

An article on

TECHNOLOGY MANAGEMENT, INTELLIGENCE and STRATEGY

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A. TECHNOLOGY MANAGEMENT

Technology management is a set of management disciplines based on certain rules and behaviors that allows organizations to manage their technological fundamentals, human resources, cohesive relationships between verticals and horizontals to create competitive advantage to sustain in the market for long time while ensuring better social responsibilities.

B. In effective Technology Management a critical activity is learning about

Markets,
Customers and
Competitions.

C. Main Components of Technology Management are

- **Identification (Intelligence/ Forecasting)**

Identification of technology based on technology forecasting and technology intelligence is necessary. It should meet the technology strategy of an organization.

- **Selection(Technology Strategy/Planning)**

Selection of technology should be based on long term and short term goal and objective of the organization. Proper selection of technology should be done after proper planning keeping in technology strategy.

- **Internal acquisition (R&D Management)**

For long term survival of an organization R&D management is very important. Acquisition of technology internally based on commercial aspects will help business to grow.

- **External acquisition (Technology Acquisitions and Collaborations)**

Innovation is not specific to one or a few organization. Innovations are being done worldwide by various industries, individuals and government organization. So based on needs of the hour technology acquisitions and collaborations should be done.

- **Exploitation/Assimilation (Technology Transfer/Utilization/Commercialization)**

Exploitation/ assimilation of technology by technology transfer and their utilization for commercial purpose helped in the business growth.

- **Protection (R&D Management, Knowledge Management, IPR Management)**

Protection of intellectual property of an organization is an important activity. IPR for various inventions should be taken so that others should not exploit them.

- **Learning (Knowledge Management, IPR Management)**

Management of inventions are to be done properly. Individual in groups having innovative bend of minds should be encouraged.

D. Invention and Innovation

Invention is either a concept or the creation of a novel technology typically a device or process new to the world and may not be known to anybody previously in masses and may be known to a few people not to masses in some cases and may or may not be commercially viable. Inventions normally occurred as a result of human ingenuity, imagination and sustained efforts and happen only sporadically, sometimes by chance or some times by sustained efforts through R & D using trial and error method as well as sustained input of man and money to meet a specific needs probably should be economical, more reliable and efficient than the exiting one.

Innovation is manufacturing of a device, creation of a service, starting a process or managing human resource or meeting corporate social responsibilities which is new to an organization necessarily may not new to the world. It may be a change in industrial practice and organisational setup, which improve productivity of man and machine and reduce cost.

An **invention/ innovation** is not accepted immediately by potential users due to many reasons and many innovations fail because of poor marketing, opposition from firms selling other products etc. When successful, an innovation gets adopted over a period of time in a system by natural selection.

Different types of users adopt invention/ innovation at different times during life cycle of the innovation. The technological evolution of an innovation follow a bell shaped curve.

E. Process of Technology Change : Diffusion

Every accepted invention adopted by adopters and commercialised passed through a process called diffusion by which an invention propagates through certain channels over time among the units of a system.

Four Major Elements of diffusion process are:

1. Innovation
2. Propagation
3. Time
4. System

1. Innovation:

From the point of view of a potential customer, a technical solution is considered to be an innovation when it is new or perceived as new by the individual or the unit of adoption.

2. Propagation:

Propagation refers to the spread of an invention beyond its inventor to be used by customer.

3. Time:

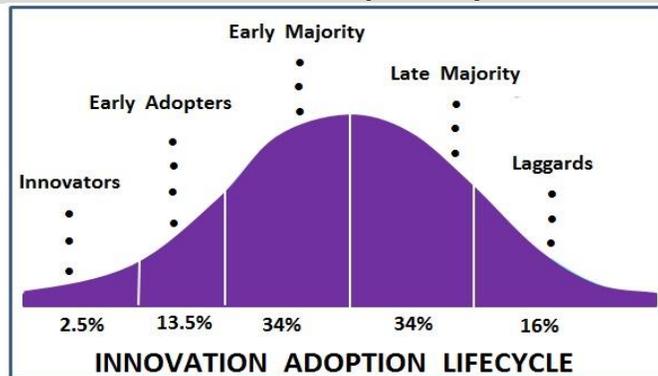
Individuals or firms take time to decide to adopt an invention. Adopters adopt an invention at different time.

