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ASSESSMENT AND EVALUATION OF THE TECHNICAL FEASIBILITY AND COMMERCIAL VIABILITY OF INVENTIONS AND RESEARCH RESULTS: THE ROLE OF INTELLECTUAL PROPERTY RIGHTS (IPR)

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TABLE OF CONTENTS

INTRODUCTION

1. The recent economic achievements of many countries have not sprung from their natural resources. Prosperity is no longer based on tin, rubber or timber. Countries rich in natural resources, for example, oil producing countries, are not necessarily the great economic powers. Latest studies and experience show that contribution of raw materials, and in many cases of labor, has steadily declined in providing competitive edge to the products: their percentage in overall costs has reduced.

2. This is perhaps best reflected in microprocessor technology where raw material content has steadily fallen to an insignificant proportion of its price but the intellectual component has increased. Also the value addition in most new products comes basically through intangible components, including technology.

3. Economic progress requires a constant stream of new ideas and products to improve quality of life, regardless of whether the innovation is a simple gadget or a sophisticated invention. Today it has become evident that innovation and creativity bring competitive advantage to companies and nations. *Per capita* economic growth of countries is driven increasingly by innovation, not by aggregate capital investment per se.

GROWING ROLE OF INTELLECTUAL PROPERTY RIGHTS (IPR)

4. Intellectual capital is often of considerable value because it is unique. It comprises, *inter alia*, patents for inventions, trademarks, industrial designs, utility models, appellations of origin, integrated circuits topographies, copyrights, but also know-how, trade secrets, proprietary technology, talents, skill and knowledge of the work force, training systems and methods, customer lists, distribution networks, quality management systems, etc.

5. The role of Intellectual Property Rights (IPR) in economic activity is increasing significantly in the new international economic and commercial set up. In economic growth and competition, intellectual capital is increasingly being recognized as been among the most important asset of many of the world's largest and most powerful companies. At the corporate level there is an increasing awareness that active and full control over technology, new products and processes secures the way to competitive advantage. More and more attention is being paid to project design and development based on innovation and invention.

6. IPR assets are becoming a powerful tool to face the competitive market forces in addition to the traditional techniques of inventory management, human resource development and total quality management. IPR are being pledged as security for loans and assessment of the real worth of businesses increasingly require valuation of their intellectual property portfolio.

7. Today, intangibles, such as knowledge, technology, know-how, inventions, trademarks, etc., are very valuable assets. It is now widely acknowledged that technological progress occurs as a result of entrepreneurial activities in anticipation of profits from innovations. A sound patent system contributes to the practical use of technology and research results by providing a legal environment that is conducive to encouragement of technology transfer and application.

8. Intellectual property represents the creations of the human intellect. Intellectual property relates to information that can be incorporated in tangible objects and reproduced in different locations and can be used by several persons at the same time, unlike immovable or movable tangible property. The fact that IPRs can be used simultaneously by many persons, in many different locations, makes them very attractive goods, if the owner can manage them properly.

9. Assessment and evaluation of inventions and R&D results for the purpose of their industrial and commercial use is not simple and needs a lot and diverse specialized knowledge and experience: knowledge of the special field of technology, of the state-of-the-art, of the market situation, users needs, plans and activities of the competition, etc. is essential. When an invention or R&D result are created, they have to be tested and adapted before they can be translated into applications. This process starts with innovation and ends with innovation.

THE PATENT SYSTEM AND ASSESSMENT AND VALUATION OF INVENTIONS AND RESEARCH RESULTS

10. The patent system can provide useful instruments for the assessment and valuation of inventions. First there is the information aspect of the patent system: awareness of the state-of-the-art in a particular technical field can avoid duplication in research work by indications that the desired technology already exists. Also it can provide ideas for further improvements and can give an insight into the technological activities of competitors and, by reference to the countries in which patents have been taken out, the marketing strategies of competitors. A new invention, without any analogue, might be of considerable value, if there is a market for it. On the contrary, an invention in a field, where many similar solutions exist, may have a lower value, if it does not lead to considerable savings of resources.

