the specific needs of developing countries;

commercial fees are sometimes waived in lieu of an equity stake in the business. As a result of the potential complexity of the technology transfer process, technology transfer organizations are often multidisciplinary, including economists, engineers, lawyers, marketers and scientists. The dynamics of the technology transfer process has attracted attention in its own right, and there are several dedicated societies and journals.

There has been a marked increase in technology transfer intermediaries specialized in their field since 1980, stimulated in large part by the Bayh-Dole Act and equivalent legislation in other countries, which provided additional incentives for research exploitation.

Partnership intermediaries [edit]

The U.S. government's annual budget funds over $100 billion in research and development activity, which leads to a continuous pipeline of new inventions and technologies from within government laboratories.[6] Through legislation including the Bayh-Dole Act, Congress encourages the private sector to use those technologies with commercial potential through technology transfer mechanisms such as Cooperative Research and Development Agreements, Patent License Agreements, Educational Partnership Agreements, and state/local government partnerships.

The term "partnership intermediary" means an agency of a state or local government—or a nonprofit entity owned, chartered, funded, or operated by or on behalf of a state or local government—that assists, counsels, advises, evaluates, or otherwise cooperates with small business firms; institutions of higher education defined in section 201(a) of the Higher Education Act of 1965 (20 USC § 1141 [a]); or educational institutions within the meaning of section 2194 of Title 10, United States Code, that need or can make demonstrably productive use of technology-related assistance from a federal laboratory, including state programs receiving funds under cooperative agreements entered into under section 5121 of the Omnibus Trade and Competitiveness Act of 1988 (15 USC § 2781).[7]

Drawbacks [edit]

Despite incentives to move research into production, the practical aspects are sometimes difficult to perform in practice. Using DoD technology readiness levels as a criterion (for example), research tends to focus on TRL (technology readiness level) 1–3 while readiness for production tends to focus on TRL 6–7 or higher. Bridging TRL-3 to TRL-6 has proven to be difficult in some organizations. Attempting to rush research (prototypes) into production (fully tested under diverse conditions, reliable, maintainable, etc.) tends to be more costly and time-consuming than expected.[8]

See also [edit]

- Angel investor
- Bayh-Dole Act
- Business incubator
- Commercialization
- Commercialization Reactor
- Diffusion of innovations
- Discovery (observation)
- Innovation
- Intellectual property
- Invention
- Licensing Executives Society International
- Open innovation
- Patent
- Prior art
- Seed money
- Startup company
- Technology assessment
- Technology licensing office (TLO)
- Technological revolution
- Value chain
- Venture capital
- New product development

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1. ^ Grosse, Robert (1996). "international Technology Transfer in Services". *Journal of International Business Studies*. **27** (4): 782. doi:10.1057/palgrave.jibs.8490153.

Technology Absorption & Diffusion

By
Dr. Vijay Kr Khurana

THE BELL CURVE DEFINED

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Definition of *Technology Package*

Search Within *Technology Package* Definitions

Use of *Technology Package* in a Clause

Technology Package LMSC shall deliver the Technology Package to Talarian within 20 days of execution of this Agreement.

See All ***Technology Package*** Clauses →

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Technology Package means all relevant documents relating to the Intellectual Property, regulatory information, biological materials, manufacturing and CMC and other materials owned and/or Controlled by Momenta, necessary for CSL to exercise its rights under the license, to be included in the Technology Transfer Plan.

Sample 1 Based on 1 documents Save Copy

Technology Package means the Technical Information relating to the topics listed in Technical Appendix A to the Technology Service Agreement.

Sample 1 Based on 1 documents Save Copy

Related Definitions

Manufacturing Technology

Clean coal technology demonstration project

Manufacturing Process

Drug Substance

Technology

Clinical Data

Examples of *Technology Package* in a sentence

Client, in accordance with this Agreement, shall provide and/or disclose to Hollister-Stier certain materials, equipment and know-how, defined as the Client's ***Technology Package***.

CI may terminate its obligations to pay to MPI any Annual Minimum Royalty payments and royalties under any particular MPI ***Technology Package*** by notifying MPI in writing of such intent before the next Annual Minimum Royalty payment is due pursuant to Section 3.2, and concurrently terminating all activities described under Sections 2.1, 2.2 and 2.3 above, with respect to such MPI ***Technology Package***.

If such efforts without litigation are unsuccessful, prosecution of a third party for the infringing use of MPI's ***Technology Package*** may be undertaken.

Technology's Negative Impact on Business

- Small Business | • Business Technology & Customer Support | • Business & Technology

By John Papiewski Updated March 19, 2019

If you've been in business for more than 10 minutes, you're probably aware that the technology "genie" brings with it both amazing advantages and agonizing negatives. On the one hand, payments and orders can happen at lightning speed; on the other, expenses and vulnerabilities may arrive unexpectedly. A sober look at the negative impacts of any technology is a healthy practice for any businessperson.

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Tech Expenses

The "no free lunch" rule applies in spades to technology. Virtually every meaningful piece of tech can come with a host of costs, including upfront expenses, recurring fees and maintenance charges. Before you commit your hard-earned cash to technology, it pays to comparison shop and analyze costs and benefits to determine if the expense is worth it to you.

Training and Retraining

Many technologies involve new ways of doing things, which means training on hardware, software and methods. The investments in money and employee time for training can be substantial. Hours and days spent learning new to use technology is time not spent taking care of customers. Also, few technologies stand still. With constant advancements in technology, retraining becomes necessary to keep up with the latest vendor offerings.

Tech Dependence, Part I

Because your business benefits from technology, your company also becomes dependent on it. When the inevitable glitches, bugs and power failures come, you may find yourself unable to accomplish simple business tasks. For example, a glitch in a credit-card processing operation will create major headaches. A power outage might mean long lines of grumpy customers as clerks write up receipts by hand.

Tech Dependence, Part II

Technology dependence can rear its ugly head even under the best of circumstances. Many tech companies use custom hardware and software that leads to a situation called **vendor lock-in**. If you become dissatisfied with a particular vendor's products, it may be difficult to try another vendor. In many cases, businesses simply put up with the idiosyncrasies of a vendor's technology because changing is too hard.

The Tech Treadmill

To bolster their own revenue, some tech vendors introduce new and upgraded products in rapid succession. Staying up to date means regularly replacing software and hardware with newer versions. Although they can bring benefits, the expense and time involved in upgrading your tech can be a drain on your company.

Hacking and Data Loss

Hacking is a fact of modern life. Almost regularly it seems the news reports yet another major company has had files stolen by data thieves. When this happens, private, confidential and sensitive information may be lost, along with the target company's reputation. Although some organizations have been hacked because of lax data security, others who had good practices have also been broken into.

The Bleeding Edge

Dealing with new technology can conjure up the saying, "You can recognize a pioneer by the arrows in his back." The advantages that come with very new technology may be accompanied by serious risks. Too often, tech vendors rush cutting-edge products to market with inadequate testing and support. Early adopters may be stuck with tech that doesn't meet expectations.

Tech is Disruptive

Technology plays no favorites. Although it may improve your own operation substantially one day, the next, a competitor's tech might adversely affect you. Because technology evolves and spreads rapidly, major disruptions can happen with surprising speed.

References

About the Author

Chicago native John Papiewski has decades of IT consulting experience, and has worked with a wide range of businesses including finance, real estate, distribution and publishing. His articles have appeared in various outlets including azcentral.com and seattlepi.com. Please, no workplace calls/emails!

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Problems in Technology Transfer

- **Costly**: Investment in technology higher than the level of attained profits. Cast paid for royalty and interest is higher than that of inflow.
- **Appropriateness:** Technology in many cases is not suitable with the socio economic priorities and conditions
- **Dependence:** Technological dependence has to increase in import of modern sophisticated technology that has displaced indigenous technology. The new product and processes introduced by multinational into developing countries discouraged the self dependence on technology
- **Obsolescence:** Import of outdated technology thus the importing action lag behind, the owners of modern technology view developing nations as a mean to salvage technology that is obsolescent in advanced country if when they posses advanced technology.

