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IPT's Quick & Dirty Economic Valuation Method: An Empirical Test on Three Cases

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The assessment of economic potential of technological innovation projects and its valuation are key aspects in negotiations among universities, research institutes, and companies. Among the reasons for this, it can be quoted portfolio prioritization, which involves several different economic, social, and environmental impacts aspects and industrial productivity. The standard of economic potential is an important reference in the project selection process. For technology transfer, the valuation of technologies consists in a relevant task to support intellectual property (IP) negotiations. However, in dynamic environments, negotiations for the commercial exploitation and payment of IP resulting from research projects require quick answers, due to several aspects like tight deadlines to sign contracts. Moreover, technology valuation is one of the most complex activities related to the technology transfer. Due to these challenges faced by Instituto de Pesquisas Tecnológicas do Estado de São Paulo (IPT—Institute For Technological Research) in its participation in Brazilian Association of Industrial Innovation (EMBRAPII, acronym in Brazilian Portuguese), authors developed an expedite technology valuation method, based on concepts of discounted cash flow (DCF) associated with Gompertz curve adaptations as a way to support universities and research institutes in negotiations with enterprises. This method has been regularly applied on negotiations between IPT and companies. This paper will present cases of metallurgical companies. The results obtained confirm the validity of the method in supporting the definition of the payable amounts for commercial exploitation of technologies, enabling the application of this method as an alternative to some methods found in the literature and eventually employed by universities and research institutes in Brazil. For future research, authors recommend comparative studies between Gompertz curve and other methods, such as the Pearl curve, using the same variables of our method.

Keywords: technology valuation, technology transfer, intellectual property, economic evaluation, intellectual property (IP) agreements

Introduction

The Institute for Technological Research of the State of São Paulo (IPT—Institute For Technological Research) is one of Brazil's largest research institutes, with state-of-the-art laboratories and a highly qualified

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team of researchers and technicians working basically in four major areas: innovation, R&D, technological services and metrological support, and information and education in technology. It was founded in 1899 as engineering school laboratory. IPT is a public research institute linked to the State of São Paulo, Brazil. According to 2013 figures, the IPT had this organizational profile:

- number of laboratories: 37;
- employees: 908;
- budget: R$ 140 million (€ 45 million).

Since 2012, IPT has been a part of the Brazilian Association of Industrial Innovation—EMBRAPII, founded by the Brazilian government. EMBRAPII promotes the interaction among research organizations with Brazilian companies to develop technological innovation. Besides innovation, the Brazilian government expects to increase the number of industrial property (IP) agreements and patents. During the IP negotiations, it is quite important to get some ideas of the technology's economic potential as well as the period of the negotiations, always defined in the short term.

Under this context, the Department of Business Support of Planning and Business Coordination of IPT developed a "Quick & Dirty method" to estimate the value of technological projects to support decision makers in the IP agreements between companies and IPT. Since December 2012, the method has been applied in the negotiations of commercial exploitation of technologies resulting from EMBRAPII projects.

The main goal of this paper is to demonstrate the application of the IPT's "Quick & Dirty method" and illustrate it with the metallurgical companies' cases. The results obtained confirm the validity of the method in supporting the definition of the payable amounts for commercial exploitation of technologies, enabling the application of this method as an alternative to the methods found in the literature and eventually employed by universities and research institutes in Brazil.

The paper structure defined for this objective starts with this introduction. In sequence, it presents some considerations of theoretical concepts. Next, it describes the method, presents the main results, and finally finishes with the conclusions.

Theoretical Background

The term "valuation" refers to the task of obtaining the monetary value of an asset, object, or organization (Boer, 1999). The valuation methods can be summarized into three different approaches: cost, market, and income (Parr & Smith, 1994; Y. Park & G. Park, 2004). Each approach carries specific methods, with their advantages and limitations, for example, methods based on the cost tend to ignore the future value of a technology, but, instead, require fewer assumptions for its application (Santos & Santiago, 2008). However, since technology value is based on historical values, it cannot be taken with its real potential value (Boer, 1999). The theory of real options—method based on income—has several benefits, such as managerial flexibility and technological uncertainty. However, it is a complex method application, requiring several assumptions use (Black & Scholes, 1973; Trigeorgis, 1995; Copeland & Antikarov, 2001; Erbas & Memis, 2012). In section three, the basic IPT's method proposed to this article will be presented in more detail.

