

Factors to be Considered for Technology Assessment and Valuation

N. K. SHARMA

*Managing Director, National Research Development Corporation,
New Delhi*

Abstract : Technology assessment depends on number of factors such as (a) technology related factors – type of technology, state of development, Quality of end products, environmental concern (b) Intellectual Property related factors patent (India, other countries - copy right, Design registration, confidentiality status of scientists (c) Technology completeness Assessment. It also depends on type application, status of competing technology, track record of scientist who has developed it, cost of technology project development cost and the type of funding. Whereas valuation of technology is based on determining the actual cost incurred in undertaking the R&D, cost of maintenance patents. At the end licensing process has been explained through a case study.

Keywords : *Technology assessment, Technology valuation, Technology marketing, R&D Management.*

INTRODUCTION

On technology Assessment what emphasis one has to give is that the assessment of the technology *per se* International Patent Searches. There should be a system of carrying out a national patent searches on technological assessment not marketing. There should be patent research in each R&D institution. Secondly, what is the cost incurred in a particular project ? There should be a specific valuation system that is the cost. Third is the technology evaluation system wherein worked out like - this

is the replacement cost, this is the incurred cost, this is the competitive technology cost, so what is the evaluation of the technology in terms of the licensing fees that the institution should charge. These three are the key issue in the Technological Assessment and Evaluation.

R&D institutions must aim at technology development of strategic importance. That is not really a point of Technology Assessment but it is a point of R&D Management. The R&D institutions should manipulate the suitable technological evaluation systems and use it as early as possible to bring to competitiveness, marketing ability. The larger question of R&D Management, is the critical issue today before the R&D institutions like CSIR, is the industrial need based technological development. For examples, if 10 people come to NRDC, five of them are asking for a technology which no R&D institution in the whole country are developing, or, even conceiving to develop. There are whole variety of sports goods from cricket bats to hockey sticks, to table tennis bars to children gun, whole range of sports goods, from mountaineering sports goods etc. There is no institution in the whole country who have taken - the toy industry. China has a three billion dollar toy export, there are 11 toy development centres all over China. We trying to get one centre at Noida. The foundation stone has been laid. The toy industry is crucial. We have the largest children in the world more than China. Every child needs a toy. No institution, no IIT, tell us about this. Let us take the house hold goods. The mixies, the speakers, the photo copiers, the air-conditioners, the tube lights, the torch, ovens, heaters, geysers, whole range of electricals, refrigerators. It needs high coating techniques which will not rust, high temperature, high intensity heat resistant materials. The lock industry. Every house have to have. How many people are there in country? How many locks are needed ? The R&D institutions should identify what techniques are needed by the industry. NML has done a very good work for foundry. In R&D Management, there was some controversy on corporates centralised engineering set-up of technology transfer and commercialisation. In a product development sector, you have the product, you have improved material coating, put the material coating as a product. Add 20%

value to that product. So, say developed a technology for teflon coating of shoe and shoe with a leather piece of teflon coated which has been worn, or somebody has walked on those shoes for 100 kms, this has been washed 10 times and this is the actual teflon coated shoes.

In R&D management, every institution is not knowing what is the state of the art of those products which are developing. Institutions in Japan, China, Taiwan and all over Europe, the first thing and its not only outside, you visit auto lamp factory in Jaipur, totally indigenous development which has been beaten Halios and Brukas for automobile lamps produced all over the world are there. This is such a lamp, three months back these were the features, this the price and then they say these are my products which has been developed. Latest three months back launched by Lucas in Germany. What is the difference. Compare them. So, plan the product you should develop with the latest state-of-art of a product.

Technology related factors

- ❖ Type of technology
 - Simple
 - Complex
 - Disruptive
- ❖ State of Development
 - Lab Scale
 - Bench Scale
 - Pilot Plant
 - Semi Commercial
 - Commercial (Life Cycle State of S Curve)
- ❖ Testing / Certification of end Products
 - Status of Statutory Certification
 - Product Quality
 - User Feedback
- ❖ Stage of Development of Bye Products and Pollution/Waste Minimisation

Intellectual Property Related Factors

- ❖ Type of Protection provided
 - Patents (India, other countries)
 - Design Registration
 - Copy right
 - Integrated Circuits
- ❖ Confidential Information
 - How difficult it is to replicate the technology
 - Technology Replication safeguards.
 - Catalyst
 - Enzymes
 - Hidden technical features
- ❖ Scientist Confidentiality Status

Technology Completeness Assessment

- ❖ Knowhow Manual Completeness
- ❖ Process Optimisation (Cost & time)
- ❖ Process Parameter Boundary Condition Specifications
- ❖ Technical Danger/risk factors (such as risk of explosion/contamination, raw material quality verification, worker safety, pollution control)
- ❖ Risk assessment for shut down/down time for introducing new technology.