CONTRIBUTOR

Anand & Anand

ARTICLE

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India: Liberalisation Of Technology Imports In India

15 September 1998

by

Anand & Anand

In the last one year the Reserve Bank of India (RBI) granted permission under the automatic approval scheme, to about 60 per cent of all the technology import licences in India. The government in the same period approved about 341 cases of technology transfer, of which only 15 provided for lump-sum know-how fees above US dollars 2 million.

The automatic route supervised by the RBI permits a maximum lump-sum know-how fee of US dollars 2 million, royalty payments of 5 per cent on domestic sales and 8 per cent on export sales. On 4th September 1998, the government with a view to enhance the competitive ability of Indian industry, has announced that henceforth these limitations would not apply incase of technology imports in projects assessed and funded by Financial Institutions (FI's) and projects of central and public sector undertakings (PSU's).

Hence, once the financial institution or the Chief Executive Officer of the PSU would consider and approve the terms of lump-sum know-how fee and royalty payments, the RBI would automatically grant permission to the technology transfer license. This decision will ensure that in critical sectors the countries endeavour to acquire competitive technologies would not be hampered by the limits placed on know-how fee and royalty payments, which in case of advanced technology may be on the higher side.

To ensure that unnecessary technologies are not imported, the Ministry of Industries will shortly release a negative list of technologies detrimental to national interest. Further the Ministry of Finance will make changes in the proposed Foreign Exchange Management Bill, to effectively deal with the misuse and fraud in import of technology.

This article is correct to the best of our knowledge as at the time of its publication. However, it is written as a general guide. Therefore specialist advice should be always be sort.

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How to Conduct a Technology Assessment: A Four-Step Guide

Posted /
03 July, 2019

Author /
Enginess

Posted in **Digital Transformation**

If selected correctly, technologies can create competitive advantages for organizations. However, this selection process can be one of the most challenging decisions businesses face. Technology assessment done prior to the technology adoption reduces the risk of ineffective investment decisions.

We often forget a fundamental truth: software is a tool. It's something that's designed to help you do a job better, faster and more efficiently.

But like any tool, if you use the wrong one, you're not going to get the results you want. You can have the fanciest screwdriver in the world, but it's never going to be very good at hammering in nails.

That's why it's absolutely critical to conduct a thorough technology assessment, so you know you have the right tool to get the job done.

Here's how you do it.

Why Bother With a Technology Assessment?

First, a technology assessment makes it much more likely to get a solution that suits your requirements and environment. We often know we have a problem and can visualize the ideal state we want our technology solution to get us to. However, it is challenging to know how to get there because it's easy to confuse the symptoms with the cause of a problem. Thus, you end up solving the "symptom" with a (potentially expensive) piece of technology that is ill-equipped to address the underlying cause.

A structured process to assess and select a technology solution helps you get around this problem, reduce risks, and achieve your true objective, by forcing you to both identify the right problem and solve it in the right way.

Now that we know why we should do a formal technology assessment, how do you actually do it?

Step 1: Discovery

The first step towards picking the right technology is discovery. The purpose of the discovery phase is to deeply understand your existing reality, the problem you're solving, and who you're solving it for.

Understanding your current technology eco-system

You need to discover your current technology environment. This includes both the solutions you're currently using as well as the systems and processes used to connect those systems. A good way to look at this is to look at it through the lens of a business process, and looking at what data is moved along the way, where that data is stored / what's the source of truth, and how it gets from point A to point B.

A few questions to consider in this phase are:

- What data is important here?
- Who's owning each system?
- What's the source of truth for this process?

Understanding the problem

Next, you need to understand the problem, both in terms of the business and in terms of your end-user experience.

For example, say you are a sales organization struggling to hit your targets. Your business problem might be that you are not generating enough new business, and you are not sure why, what to do about it, or where to improve. In the same instance, your end-user problem might be that they don't know what works and what doesn't, so your sales reps just guess.

So your problem might boil down to documenting and sharing data readily throughout the sales organization so you can make better decisions and drive more revenue.

By combining both a business problem and the end-user problem, you can get a better sense of what the actual problem is, and begin to devise a way to solve it.

Understanding your people

Finally, you need to understand your people. That end-user insight isn't going to come unless you take the time to really understand what your end users are struggling with and link this back to the high-level business problem. Shadowing of how people do their jobs, reviewing the existing usage data, user interviews, and rapid prototype testing are all excellent ways to uncover this information.

Once you have a holistic understanding of your technology environment, you can move on to the next step: analysis.

Step 2: Analysis

By the end of the discovery stage, you should be armed with information about where you are now and where you want to go. Ideally, you'll have the beginnings of requirements to get there.

Next, you need to analyze the precise functionality that you have internally and how it's currently being applied.

Since you have a good understanding of the problem, the goal, and the environment and systems, a good place to start is to look at what your existing tech stack can do.

You need to look at how the technology is being applied at a granular level. What's more, you want to look at how it's being worked around or misused. Are end-users avoiding features and functions? If so, why?

The reason you want to poke into these problems is that you might not need as complex a solution as you thought. Far more often, organizations are misusing their existing stack rather than using it to its full potential and still running into problems.

That said, you will find some gaps and holes. That's where your technology assessment should focus, especially as you flesh out the requirements for what to buy to achieve your business objectives. The end state of the Assess and Analysis stage is an understanding of credible and prioritized options to fill your gaps with the pros and cons of each option.

Step 3: Define & Develop

Next comes to define and develop. You have a high-level business goal and a good understanding of the problem, environment, and the holes you're trying to plug.

Next, you need to build out your vision for the end state. It's not just about what problem you're looking to solve, but more granular; what is your technology solution going to deliver the business forward?

One common problem we see in this stage is a misalignment between the business, ops teams, and overall technology strategies. The challenge is that early research is often completed by technology teams (IT, etc…) but in reality, the entire project needs to be rallied around the business and operational requirements.

To do so, you need to develop and define your technology vision through the lens of the business and operational requirements. Ask yourself: does this feature/function/vendor solve the problem that the company has?

Naturally, there's going to be some give and take here. Every decision or option you present will have tradeoffs. Defining and developing is about refining your vision down to be laser-focused on the business problem, and using the criteria you've built so far to hone in on exactly what you need.

Step 4: Document

The final step is to put all your work down on paper in a well-documents plan. Your final document should include:

- A high-level overview
- A crisp explanation of what you are solving and what you are asking for
- All the details of the implementation and deployment
- Details on project timelines and ownership.

One final piece of documentation is verbal communication. Make sure that the whole team knows the "elevator story"—that is, the high-level messaging to capture the interest and attention of key executives. You will also need to schedule the meetings with the executive decision-makers to gain buy-in. Ideally, these should be done one on one and then collectively, so there is both individual and group support. Finally, be ready to iterate as required based on executive feedback. Don't assume just because it's in your master plan its fact. Remember to be flexible, because it's much better to tweak the project now than end up with technology you're unhappy with.

Conclusion

As businesses get more complex, manual processes and systems become increasingly error-prone and risky, not to mention expensive and slow. Technology can help automate, streamline, and refine, giving valuable team members the space they need to do meaningful, high-value work.

Getting buy-in for it, buying the right tool, and then seeing that business impact, though, is far from simple.

Hopefully though, with these four steps, you will move toward your business goals by building and then executing your technology assessment plan. From here, your next steps are to pursue the specific technology you need to procure, document detailed requirements, evaluate vendors, and negotiate the paperwork. Once you select a vendor, embark on a consultative, collaborative approach to design and other steps for implementation. Remember that successful technology implementation requires a broader focus on process and organizational design. To achieve business value, consider how the technology change will drive changes in your metrics and support models.

Then implement, integrate, maintain… and repeat!

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Diffusion (business)

From Wikipedia, the free encyclopedia

Diffusion is the process by which a new idea or new product is accepted by the market. The **rate of diffusion** is the speed with which the new idea spreads from one consumer to the next. **Adoption** (the reciprocal process as viewed from a consumer perspective rather than distributor) is similar to diffusion except that it deals with the psychological processes an individual goes through, rather than an aggregate market process.