Method

The IPT's method is defined in four steps. It's based on concepts of Discounted Cash Flow (DCF) associated with variations of Gompertz curve (Gompertz,1825) as a way to support IPT in IP agreements with companies.

Gompertz curve was created by Benjamin Gompertz in the 19th century for human mortality rate influenced by age-dependent component. It is a mathematical model related to time series (logistic curve with S-curve behaviour). Under these features, it's possible to develop different uses for the original model (Gompertz) such as designing scenarios for the value of technology. Basically, the Gompertz technique works with three variables: B-factor, K-factor, and limit value. B-factor has influence in the beginning of the curve. Changes on B-factor can extend the period of time to market (Figure 1). K-factor, otherwise, has influence in the slope of the curve until the limit, when the technology presents high demand or slow insertion. Changes on the K-factor can adjust the curve for these conditions (Figure 2). Limit value is the goal to be reached, as, for example, 15% of market share or 24% of company's revenue. In the figures below, 100% means that it reaches this goal. The formula is:

$$P_t = Le^{(e^{-kt})-b}$$

where, P = participation; t = time (year); k = K-factor; and b = B-factor.

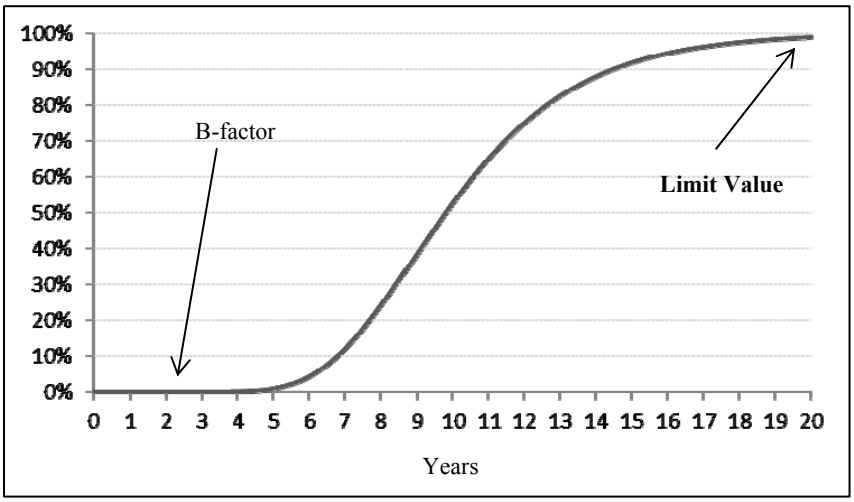

Figure 1. B-factor and limit value.

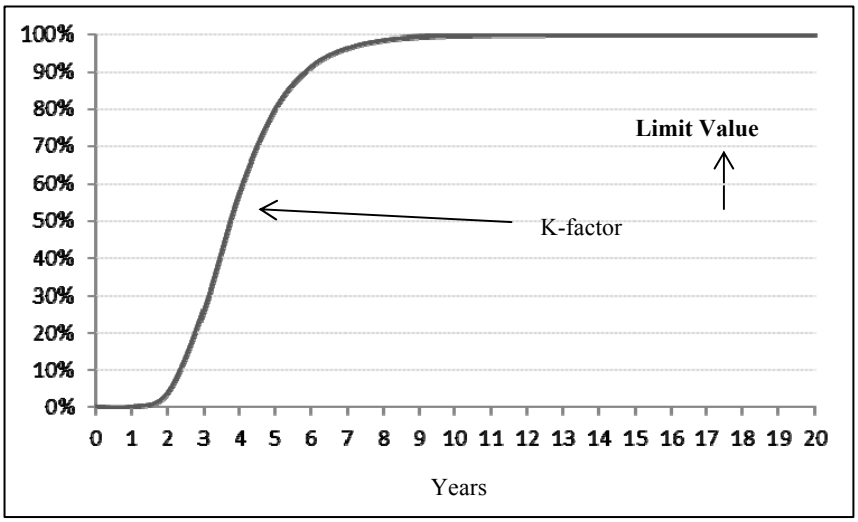

Figure 2. K-factor and limit value.