Market and Business Potential Factors

- ❖ Status of Competing Technologies (International Patent Search)
- ❖ Type of Application
 - Single vs Multiple industry Uses
 - Size and value of Market
 - Indian
 - Foreign
 - Market Entry Barriers

Funding Related Factors

- ❖ Project Development Cost
- ❖ Availability of Technology Commercialisation Funds
 - From Market (Equity)
 - From Banks
 - From Technology Development Funding Agencies/Schemes

Scientist Related Factors

- ❖ Reputation and Experience of Technology Development Institute/University
- ❖ Track Record of Scientists (Industry experience)
- ❖ Availability of Scientists
 - Stability
 - Mobility
 - Transfer on deputation

Technology Transfer Factors

- ❖ Cost of Technology
- ❖ Logistics of Technology Transfer
- ❖ Provision of Post Technology Transfer Services
 - Process Optimisation
 - De-bottlenecking
 - Supervisions of Testing and Commissioning

TECHNOLOGY VALUATION METHODOLOGY

There are a number of methods used to assess the value of technology but as mentioned earlier, none of them is perfect, they are only indicative. So, the most common ones and discussed here.

Cost Based Valuation

There are two main cost based methodologies which can be applied to valuing technology. One is based on determining the actual cost incurred in undertaking the R&D, protecting and main-

taining the IPR(cost of patenting, copyright, design registration etc.). The other relates to estimating the cost of replacing the technology or creating an equivalent asset. For this, one must calculate the expenses which the Buyer would incur if he did not acquire the technology. This method suffers from a fundamental draw back, in that, there is no direct connect between the expenditure incurred in creating the technology and its subsequent value. That more, in the Indian context many of our R&D institution/universities do not have an adequate accounting/budgeting system to correctly assess the actual costs incurred. It is often noticed that only the direct costs incurred on manpower, equipment and consumables are taken into account. Indian R&D costs being very low as compared to R&D costs in the developed contries, the actual worth of an internationally protected technology may be several times more than the actual costs incurred in undertaking the R&D in India.

Comparable Market Value

In this method, the value of technology is determined by reference to the price obtained for a comparable technology in recent transactions i.e., in recent licence agreements. This methods also suffers from the draw back that the reliable data on comparable technology may not be easily avaiabile. Novertheless, there are "Industry norms" which licensing/acquisition professionals generally know. Determining the licensing fees using this method is the implication that the market value of technology is not related to the cost of development but more to the income it can generate.

Income Method/Percentage of Sales Turnover

This method is based on determining the expected profit that a buyer will make over the income life span of the technologg. In this method a cash flow projection is derived from the use of the technology. These cash flows are discounted back using a discount rate (typically 10-12%) to determine the net present value.

Client Based Market ValuatIn-Percentage of Sales Turnover

This concept is based on the fact that the inventor must receive a share (typically 25-30%) of the profits that the client (licensee) is expected to make by use of the technology. The provides which can be as high as 50-70% in case of technologies relating to the new economy (software, bio-technologies, internet technologies)

and as low as 10-15% in the case of the old economy technologies steel, agro processing, mineral processing etc.

Many technology transfer agencies therefore initially determine the approximate technology transfer fees to be charged to particular client as a percentage (5-10%) of the estimated turnover of the cost of the manufacturing plant e.g. for a 2000 TPA Rice Husk Board Plant costing Rs 30 million the total technology fee at 5% works out to Rs 1.5 million which is then split (50-50) into lumpsum premium of Rs. 0.75 million to be paid at the time signing of the licence agreement and an additional 2.5% annual royalty on sales to be paid for a period of 10 years (or for the period of validity of the patents).

Patent Auction Methods

With the advent of the internet a number of web sites have come up offering facilities for on-line auction of IPR(s). Some of these are :

- Knowledge express.com
- Yet2.com
- Firstuse.com

Patent Related Evaluation Index

To overcome the difficulty in correctly evaluating IPR, the Japanese have formulated a Patent Related Evaluation index which takes into account the various criterion the influence the value of an IPR.

In this method, it is assumed that evaluation shall be done by technology transfer specialists / patent attorney and specialists related to the particular business sector to which the IPR relates to. However, even in this method accurate evaluation cannot be made without the cooperation of the IPR holders, inventors and the business partner (Buyers).

I shall explain in some detail as to how this method is applied. The first step is to fill in the Patent Evaluation Form (Annexure 1) and thereafter the following three worksheets (Annexure 2) are used to calculate the total number of points for these indexes viz.