11. Registered trademarks witness a clear commercial interest in the market of a country or group of countries. Analyses of IPR and their presence in different countries provide a means of forecasting future industrial developments, identifying areas in which market demand is increasing, monitoring general technological progress, and testing the soundness of policy and investment decisions.

12. Technology, and inventions, as a fundamental part of it, are, by nature, both private goods in creation and public goods in productive use or consumption. They are private goods in so far as their creation consumes both mental and physical resources, which are thereby diverted from other production or consumption activities. Once technology or inventions become available in the form of information, however, they lose their characteristics as private goods. Unlike a tangible object, they can be used by many without loss to any person, and without further investment in re-creating it for new users.

13. These characteristics of technology and invention create a dilemma. If all are free to use technology and inventions that have been created, who will be willing to bear the cost associated with their creation? One of the basic rationales of the patent system is to provide such an incentive for the creation of new technology and inventions. It does this by offering to inventors exclusive rights to commercially exploit patented inventions for a limited time in return for the disclosure of the inventions to the public.

14. The exclusive rights to exploit the invention commercially permit its owner to recover research and development costs through the competitive advantage, which the exclusive rights to exploit the invention, confer. The patent grant in this respect acts as an instrument of economic policy to stimulate further risk-taking in the investment of resources in the development of new products and technology.

15. Patents are granted on technical criteria and not on the basis of commercial or market criteria. The exclusive rights conferred by the patent relate to the commercial exploitation of the invention, and do not preclude another person from experimental work using the technological information contained in the patent specification.

16. In other words, while the patent owner can prevent others from using, for commercial purposes, the same technology as is revealed in the disclosure of his invention, he is not protected against those who derive from his disclosed invention a perception of a market need which may be satisfied by the legitimate adaptation or improvement of his technology, or through the discovery of a different technical solution to satisfy the same market need

17. The existence of a patent also introduces another measure of certainty to the commercial transfer transaction by enabling the potential recipient of the technology to sight the essence of the technology that he is wishing to acquire. In the absence of a patent, such initial sightings of the technology which it is proposed to transfer must take place through disclosures under secrecy and confidentiality agreements, which can again introduce an element of commercial risk of the leakage of the technology to third parties, thus undermining both the value of the technology from the point of view of the supplier, and the value of the technology for which the recipient will be paying. Furthermore, to cover such high risk the supplier would calculate it into a higher price of his technology.

18. Protected IPRs increase the value of inventions and R&D results to which they are related. The patent system represents a strong shield for the development of innovative domestic industry however small it may be at the moment.

19. The framework of the patent system also provides a necessary element of certainty for a technology transfer transaction. If a potential technology recipient were located in a country which did not maintain a patent system, the supplier of the technology would need to rely on purely contractual arrangements seeking to guarantee non-disclosure and use of the invention by third parties. Such arrangements establish an element of commercial risk for technology suppliers, which is more pronounced than in circumstances where the transfer transaction can be linked to a patented invention or technology guaranteeing protection against illegal exploitation by third parties.

VALUING INTELLECTUAL PROPERTY RIGHTS

20. Valuing inventions and R&D results is necessary to estimate the value of the company's intellectual property portfolio. Furthermore, it is essential to working out the cost of technology for transfer purpose. Risk affects valuation analysis, corporate valuation must reflect risk and, most importantly, risk should reflect value.

21. Valuation is not easy. There is no agreed formula, or a common approach, to the valuation of technology, R&D results, know-how or intellectual property rights in general. It is easy to predict a person's contribution to a society when he or she is grown up and we can evaluate the usefulness of that person's contribution by ascertaining age, education, work experience and accomplishments but valuation of inventions is like predicting the future contribution of a child, if not that of a new born baby. Indeed, many inventions need not have immediate economic benefits to be valuable. Embryonic technology often needs further development before its actual value is realized.

22. This has led many persons to believe that valuation of inventions is not amenable to scientific treatment and could be based more on 'gut feeling' and intuition than on precise calculations.

23. Today, one of the key factors affecting a company's success or failure is the degree to which it effectively exploits intellectual capital and values risk associated with its activities.

24. Management needs to know the value of the company's brands, other intangibles at risk for the same reasons, as they need to know the underlying value of their tangible assets. To make sure that such values are maintained.

