Development of a model based on financial and operating metrics for investment decisions

Nilton C. Carraro*, Giovani B. Gemente*, Carlos C. Lima*

* Production Engineering Graduate Program, Methodist University of Piracicaba, Santa Bárbara d'Oeste, São Paulo, Brazil.
+ ABEPRO, Brazil

Email: nilton.carraro@fgv.br; g.beccari@yahoo.com.br; crlima@unimep.br

Abstract

This study aims to demonstrate mechanisms for evaluating the performance of an asset through the operation strategy approach as a fundamental element to a successful corporate strategy. Based on the model of measuring performance targets proposed by Slack, an extensive literature review was performed enabling the creation of a special and unique model for financial and operational metrics that drives investment decisions as assumptions to define the corporate strategy. Defined the model, simulations were conducted at some companies from different economic sectors and tests were carried out to verify adherence to the model. Therefore, given the resulting high level of suitability of the proposed model, the objective of this paper is to show these results to other researchers with the intention of encouraging contributions to the model and make it a useful tool for this kind of decision.

Keywords: assets, operations strategy, corporate strategy.

1 Introduction

There are several factors that can lead to the replacement of assets in industrial, commercial, and even service organizations. Deterioration may be one factor, which manifests by operational costs arising from excessive maintenance as well as loss of productivity.

The need for innovation is another situation that requires massive investment in research and development, often culminating in the acquisition of new assets.

Basically the combination of these two factors promotes a lot of pressure from the competitors in the market which need to generate competitive advantages seeking to maintain its main objectives: profit and continuity.

However, there is not always a certainty that these benefits will be achieved with this new investment. This is a concern that would justify some deeper investigation.

The right moment to evaluate and to replace equipment related to company's strategy should be mentioned, as the quest for competitiveness is intrinsically connected to that decision. Decision makers must be aware of a major triad: strategic alignment, asset productivity and technology trends. This condition has been the focus of several studies (CINTRA and CAGNIN, 2012; BACADAR, 2008; BUSSE, GOYAL and WAHAL, 2010).

One element of great importance for investment decision in new assets is related to machines and equipment. As a basis for corporate strategy aligned with market trends, it is necessary that investments in these assets are consistent with a major concern for entrepreneurs, i.e., if the need to invest really exists. This decision shall first seek the harmonization of investment with the operations strategy (SLACK, LEWIS, 2008) and the maintenance strategy (NAKAJIMA, 1988).

So, seeking productivity and maintainability in investment for production assets is necessarily to get the velocity with which the production has to be performed, the flexibility to change in different types of

operations, the costs involved in maintenance, the reliability it has with customers from the use of these assets, and, in particular, the quality received by the final consumer.

In this sense the main objective of this work is to demonstrate mechanisms for evaluating the performance of an asset from the approach of operations strategy as the base element to the financial and economic stability. To this end, a proposal is shown, developed based on five performance objectives of Slack and Lewis (2008) where through operational and financial metrics it was possible to create an analysis model that favors subsidies that can assure more confidence to the decision maker on capital investment.

A brief literature review on the subject will be presented providing a basis for building the model that will be demonstrated in section 3. The main considerations about the model and the prospects for future contributions will be shown in section 4.

2 Theoretical Reference

According to Slack et al. (2006), the tangible assets of enterprises are important components of the manufacturing function, which in a healthy state, allows organizations to meet their goals and objectives.

The increase in assets of these companies in search of lower costs and higher overall efficiency has increased considerably in recent decades. This trend drives companies to increase the number of machines in its plants thus generating higher return expectations from this new investment.

The economic and financial engineering lately has occupied an important place in management decisions, seeking mainly to design safety in decisions, through mechanisms that design time, rate, and estimated return. In this sense, the use of many tools in this field has been expanded, but there is still little practical combination of indicators from production of the corporate strategy. This study aims to present an attractive combination of these elements.

It is therefore important to make a brief presentation of the elements, their purpose and what is their participation within the proposed model. Starting with EVA® (Economic Value Added) of Stewart (1991), it recommends operating profit as the one able to pay above the weighted average cost of capital, and now is very different from accounting profit, which is susceptible to interference from the tax on income which includes the deduction of some financial expenses and even the non-payable ones, increasing operating accounting profit, modifying the operating return on investments. Within the model, the EVA® will be the key to the decision maker to be sure that the investment will achieve a net operating profit above the weighted average cost of capital.