- Worksheet for the Specific Evaluation of Rights

- Worksheet for the Transfer and Distribution Potential
- Worksheet for the evaluation of business potential

Finally, the total number of points from these worksheets are used to determine a grade using the following table.

GRADE	
a	81-100
b	61-80
c	41-60
d	21-40
e	Under 21

This method to has the draw back that is does not provide an absolute evaluation of the IPR in dollar terms. At best it provides a broad framework for starting the negotiations between the jIPR Holders and the IPR Buyers.

Practical Evaluation Methodology

Before I come to the most important part of my presentation, I most point out that the valuation of an technology asset is often quite different from the value of that technology for a specific client (except in the case when the absolute rights to a technology) are granted in its entirety to one Buyer for the whole world, for the complete life of the IPRs, without any restrictions on its use or sale of the product(s) based on that technology. In reality, however, the value of a technology for a specific client depends on a host of factors viz. The strength/weakness of the Buyer, the track record of the scientists/R&D Institutes, the extent to which the IPR is protected through Patent(s), copyright, design registration, trade marks, brand names, domain name registration and more importantly by a combination of these different IPRs, on the licensing terms with particular reference to exclusivity of territory (manufacture and sale), exclusivity of applications, time period exclusivity etc. Whenever I meet an inventor or a client who is interested in licensing of a technology or an IPR, the first question they ask me is how do I put a price to that technology. I tell them that this is a complex question and that is depends on a number of factors. Then starts the pro-

cess of eliciting information on the technology, the background of the parties (seller and buyers) involved their interest etc.

After having obtained as much information as possible using the Patent Index System (rarely is the full information available), I have to come to a ballpark figure for the lump sum amount that is to be paid up front i.e. on signing of the licence agreement and the annual royalty rate that is payable for the period of licensing.

This depends on the intention and the interest of the Buyer. Typically the Buyer may have the following intentions/interests.

- a) Genuine Buyer, desires to actually use the invention for manufacture may want exclusivity.
- b) Buyer already has similar technology, but does not want a competitor to come up, wants to buy and block the IPR as he has already made substantial investments in his plant.
- b) Buyer wants exclusive rights for India and desires to later jointly license the technology IPR to major international company for a win win situation. Applicable in case of drug technologies.
- d) Inventor does not have the resources to develop the invention into a usable product but wants to wait to create a nuisance value to any corporate who may develop a similar product on their own and make substantial investments. The Inventor then wants to muscle in and ensure that corporate (wait, watch sure theory).
- e) Fake buyer, only wants to collect as much information as is practically possible and then then develop his own technology with that information. Taking all these factors into account, it may be necessary to pursue the matter cautiously by signing of MOU, confidentiality agreement/disclosure agreement before a licence agreement much before starting the negotiations for licensing the IPR.

I propose to explain this process through a case study of licensing the IPR on Rice Husk Board technology to a client in Indonesia.

Case Study : Rice Husk Board Indonesia

TECHNOLOGY PRICING

Lumpsum premium options

- Total Amount
- Installment Payments

Royalties

- Percentage of Ex-Factory Sales Value
- Percentage of Profits
- Varying Royalties
- Conversion of Royalties To Equity

Period of licensing

Nature of licensing

- Exclusive Vis-A-Vis Non Exclusive
- Territory Exclusivity
- Period Exclusivity
- Exclusivity For Sales Only

Equity in lieu of technology fees

1. Problem : Exclusive Vs Non Exclusive License

a) *Licensor's interests*

To License To As Many Parties As Possible Globally and Even in Indonesia

Access to Licenss's Plant by Licensor and for Third Parties

Training of Third Party Licensee's Personnel.

b) *Licensee's interests*

To Have Exclusive License For Manufacture and Sale in/to as may Countries as Possible

Equity Participation

Buy Back

Product Quality Guarantees

Supply of Raw Materials/Parts on Rate Contract for Long Duration

Supervision of Erection, Testing and Training of Personnel Both at Licensor's Premises and Licensee's Plant

Deputation of Key Operatin Personnel

Interaction Financing of Project.

Access to Licensor's Plant

c) *Marketing assistance*

Quality Assurance

International Certification

Advertising Support

Upgradation of Product to Suit Local Conditions.