4. System:

It is a set of interlinked units/ groups that participate in the diffusion process in the commercialised inventions.

F. Bell-Shaped Curve of Diffusion or Innovation adoption cycle.

Bell shaped curve is a graph between time on X-axis and no. of adopters on Y-axis. The percentage of potential users followed a bell shaped curve as shown in the figure and it is found true for almost all invention. It is observed in many cases that early adopters are only 2.5% and majority adopters are 68% of total users. It shows number of individuals adopting an innovation each year.



It is also observed that many technologies evolve over the period follow a Bell shaped curve.

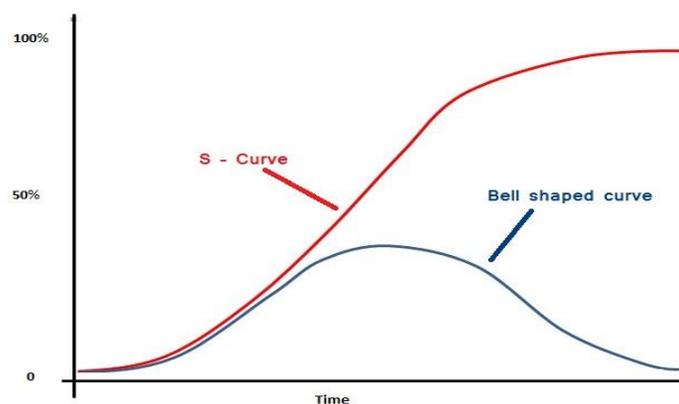
G. S Curve of Diffusion

It shows the number of individuals adopting an innovation on a cumulative basis over the life cycle period of the invention.

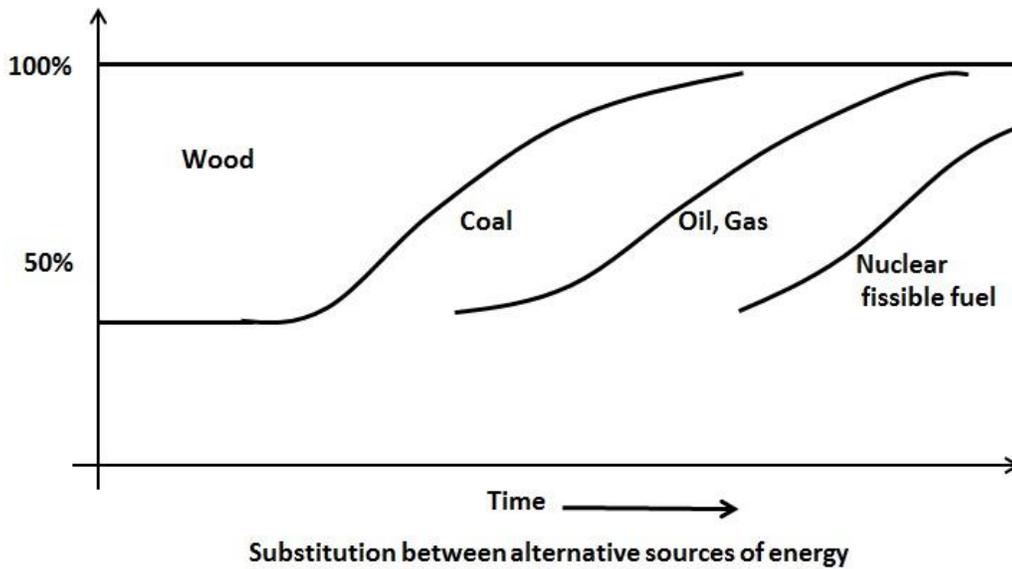
There are four major areas in the diffusion history of an invention which is clear from the S-shaped curve shown below:

1. **Emergence** characterized by a slow advance in the beginning of S-curve, suggesting that adoption proceeds slowly at first where a few adopters adopt the invention.
2. **A rapid growth phase (acceleration)**, after emergence, when adoption rate accelerates, because of purchase of the product by large masses, until almost half of the individuals in the system of adoption have adopted the invention.
3. **A slow growth phase (deceleration)**, after a rapid growth phase, this slow growth phase started because of introduction of new technology or lesser demand by adopter where the rate of growth declines, but adoption of the invention continues.
4. **Maturity, the final stage**, after a slow growth phase after which the diffusion almost comes to a halt, either as a result of market saturation or the introduction of a new product, process, or service into the market replaces the existing invention or some other unknown reasons.

S-shaped (red colour) and Bell-shaped (blue colour) curves are given below:



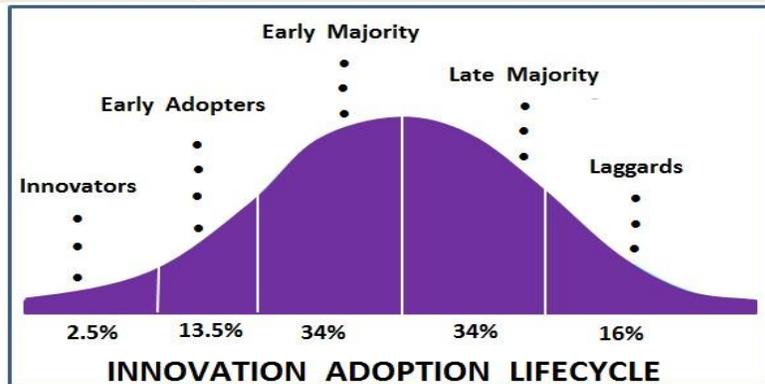
It is observed that substitution of one energy source by others following S-Curve as shown in diagram



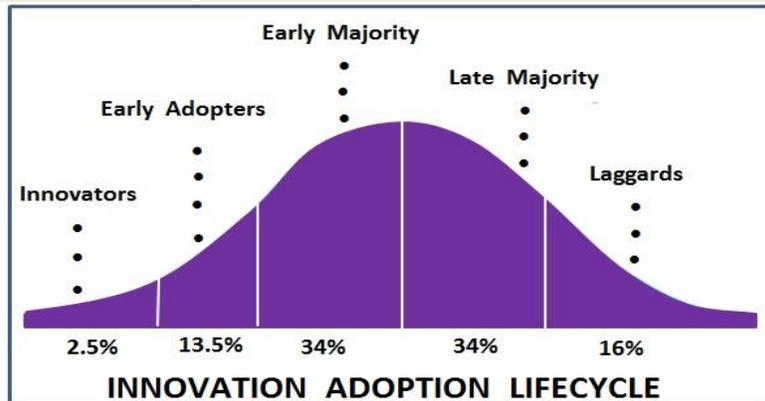
H. Bell-Shaped Curve for Railway Technology

It is observed that Technological Evolution and Process of Diffusion follow a bell shaped curve. This is/ will be true for many technologies in railways also. Below is given a thought for Bell shaped curve for Steam Engine, Diesel Engine, Electric Engine, High Speed Train and Maglev Train. I foresee the future railway technology will be based on Antigravity.

