















	than a fixed point. The adjustment of the size of the lungs of resources in a participatory way allows a better understanding of the risk appetite of the company for each investment.
Run	The method adopts a prioritization scheme of activities where investments will be made based on <b>constraints</b> and <b>risks</b> of the organizational system. This prevents attention span from being dictated by internal policy. Teams are encouraged for delivery tasks, if possible, on optimistic dates. There is incentive to deliver the results of the actions before the full consumption of the budget lung.
Resource Contingency	The method adopts resource contingency in the form of statistically calculated lungs. Each project has lungs of investment financial resources that help deal with contingency changes in investment implementation projects.
Forecast Review	Budget targets are defined in rangelines (e.g. investment lungs). Therefore, not all deviations require corrective action (in addition to lung consumption). Even some level of important deviations can happen without compromise with scope or the expected cost and time intervals. However, any change in realistic projection, for more or less investment resources, has to be reported to Budget Management, which will do the impact analysis and change the volume of the lung of resources for capital investment.

For the full integration of Investment Capital Budget and Project Management by the OCIC/CCIB approach, it will be important that all capital investment be organized on the basis of projects that act on operational constraints and risks. The OCIC/CCIB method acts on the problems studied (Table 1) by meeting the needs to be met by a new budget model (Table 6), as follows:

Table 6  
*Forms of OCIC /CCIB service to the needs to improve the budget process*

<b>Need to be met by a new budget model</b>	<b>How to meet the needs by the OCIC / CCIB</b>
Flexibility to deal with unforeseen situations	The lung of resources for capital investment is a means of generating great flexibility in budget management in the face of unforeseen situations.
Focus on strategic perspective	The estimates of investments of managers are made based on the expectations and objectives of the organization generated in the current strategic orientation. Strategic planning is the source of strategic actions that always seek to understand the organization's restrictions and risks that affect its competitiveness.
Speed of Budget Management	The OCIC/CCIB model has to be simpler to manage when it comes to investment capital. The number of projects invested tends to be smaller because they are more critical. And the monitoring of achieving the budget target becomes more efficient with the adoption of project management.
Economicity in the use of budgetary	Certainly, stimulating the economicity of resources given to managers opens up



resources	good possibilities for the good use of budgetary resources. And the structuring of the projects that spend these resources tends to generate more efficiency in their use. The focus of managers will be on achieving objectives with the generation of savings in order to return resources to the capital budget lung.
Adding value to the company	Organizations that have strategic management, budget management, project management and efficient and integrated process management tend to achieve greater competitiveness in their markets. And the information provided by these administrations makes the organization more transparent and valued by shareholders and investors in companies.
Stimulating Collaboration	The OCIC/CCIB model will only succeed with the commitment and collaboration of managers. In the search for better management of investment capital resources will stimulate the participation of managers in collaborative decision making. And equating constraints and risks tends to generate projects that involve several areas of the organization, generating more collaboration.

### 6.1 Calculation of the Investment Capital Budget Lung

Best management practices show that the allocation of capital for investments in the company's budget must be strongly linked to strategic planning. The actions are later implemented in projects and programs through Project Management, contributing to the correct application of resources.(Samuel, 2005)(Mendes, 2006)

However, at the time of the traditional annual budget forecast, an accurate list of projects to run is not available. This is a situation very similar to the problems faced in project management. It is therefore natural to adapt the successful "critical current" approach to budget management.