The proposal open in this work also presents methods of financial engineering that compose the group called corporate finance. Among the key indicators arising from this area, according to Damodaram (2001) and Brealey and Myers (2001), are the payback (measures the return time), IRR (measures the Internal Rate of Return), NPV (measures the Net Present Value) and ROI (measures the profit generated by the investment). These indicators have been calculated separately and further combined seeking to justify a particular decision, but in the proposed model the combination of time, rate, net value and profitability, will allow the addition of factors arising from the proposed economic engineering and production to have more acuteness on the EVA® being designed.

This model also presents matrices of capacity and demand strategy according to Slack and Lewis (2008). The matrices of capacity will seek an alignment between operations strategy and corporate strategy, from the following key question: "Do you really need to invest, and will this investment be sufficient to reach production and quality needed to keep the company competitive?" In response to this question, the performance matrix from the model presented will ensure that the investment decision is correct, allowing a satisfactory financial and economic outcome that will meet both market demands and the demands of investors, minimizing the so-called agency conflict (PRATT and GRABOWSKI, 2008).

The extension of this study is much larger than the page limit for publication in Journals and Conferences, so this chapter was limited to a brief concept of each technique and presentation of references, allowing that the extension to be used in the next section enables the full understanding and integration with the proposed work.

3 Methodological Approach

One assumption of this work based on the large previous experiences of the authors is that the combination of the elements presented in section 2 could generate a new and significant model to justify an investment decision harmonizing the interests of investors (profit) and the interests of the company under competitiveness gain. It is assumed that these inferences would fit into a model that could be accepted and validated by both the academy and the market. Thus, it is intended in this section to outline how the research was developed, including the definition of the population, data collection, exploratory analysis, attempting to ensure the reliability, and scientific rigor.

The scientific method wants to find out the reality of the facts as they are discovered and these must in turn guide the use of the method. However, as already stated, the method is only one means of access; only the intelligence and reflection to discover the facts and phenomena really would give answers to the decision problem (CERVO and BERVIAN, 2002, p. 25).

The scientific method want to discover the reality of the facts as they are discovered, and these must, in turn, guide the use of the method. However, as already stated, the method is only one means of access, only the intelligence and reflection to discover the facts and phenomena really are (CERVO and BERVIAN, 2002).

Collis and Hussey (2005) define that the descriptive and qualitative research is the most appropriate for this type of treatment because of the methodology that was used for this investigation. To make up the corpus technique data collection it was used that, according to Beuren (2003), is the kind of research that is based on "materials that have not yet received an analytic treatment or can be reworked in accordance with the research objectives". Once structured composition of the corpus was defined as a method for interpreting the data for the content analysis that, according to Bardin (1991, p. 42), consists of a set of techniques for analysis of communication in order to obtain, for procedures, systematic objective description of the content of messages, indicators (quantitative or not) that allow the inference of knowledge concerning the conditions of production/reception (inferred variables) of these messages.

4 Proposal

Once the collection of the entire database has been developed and drawn, initially we started up for the analysis using the software Sphinx, which allows the lexical and content analysis, and statistical processing, where after the stratification of the database by economic groups, the first step was to determine which acquisitions had similarity between investment and return through the application of various quantitative methods.

After obtaining the treatment of this database and the creation of views, it was decided to apply the same considerations to obtain simulations with publicly traded companies to disclose their financial information to the public, however, the results were biases, because factors such as the average cost weighted capital were not explicit in the financial statements, determining certain level of subjectivity in the results.

Therefore, before exhibiting this new model to the market, this research considers how salutary to submit it to scientific scrutiny, so that under the analysis of scholars it could obtain contributions to the improvement of what is being called the method "U^{ic}", according to the formula:

$$U^{ic} = \frac{\text{Payback x (Investment - NPV) x } \sqrt{\text{IRR}}}{\text{ROI + (100 – Doper)}} \geq \text{EVA}^{®}$$

The name given to this assessing model for new investment means: "U" honoring the University that welcomes research and researchers, leading to such type of results; "IC" means Certificate of Investment; and Doper stands for "Operating Performance". To better understand the applicability of the concepts shown in section 2 and the formula above, a real case of investment is presented which for ethic and professional secrecy will not be identified.