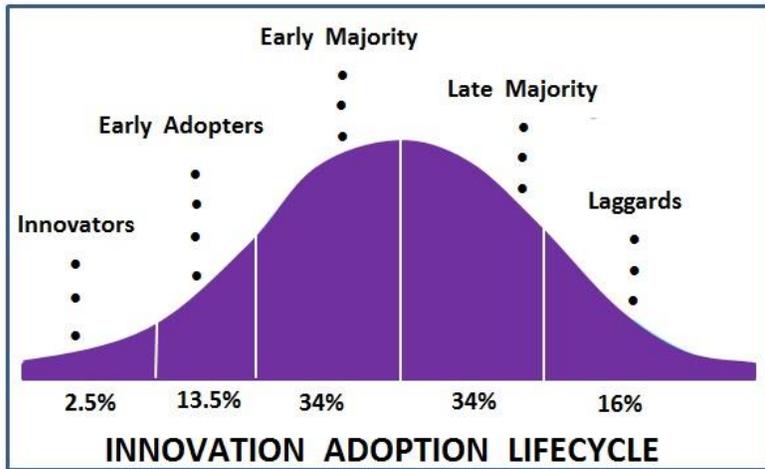
a). Innovation Adoption Lifecycle for Steam Engine



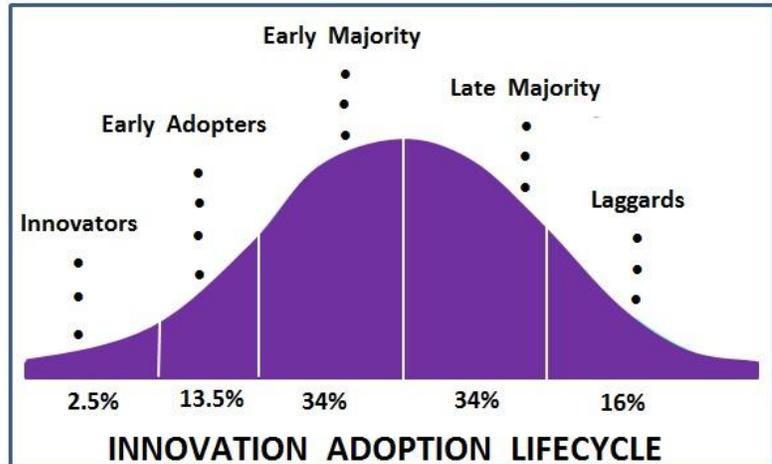
b). Innovation Adoption Lifecycle for Diesel Engine



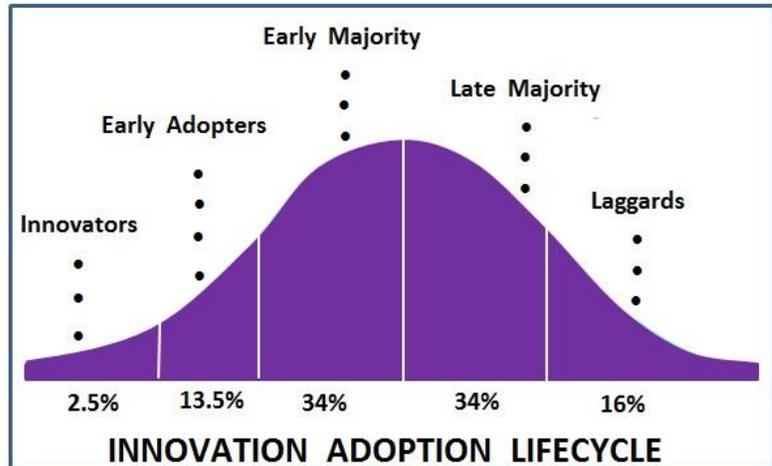
c). Innovation Adoption Lifecycle for Electric Engine