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1 Theories
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Theories [edit]

There are several theories that purport to explain the mechanics of diffusion:

- **The two-step hypothesis** – information and acceptance flows, via the media, first to opinion leaders, then to the general population
- The **trickle-down effect** – products tend to be expensive at first, and therefore only accessible to the wealthy social strata – in time they become less expensive and are diffused to lower and lower strata.
- **The Everett Rogers Diffusion of innovations theory** – for any given product category, there are five categories of product adopters:
  - **Innovators** – venturesome, educated, multiple info sources;
  - **Early adopters** – social leaders, popular, educated;
  - **Early majority** – deliberate, many informal social contacts;
  - **Late majority** – skeptical, traditional, lower socio-economic status;
  - **Laggards** – neighbours and friends are main info sources, fear of debt.
- **Crossing the Chasm** model developed by Geoffrey Moore – This model overlays the Everett Rogers' adoption curve with a 'chasm'. According to Moore, the marketer should focus on one group of customers at a time, using each group as a base for marketing to the next group. The most difficult step is making the transition between visionaries (early adopters) and pragmatists (early majority). This is the chasm that he refers to. Technologies or products that cannot cross this chasm will die or remain niche. If successful, a firm can create a bandwagon effect in which the momentum builds and the product becomes ubiquitous.
- **Technology driven models** – These are particularly relevant to software diffusion. The rate of acceptance of technology is determined by factors such as ease of use and usefulness.

Rate [edit]

According to Everett M. Rogers, the rate of diffusion is influenced by:

- The product's perceived advantage or benefit.
- Riskiness of purchase.
- Ease of product use – complexity of the product.
- Immediacy of benefits.
- Observability.
- Trialability.
- Price.
- Extent of behavioural changes required.
- Return on investment in the case of industrial products.

Models [edit]

There are several types of diffusion rate models:

1. **Penetration models** – use test market data to develop acceptance equations of expected sales volume as a function of time. Three examples of penetration models are:
   - Bass trial only model
   - Bass declining trial model
   - Fourt and Woodlock model
2. **Trial/Repeat models** – number of repeat buyers is a function of the number of trial buyers.
3. **Deterministic models** – assess number of buyers at various states of acceptance – later states are determined from calculations to previous states.
4. **Stochastic models** – recognize that many elements of the diffusion process are unknown but explicitly incorporate probabilistic terms.

See also [edit]

- Bass diffusion model
- Coolhunting
- Diffusion (anthropology)
- Diffusion of innovations
- Early adopter
- Marketing
- Marketing management
- Marketing plan
- New Product Development
- Percolation
- Product life-cycle management
- Technology Adoption Lifecycle
- Technology lifecycle

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Categories: Cultural trends | Innovation | Innovators | Product development | Product management | Technological change

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Adopter categories [edit]

Rogers defines an adopter category as a classification of individuals within a social system on the basis of innovativeness. In the book *Diffusion of Innovations*, Rogers suggests a total of five categories of adopters in order to standardize the usage of adopter categories in diffusion research. The adoption of an innovation follows an S curve when plotted over a length of time.[41] The categories of adopters are: innovators, early adopters, early majority, late majority and laggards[2] In addition to the gatekeepers and opinion leaders who exist within a given community, change agents may come from outside the community. Change agents bring innovations to new communities– first through the gatekeepers, then through the opinion leaders, and so on through the community.

Adopter category	Definition
Innovators	Innovators are willing to take risks, have the highest social status, have financial liquidity, are social and have closest contact to scientific sources and interaction with other innovators. Their risk tolerance allows them to adopt technologies that may ultimately fail. Financial resources help absorb these failures.[42]
Early adopters	These individuals have the highest degree of opinion leadership among the adopter categories. Early adopters have a higher social status, financial liquidity, advanced education and are more socially forward than late adopters. They are more discreet in adoption choices than innovators. They use judicious choice of adoption to help them maintain a central communication position.[43]
Early Majority	They adopt an innovation after a varying degree of time that is significantly longer than the innovators and early adopters. Early Majority have above average social status, contact with early adopters and seldom hold positions of opinion leadership in a system (Rogers 1962, p. 283)
Late Majority	They adopt an innovation after the average participant. These individuals approach an innovation with a high degree of skepticism and after the majority of society has adopted the innovation. Late Majority are typically skeptical about an innovation, have below average social status, little financial liquidity, in contact with others in late majority and early majority and little opinion leadership.
Laggards	They are the last to adopt an innovation. Unlike some of the previous categories, individuals in this category show little to no opinion leadership. These individuals typically have an aversion to change-agents. Laggards typically tend to be focused on "traditions", lowest social status, lowest financial liquidity, oldest among adopters, and in contact with only family and close friends.

Failed diffusion [edit]

Failed diffusion does not mean that the technology was adopted by no one. Rather, failed diffusion often refers to diffusion that does not reach or approach 100% adoption due to its own weaknesses, competition from other innovations, or simply a lack of awareness. From a social networks perspective, a failed diffusion might be widely adopted within certain clusters but fail to make an impact on more distantly related people. Networks that are over-connected might suffer from a rigidity that prevents the changes an innovation might bring, as well.[44][45] Sometimes, some innovations also fail as a result of lack of local involvement and community participation.

For example, Rogers discussed a situation in Peru involving the implementation of boiling drinking water to improve health and wellness levels in the village of Los Molinas. The residents had no knowledge of the link between sanitation and illness. The campaign worked with the villagers to try to teach them to boil water, burn their garbage, install latrines and report cases of illness to local health agencies. In Los Molinas, a stigma was linked to boiled water as something that only the "unwell" consumed, and thus, the idea of healthy residents boiling water prior to consumption was frowned upon. The two-year educational campaign was considered to be largely unsuccessful. This failure exemplified the importance of the roles of the communication channels that are involved in such a campaign for social change. An examination of diffusion in El Salvador determined that there can be more than one social network at play as innovations are communicated. One network carries information and the other carries influence. While people might hear of an innovation's uses, in Rogers' Los Molinas sanitation case, a network of

The Diffusion of Innovation – Strategies for Adoption of Products

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The diffusion of innovation is the process by which new products are adopted (or not) by the intended audiences. It allows designers and marketers to examine why it is that some interface products are successful when some superior products are not.

The idea of diffusion is not new; in fact it was originally examined by Gabriel Tarde, a French sociologist, in the 19th century. However, it wasn't until the 1950s and 1960s that the phenomenon began to be investigated in depth by researchers.

One of the most significant early studies was conducted by Ryan and Gross in 1943. This established previous research into the adoption of seeds in agricultural communities and provided a strong basis for diffusion research in the future.

In his book, Diffusion of Innovations published in 1962, Everett Rogers, a sociology professor, provides a full framework for diffusion of innovation based on over 500 studies into the phenomenon in many different disciplines. Rogers' text, to this day, provides the formal understanding on which modern research into the diffusion of innovation is based.

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The Process for Diffusion of Innovation

Rogers' draws on Ryan and Gross's work to deliver a 5 stage process for the diffusion of innovation.

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1. Knowledge

The first step in the diffusion of innovation is knowledge. This is the point at which the would- be adopter is first exposed to the innovation itself. They do not have enough information to make a decision to purchase on and have not yet been sufficiently inspired to find out more.

At this stage marketers will be looking to increase awareness of the product and provide enough education that the prospective adopter moves to the 2nd stage.

As it was once said (by whom we're not sure): "If the user can't find it, it doesn't exist."

2. Persuasion

Persuasion is the point at which the prospective adopter is open to the idea of purchase. They are actively seeking information which will inform their eventual decision.

This is the point at which marketers will be seeking to convey the benefits of the product in detail. There will be a conscious effort to sell the product to someone at this stage of the diffusion of innovation.

3. Decision

Eventually the would- be adopter must make a decision. They will weigh up the pros and cons of adoption and either accept the innovation or reject it.

It is worth noting that this is the most opaque part of the process. Rogers cites this as the most difficult phase on which to acquire intelligence. This is, at least in part, due to the fact that people do not make rational decisions in many instances. They make a decision based on their underlying perceptions and feelings and following the decision they attempt to rationalise that decision. Thus, obtaining an understanding of the decision making process is challenging – the reasons given following a decision are not likely to be representative of the actual reasons that a decision was made.