In the OCIC/CCIB, the capital budget is translated into a conservative forecast and a contingency lung budget. This lung can be called a buffer or pool. For its calculation, each area should provide the most conservative forecast and its pessimistic capital investment forecast, as shown in Figure 3, as follows:

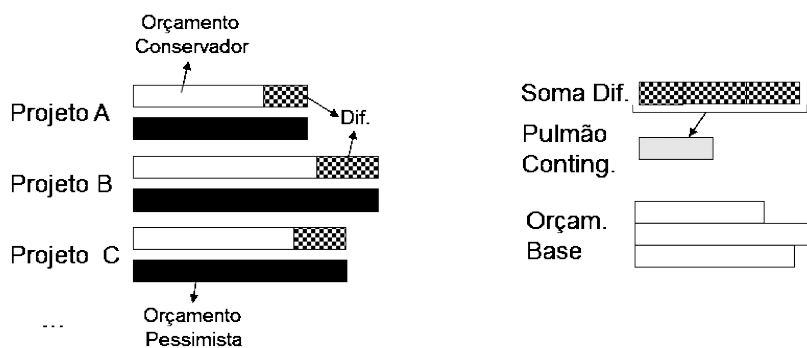


Figure 3 - Calculation of investment capital and base budget contingency lung

In order to calculate the contingency lung of the project, Mendes (2006) used the approach suggested by LEACH (2014), used in other project management techniques such as PERT. Its logic lies in the fact that the time used by activities are, in practice, greater or shorter than expected.

If the OICC/CCIB is used the same calculation can be adopted for the estimation of the contingency lung of the capital budget. Therefore, the constructs of the Critical Current for OICC / CCIB, the pessimistic budget (PP – *Pessimist Budget Prevision*) refers to a conservative forecast that the project manager attributes to the budget of his project, provides comfort for its implementation. A realistic budget proposal (AP – *Average Budget Prevision*) for a project should be requested from responsible managers. This estimate is cumbersome, but possible, if realistic expectations are applied to project stages, as recommended by Goldratt.

Regarding the investment definitions obtained in detail in the structuring of projects, we assume that the variations will follow a Gaussian probability function. The behavior of this curve is entirely determined by two parameters: its mean or expectation and its standard deviation. If these two values are known, we can calculate the probability that the actual cost will be less than a certain value. Good statistical practice guides that the proposal of the Average Budget is as the average estimates with probability of 50 percent occurrence and the Pessimistic Budget as approximately the value that represents 95 percent probability of accomplishment of the project.

The central limit theorem states that, under certain conditions, the total investment probability curve will be roughly distributed normally, regardless of the underlying distribution of resources in projects. In addition, the average of this total expense will be the sum of the averages of each project and the variation of this total expenditure will be the sum of the variance of each project. Variance is just the square of the standard deviation.

Applying-se this approach to calculating the capital budget lung, the following formula will be adopted:

$$BCapB = \Sigma [AP]$$

$$BCP = 3 \times \sqrt{\sum_{i=1}^n \left( \frac{[PP_i - AP_i]}{2} \right)^2}$$

99 percent occurrence

$$TCB = BCapB + BCP$$

Where:

TCB (*Total Capital Budget*) = Total Capital Budget.

BCB (*Contingency Budget Buffer*) = Capital Budget Contingency Lung.

PP (*Pessimistic Budget Prevision*) = Pessimistic Budget for the project (with a 95 percent chance of occurring).

AP (*Average Budget Prevision*) = Optimistic Budget for the project (with 50 percent chance of occurrence), representing the realistic conservative budget

BCapB (*Base Capital budget*) = Capital Base Budget

With each review of the necessary investments, it is necessary to verify variations in expenses more or less in the project that carries out the budget execution. With the approval of variations by Budget Management, the capital contingency lung is reduced or increased. This practice, confirmed in project management by the adoption of the "critical current", will increase the probability of achieving the objectives, while at the same time that it will make activities more flexible, according to the unpredictability inherent to the current business environment. The following section presents the development of the method.