Marketing Policy formulation

d) *Negotiated solution*

Licensee shall set up three Plants in a Specific Time Frame for Validity of Exclusive Licence

Minimum Royalty Clause for Payment of us \$ 20,000 /Year / Plant

2. Negotiation on technology

Improvement/ New Product Development

a) *Licensee's interests*

To Get all Technology Improvements of Licensor (Process or Product) During Life Time of Agreement

To Keep Confidential Licensee's Own Improvement/ Developments

b) *Licensor's interests*

To Change Additional Compensaion for Licensor's Technology Improvements

To Get Access to Licensee's Technology Ijmplvements for Benefit of Other Licensees

3. Period of licensing : 10 years

4. Nature of license

Exclusive Subject to 3 Plants Being set up in a Specific Time
Exclusive for Manufacture and Sale in Indonesia

Non Exclusive for Sale to Other Countries (Except in India and Malaysia Where no Sales are Permitted without Approval of Licensor)

5. Negotiation on technology pricing

a) Lumpsum premium

- 1st Plant US \$ 90,000 (Net of Taxes)
- 2nd Plant US \$ 60,000 (Net of Taxes)
- 3rd Plant US \$ 50,000 (Net of Taxes)

b) Royalties

- 2.5 % on Sale Price for First 3 Years
- 2 % for Next 4 Years
- 1.75% for Next 3 Years
- Subject to Minimum Royalty of US \$ 20,000 Per Year Per Plant
- Net of Taxes.

Annexure-1

PATENT EVALUATION FORM

Face Items

Name of Invention	
Patent of application no :	
Inventor's (or applicant's) name	
Date Filled out :	
Evaluation (position) :	Person responsible : (), ()

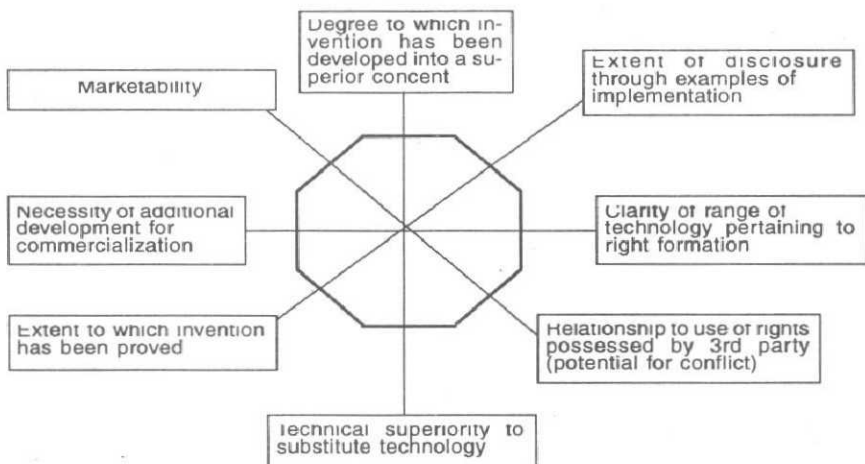
A : Basic Items

Item	Status
1. Status of patent rights formation	(1) Application in process (2) Approved
2. Term of duration of rights (Date of application : __ (month) __ (Year))	Until : (Year)
3. No. of foreign countries to which applications have been made and no, in which rights have been approved	Application made to __ countries (names:) Rights approved in __ countries (names:)
4. Disputes with 3rd parties	Objection made
	No. of cases of invalidation
	No. of cases settlement status
	Cases (complaints : _____) (1) Objection in process (2) Objection settled
	_____ cases (complaints : _____)
	_____ cases (claimants : _____)
5. Licensing status	(1) Established (2) Not established
Special Implementation rights	
Implementation Overview	(1) Approved (2) Not approved [Overview of establishment and approval :]
6. Technical nature of Invention	(1) Basic technology (2) Greatly Improved technology (3) Marginally Improved technology
7. Related patents	Nos.
8. Other patent-related items(ref).	
	Acquisition expense : _____ EN (Include in-house expenses and external expenses for patent attorneys, etc., from the time of application to the time of approval) Maintenance expense: _____ EN (Include patent fees and litigation-related fees)

B. Specific Evaluation of Rights

Grade : a b c d e

- A grade is given by classifying the total number of points in terms of five ranks



[Product markets to which the relevant patent applies :]

[Ref : Other applicable fields (beside the above product markets) to which the relevant patent applies:]

C. Evaluation of Transfer and Distribution Potential

Total no. of points: _____

Grade : a b c d e

- A grade is given by classifying the total number of points in terms of units of 20 points each.

D. Evaluation of Business Potential

Name of business likely to implement rights:

Type of business likely to implement rights:

Total no. of points : _____

Grade : a b c d e

- A grade is given by classifying the total number of points in terms of units of 20 points each.