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4. Implementation

Once a decision to adopt a product has been made the product will, in most cases, be used by the purchaser. This stage is when the adopter makes a decision as to whether or not the product is actually useful to them. They may also seek out further information to either support the use of the product or to better understand the product in context.

This phase is interesting because it suggests that designers and marketers alike need to consider the ownership process in detail. How can a user obtain useful information in the post- sale environment? The quality of the implementation experience is going to be determined, to a lesser or greater extent, by the ease of access to information and the quality of that information.

5. Confirmation

This is the point at which the user evaluates their decision and decides whether they will keep using the product or abandon use of the product. This phase can only be ended by abandonment of a product otherwise it is continual. (For example, you may buy a new car today – you are highly likely to keep using the car for a number of years – eventually, however, you will probably sell the car and buy a new one).

This phase will normally involve a personal examination of the product and also a social one (the user will seek confirmation from their peers, colleagues, friends, etc.)

Diffusion and Adoption

It is worth noting that adoption is the process by which a user begins and continues to use a product; diffusion is a measure of the rate of adoption. It considers the relationship not just between any given user and a product but the relationship between all users, each other and the product.

Rogers' diffusion studies offered some interesting advice for driving the rate of diffusion including:

- Examining social networks (it's worth noting that Rogers wasn't talking about Facebook or LinkedIn here though the idea applies in a similar way in digital networks but rather "real life" social networks) and finding highly respected individuals and working with them to create desire for an innovation
- Determining a representative group of desired users and "injecting" the innovation into that group to gain positive feedback, case studies, etc. to help make the decision making process easier for other would- be early adopters

Diffusion recognizes that adoption is not an isolated process but rather one which is influenced heavily by other members of the adoption cycle.

Failure of Diffusion

Failure for a product to diffuse within a market does not always mean that there is a flaw in the product. It may mean that the product has failed due to competition from other innovations or simply because of a lack of awareness or knowledge.

Rogers cites a village called Las Molinas in Peru. This place of poverty had high rates of disease. Villagers did not understand the relationship between cleanliness and their own health.

This should have been easy to address; the residents had the resources to devote to hygiene and thus just required education. A campaign team arrived to provide that help. They taught how to boil water for drinking, to burn garbage to prevent it from contaminating healthy materials, and how to install and use toilets.

Simple enough, right? So was the campaign a success? No. The educational efforts were continued by the local people. Their impression was, for example, that boiled water was only something that sick people needed. Thus a social stigma developed regarding the consumption of boiled water if you were healthy.

The lesson from Peru is that it's important to examine the effectiveness of communication as part of a diffusion strategy. If the message isn't understood within a social group – the wrong messenger may spread quickly and impede the adoption or prevent it altogether.

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The Take Away

The diffusion of adoption is important to marketers and designers because it considers adoption in context of a larger social system. The aim is not just to support an individual through the adoption process but rather a community through that process. Understanding each step in the diffusion of adoption allows you to creatively examine how you might influence people at each stage – including the final stage of confirmation where a user may begin to influence others in their purchasing decisions too.

References & Where to Learn More:

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Technological environment refers to the state of science and **technology** in the country and related aspects such as rate of **technological** progress, institutional arrangements for development and application of new **technology**, etc. According to the well known economist J.K. Feb 16, 2015

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Technological environment refers to the state of science and technology in the country and related aspects such as rate of technological progress, institutional arrangements for development and application of new technology, etc.

According to the well known economist J.K. Galbraith, technology means, “systematic application of scientific or other organised knowledge to practical tasks”.

Technology comprises of both machines (hard technology) and scientific thinking (soft technology) used to solve problems and promote progress. It consists of not only knowledge and methods required to carry on and improve production and distribution of goods and services but also entrepreneurial expertise and professional know how. Technology includes inventions and innovations.

The main features of technological environment are as follows :

- Technological environment is a component of macro or indirect action environment.
- Technological environment changes very fast.
- Technological environment affects the manner in which the resources of the economy are converted into output.
- Technological environment is self reinforcing. An invention in one place leads to a sequence of inventions in other places.

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Science and technology in India

From Wikipedia, the free encyclopedia

This section **needs expansion**.
You can help by adding to it. *(April 2020)*

This article needs to be **updated**. Please update this article to reflect recent events or newly available information. *(April 2020)*

After independence, Jawaharlal Nehru initiated reforms to promote higher education and **science and technology in India**.[2] The Indian Institute of Technology (IIT)—conceived by a 22-member committee of scholars and entrepreneurs in order to promote technical education—was inaugurated on 18 August 1951 at Kharagpur in West Bengal by the minister of education Maulana Abul Kalam Azad.[3] More IITs were soon opened in Bombay, Madras, Kanpur and Delhi as well in the late 1950s and early 1960s. Beginning in the 1960s, close ties with the Soviet Union enabled the Indian Space Research Organisation to rapidly develop the Indian space program and advance nuclear power in India even after the first nuclear test explosion by India on 18 May 1974 at Pokhran.

India accounts for about 10% of all expenditure on research and development in Asia and the number of scientific publications grew by 45% over the five years to 2007. However, according to former Indian science and technology minister Kapil Sibal, India is lagging in science and technology compared to developed countries.[4] India has only 140 researchers per 1,000,000 population, compared to 4,651 in the United States.[4] India invested US$3.7 billion in science and technology in 2002–2003.[5] For comparison, China invested about four times more than India, while the United States invested approximately 75 times more than India on science and technology.[5]

While India has increased its output of scientific papers fourfold between 2000 and 2015 overtaking Russia and France in absolute number of papers per year, that rate has been exceeded by China and Brazil; Indian papers generate fewer cites than average, and relative to its population it has few scientists.[6]

History of science and technology in the Indian subcontinent

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Research and Development (R&D)

By WILL KENTON | Reviewed By MARGARET JAMES | Updated Jul 5, 2020

What Is Research and Development (R&D)?

Research and development (R&D) includes activities that companies undertake to innovate and introduce new products and services. It is often the first stage in the development process. The goal is typically to take new products and services to market and add to the company's bottom line.

KEY TAKEAWAYS

- R&D represents the activities companies undertake to innovate and introduce new products and services or to improve their existing offerings.
- R&D allows a company to stay ahead of its competition.
- Companies in different sectors and industries conduct R&D; pharmaceuticals, semiconductors, and technology companies generally spend the most.

Understanding Research and Development (R&D)

Feedback

TECHNOLOGY MISSIONS

Sam looking at Land Record

In 1987, Prime Minister Rajiv Gandhi appointed Sam Pitroda advisor to the Prime Ministor on National Technology Missions. Together, Pitroda and Gandhi decided these missions would focus on five critical areas:

- Drinking water
- Immunizations
- Literacy
- Oil seeds
- Telecommunications

They later added a sixth:

- Dairy production

Mission goals

The missions' specific goals were as follows:

1. Make clean potable water available to 100,000 problem villages in the amount of 40 liters a day per person and 30 liters a day per head of livestock.
2. Immunize 20-million pregnant woman and 20-million children per year.
3. Teach 80-million people ages 15-35 (75% of the adult illiterate) to read and write at the rate of 10-million each year.
4. Increase oilseed production by as much as 18-million tons and reduce, eliminate, or reverse India's annual 10-billion rupee import bill for edible oils.
5. Increase dairy production from 44- to 61-million metric tons per year over eight years, raise dairy employment and incomes, and expands the number of dairy cooperatives by 42%.
6. Improve service, dependability, and accessibility of telecommunications across the county, including rural areas.

Drinking water

The drinking water mission identified 100,000 problem villages. Research was done, using geohydrological mapping, to determine where to drill new wells, increasing water sources.

Many villages had some water, but did not have access to clean water. Water was tested in labs, and official standards of quality and quantity were established.

The mission also included an effort to educate people how to repair broken pumps when they broke. Before, when pumps broke, they usually stayed broken due to lack of local knowhow. Easy to understand repair manuals were distributed in each of India's fifteen languages, and later made available online.

Immunizations

In 1987, India had the highest amount of polio in the world. The mission met with top immunization experts decided to begin immunizing the country using an oral vaccine. As a live virus vaccine, the oral version had to be refrigerated. They developed a cold chain for handling the vaccines with industrialists to get refrigeration to all parts of India.