4.1 Financial Model - Numerator

This proposed model has emerged as traditional alternatives used until then, that seek to analyze an investment in the financial focus (return) or in the operational focus (production). Thus, based on the use of the method "U^{ic}", these analyses were obtained in a single model that would provide answers under the operational gain (competitive) and also under the financial gain (return to investors). To illustrate the applicability of this model, one recent case was extracted from the analyzed database, where mutually exclusive investment options are described in Table 1.

Table 1 – Information of a new investment (Amounts in $ thousands)

Equipment	Investment Year 0	Cash Flow End of Year 1	Cash Flow End of Year 2	Cash Flow End of Year 3	Cash Flow End of Year 4	Cash Flow End of Year 5
A	-1,800	300	700	1,000	600	800
B	-1,800	400	500	600	1,100	1,300

The first step in the traditional investment analysis is to calculate the discounted Payback, IRR and NPV. In this case the compound interest rate of 18 percent on a year was adopted, as calculations presented in Table 2.

Table 2 – Calculation of key indicators of return on new investments

Equipment	Investment Year 0	PAYBACK discounted	IRR	NPV
A	-1,800	4.37 on a year	22.77%	$ 224.76
B	-1,800	4.30 on a year	25.52%	$ 398.86

In a traditional analysis of investments, this would be the main scope of analysis from the financial perspective or from the investor perspective: how much capital is required, what is the payback, what is the internal rate of return on this investment, and net present value which would take place. Importantly, for the NPV to be accepted, it must be greater than zero. These indicators respond to investors only in the financial perspective.

Thus, this type of analysis has no relation to the needs of competitiveness that enterprises face. This is how the experience of consultants, obtaining outlooks from a substantial database, allowed to add elements from the economic engineering and production, which would answer the question to solve the second part of the model, which is shown in the next section.

4.2 Operational Performance Model (Doper) - Denominator

Based on an analysis of operating a machine, you can determine how important is the investment for the company in terms of competitiveness, because besides responding the needs of investors in obtaining the financial return, it would also help in understanding the earnings in the scale between capacity and demand, allowing to see the strategic gains in quality, velocity, reliability, flexibility and cost (Fig.1).

This is an extremely qualitative approach, although it seems the opposite, because these five performance objectives, along with the balance between capacity and demand, rely almost exclusively on market behavior, which according to Farrel Jr. (1997) is regarded as a macroeconomic variable taken as systematic risk, therefore, uncontrollable.