25. In order to value intangible assets or intellectual property, it is absolutely necessary to address the question of economic life. The two concepts are inextricable.

26. Some questions that have to be answered when assessing a company's intellectual property assets:

- What IPR are used in the business?
- Who owns IPR?
- Are these IPR protected, how and where?
- What is the value of IPR (as a whole and separately)?
- What is the level of risk related to IPR (infringement third party's rights, infringement by others)?
- How can IPR be transferred or exploited?

27. When valuating intellectual property rights with a view of their commercial use it is essential that the assessment of all aspects of the transaction is seen in the whole context of the venture. Some of the considerations in respect of technology valuations are:

Size**:** Is there a market for the product of the technology?

Scale**:** Is the scale of operation of the technology appropriate to that market

Maturity: Is the technology market proven or is it new, which will require further development?

Obsolescence: On the other hand, is the technology stale, which is about to be supplemented by new developments?

Environment: Can the technology be operated satisfactorily in the licensee's environments, both climatic and cultural?

Suitability: Is the technology appropriate for the infrastructure which is available e.g. power supply, telecommunication, transport, waste disposal etc.?

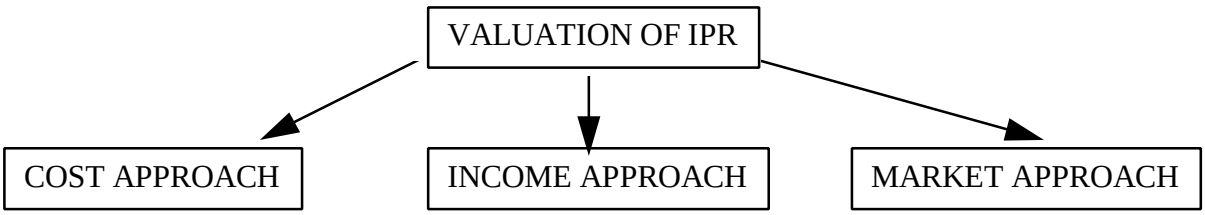
APPROACHES TO VALUATION

28. A fundamental principle of valuation theory is that the value of any asset or liability is the present value of future economic benefits or losses that can be anticipated to accrue to the owner of that asset or liability.

29. Since value can be defined as the present value of future benefits to be derived by the owner of a property, in theory a valuation needs only to quantify the future benefits and calculate their present value. These future benefits may be

- in form of income, as in the case of a security or investment real estate or royalties derived from intellectual property rights licensed to others;
- in the form of service, such as the production of goods by process equipment or manufacturing machinery;
- in the form of use benefits, such as mineral reserves or residential occupancy, or
- in the form of enjoyment, as in the case of fine arts or jewelry.

30. There are three accepted valuation methodologies:



Cost Approach

31. The cost approach is used to estimate the value of an asset by defining the amount required to replace the asset: In other words, the cost approach seeks to measure the future benefits of property by quantifying the amount of money that would be required to replace benefit the property in question could generate in future. This is usually defined *as cost of replacement.* The assumption underlying this approach is that the price of new property is commensurate with the economic value of the service that the property can provide during its lifetime.

32. One must quantify any reduction from the brand new state, taking into account the physical, functional and economic life of the asset.

33. This method is based on the cost to the buyer for replacing or finding an alternative solution. When applying the cost method to valuing an invention or technology, one must calculate the expenses necessary to redevelop (or redesign) the invention or technology. This could comprise the expenses (including the uncertainty of success) to create a new invention which would be better than the existing technology; the cost to find an alternative invention to serve the same purpose; or the cost (including uncertainty) of inventing around' a particular patented invention. Some components of the cost approach are:

- the cost of reproduction;
- the cost of replacement;
- the depreciation cost;
- the original cost;
- the book cost.

34. In relation to IPR, costs are usually not depreciated as they are written off in the year in which they are incurred. The book cost, which is the original cost less depreciation, is therefore not usually used in relation to economic evaluation of inventions, technologies or research results.