For the purpose, this technique helps to make scenarios with several possibilities, as expansion, maturity, and decline of technology in the market and forecasting growth period. In general, authors work with three

probability scenarios: pessimistic, expected, and optimistic. Through occurrence probabilities, it has the expected value (EV) of technology. The IPT's "Quick & Dirty method" can be applied in a short period of time, since authors have reliable input informations. The reference method assumes that technical success and successful market share of the project will be well succeeded. Basically, the method is defined in four steps as shown in Figure 3.

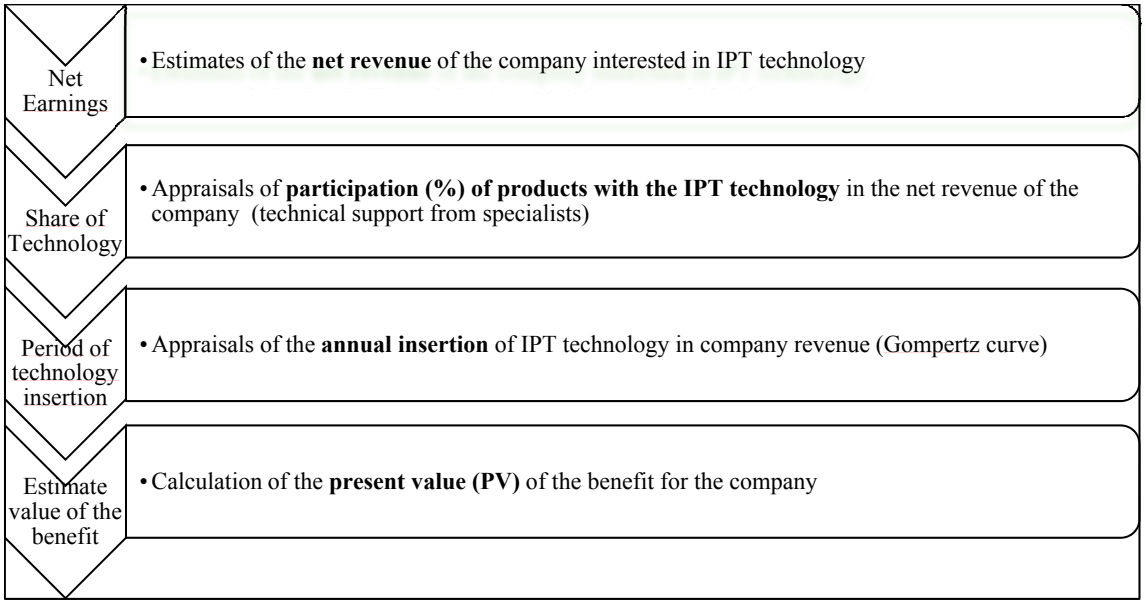

Figure 3. Steps of the IPT's "Quick & Dirty method" application.

Estimates or data of the net revenue of the company are the starting point. The next step is the most important and complex phase of the method. Authors need a lot of discussion with technical experts in order to abstract properly what specific company activities could suffer the impact of new technology implementation.

The next phase of the method is appraisals of the participation of this technology in the net sales of the company along the time curve (technology adoption). From these curves, authors get a financial cash flow of the technology benefits. According to the industrial segment, the technology may have different life cycles as well as any product in the market. So, the broad understanding of the innovation dynamics, such as S-curve analyses and technology cycles are fundamental to analyse possible routes of technology evolution.

Finally, authors calculate the present value of technology benefit. From the IPT's point of view, the net present value (NPV) of each project considers the economic and financial amounts invested by IPT in the projects. Basically, this resources are those related to the payment of workforce, indirect costs, overhead, and researcher prizes (1/3 royalties or success fee resulted from negotiations). The hurdle rate used by IPT is 9.5% per year. In this condition, the minimum NPV needs to be greater than IPT expenses for each project. Thus, the values for the royalty rate or success fee (fixed value) have been calculated on the basis of participation considered "fair value" by the IPT—in most cases, in agreement with the partner firm—in general never being less that minimum NPV calculated, unless other strategy benefits are taken into account.

It's important to emphasize the results of "Quick & Dirty method" application in the negotiation process strategy. In general, IPT's researchers meet members of the partner company to present: calculation procedure,

assumptions, and variables used for the valuation plus market analysis. Several meetings between IPT and firms happen to refine data and valuation results. This is the main step for the negotiation success. It aims to achieve two specific objectives: (1) decrease the gap of information (market, financial, business, and etc.) between IPT and the partner company; (2) transparency in relation to the negotiation assumptions and information data used in the valuation method.