## 7. Method development

In the proposal of investment capital budget, the heuristic derived from this work for the construction of the OCIC / CCIB (**Error! Reference source not found.**), considering the necessary situation and deliverables of the budget process, as depicted in Table 7:

Table 7  
*Proposed steps for the OCIC / CCIB*

<b>Step</b>	<b>Situation required</b>	<b>Deliverable</b>
Strategic Planning	For the corporate budget to be oriented to objectives and actions of high relevance to achieve these, it is necessary that the strategic planning of the corporation be elaborated.	Corporate Objectives Strategic Action Plan
Strategic Impact Analysis in the corporation's business processes	Strategic actions and business objectives will require changes in the systemic model of the organization under analysis. Thus, it is necessary that all business processes are reevaluated in order to be compatible with the defined strategic benchmarks.	With regard to the current strategy, the: Current Process Lag Identification Diagnosis of Operational Restrictions of Current Processes to meet strategic references Operational Action Plan for compatibility of current processes Operational Risk Map that threaten the achievement of strategic objectives through business processes
Project Definition	Based on the strategic actions defined in strategic planning and operational tactical actions defined on the lags of current processes, the organization can consolidate projects, programs or portfolio of projects necessary for the realization of the necessary actions identified.	List of Projects for the implementation of the necessary actions defined Term of opening of Projects, Programs and Portfolio.
Project Prioritization	Having available the list of projects, programs and project portfolio, the organization should evaluate the priority of the realization of projects in view of the organizational constraints verified and the operational risks to be faced by the company.	Prioritized list of business projects
Totalization of The Capital Budget based on Projects	For projects defined in a simplified way but organized around constraints and risks, the organization should detail the most priority projects in the 10 areas of project management knowledge. With regard to the cost of the project, the realistic budget and the pessimist based on the best available technical information should be created. The cost of the set of projects and implementation stages that are planned for the next budget period should be totaled and the capital budget lung required for the period is estimated.	Total capital investment budget for the realization of prioritized projects

Definition of the OCIC / CCIB	With the available data of the monthly budget of capital investment in projects and the calculated budget lung, the budget proposal must go through the evaluation of the senior management for its homologation.	Approved Corporate Investment Capital Budget
OCIC Review / CCIB	With the progress of coordinated project management in the company and the monitoring of the expenditures realized and the results of the projects, adjustments of the capital budget and the budget lung will be carried out by the governance of the organization.	Revised Corporate Investment Capital Budget

The proposal for this method covers only the decision for investment capital budget. The operating budget can be operationalized by any budget management approaches already described.

## 8. Method Evaluation

To evaluate the proposed OCIC/CCIB method, a capital investment simulation based on business projects was used.

In the example of Table 8, projects (A) to (E) are defined and prioritized for systemic risks and restrictions verified for an organization. The realistic and pessimistic budget is proposed by project managers together with the managers of the areas benefited by the project. By this method, the AB budget is the sum of conservative forecasts for projects. For a 95 percent probability of budgeting, bcb95 percent would be the Budget for the budget contingency lung. For 99 percent probability of budgeting, BCB 99 percent would be the budget for projects with a 99 percent probability. Both in total are smaller than the pessimistic PP budget, as shown in Table 8, as follows:

Table 8  
*Example of Application of the GCIC / CCIB Method*

	<b>PP Pessimistic Forecast (x1000)</b>	<b>AP Realistic Forecast (x1000)</b>	<b>ifference R= (PP-AP) x1000)</b>	<b>Standard Deviation (R/2) x1000)</b>	<b>Variance (R/2) ^ 2 (x1,000,000)</b>
<b>Project A</b>	1,200.00	400.00	00.00	00.00	160.000.00
<b>Project B</b>	900.00	450.00	50.00	25.00	50.625.00
<b>Project C</b>	1,500.00	600.00	00.00	50.00	202.500.00
<b>Project D</b>	600.00	400.00	00.00	00.00	10.000.00
<b>Project E</b>	300.00	100.00	00.00	00.00	10.000.00