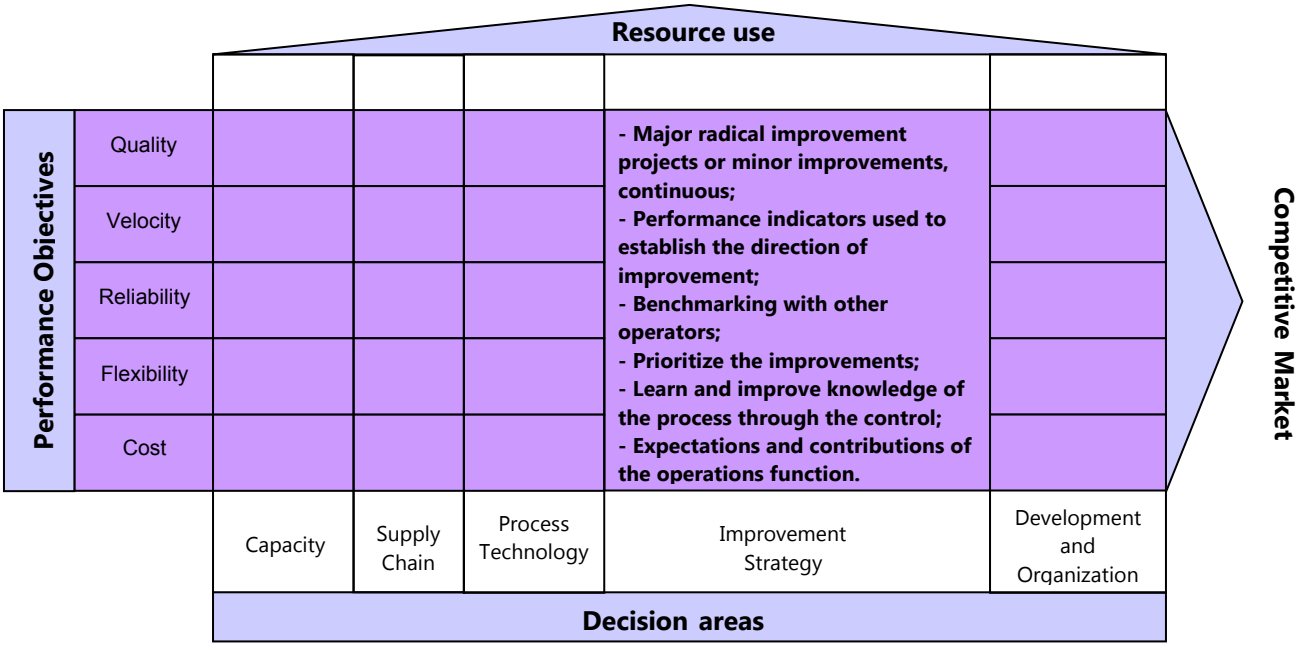

Figure 1 – Matrix of five performance objectives. Source: Slack and Lewis (2008)

The use of the matrix of figure 1 is shown next; however, each company can and should adapt it for its specific operations and objectives.

In the same way as in item 3.1, results were shown in the numerator view for the model "U^{ic}", it will be shown as a denominator with the quantitative results obtained using the matrix of five performance objectives. The performance parameterization is shown in Table 3.

Table 3 – Performance parameterization

	VELOCITY	FLEXIBILITY	COST	DEPENDABILITY	QUALITY
A	Parts Produced / Total of parts produced	Different operations performed / Total of different operations performed	Maintenance Cost / Value of Equipment	Total number of complaints / Total numbers of invoices	Defective parts / Total of defective parts
B	Parts Produced / Total of parts produced	Different operations performed / Total of different operations performed	Maintenance Cost / Value of Equipment	Total number of complaints / Total numbers of invoices	Defective parts / Total of defective parts

Source: Slack and Lewis (2008)

In order to verify the applicability of this research in each type of company relating to corporate strategy, a mark (%) should be inserted in each of the indicators according to the degree of importance. For

example, in this research the considered marks were: 10% (Velocity); 10% (Flexibility); 60% (Cost); 10% (Reliability); 10% (Quality). After this, multiply the percentage found in each of the five performance objectives and multiply those by their assigned weight.

The observation period to extract the numbers of indicators should be chosen according to the needs of each company. The higher precision, the lower should be the observation time (hours/days/month/year).

To determine the Doper, data from the company under study are faithfully presented in the following section (Table 4).

Table 4 – Profile of the financial and economic investment alternatives

	Equipment A	Equipment B
Indicators	Real/Estimated	Real/Estimated
Velocity	150/200	130/240
Flexibility	05/06	04/09
Cost	$ 130,000/$ 500,000	$ 10,000/$ 1,060.000
Reliability	15/170	22/29
Quality	97/200	131/240
Result on Doper	36%	23%
Investment	$ 1,800	$ 1,800
ROI	36.3%	46.1%
EVA® = (ROI – WACC) x Investment	$ 310	$ 250

However, it is important to demonstrate how the Doper should be analyzed (Table 5).

Table 5 – Doper deployment

	VELOCITY	FLEXIBILITY	COST	RELIABILITY	QUALITY
EQUIPMENT A	75%	83%	26%	9%	49%
EQUIPMENT B	54%	44%	1%	76%	55%
MARKS	10%	10%	60%	10%	10%
EQUIPMENT A	0.08	0.08	0.15	0.01	0.04
EQUIPMENT B	0.05	0.04	0.01	0.08	0.05

There weren't presented the economic and financial data that would allow do calculate ROI and EVA®, as way to maintain secrecy about the identity of the company.