d). Innovation Adoption Lifecycle for High Speed Train



e). Innovation Adoption Lifecycle for Maglev Train

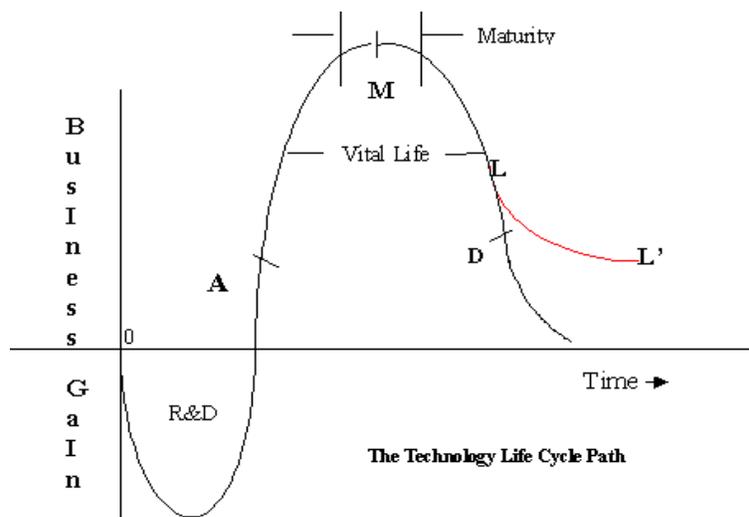


I. Technology life-cycle,

Many industries, firms and individuals do R & D work and invest on it. They do not sure about the financial outcome. After some innovation/ invention is commercially viable then the owner starts marketing and selling the new products and starts earning. Life cycle of such innovation/ invention can not be forecasted as it depends on many factors but every innovation most probably follows a bell shaped curve path.

The technology life-cycle (TLC) describes the commercial gain of a product through the expense of research and development phase, and the financial return during its "vital life". The vital life span for a product varies with time.

In some instances, after reaching a point such as D in the below diagram, the earnings from the technology begin to decline rather rapidly. To increase the life cycle period, owners of technology might try to license it out at some point say L when it can still be attractive to firms in other markets. This, then, traces the lengthening path, LL' there by increasing further the period of life cycle for that invention and increasing earnings.



(Courtesy: wikipedia. GNU free documentation license)

J. Technology Intelligence

Technology intelligence is basically nothing but technology-related information obtained by spying or many other means by firms that are useful and utilized by the firm during strategic decisions to sustain in the market. It is an important tool in decision making by an organisation. Proper technology intelligence helps an organization in saving expenditure due to proper investment planning for the future.

It serves mainly three major function:

1. The intelligence provides an understanding of current and potential changes taking place in the environment around the world in their technology related field mainly in the invention for which the organization is planning to involve itself.
2. Technology Intelligence provides important information for Strategic Decision makers there by saving in a lot of money and time leading to financial strength of the organization to sustain in the market for longer period.

3. Finally, the intelligence facilitates and fosters strategic thinking in organization for better future prospect and investment planning.

Three broad types of level of technology intelligence are Macro-level, Industry or business-level, Program or Project-level. Macro-level refers to broad technology trends that are developing in an economy globally or localized and its technology intelligence is at state or group of states level. Industry or Business-level refers to technology trends and factors that affect or are likely to affect specific industries globally or in a country and its technology intelligence is industry or business-level. Program or Project-level refers to technology-related factors essential for a specific technology-related program or project and its technology intelligence is at small level like program or project level.

K. Technology Strategy

Technology Strategy is the **revealed pattern in the technology choices of firms to sustain in the competitive environment**. The choices involved the commitment of resources for the appropriation, maintenance, deployment, abandonment of technological capabilities and social corporate responsibilities. These **technology choices** determine the character and extent of the firms' principal technical capabilities, the set of available product and process platforms and human resource.

Three important points of technology strategies are:

1. The company's ability to perceive the need for change in its technology base based on technology intelligence and forecasting. Technology strategy focuses on the kinds of technologies/ process that a firm selects for acquisition, development, deployment, or divestment or corporate social responsibility.
2. Commitments for technology selection and its surrounding not alone confined to high-technology define technology strategy. Even a capacity-driven industry or a customer-driven industry or service provider requires a technology strategy to survive and perform well in this competitive markets.
3. Finally, technology strategies embrace both the hardware and software elements of technology including pyramid structured human resource of an organization.