A Portfolio Inspired Metric For Project Selection in Construction Management

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Research paper

IN THIS PAPER WE ADOPT A PORTFOLIO MANAGEMENT APPROACH TO MAKE PROJECT SELECTION DECISIONS EASER IN CONSTRUCTION MANAGEMENT. In particular, we suggest to extend value-based analysis to project selection within a Portfolio of related projects. We define a new value based indicator, "Project Value to Portfolio Value" (PV2PV) to asses the added value of a new project to the value of the firm's actual portfolio of projects. The PV2PV indicator allows us to establish the modified ranking of the individual projects of the portfolio should a new incoming project be included in the firm's portfolio of standing projects. The approach not only is useful for construction corporations but for some financial corporations like Spanish banks, which after the construction bubble have become "project and facility owners".

Keywords

Project Portfolio Management, Portfolio Evaluation and Selection, Value-Based Analysis, Construction Management.

Introduction.

Construction firms are continually analysing, investing and developing several projects at the same time. The combination of projects can be modelled as a portfolio of projects (Kangari and Riggs, 1988) and therefore, project portfolio theories and methodologies can be used to increase the efficiency and performance of the construction corporate business. In another context, Langford and Male (2001) underlie the importance of the portfolio approach in construction, but, no matter the industrial sector, project portfolio management is becoming one of the more promising research fields in project management (Hoon Kwak and Anbari, 2009). Portfolio approach helps construction firms to align their projects with corporate strategy.

The project portfolio approach to construction is also very useful for financial institutions, specially in some countries like Spain, where, after the construction bubble, banks have become the owners of thousands of construction projects (sometimes partially preformed) and they need managerial tools to take decisions about continuing or aborting projects, according to the portfolio expected return – risk trade-off.

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Although analysts working for banks are familiar with financial methodologies used for financial investment decisions, they are not used to work with "real" construction projects, where the interrelations between projects in terms of risk, schedule and capital cost are crucial.

When a new project is included in the portfolio the entire portfolio has to be reprogrammed since it will be affected in terms of their risks, capital costs and cash flows. Therefore, the value of the entire final project portfolio might change and this fact should be taken into account when deciding to include or not the new project into the corporate portfolio. We will evaluate the new incoming project in terms of the total value added to the portfolio by means a new indicator, the project Project Value to Portfolio Value (PV2PV), which measures the value a new project adds to an existing portfolio of projects, taking into account changes in the previous existing portfolio.

The rest of this paper is organised as follows: First, we will summarize the core ideas in mainstream project portfolio management practice. Then, in section 3 we define PV2PV and in section 4 we show how it works by means of a case study. We finish with the main conclusions of our research.

Project portfolio management core ideas.

A portfolio of projects is "*a collection of projects (temporary endeavours undertaken to create a unique product, service, or result) and/or programs and other work that are grouped together to facilitate the effective management of that work to meet strategic business objectives*" (PMI, 2008). Usually, projects belonging to the portfolio share the same set of common (and limited) resources.

Most construction companies can be seen as a portfolio of projects. In general, an actual trend in Business Management is to consider the firm as a portfolio of running or potential projects (Artto et al. 2005; Winter et al. 2006; Winter et al 2008; López-Paredes et al. 2010). This trend has called for the development of new tools to select, monitor and control the portfolio of projects (Project Portfolio Management, PPM). PPM is involved in a wide range of activities such as developing methodologies for aligning projects to strategy, valuing projects, selecting the best ones, balancing the portfolio in terms of risk, cost, scheduling, and coordinating the joint execution of individual projects, so that synergies could be achieved.

The goal of project portfolio management is to organize a series of projects into a single portfolio that describes project objectives, costs, timelines, accomplishments, resources, and risks. In theory, this would allow executives to regularly review entire portfolios, spread resources appropriately and adjust projects to produce the highest value added to the firm as a portfolio of the living projects.

In Fig.1 we illustrate the stages and dimensions of the project portfolio management process: Search, valuate, rank, select, balancing, and aligning with the mission and the strategic goals of the firm.

Portfolio definition starts with the definition of corporate strategy and firm objectives. Project search is related to finding new suitable projects for the company, by means of customers or internal projects (growth, maintenance, etc.). Once new projects have been identified, they must be evaluated in order to be selected to form part of the portfolio. Most common evaluation methodologies are check-lists, multi-criteria scoring and mathematical models. Main evaluation criteria are strategy alignment (contribution to organisational goals), financial, technical issues, marketing (market share), etc.

Financial criteria usually is one of the most important as it is related to shareholder's objectives. The most common criteria for financial valuation are Return on Investment (ROI), Net Present Value, Pay-back, etc., that is, the traditional indicators used for financial investments. These techniques have been complemented with financial measures that provide information about the financial cost of a project such as the Weighted Average Cost Of Capital (WACC), cash flow measures, etc.