35. The price is often not solely related, if at all, to the value the invention has to the success of the licensee. Expenses incurred in transfer of know-how is one such example. Among other difficulties in putting a cost to these elements is the importance of actual time when the development began. The valuation is usually based on the historical costs and depends largely on the accuracy of financial record keeping. The valuation becomes more complex if one or more technology transfer or licensing agreements have also to be taken into consideration.

36. Principal disadvantage of the cost approach lies in the correlation of cost with value. A major danger in using the cost approach to evaluate inventions is that not all development based on inventions lead to successful products. A number of inventions, duly backed by engineering effort, ultimately do not result in market success. How should these costs be included in the cost base for the successful products? How should we apportion the failed product development costs to the cost of successful inventions?

Income Approach

37. The income approach steps away from the cost of constructing, creating or developing a new invention or technology and focuses on a consideration of the income producing capability of the IPR. The value of an asset is the present value of its future stream of economic benefits.

38. The underlying theory is that the value of property can be measured by the present worth of the net economic benefit (cash receipts less cash outlays) to be received over the life of the property. This concept is well described by Campbell and Taylor:

> *It has often been stated, but bears repeating, that assets (whether bricks and mortar, land, equipment or corporate shares) are only worth in the open market what they can earn, and the true measure of worth is the assets' earnings when related to the risk inherent in the business situation.*
>
> IAN R. CAMPBELL AND JOHN D. TAYLOR, "VALUATION OF ELUSIVE INTANGIBLES," *CANADIAN CHARTERED ACCOUNTANT*, MAY, 1972, P. 41.

39. When applying the income approach, one should not forget the "time value of money" or in other words the fact that a dollar to be received in future is less worth than a dollar to be received immediately.

40. The present value of a cash offer is obvious, and the comparison between two different cash offers can be made without difficulty. However, what is the present value of $300,000 to be received in one year? And what do we need to know about the situation in order to calculate it?

41. The first consideration we must address is how confident we feel that the payment will be made, in full and on time. If the calculation is made on the basis of an interest rate of 4% then the result would be that the present value of the right to receive $300,000 in one year is $ 288,256, or at 15% it would be $258,453[*] .

42. The three essential elements of the income approach are:

- The amount of the income stream that can be generated by the property;
- An assumption as to the duration of the income stream;
- An assumption as to the risk associated with the realization of the forecasted income.

43. A time is assumed over which the invention will generate income. A risk is also assigned to predicted income. In spite of due diligence and caution, no one can eliminate the uncertainty associated with forecasting the future. Thus it is reasonable to assume that, in commercialization, an invention is likely to fail. The chances of failure increase in the face of rapidly changing technologies

44. In determining the value of intellectual property rights, the cost of the original research and development is usually not included. They are necessary but irrelevant as regards

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[*] Table showing the present value of the right to receive $300,000 in 1, 2, 5 and 10 years

	1 Year	2 Years	5 Years	10 Years
@ 4%	$288,256	$276,972	$245,701	$201,230
@ 15%	$258,453	$222,659	$142,370	$ 67,564
@ 25%	$234,241	$182,896	$ 87,062	$ 25,266

calculating the value. Many millions of dollars can be spent upon R&D, but if the final product does not have any application, it will have no value.

45. The income accounting technique is suitable where the outcome of inventions can be evaluated fairly accurately in terms of cash income. Where it is not possible to give specific value to the commercialization of invention, this approach is not useful as it leads to assigning arbitrarily value to intellectual property.

46. The income method presumes that expected sales income sets the value. A typical calculation in the income method is to estimate the market potential of the technology, predict a portion of the market size that a company could realistically expect to capture and then to assess a royalty on the sales to work out the total value of the technology.

47. The income approach is best suited for the appraisal of the following:

- Contracts;
- Licenses and royalty agreements concerning patents, trademarks, and copyrights;
- Franchises;
- Securities;
- Business enterprises.

Market Approach

48. The market approach is the most direct and the most easily understood appraisal technique. It measures the present value of future benefits by obtaining a consensus of what others in the marketplace have judged it to be. Here, 'fair market value' is taken as the amount at which the IPR (invention, technology, trade mark, know-how, etc.) profitability would exchange hands between a willing buyer and willing seller.

49. There are two requisites for the market approach:

i) an active, public market; and
ii) an exchange of comparable products.