Tp	Traditional Budget (Sum PP)	4,500,000 .00
Ab	BCapB Capital Base Budget(Sum AP)	1,950,000 .00
Bv	BV - <i>Budget Variance</i> (Sumatório de Variâncias)	433.125.000.000 .00
Bsd	BSD- Standard Deviation( <i>Budget Standard Deviation</i> ) (BV square root)	658,122 .33
BCB95%	Pumão de Contingence with a 95% chance of occurrence (2* BSD)	1,316,244 .66
B95%	Budget with 95% chance of occurrence (AB + BCB95)	3,266,244 .66
BCB99%	Contingency Lung with 99% chance of occurrence (3* BSD)	1,974,366 .99
B99%	Budget with 99% chance of occurrence (AB + BCB99)	3,924,366 .99

The definition of capital investment is based on structured projects oriented to the real systemic needs of organizations. For the example presented, the proposed investment based on probabilistic (B99 percent) it is better substantiated than the initial traditional budget proposal for the areas (TB) or that it was the result of the reductions imposed by those responsible for managing the budget. Any cuts to suit the organization's total investment capacity would impact on a set of deductive decisions regarding scope, cost, time, quality, risks, etc. in structured projects. With the practice generated by project management in these adjustments, it can be believed that the effectiveness of investment actions tends to be better than the conventional budget method.

## 9. Lessons learned and conclusion

This article is oriented to companies in search of excellence, which must be prepared to deal with business environments and unpredictable scenarios. The adequacy of current budget management practices and project management to this environment was questioned. Next, the similarities between budget management and project management were studied in positive and negative aspects. Based on the finding of this study, a method of managing the investment capital budget was proposed through projects oriented to the equation of constraints and risks and the calculation of the capital budget based on a good understanding of how budget estimates are actually made.

The conclusions hereafter presented, is applicable, and therefore helpful, to a greater number of managerial activities, such as (a) e-business negotiation (Dias, M.O. & Duzert, 2017); (b) aircraft manufacturer industry (Cruz, B.S. & Dias, M.O., 2020; Dias, M.O., Teles, and Duzert, 2018; Dias, M.O. and Duzert, 2018); (c) automobile industry (Dias, M.O., Navarro and Valle, 2013, Dias, M.O., et al., 2014; Dias, M.O., et al., 2013); (e) limestone industry (Dias, M.O., & Davila, 2018); (d) non-market forces (Dias, M.O. & Navarro, 2018); (e) brewing industry (Dias, M.O. & Falconi, 2018; Dias, M.O., 2018); (f) Non-governmental organizations (Paradela, Dias, M.O.; Assis; O., J.; Fonseca, R. (2019); (g) governmental negotiations (Dias, M.O. & Navarro, 2017); (h) airport network management (Dias, M.O. 2020;Dias, M.O.; 2019; Dias, M.O.; 2019b; Dias, M.O. & Albergarias, 2019, 2019b; Dias, M.O., 2019c, 2019d; (i) streaming film industry (Dias, M. O., & Navarro, 2018), among others.

It is understood that the application of this paradigm of budget management of capital OICC / CCIB will catalyze the system of implementation of targets through budget and projects by which:

*Conclusion 1:* Senior management will understand the efficiency of your investment and the profitability obtained, enabling the continuity of its support to the budget process;

*Conclusion 2:* A collaborative environment will be developed among the actors of the system (area managers, budget manager, project manager), generating gains in innovation, learning and efficiency;

*Conclusion 3:* The organization improves its initial conditions by increasing its operational flexibility and operational agility. This increases its probability of success in achieving its objectives and in the confrontation of adverse or favorable conditions in its external business environment.

Although the proposed OICC/CCIB method, to be implemented in organizations, requires them to exercise and integrate strategic management, budget management, project management and process management, these instruments are inherent in good corporate governance.

It is also recommended that every capital investment action of the organization be structured in the form of projects and the method of reward of managers should also reward those who achieve objectives with minimal use of investment resources. If possible, the manager should seek even return resources to the investment capital lung.

The proposed model was developed from the perspective of private organizations or business units of an organization, and should be reevaluated against specific conditions of public organizations and corporations formed by multiple companies.

Finally, it is suggested for future research on developed aiming at the identification of other business practices that may benefit from this paradigm shift.

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