By the transcription of the results of tables 2 and 4 to the method "U^{ic}", the verification of the suggested applicability of the model is presented. The investment alternatives are shown below:

$$U^{ic} = \frac{\text{Payback x (Investment - NPV) x } \sqrt{\text{IRR}}}{\text{ROI + (100 – Doper)}} \geq \text{EVA}^{®}$$

Replacing the data in the formula, we have:

Equipment A

$$U^{ic\ A} = \frac{4.37 \times (1{,}800 - 224.76) \times 4.77}{36.3 + (64)} \geq EVA^{®}$$

$$\mathbf{U^{ic\ A} = 328.36 \geq 310.00}$$

Equipment B

$$U^{ic\ B} = \frac{4.30 \times (1{,}800 - 398.86) \times 5.05}{46.1 + (77)} \geq EVA^{®}$$

$$\mathbf{U^{ic\ B} = 247.37 \leq 250.00}$$

Using the matrix of the five performance objectives the Doper can be calculated and then get through the model proposed a new systemic view of investment possibilities.

From the financial point of view (the investor), the investment in equipment B would be more interesting, because it would have a lower payback and higher return and net present value. However, by observing factor EVA®, it can be noted that the investment is less than in A precisely because of the operational achieve results in greater amounts and not only in cost.

Adding Doper of the method "U^{ic}", the results were favorable in the equipment A as a reflection of the projected financial results in economic gains will result in a global optimum better than the alternative of investment in equipment B.

Thus, it was found that "U^{ic}" for the equipment A is above designed EVA®, comprising results above of the economic and financial prospects.

Presented these considerations on the applicability of the model, it is essential to achieve the evaluation of the academic community for its consideration before submitting the model to the assessment of companies.

5 Conclusion

This research is the result of deep reflection involving quantitative and qualitative methods from a substantial database that has allowed that the integration of theory and practice could be achieved.

It is understood that the proposed work was carried out because the applicability of the model was established, encompassing factors from operations which will result in a better prospect for investment.

The final result was to present the new model based on financial and operating metrics for investment decisions called "U^{ic}".

This model consists of a proposed merger of financial engineering to production engineering, resulting in an alternative analysis for new investments aligned with corporate strategy and operations, seeking to deliver value to its users through an analysis and reflection that the method is really applicable.

As a further input, it is expected that other tests of this proposal may arise in order to improve the model. So, with gains in relevance and applicability, the model would allow companies and investors to have a broader vision of the importance of new investment to the continuity and profitability of their companies.

References

BACADAR, B.M. (2008). The foreign direct investment in developing countries and the recent Brazilian experience. Porto Alegre, Brazil.

BARDIN, L (1991). CONTENT ANALYSIS. Lisboa: Edições 70.

BEUREN, I. M. (2003). How to develop monographs in accounting: theory and practice. São Paulo, Atlas.

BREALEY, R. A.; MYERS, S.C. (2001). Principles of corporate finance. 6. ed. New York: McGraw-Hill.

BUSSE, J. A., GOYAL, A. and WAHAL, S. (2010). Performance and Persistence in Institutional Investment Management. The Journal of Finance.

CERVO, A. L.; BERVIAN, P. A. (2002). Scientific Methodology. 5. ed. São Paulo: Pearson Prentice Hall.

CINTRA, M.A., CAGNIN, R. (2012) Euphoria and pessimism: cycles of assets, credit and investment in the U.S. economy after 1982. São Paulo. Brazil.

COLLIS, J.; HUSSEY, R. (2005). Management research: a practical guide for undergraduate and postgraduate. Porto Alegre: Bookman.

DAMODARAN, A. (2001) Corporate finance. 2. ed. New York: John Wiley.

FARRELL JR., J. L. (1997) Portfolio management. 2. ed. New York: McGraw-Hill.

NAKAJIMA, S. (1988) Introduction to Total Productive Maintenance (TPM). Productivity Press, Cambridge. MA.

PRATT, S. P.; GRABOWSKI, R. J. (2008) Cost of capital: Applications and Examples. 3. ed. Nova Jersey: Wiley.

SLACK, N.; CHAMBERS, S.; JOHNSTON, R.; BETTS, A. (2006). Operations and process management: principles and practice for strategic impact. Financial Times Prentice Hall, Harlow, UK.

SLACK N.; LEWIS, M. (2008) Operations Strategy. 2nd ed. Harlow / Prentice Hall.

STEWART, G.B. (1991). The quest for value: The EVA management guide. New York: Harper Business.