50. The residential estate market is a good example of a market where these conditions are usually present. There is generally some activity in this market in a given area, and selling, asking, and exchange prices are public. Of course not all residential properties are similar, but given enough activity, reasonable comparisons can be made. Where these optimal market conditions do not exist, using this approach involves more judgment, and may become a less reliable measure of value.

51. The market approach depends on what others have paid for similar technology and relies on the concept of 'prevailing industry standards.' The difficulty with industrial property valuation is that one does not always know what others are paying for similar technology since price information or such sales or licensing statistics are usually kept secret and not as easily available. Nevertheless, there are 'industry norms' which licensing or acquisition professionals generally quote and use.

52. The market approach is rarely used for the valuation of intangible assets and intellectual property, largely because of the absence of one or more of the following conditions: active market[1],.public market[2], comparability[3], and difference in time[4].

53. Where there is enough and reliable information about the sales of properties that are similar to the subject, the market approach can be the best method to measure value. As the number of "comparable sales" or the information about them dwindles, or when the lack of comparability makes adjustment speculative, then this approach ceases to be useful.

54. The market approach is most effective for variety of consumer goods, equipment, real estate, but it is least effective for special-purpose or unique machinery or equipment and most intangible assets and intellectual property rights.

55. The market approach takes the analyst right to the "bottom line" of fair market value. The assumption is that other buyers of comparable property were willing, had knowledge of all relevant facts, and struck a deal that was fair and, therefore, represented fair market value at that time and for that property. The market measures and adjusts for all forms of appraisal depreciation: physical, functional, and economic.

56. In conclusion one can say that the cost, income and market approaches are tools of valuation and virtually all types of property can be valued using them. The analyst should consider the use of all three for every property because a comparison of the values resulting from each will either confirm the conclusions or highlight inconsistencies that should be investigated.

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[1] *Active Market* The ideal situation is to have a number of property exchanges to use in this analysis. One sale does not make a market. There are, for example, publicly-traded common stocks in which only a few shares are traded in a year. Their exchange price has much less validity as a measure of their value than, for instance, General Motors stocks, in which thousands of shares are traded each day.

[2] *Public Market:* To be useful, the exchange consideration must be known or discoverable. The prices of common stock in the primary exchanges are known in minute detail. For other types of property, it becomes more and more difficult to discover the exchange price. Even with real estate, the published price may be misleading due to financial arrangements between buyer and seller that are not made public. Transactions between businesses, such as the sale of a plant, product line, subsidiary branch, know-how, patent or trademark may be very difficult or impossible to evaluate because competitive pressure motivates the participants to keep the details confidential.

[3] *Adjustments for Comparability:* The best of all worlds for an appraiser is to find, for a specific property, at an arm's-length sale of an exact replica property, across the street, the day before the appraisal. Unfortunately this does not happen with enough regularity to eliminate the need to make adjustments when the "comparable sales" are not exactly comparable. Real estate appraisers continually grapple with the problem of quantifying differences in property, so that the location, amenities, zoning, size, shape, and topography of comparable sales can be equated to the subject and thus provide an indication of value.

[4] *Adjustment for Time:* Sometimes it is necessary to utilize sale information that is not contemporaneous with the appraisal. In this case, the appraiser must adjust for price changes over time, and this may necessitate a separate study of changes in property value in the subject area during a recent period of time so as to develop some specialized indices to use in the adjustment process.

Practical Valuation Methods

57. What are the practical ways to value an invention? When possible, the financial aspects should be the primary basis for a business evaluation: i.e., the revenue potential and the cost. But just as important is to judge the probability of success. In the context of university research useful checklists have been developed which allow consideration of several categories to evolve an overall picture. The purpose of such checklists is to give one a general idea of the economic potential of inventions or research results. One such checklist, based on a checklist used at Stanford University, is shown in the Annex.

CONCLUSION

58. Some of the methods outlined in this presentation highlight various pathways of valuation intellectual property rights, including the valuation of inventions and research results for purpose of commercialization. They point out the variety of options available in working out financial compensation as a part of overall technology transfer, or a merger and acquisition, or even the privatization of enterprises.