The output of this process is a set of accepted projects ranked in terms of strategic and financial importance to the firm.

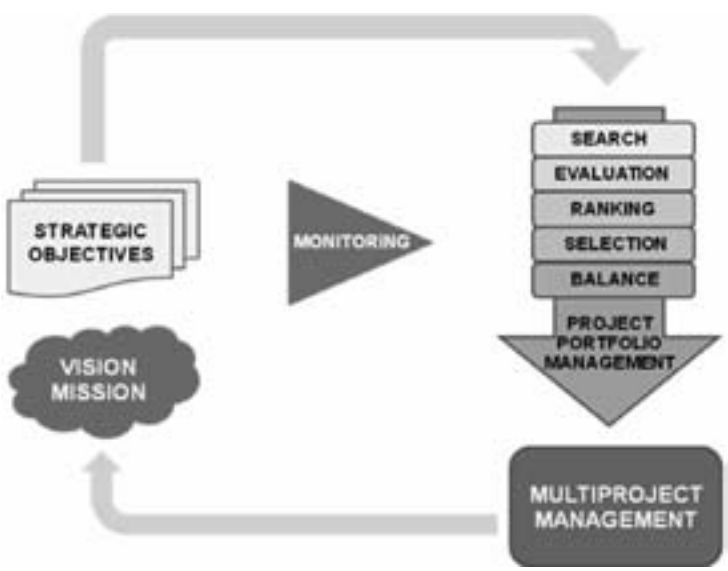

Figure 1: **Integrated system of Portfolio Project Management**

In case of conflicts for the resources, those projects which are ranked as more important for the firm should receive the resources first.

In this paper, following Norman (2001) we will focus on the contribution of a new project to the value added of the standing project portfolio. In addition to the cost, delivery and quality of a project the final goal is to asses its contribution to the firm`s value, taking into account the interrelations between the candidate project and the existing portfolio.

Project Value to Portfolio Value: PV2PV

The analysis of the independencies and "internal externalities" of the projects in the portfolio has to take care of the variation of the portfolio life span when a new project is accepted and of course, this analysis has to be carried out even before reprogramming the portfolio.

Based on these considerations we propose an alternative approach to valuate and to select new investment projects. Based in created value measures we study the marginal contribution of a candidate project to the total value of the standing projects of the portfolio. This study will give us a basis to accept a project or "wait and see". Even more: if a new project is accepted we could assign the new value added ranking of the standing projects.

The proposed designed framework for the Portfolio analysis is based on existing models for the measurement of the created value. Pajares et al. (2001) use the Market Value Added (MVA) and the Economic Value Added (EVA) to define a new metric: the Valueback. It is useful to establish an exit condition based in the created value for venture capitalist and private equity firms.

Following the analogy of managing firms as a portfolio of projects, we propose a new indicator to measure the value of an existing portfolio when a new project is adopted: the **Project Value to Portfolio Value (PV2PV)**. It is useful as an alternative to classical methods for ranking a set of potential and candidate projects from the financial perspective of value creation. To compute this new indicator we use the same data that is required to compute the Net Present Value (NPV) plus the information related to the financial requirements. In our approach we substitute the "cash-flows" by "value-flows" which are estimated as "expected EVA (Economic Value Added) flows".

Our proposal considers the dynamics of the portfolio over the time (new projects come and existing projects finish). For this reason, the initial conditions must be updated after each period of time. This applies to the Weighted Average Cost of Capital (*WACC*), because it depends on the portfolio life span as well as on the evolution of the funding sources needed to develop each different project. Therefore, the $WACC(a)_b$ will be defined and calculated for every period of the analysed time *'t=a'*, and for a given length of years *'b'* of the portfolio lifetime.

The expected economic value flows of each project *'j'* in each time step $FVE_j(t)$ will be obtained as the result of the difference (see eq.1) between the Free Cash Flows ($FCF_j(t)$) and the global financial expenses ($fej(t)$) in which we incurred to undertake those *FCF*, namely EVA flows.

$$FVE_j(t) = FCF_j(t) - fe_j(t) \quad \forall j \in [1,N]$$

On the other hand, the cumulative expected economic value of each project *j* will have to be calculated (see eq.2) for each period of time *(t=a)*, that is the outstanding or remaining value considering the defined $WACC(a)_b$.

$$FVE_{total}^{a,*} = \sum_{h=a}^{ej} \frac{FVE_j(h)}{\prod_{k=1}^{h-a+1} (1+WACC(a)_k}$$

$$\forall j \in [1,N], \forall a \in [MinP, MaxP]$$

The portfolio cumulative expected value each period of time, (expected value flow: $FVE_{total}^{a,*}$) can be obtained from the accumulated values of the *N* projects that integrate the ongoing Portfolio (eq.3).