The mission also launched India's polio vaccine production capacity. In 1987, India had zero production capacity. With government backing, they began to study France and Russia's methods. Several years later, India was producing all of their own vaccines.

25 years later, in 2013, India was declared polio-free.

Literacy

When the Technology Missions began, India's literacy rate was around 50%. Several hundred million adults were illiterate, most of them women.

The mission had the dual focus of motivating people (adults in particular) to learn, and providing materials and teachers.

In 1999, they were awarded UNESCO'S NOMA Literacy Prize.

Oilseeds (edible oils)

India was importing one billion dollars of cooking oils each year, when large portions of Indian land are well suited to growing oil crops. Farmers did not grow these crops because they found other crops were more profitable. This was causing India costly economic situation.

Their goal was to make farmers see the benefits of planting oilseeds.

Kurian, who handled buffer stocks, described his plan as such: "We move into areas where there is gross exploitation and try to restructure the marketing system so that the small producer is not fleeced by middlemen or the oil kings."

Once the intervention on oil was complete, India was exporting oil cakes at the rate of 600 million per year.

Telecommunication

Pitroda has always been closely involved with the telecom development in India.

The official goal of the telecom mission was to improve service, dependability, and accessibility of telecommunications across the county, including rural areas. This was through indigenous development, local young talent, rural telecom, digital switching networks, local manufacturing and privatization.

Dairy

The goal of the dairy mission was to develop and implement technologies to improve breeding, animal health, and fodder and milk production.

Today, India is the number one producer of milk in the world.

Telecom

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Commercial policy

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A **commercial policy** is referred to as a **trade policy** or **international trade policy**) is a government's policy governing international trade. Commercial policy is an all encompassing term that is used to cover topics which involve international trade. Trade policy is often described in terms of a scale between the extremes of free trade (no restrictions on trade) on one side and protectionism (high restrictions to protect local producers) on the other. A common commercial policy can sometimes be agreed by treaty within a customs union, as with the European Union's common commercial policy and in Mercosur. A nation's commercial policy will include and take into account the policies adopted by that nation's government while negotiating international trade. There are several factors that can have an impact on a nation's commercial policy, all of which can have an impact on international trade policies.

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Theories on international trade policy [edit]

Trade policy has been controversial since the days of Mercantilism. Economics (or political economy) has developed in major part as an effort to make clear various effects of trade policies. See International trade theory. Hottest topic in economic policy is upgrading in Global Value Chains.

Types and aspects of Commercial policy [edit]

Regionalism [edit]

Regionalism, or Regional Trade Agreements (RTA), are trade policies and agreements that are crafted by the nations in a region for the purposes of increasing international trade in the area. RTAs have been described by supporters as a means of increasing free trade with the goal of eventually merging into larger, either bilateral or multilateral, trade deals. The more relatively local area of RTAs are useful in resolving trade issues as well without causing gridlock in other trade agreements. Critics of RTAs say that they are a hindrance to the negotiation of trade because they can be lopsided or unfairly beneficial to one side over the other sides, particularly if some of the participants are nations that are still in development.[1]

As China was rising in economic power and prominence, they turned to regionalism as a strategic method of leveling the playing field with Europe and the United States. In 2000, China signed the Bangkok agreement with the Association of Southeast Asian Nations (ASEAN) to reduce tariffs in the region. The signing of the agreement also began the push for a formal Free Trade Agreement between China and ASEAN. However, strained relations between China and other Asian nations such as Japan have prevented the same level of regional FTAs to be put in place with Northeast Asia.[2]

Bilateral Free Trade Agreements [edit]

When two countries enter into a bilateral trade agreement, they are essentially giving one another special deals and favorable treatment in the arrangements. These privileges can include lowering tariffs on each others goods and services. The United States has signed such treaties as the North American Free Trade Agreement in 1994 as well as with Israel in the 1980s. Experts who support such free trade agreements argue that these deals help to increase competition and offers larger markets that businesses can reach out to. Critics of bilateral agreements claim that a larger nation, such as the United States, can use these agreements to unfairly push smaller states into much harsher work loads than the World Trade Organization already requires.[3]

Relations between the European Union and South Korea have led to both parties signing several bilateral agreements regarding trade policy. In 2009, South Korea and the EU signed the EU-Korea Free Trade Agreement. The signing of the agreement created an FTA that is second only to NAFTA in size. The agreement held the benefits of increased free trade between the participants in the FTA as well as increased challenge to the United States.[4]

Preferential Trade Agreements [edit]

Preferential agreements are trade deals that involve nations making deals with specific countries that can aid the interests of one another as opposed to the nondiscriminatory deals that are pushed by the WTO. Nations have been increasingly preferring such deals since the 1950s as they are quicker to show gains for the parties involved in the agreements. A common argument that has been made is that it allows businesses to open up markets that would otherwise be considered closed and therefore falls into the free trade idea that most countries will push for. Countries that have similar levels of GDP and a higher scope in their economies as well as their relative position to one another and the rest of the world are more likely to have preferential trade agreements. PTAs can also be applied to regional areas with unions such as NAFTA, the European Union, and ASEAN being examples of regional PTAs.[5][6]

Those who opposer PTAs argue that these deals have increased the importance of where a product is made so that tariffs can be applied accordingly. The certification of a product's origin also unfairly holds back smaller countries that have less resources to spend. Others argue that PTAs can hinder negotiations of trade disputes and places an emphasis of which country has more power.[6]

Ways in which commercial policy is affected [edit]

Tariffs [edit]

Trade tariffs are a tax that are placed on the import of foreign goods. Tariffs increase the price of imports and are usually levied onto the country the goods are being imported from. Governments will use tariffs as a way to promote competition within their own country with businesses of the foreign country that wishes to sell their goods or services. In some instances, a country's government will use them as a means of protectionism for their own interests. In modern history, generally starting at the mid-20th century, the use of tariffs has been largely diminished in favor of the rise of international trade.[7] Beginning in 2017, the Trump administration began to impose tariffs on several of nations that were involved in trade deals with the United States. The countries targeted by the Trump Tariffs then retaliated with their own tariffs on American goods.

Import Quotas [edit]

Import quotas are the limitations of the amount of goods that can be imported into the country from foreign businesses. Generally, an import quota is set for a specific period of time with one year being the most common metric. Some versions of the quotas limits the quantity of specific goods being imported into a country while other versions place the limit on the value of those goods. The objectives of quotas can include: the protections of a nations interests, ensuring a balance of trade so as not to create deficits, retaliation to restrictive trade policies of other countries that do business on the international playing field.[8]

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National Policy on Education

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The **National Policy on Education (NPE)** is a policy formulated by the Government of India to promote education amongst India's people. The policy covers elementary education to colleges in both rural and urban India. The first NPE was promulgated by the Government of India by Prime Minister Indira Gandhi in 1968, the second by Prime Minister Rajiv Gandhi in 1986, and the third by Prime Minister Narendra Modi in 2020.[1]

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History [edit]

Main article: Education in India

Since the country's independence in 1947, the Indian government sponsored a variety of programmes to address the problems of illiteracy in both rural and urban India. Maulana Abul Kalam Azad, India's first Minister of Education, envisaged strong central government control over education throughout the country, with a uniform educational system. The Union government established the University Education Commission (1948–1949), the Secondary Education Commission (1952–1953), University Grants Commission and the Kothari Commission (1964–66) to develop proposals to modernise India's education system. The Resolution on Scientific Policy was adopted by the government of Jawaharlal Nehru, India's first Prime Minister. The Nehru government sponsored the development of high-quality scientific education institutions such as the Indian Institutes of Technology. In 1961, the Union government formed the National Council of Educational Research and Training (NCERT) as an autonomous organisation that would advise both the Union and state governments on formulating and implementing education policies.[2]

1968 [edit]

Based on the report and recommendations of the Kothari Commission (1964–1966), the government of Prime Minister Indira Gandhi announced the first National Policy on Education in 1968, which called for a "radical restructuring" and proposed equal educational opportunities in order to achieve national integration and greater cultural and economic development.[3] The policy called for fulfilling compulsory education for all children up to the age of 14, as stipulated by the Constitution of India and specialized training and qualification of teachers.[3] The policy called for a focus on the learning of regional languages, outlining the "three language formula" to be implemented in secondary education - the instruction of the English language, the official language of the state where the school was based,

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Education policy

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Education policy consists of the principles and government policies in the educational sphere as well as the collection of laws and rules that govern the operation of education systems.