E. Comprehensive Evaluation

Overall Grade : A * B * C * D * E

[Special Items: Comments]

Grade	Total no. of points
a	38-40
b	28-34
c	21-27
d	14-20
e	Under 14

Annxure-2

WorkSheets Patent Evaluation Form

Worksheet for the specific evaluation of rights

Evaluative Index		Points
Technical dominance of rights		
1. Degree to which invention has been developed into a superior concept		5 4 3 2 1
2. Exdtent to which it has been disclosed through examples of implementation		5 3 1
3. Clarity of range of technology pertaining to rights formation		5 3 1
4. Relationship to use of rights possessed by 3rd party (potential for conflict)		5 1
5. Technical superiority to substitute technology		5 3 1
*Patent's degree of completion as a technology		
6. Extent to which invention has been proved		5 4 3 2 1
7. Necessity of additional development for commercialization		5 4 3 2 1
* Markets in which commercialization is possible		
8. Marketability	(1) Current	5 4 3 2 1
	(2) Future	5 4 3 2 1
Total		

Calculate the total number of points for these indexes.

Total number of points: _____

Grade : a b c d e

Convert the total number of points from above into a grade using the following conversion table

Grade	Total no. of points
a	35-40
b	28-34
c	21-27
d	14-20
e	Under 14

Fill in the number of points for each index on the letter chart on the evaluation form and then fill in the final grade there.

Worksheet for the Evaluation of Transfer and Distribution Potential.

Evaluative Index Importance (1)	Degree of Points (2) (1)x(4)	No. of of Points	Max. No. (1)x(2)	Score
I. Reliability of Technology Transfer				
1. Can the results of the inventor's or right holder's continued related technical developments be enjoyed?		4 2 0		
2. Can sufficient guidance on introducing the technology be received from the business that developed it?		4 2 0		
3. Are there any restrictions on the places that it can be licensed to ?		4 2 0		
4. If the rights are shared jointly, have the right holders agreed to their transfer or approved their implementation ?		4 2 0		
II. Stability of Rights and the Exercise of them				
5. Does the right -holder have the means, ability, time, etc. to exercise its rights against infringing parties ?		4 2 0		
6. What is the possibility that the rights will be invalidated, canceled, or limited ?		4 2 0		
Total				

* Mark "O" for the degree of importance of indexes that were not subjected to evaluation.

Total no. of points : _____ (=4)(3) x 100)

Grade : a b c d e

Convert the total number of points from above into a grade using the following conversion table

Grade	Total no. of points
a	81-100
b	61-80
c	41-60
d	21-40
e	Under 21

Worksheet for the Evaluation of Business Potential

Evaluative Index Importance (1)	Degree of Points (2) (1)x(4)	No. of of Points	Max. No. (1)x(2)	Score
I. Business Potential Invention				
1. How clear are the benefits that the invention will convey?		4 2 0		
2. How conceivable are the users who will be able to enjoy these benefits ?		4 2 0		
3. How possible is it that a product using this invention can be manufactured at a reasonable price ?		4 2 0		
4. How conceivable is the sales route for this product?		4 2 0		
5. Does selling the product require legal permits, licenses etc? If so, be required and how long will they last ?		4 3 2 1 0		
6. Are other permit from 3rd parties deemed necessary to the business process ?		4 3 2 1 0		
6. What is the possibility that the rights will be invalidated canceled, or limited ?		4 3 2 1 0		
7. What is the extent to which this invention will contribute to the product ?		4 3 2 1 0		
8. Is is possible that substitute technology for the invention will be developed ?		4 3 2 1 0		
9. How conceivable is it that competing or substitute products will appear ?		4 2 0		
10. Can infringing (imitation) products be easily manufactured ?		4 2 0		
11. Would it be easy to detect infringing (imitation) products ?		4 2 0		

FACTORS TO BE CONSIDERED FOR TECHNOLOGY ASSESSMENT....

Evaluative Index Importance (1)	Degree of Points (2) (1)x(4)	No. of of Points	Max. No. (1)x(2)	Score
II. Profitability from Business				
12. What market share, roughly, can expect to be acquired ?		4 2 0		
13. What market share, roughly, can expect to be acquired ?		4 2 0		
14. In what time frame can be targeted market share be acquired ?		4 2 0		
15. What is the rough life span for the product's market ?		4 2 0		
16. How high a price will the customer pay for the value generated by the relevant patent right ?		4 2 0		
17. How attractive will the absolute profit be that can be anticipated from a business stand point ?		4 2 0		
Total				

* Mark "O" for the degree of importance of indexes that were not subjected to evaluation.

Total no. of points : _____ (=4)x(3) x 100)

Grade : a b c d e

Grade	Total no. of points
a	81-100
b	61-80
c	41-60
d	21-40
e	Under 21