$$FVE_{total}^{a,*} = \sum_{j=1}^{N} FVE_j^{a,*} \quad \forall a \in [MinP, MaxP]$$

Finally, $PV2PV_i$ will be calculated as the impact of the studied project in the referenced portfolio, meaning by impact the expected added value from the project *'i'* to the initial portfolio value (VEC_o) as shown in Eq.4:

$$PV2PV_i = VEC_i - VEC_0 \quad \forall i \in [1,P]$$

VEC_o is the expected economic value of the ongoing portfolio and will be obtained integrating the $FVE_{total}^{a,*}$ curve of the main portfolio over the time, and VEC_i is the expected economic value of each of the *'P'* candidate portfolios considered by including each of the *'i'* project candidates.

Simulating this process for everyone of the potential projects *(i)* and selecting the one that produces the maximum accumulated economic value in the Portfolio ($PV2PV_{max}$), we will obtain the most interesting project to be included in the ongoing Portfolio in terms of economic value added (see Eq.5).

$$PV2PV_{max} = Max_{i=1}^{P}(PV2PV_i)$$

Case study

To illustrate the utility of the developed methodology based on the PV2PV indicator, a case study will be presented to show how the decision of selecting the best project among a list of potential candidates can change depending on the analysis we choose to use. We have designed a simple example to enhance the main result: to show how the rating of the individual projects may change if we consider the same problem under a portfolio context.

During the year 2010, a company is considering the option of including a new project in an existing portfolio of projects that was launched in 2009. The life span of the portfolio spreads until the year 2013 and we are confident about the expected free cash flows (net operative profit after taxes) and the financial expenses (Table 1). The portfolio is composed of three projects (P1, P2, P3) which individual performance (Internal Rate of Return IRR, WACC, and the created Value) is presented in Table 2.

We are analysing the ranking to introduce only one project from a list of four candidates (all of them are similar in terms of risk, strategic relevance, duration and capital requirements). The economic and financial data of these candidates are shown in Tables 3 and 4:

Total Investments (Year 2009) =			290.000 €		
Period	**2009**	**2010**	**2011**	**2012**	**2013**
Free Cash Flows	53.500 €	64.000 €	122.000 €	164.000 €	44.000 €
Financial Expenses	47.000 €	45.250 €	72.200 €	169.050 €	55.900 €

Table 1: **Economic and financial data for the existing portfolio**

Portfolio Performance Indicators	IRR (%)	WACC (%)	Value (%)
P1	18,12	7	11,12
P2	21,66	15	6,66
P3	14,4	10,37	4,04

Table 2: **Economic and financial performance indicators of the existing portfolio**

Candidate Projects					
Investment: 200.000 €					
Candidate	**Economic and Financial data**	**2010**	**2011**	**2012**	**2013**
PA	Free Cash Flows	71.000 €	78.000 €	85.000 €	99.000 €
	Total Financial Flows	44.720 €	43.040 €	41.360 €	159.680 €
PB	Free Cash Flows	57.000 €	57.000 €	67.500 €	67.500 €
	Total Financial Flows	54.200 €	53.150 €	52.100 €	51.050 €
PC	Free Cash Flows	64.000 €	71.000 €	78.000 €	85.000 €
	Total Financial Flows	55.500 €	52.875 €	50.250 €	97.625 €
PD	Free Cash Flows	85.000 €	88.500 €	92.000 €	99.000 €
	Total Financial Flows	48.320 €	46.640 €	44.960 €	163.280 €

Table 3: **Economic information of the list of potential candidates considered**

Candidate Performance Indicators	IRR(%)	WACC(%)	Project Value (%)
PA	22,54	12,98	9,56
PB	9,05	2,1	6,95
PC	17,15	9,7	7,45
PD	28.33	15,04	13,29

Table 4: **Candidates Performance Indicators**

All the candidates are viable and profitable. With the available information, if we do not matter about the impact of every project in the existing portfolio, it seems clear that the decision would be to accept the Project D (*PD*), as it generates for its own a 13,29% of economic value.

Nevertheless the decision must be considered attending to the reality of the problem: the project will be embedded in a portfolio and it will affect and be affected by the ongoing projects. So we have to consider the global problem: to maximize the value of the resulting portfolio. The four projects have the same capital requirements which is similar to the total capital requirement of the portfolio. This means that the project with the biggest WACC (PD) will increase the capital cost of the resulting portfolio, and consequently it will decrease the value contribution from the ongoing projects.

We propose to apply the PV2PV metric to rank the candidate projects. In fig. 2 we show the value for every potential portfolio. We can also compare the resulting portfolio with the initial portfolio. The Project B (PB) is the best choice: it has the maximum PV2PV (see Table 5).