Education occurs in many forms for many purposes through many institutions. Examples include early childhood education, kindergarten through to 12th grade, two and four year colleges or universities, graduate and professional education, adult education and job training. Therefore, education policy can directly affect the education people engage in at all ages.

Examples of areas subject to debate in education policy, specifically from the field of schools, include school size, class size, school choice, school privatization, tracking, teacher selection, education and certification, teacher pay, teaching methods, curricular content, graduation requirements, school infrastructure investment, and the values that schools are expected to uphold and model.

Issues in education policy also address problems within higher education. The Pell Institute analyzes the barriers experienced by teachers and students within community colleges and universities. These issues involve undocumented students, sex education, and federal grant aides.[1]

Education policy analysis is the scholarly study of education policy. It seeks to answer questions about the purpose of education, the objectives (societal and personal) that it is designed to attain, the methods for attaining them and the tools for measuring their success or failure. Research intended to inform education policy is carried out in a wide variety of institutions and in many academic disciplines. Important researchers are affiliated with departments of psychology, economics, sociology, and human development, in addition to schools and departments of education or public policy. Examples of education policy analysis may be found in such academic journals as *Education Policy Analysis Archives* and in university policy centers such as the National Education Policy Center housed at the University of Colorado Boulder University of Colorado Boulder.

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Education reform in the United States [edit]

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Venture Capital

By JAMES CHEN | Reviewed By GORDON SCOTT | Updated Feb 25, 2020

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1. What is Venture Capital?

Venture capital is a form of private equity and a type of financing that investors provide to startup companies and small businesses that are believed to have long-term growth potential. Venture capital generally comes from well-off investors, investment banks and any other financial institutions. However, it does not always take a monetary form; it can also be provided in the form of technical or managerial expertise. Venture capital is typically allocated to small companies with exceptional growth potential, or to companies that have grown quickly and appear poised to continue to expand.

Though it can be risky for investors who put up funds, the potential for above-average returns is an attractive payoff. For new companies or ventures that have a limited operating history (under two years), venture capital funding is increasingly becoming a popular – even essential – source for raising capital, especially if they lack access to capital markets, bank loans or other debt instruments. The main downside is that the investors usually get equity in the company, and, thus, a say in company decisions.

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Venture Capital

2. Basics of Venture Capital

In a venture capital deal, large ownership chunks of a company are created and sold to a few investors through independent limited partnerships that are established by venture capital firms. Sometimes these partnerships consist of a pool of several similar enterprises. One important difference between venture capital and other private equity deals, however, is that venture capital tends to focus on emerging companies seeking substantial funds for the first time, while private equity tends to fund larger, more established companies that are seeking an equity infusion or a chance for company founders to transfer some of their ownership stakes.

KEY TAKEAWAYS

- Venture capital financing is funding provided to companies and entrepreneurs. It can be provided at different stages of their evolution.
- It has evolved from a niche activity at the end of the Second World War into a sophisticated industry with multiple players that play an important role in spurring innovation.

3. History of Venture Capital

Venture capital is a subset of private equity (PE). While the roots of PE can be traced back to the 19th century, venture capital only developed as an industry after the Second World War.[1] Harvard Business School professor Georges Doriot is generally considered the "Father of Venture Capital". He started the American Research and Development Corporation (ARD) in 1946 and raised a $3.5 million fund to invest in companies that commercialized technologies developed during WWII.[2] [3] [4] ARD's first investment was in a company that had ambitions to use x-ray technology for cancer treatment. The $200,000 that Doriot invested turned into $1.8 million when the company went public in 1955.[5]

Location of the VC

Although it was mainly funded by banks located in the Northeast, venture capital became concentrated on the West Coast after the growth of the tech ecosystem. Fairchild Semiconductor, which was started by the traitorous eight from William Shockley's lab, is generally considered the first technology company to receive VC funding.[6] It was funded by east coast industrialist Sherman Fairchild of Fairchild Camera & Instrument Corp.[7]

Arthur Rock, an investment banker at Hayden, Stone & Co. in New York City, helped facilitate that deal and subsequently started one of the first VC firms in Silicon Valley. Davis & Rock funded some of the most influential technology companies, including Intel and Apple.[7] [8] By 1982, 48% of all investment dollars were on the West Coast and the Northeast coast accounted for just 20%.[9] According to the latest data from PitchBook and National Venture Capital Association (NVCA), the situation has not changed much. During the second quarter of 2020, west coast companies accounted for 36.7% of all deals (and a massive 68.2% of deal value) while the Mid-Atlantic region had 20.9% of all deals (or approximately 18.6% of all deal value).[10]

Help From Innovations

A series of regulatory innovations further helped popularize venture capital as a funding avenue. The first one was a change in the Small Business Investment Act (SBIC) in 1958. It boosted the venture capital industry by providing tax breaks to investors.[11] In 1978, the Revenue Act was amended to reduce the capital gains tax from 49.5% to 28%.[12] Then, in 1979, a change in the Employee Retirement Income Security Act (ERISA) allowed pension funds to invest up to 10% of their total funds in the industry.[13]

This update to the "Prudent Man Rule" is hailed as the single most important development in venture capital because it led to a flood of capital from rich pension funds. The capital gains tax was further reduced to 20% in 1981.[14] These two developments catalyzed growth in venture capital and the 1980s turned into a boom period for venture capital, with funding levels reaching $4.9 billion in 1987.[15] The dot.com boom also brought the industry into sharp focus as venture capitalists chased quick returns from highly valued Internet companies. According to some estimates, funding levels during that period peaked at $119 billion.[16] But the promised returns did not materialize as several publicly-listed Internet companies with high valuations crashed and burned their way to bankruptcy.[16]

4. Angel Investors

For small businesses, or for up-and-coming businesses in emerging industries, venture capital is generally provided by high-net-worth individuals (HNWIs) – also often known as "angel investors" – and venture capital firms. The National Venture Capital Association (NVCA) is an organization composed of hundreds of venture capital firms that offer to fund innovative enterprises.

Angel investors are typically a diverse group of individuals who have amassed their wealth through a variety of sources. However, they tend to be entrepreneurs themselves, or executives recently retired from the business empires they've built.

Self-made investors providing venture capital typically share several key characteristics. The majority lock to invest in companies that are well-managed, have a fully-developed business plan and are poised for substantial growth. These investors are also likely to offer to fund ventures that are involved in the same or similar industries or business sectors with which they are familiar. If they haven't actually worked in that field, they might have had academic training in it. Another common occurrence among angel investors is co-investing, where one angel investor funds a venture alongside a trusted friend or associate, often another angel investor.

5. The Venture Capital Process

The first step for any business looking for venture capital is to submit a business plan, either to a venture capital firm or to an angel investor. If interested in the proposal, the firm or the investor must then perform due diligence, which includes a thorough investigation of the company's business model, products, management, and operating history, among other things.

Since venture capital tends to invest large dollar amounts in fewer companies, this background research is very important. Many venture capital professionals have had prior investment experience, often as equity research analysts; others have a Master in Business Administration (MBA) degree. Venture capital professionals also tend to concentrate in a particular industry. A venture capitalist that specializes in healthcare, for example, may have had prior experience as a healthcare industry analyst.

Once due diligence has been completed, the firm or the investor will pledge an investment of capital in exchange for equity in the company. These funds may be provided all at once, but more typically the capital is provided in rounds. The firm or investor then takes an active role in the funded company, advising and monitoring its progress before releasing additional funds.

The investor exits the company after a period of time, typically four to six years after the initial investment, by initiating a merger, acquisition or initial public offering (IPO).

6. A Day In The Life

Like most professionals in the financial industry, the venture capitalist tends to start his or her day with a copy of *The Wall Street Journal*, the *Financial Times* and other respected business publications. Venture capitalists that specialize in an industry tend to also subscribe to the trade journals and papers that are specific to that industry. All of this information is often digested each day along with breakfast.