Results

As a result of IPT's "Quick & Dirty application", until May 2014, 18 proposals have been analyzed. From those, 12 have become contracts and 11 technologies were valued with the method support. The type of contracts was royalties and success fee. For this paper, authors are presenting three specific cases of metallurgical companies in face of the importance of this economic segment in the Brazilian economy. Furthermore, the expressive values were obtained in the final agreements to demonstrate the process and a result of IPT's "Quick & Dirty method" application. For confidential reasons, the company's name and the technology description have been omitted. Table 1 presents the result of the final agreement of these three contracts.

Table 1
EMBRAPII Projects—Final Agreement of Metallurgical Industry Projects

Company	Technology	IPT's Break Even Point	Final Agreement	IPT's Internal Rate of Return (IRR)	Contract Type
Company A	Rolling mill rolls	€ 240.000	€ 350.000	10.5%	Success fee
Company B	Piston rings	€ 80.000	€ 1,750.000	16.4%	Royalties (1%)
Company C	Steel slag	€ 1,250.000	€ 2,750.000	7.4%	Royalties (4%)

In general, not only for the cases above, authors can detach these main issues for the IPT's "Quick & Dirty method" application:

- The optimistic, pessimistic, and expected scenarios analysis has contributed to improve the expected future revenues value from the commercial exploitation of the technology resulting from the project;
- To consider the expenditures done by IPT in research has enabled the calculation of the IPT minimum value to be accepted in the negotiation process;
- The royalty fee (when applicable) has been considered in terms of a range of values, starting from the minimum amount mentioned in the previous item to the average practiced by the market, based on the book *Royalty Rates for Licensing Intellectual Property* (Parr, 2007);
- The IPT's "Quick & Dirty method" has enabled the reduction dependence on royalty rates shown in the literature. This fact has contributed to the value calculation more appropriate to Brazilian reality, as opposed to averages shown, for example, by Parr (2007), cited as outdated and incompatible with the Brazilian management innovation in some studies (Guimarães, 2013);
- The project IRR adjustment to the hurdle rate (9.5% based on prime rate of the Brazilian economy in October 2013) enabled that two of these three metallurgical technologies have valued higher than those expected by the institution, even the technology that got lower value (IRR = 7.4%) than hurdle rate selected due to others strategies.

Besides the aspects shown in the items above, the method has made agile negotiations of royalties/fees to be paid by successful commercial exploitation of technologies developed by IPT. Before the development of

the “Quick & Dirty method”, the assessment process took from four to six months to complete. Currently, the valuation is usually completed in a week, allowing quick negotiations with satisfactory results, as shown in Table 1.

In addition, as result of the negotiation process strategy mentioned in the item three (method), it was possible to get support from most companies to the valuation process of IPT. Furthermore, companies agree with the researcher prizes and reinvestment in research politics came from the remuneration of the commercial success of the technology.

Although the method has become fundamental in the technological negotiation supporting within the EMBRAPII projects, it is necessary to evaluate more precisely the method variables, in order to determine the most sensitive aspects and thus allow accurate information survey, in face of the elasticity of (1) discount rate, period to a maximum contribution of technology in sales and (2) decrease rate, K-factor and B-factor, as shown by Azevedo and Guimarães (2013).

Conclusions

The objective of this paper was to present concepts, development, and application of the IPT’s “Quick & Dirty method”. The results obtained confirm the validity of the method to supporting decisions makers in the definition of the amounts payable for commercial exploitation of technologies, enabling the application of this method as an alternative to the methods found in the literature and eventually employed by universities and research institutes in Brazil.

The method limitations are mainly in the variable “share of technology in the company’s revenues”, due to two main aspects: (1) difficulty to define accurately the input value of the variable; (2) new technologies to the company’s portfolio, this estimation becomes impracticable, due to the lack of historical data on the performance of technology and by limitation of the revenue information to be incorporated into the current company revenues. For future research, authors recommend comparative studies between Gompertz Curve models and others, like Pearl Curve, using the same variables of the method to attend the end results, have been met with IPT’s “Quick & Dirty method”. Moreover, the method is flexible enough to accept adjustments in their variables. Therefore, it is suggested that adaptations of input variables is proposed as alternatives to the method presented in this paper.

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