PV2PVB = 84600 €
PV2PVC = 60209 €
PV2PVD = 28426 €
PV2PVA = 14442 €

Table 5: **PV2PV of every candidate.**

In the figure 3 we present the variation of the WACC of the resulting portfolios over the life span of each candidate. It gives us the explanation for the success of Project B. Despite it has the lowest profitability performance it has a very positive impact in the portfolio capital structure.

Conclusions and future research.

In this paper we introduce a new indicator (PV2PV) to select projects to be included in a corporate portfolio. The approach is particularly useful in construction management, where financial restrictions and capital costs are quite important. This approach improves traditional valuation methodologies, because 'PV2PV' considers not only the contribution in terms of individual value of each project to the existing portfolio, but it also takes into account the impact that the candidates have on the rest of the projects that are already running in the studied portfolio. The indicator also

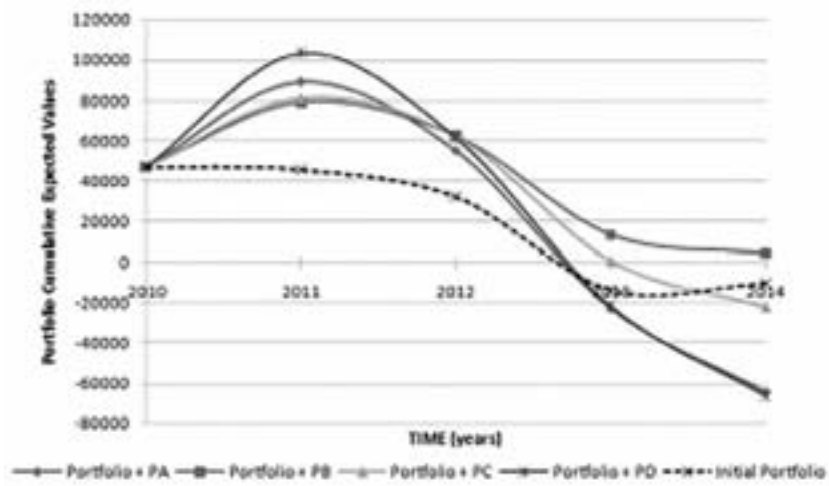

Figure 2: **Economic accumulated value flows (FVE) of each of the resulting Portfolios over the time**

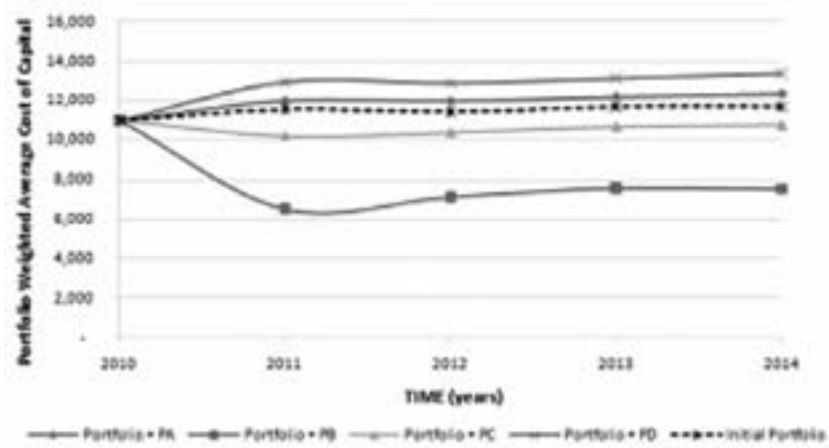

Figure 3: **Weighted Average Cost of Capital of the candidate portfolios over the time**

captures the dynamics of the problem by updating the relevant parameters, such as the variability of the Weighted Average Cost of Capital over the time.

A case study has been analyzed to demonstrate how this new tool based on the creation of value in the portfolio can offer different results than the traditional analysis, permitting a different ranking and selection of projects to be included in the portfolio. In addition, we must consider not only what projects are the best to be undertaken but also one should decide about its optimum time to enter in the ongoing portfolio.

Upon the possible extensions of this work, a new system that incorporates the uncertainty of the project's data is being developed. Including uncertainty and risk will allow us to adopt the control indexes proposed by Pajares and Lopez (2011) to determine whether portfolio under-performance is under planned values.

Our study increases its value when it is followed by another task: Reprogramming the bundle of projects each time a new one joins the portfolio. Our colleagues at Insisoc (Arauzo et al. 2009) have worked out a novel approach to this task using agent based modelling and market oriented programming as a robust alternative to the traditional methods of programming. With both contributions we think we are improving portfolio management practices with a new focus, in scope and methods.

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