For the venture capital professional, most of the rest of the day is filled with meetings. These meetings have a wide variety of participants, including other partners and/or members of his or her venture capital firm, executives in an existing portfolio company, contacts within the field of specialty and budding entrepreneurs seeking venture capital.

At an early morning meeting, for example, there may be a firm-wide discussion of potential portfolio investments. The due diligence team will present the pros and cons of investing in the company. An "around the table" vote may be scheduled for the next day as to whether or not to add the company to the portfolio.

An afternoon meeting may be held with a current portfolio company. These visits are mentioned on a regular basis in order to determine how smoothly the company is running and whether the investment made by the venture capital firm is being utilized properly. The venture capitalist is responsible for taking evaluative notes during and after the meeting and circulating the conclusions among the rest of the firm.

After spending much of the afternoon setting-up that report and reviewing other market news, there may be an early dinner meeting with a group of budding entrepreneurs who are seeking funding for their venture. The venture capital professional gets a sense of what type of potential the emerging company has, and determines whether further meetings with the venture capital firm are warranted.

After that dinner meeting, when the venture capitalist finally heads home for the night, they may take along the due diligence report on the company that will be voted on the next day, taking one more chance to review all the essential facts and figures before the morning meeting.

7. Trends in Venture Capital

The first venture capital funding was an attempt to kickstart an industry. To that end, Doriot adhered to a philosophy of actively participating in the startup's progress. He provided funding, counsel, and connections to entrepreneurs.

An amendment to the SBIC Act in 1958 led to the entry of novice investors, who provided little more than money to investees.[17] The increase in funding levels for the industry was accompanied by a corresponding increase in the numbers for failed small businesses.[18] Over time, VC industry participants have coalesced around Doriot's original philosophy of providing counsel and support to entrepreneurs building businesses.

Growth of Silicon Valley

Due to the industry's proximity to Silicon Valley, the overwhelming majority of deals financed by venture capitalists are in the technology industry.[19] But other industries have also benefited from VC funding. Notable examples are Staples and Starbucks, which both received venture money.[20] [18] Venture Capital is also no longer the preserve of elite firms. Institutional investors and established companies have also entered the fray. For example, tech behemoths Google and Intel have separate venture funds to invest in emerging technology.[18] [21] Starbucks also recently announced a $100 million venture fund to invest in food startups.[22]

With an increase in average deal sizes and the presence of more institutional players in the mix, venture capital has matured over time. The industry now comprises an assortment of players and investor types who invest in different stages of a startup's evolution, depending on their appetite for risk.

Hit From the 2008 Financial Crisis

The 2008 financial crisis was a hit to the venture capital industry because institutional investors, who had become an important source of funds, tightened their purse strings.[23] The emergence of unicorns, or startups that are valued at more than a billion dollars, has attracted a diverse set of players to the industry. Sovereign funds and notable private equity firms have joined the hordes of investors seeking return multiples in a low interest rate environment and participated in large ticket deals. Their entry has resulted in changes to the venture capital ecosystem.

Growth in Dollars

Data from the NVCA and PitchBook indicated that VC firms funded US$131 billion across 8946 deals in 2018. That figure represented a jump of more than 57% from the previous year. But the increase in funding did not translate into a bigger ecosystem as deal count, or the number of deals financed by VC, moved fell by 5%. Late-stage financing has become more popular because institutional investors prefer to invest in less risky ventures (as opposed to early-stage companies where the risk of failure is high). Meanwhile, the share of angel investors has remained constant or declined over the years.

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Technology gap

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Technology Gap Theory is a model developed by M.V. Posner in 1961, which describes an advantage enjoyed by the country that introduces new goods in a market.[1] The country will enjoy a comparative advantage as well as a temporary state of monopoly until other countries have achieved the ability to imitate the new good. Unlike the past theories which assume the market to be fixed and given, such as the Heckscher-Ohlin theory, the technology gap model addresses the technological changes. It suggests a state of economy influenced by science, politics, markets, culture and most importantly, uncertainty, which threatens the mainstream neoclassical economists as they explain economic outcomes mainly based on the natural endowment scarcity. The theory is backed up by the ideas of Joseph Schumpeter. As a result, the technology gap theory is often rejected by neoclassical economists.[2]

The theory assumes that the two countries have similar factor endowments, demand conditions, and factor price ratios before trade. The only difference is the technique. The technology gap exists between the time the new products are imported from external markets and the substitutes are created by domestic producers. Meanwhile, according to Ponser, the gap is constituted by three lags as follows:[3]

1. **Foreign Reaction Lag**: The time required for the innovative firms to produce the products with new technology, and these products will later be exported to external countries.
2. **Domestic Reaction Lag**: The time taken by all domestic firms to continue producing relatively newer versions of products as to retain their shares in the global market, before they realize the threat of the new products imported. Within the period, there is also an *imitation lag*, which suggests the time the local entrepreneurs need to learn to adopt the new technology to make and sell substitutes.
3. **Demand Lag**: The time that the domestic consumers need to acquire or adapt their tastes for the new products.

The total lag is calculated by subtracting the demand lag from the imitation lag. If the demand lag is longer than the imitation lag, then the domestic market will start to demand the foreign goods. The demand of imported goods overriding the domestic products will in turn leads to the erosion of the local market and deficit in the trade balance.[3]

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The development of an explicit technology gap model started with Ponser. The key for the theory is the rate of diffusion of technology. Moving on to 1966, Vernon further extended the technology gap model into the product life-cycle theory.[2] The degree of maturity of the technology became the new key of the dynamic economic trade. Vernon's theory resonances with

(1) The difference between people who use computers and mobile devices on a daily basis and those who do not. The technology gap is a serious impediment to students in households that cannot afford a computer or pay for Internet access every month. Also known as the "digital divide" and "app gap." See e-learning and creative destruction.

(2) The difference in technologies used and/or developed in two companies or two countries where one is more advanced than the other.

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Nintendo's "Revolution"

Sangbeom Kim, Ian Lamont, Hiroshi Ogasawara, Mansoo Park, Hiroaki Takaoka

Satoru Iwata, president of Nintendo Corporation (Nintendo), strode from the conference room with a smile on his face. It was late 2004, and he was tremendously excited with what his engineers had just demonstrated — a video game controller that was not a variation of the joystick, but rather a stubby rod that a gamer could manipulate with one hand. Not only did it enable the creation of games that mimicked real-world movements like throwing, hitting, or aiming, Iwata believed it could help open up video games to a vastly different audience than the boys and young men who traditionally bought video game consoles.

Expanding the gaming industry's customer base was key to Iwata's vision of a next-generation console codenamed "Revolution." The idea was to bring tens of millions of new customers into the gaming realm, people who had never played video games before or saw them as mere toys. Iwata believed that a new take on gaming might even attract mothers — an influential household constituency, thanks to their influence over household spending[1] — through a combination of hardware design, game-play, and price. What better way to attract them than through a controller that had a form factor similar to a TV remote control?

But Iwata's enthusiasm for the controller prototype was tempered by a number of real-world considerations. First, no other company had ever released such a controller. How would the marketplace react to such a vastly different model? Second, many of the technologies that were required to make the rod controller work — such as wireless positioning — might never operate perfectly outside of the lab, in people's apartments and homes. Third, any new Nintendo controller

[1] American Express Everyday Spending Index, via Ashish Rajan, "Convenience Drives Cards," *CardTrak.com*, March 13, 2000. Accessed via http://www.cardtrak.com/news/2000/03/13/convenience_drives_cards in June 2011.

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Technology Absorption & Diffusion

By
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What is Technology Absorption?

- Technology Absorption refers to the acquisition, development, assimilation & utilization of technological knowledge and capability by a firm or some macro entity from an external source. It occurs between transferring & receiving entities.
- The technology absorption is wider in scope than technology acquisition.
- Technology absorbed without changing parameters of acquired technology is called *Technology Adoption.*
- Technology absorbed by changing certain parameters of acquired technology is called *Technology Adaptation.*

What is Technology Adaptation?

Technology Adaptation may arise due to following reasons:

- Non availability of supporting infrastructure
- For meeting location / market specific needs
- To make it compatible with existing plant & machinery
- Non availability of ancillary units for components
- To meet legal requirements
- Pressure from NGOs, environmentalist, human rights group viz.example: Government insistence to not to use BVO in soft drinks, forced cola companies to change their formulations.