59. Reliance on costs as a basis for valuation of intellectual property rights can become misleading as the amount spent to develop know-how or to impose a trademark on the market is usually not the same as value of that know-how or trademark. Adequate return needs to be based on value, not on cost. This includes consideration of the potential income, an estimate of the risk involved, realization of that income, cost of obtaining the income, time value of money and the duration of the license.

60. Return on sales is the common approach but also has the weaknesses that the licensor's own market experience often overlooks the value and the investment risk associated with the new know-how.

61. None of the different ways of valuation of intellectual property rights are sufficient in all cases to provide a correct indication of the fee for commercial exploitation of the efforts. The theory and the established practices, however, provide guidance in arriving at equitable value of IPRs. The increasing role of technology in economic growth and the growing transfer of IPR for competitive performance within and across borders makes this an important issue.

[Annex follows]

CHECKLIST FOR EVALUATION OF INVENTIONS

(based on a checklist prepared by Dr. Katherine Ku,
Director, Office of Technology Licensing, Stanford University, California, USA)

Invention Title:
Field of Technology (IPC class/Subclass):
Inventor(s) Name :
Address:
Contact telephone, fax, e-mail, etc):
Owner of the Invention (if different from the inventor, e.g. company):

REVENUE POTENTIAL	OVERALL ASSESSMENT	(+)	(-)	(0)
What is the stage of Development	. Idea . Drawings/Formula Recipe . Prototype . Pre-Industrial Use . Regular Production			
Are Commercial Applications Identified	. First Use . Follow on Opportunities . Multiple Fields of Use . "Hot List" Fields			
What's the Competition	. How happy are Customers with current Solutions . Are alternative Technologies progressing . Number of related Patents/Patent Activity . Number of related Inventions/Disclosures			
Essential Licensees	. Are Sponsors interested . Number of Potential Licensees . Is the Industry predisposed for Licensing (+) or against Licensing (-)			
Who will derive Value	. End Customers . Licensees/Sublicensees . Other Users (specify)			
Is the Patent/License Enforceable	. Enforceable - Yes or No? . Distinguishable from Alternative Approaches - Yes or Partly No?			

Notes: (-) Unfavorable - Don't pursue
(+) Favorable - Pursue
(0) Neutral

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Invention Title:
Field of Technology (IPC class/Subclass):
Inventor Name :
Address:
Contact telephone, fax, e-mail, etc):
Owner of the Invention (if different from the inventor, e.g. company):

PROBABILITY OF SUCCESS	OVERALL ASSESSMENT	(+)	(-)	(0)
Track Record of Inventor	. Previous Successes (please list and give assessment (+) or (-) or (0))			
Who are the Champions	. Industry support . Inventors/Scientists . Customers			
Is this Project Within a Hot List Field	. Government . Venture Capital . Industry			
Does it Build on Previous Successes	. An Extension of a Related Commercial Success . Do Markets, Channels, Customers already exists? . Have manufacturing Processes been proven			
What Stage in Development Process	. Working Prototype/Mass Producible . Proof of Concept . Analytical Work . Idea			
Relationship with the Industry/Discipline	. Networks with Industry . Networks with Academics . Technology well understood			

Notes: (-) Unfavorable - Don't pursue
(+) Favorable - Pursue
(0) Neutral

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Invention Title:

Field of Technology (IPC class/Subclass):

Inventor Name :
Address:
Contact telephone, fax, e-mail, etc):

Owner of the Invention (if different from the inventor, e.g. company):

COST	OVERALL ASSESSMENT	(+)	(-)	(0)
Administration	. Time available to file for Protection . Complexity/Complications			
Licensing	. Receptivity of Potential Licensees . Number of Potential Licensees . Nature of License Terms (Industry Standards) . Monitoring/Maintenance required			
Patenting	. Financial Support from Sponsors/Licensees . Interrelationships with other Patent/Prior Art . Geographic Coverage . Complexity of Concept/Prosecution			
Enforcement	. Easy to determine Infringement?			

Notes: (-) Unfavorable - Don't pursue
(+) Favorable - Pursue
(0) Neutral

Date Patent & Literature Search Completed _____

Associate Initials & Date _____

[End of Annex and of document]