Structure/ Components of Technology Absorption

Technology Absorption involves following four basic components:

- Hardware – refers to particular physical structure of components & also their logical layout which are subject matter of absorption
- Software - refers to Know-how of carrying out tasks to achieve goals & objectives
- Brainware - refers to application & justification of hardware, software development, know-what & know-why of technology. That is what to employ, how, when, where, and why?
- Support Net - refers to complex network of physical, informational and socio–economic transformations that support the proper use and functioning of given technology.

Differences between Technology Acquisition and Technology Absorption

If both Technology Acquisition & Technology Absorption occur simultaneously, then there is no difference in two terms. Sometimes there may be time lag between two. In case of time lag, differences may be as follows:

- 1. *Technology Acquisition* - Focus is on acquiring technology i.e. becoming owner; *Technology Absorption* - Focus is on putting the acquired technology to use; i.e. reaping the benefits from technology acquired
- 2. *Technology Acquisition* - Leads to firm specific technological knowledge and advantage; *Technology Absorption* - Leads to market competitive advantage

Differences between Technology Acquisition and Technology Absorption

Differences contd:

- 3. *Technology Acquisition* - Requires substanical costs for acquistion of technology; *Technology Absorption* - Inovolves some costs for putting the technology to use and leads to increase in revenues, improvement in efficiences etc.
- 4. *Technology Acquisition* - Precedes technology absorption ; *Technology Absorption* - Succeeds technology acquisition

Management of Technology Absorption by Organizations

- Generally, enterprises / organizations plan for technology absorption within reasonable time / planned time as it provides following advantages like – early use of acquired technology and reaping benefits therefrom, gaining technological competitive edge etc.
- Sometimes there could be delays in technology absorption due to variety of reasons.
- Delays in technology absorption could be harmful to the organization.
- Therefore technology absorption needs to properly managed by the organization.

Management of Technology Absorption by Organizations

Organizations take following steps to manage technology absorption:

- Developing good understanding and mutual trust between technology transferor and technology recipient organizations
- Proper, clearcut and well-defined agreement between technology transferor and technology recipient organizations
- Developing time-bound and target-oriented schedule for technology absorption
- Top management support to the technology absportion

Management of Technology Absorption by Organizations

Steps contd …

- Use of multifunctional teams by the technology acquiring organization
- Regular review of the absorption progress by the highest level.
- Installation of effective communication system by the technology acquiring organization.
- Seeking workers' particicpation, involving one and all in the absorption process; overcoming the resistance to change through education and motivation through rewards etc.

Management of Technology Absorption by Organizations

Steps contd …

- Hiring of requisite skilled workforce; if same is not available, seeking early training of own current employees by technologists / technicians from the transferor enterprise.
- By actively complying with various government directives and requirements on technology upgradation and technology absorption.

Government Guidelines on Technology Absorption by Organizations

Due to variety of benefits of technology absorption, national governments seek quick absorption of technology.

While seeking approval to Foreign Technology Transfer Agreements under the approval route from Government of India, the technology acquiring organizations / enterprises are required to indicate and commit timebound schedule for technology absorption. This puts pressure on organizations to plan systematic and timebound technology absorption.

Government Guidelines on Technology Absorption by Organizations

Govt compliance contd …

- In addition, under Section 217(1) of the Companies Act, 1956, every company is required to attach a Board's Report / Directors' Report to every Balance Sheet which is laid before a company in general meeting.
- According to subclause(e) of the above section 217(1), amongst other things, the Board's Report shall deal with the steps taken for technology absorption by the company.

TECHNOLOGY DIFFUSION

TECHNOLOGY DIFFUSION

- Diffusion is the process by which a new idea or new product is accepted by the market.
- *Technology Diffusion* means the spread of applications / usage of a new technology and its related products, services or processes from one nation to another; from one entity to another; from one industry to another; from the owner entity to user or supplier; and from current user to the prospective user.
- *Technology Diffusion* means the study of how, why, and at what rate new ideas and technology spread across the economy.

TECHNOLOGY DIFFUSION

- Technology diffusion carries wide meaning (as also discussed in characteristics / features below).
- In a narrow sense, sometimes, *Technology Diffusion* is also known as *Diffusion of Innovation* as technology gets mainly diffused through its new usages or applications in the form of new products, services or processes.

Pattern of Technology Diffusion

- According to Everett M Rogers' theory, the diffusion takes the shape of bell curve in terms of number of adopters over the passage of time and takes the shape of *S-curve or Logistic curve* in terms of cumulative number of adopters over the passage of time.
- Various studies show that with the passage of time, technology and innovations get diffused from innovators to followers; and lastly to laggards. the trend of the percentage of organizations that adopt a new technology and innovations over a period of time - in cumulative terms – takes the shape of S-*Curve;* also called *Logistic Curve*. It is shown in the figure as follows:

Technology Diffusion

Pattern of Technology Diffusion

- During the intial stage i.e. innovation stage, technology and innovation gets diffused within the innovative organizations. Such organizations usually follow technology leadership strategy.
- During next stage i.e. consolidation stage, diffusion takes place amongst major competitors.
- During the last stage, i.e. mature technology stage, diffusion spreads to laggards. These laggards are, usually, risk-averse and small organizations or small market players.
- The rate of learnings / spread amongst various entities is influenced by profitability and investment required.

Product Diffusion

Product diffusion is a case of innovation diffusion. According to Everett M. Rogers, for any given product category, there are five categories of product adopters:

- Innovators – venturesome, educated, use multiple information sources, possess greater propensity to take risk (2.5%),
- Early adopters – social leaders, popular, educated (13.5%),.
- Early majority – deliberate, many informal social contacts (34%),.
- Late majority – sceptical, traditional, lower socio-economic status (34%)
- Laggards – neighbours and friends are main information sources, fear of debt (16%).

Product Diffusion

Product diffusion takes the shape of bell curve in terms of number of adopters over the passage of time and takes the shape of S-curve in terms of cumulative number of adopters over the passage of time. This is shown in the figure as follows.

Product Diffusion

Fig. 8.2 Product Innovation

Characteristics of Technology Diffusion

- Diffusion is not one-way traffic. The innovator can also learn from imitator.
- Diffusion is not once- for-all occurance. It is cyclical in nature.
- Diffusion can take place in varying degrees: IntraFirm - diffusion of lowest degree ; InterFirm- diffusion of medium degree; Economy wide- diffusion of highest degree.
- Diffusion can take place in variety of forms … viz product , service or a process: use & production; stock of technological knowledge

Characteristics of Technology Diffusion

- The pattern of diffusion i.e. shape of S-curve is Influenced by profitability and investment required,

FIGURE 4.5 DIFFERENCES IN DIFFUSION SPEED

What are Global Trends in Technology Management

Prior to 1990, rate of technological change has been slow due to cold war between USA & USSR, restriction on MNCs, existence of high trade barriers across countries. Since 1990s rate of technological change has become faster.

This increased rate of technological change is noticeable in following areas:

- Most of nations have adopted formal technology development policy and aim at gaining technological progress / advancement.
- Innovations (new product / process developments) are no more confined to developed world. They can take place anywhere, anytime.

What are Global Trends in Technology Management

Contd …

- Globalisation of technology is taking place at a faster pace due to variety of factors
- Technological development is becoming highly customer-oriented. As the customer needs & tastes are increasing and changing, technological changes are increasing.
- Decreasing payback period – to derive benefits of technology development
- Time compression – decrease in time available in various activities / phases of technology development
- There is faster movement of products and services from Research & Development center to markets (reduction in lead times).

What are Global Trends in Technology Management

Contd …

- There is increasing focus on simplification of products viz journey from earlier big computers to modern portable computers; emerging nano-technology.
- There is more focus on ergonomics (human convenience to use)
- Technology life cycle is getting shorter due to fast technological changes or technological discontinuties.
- Product life cycles are decreasing due to fast changes in consumer needs, increasing awareness about new or improved technologies.
- Technological change may occur not only due to development of improved / hybrid / new technology but it can occur even due to some development in unrelated technology.

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