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Infrastructure public–private partnership project ecosystem – financial and economic positioning of stakeholders

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The purpose of this paper is to construct an analytical cash flow-based project model to facilitate project appraisal of both private investors and public sector. With the help of the model that focuses on ecosystem and its stakeholders, it is simpler to identify potential conflicts usually encountered in public–private partnership (PPP) projects. The model construct is based on classical cash flow accounting and cost–benefit analysis. In the model, the flows of cash (private investors) and the flows of costs and benefits (public investors) are integrated in a single framework. The model shows that within the ecosystem the investors' (public vs. private) social, economic and financial targets are not necessarily coinciding. Prospecting of common ground and win–win situations becomes a crucial success factor for any PPP project. The paper discusses the policy and investment strategy implications for successful PPPs.

Keywords: public–private partnerships; investment; project appraisal; cost–benefit; cash flow; infrastructure

1. Introduction

To overcome the problems of funding infrastructure capital investments, for example, in transport, energy and utilities sector, a number of solutions concerning capital provision, contractual arrangements and off-balance sheet financing (from the viewpoint of the state), among other means, have been introduced. For road transport projects, where the users are mostly individual drivers, tolling of road use is perhaps the most straightforward manner of amortizing capital finance. Analogically, electricity customers pay the capital investments through their electricity bills. The capital investment recovery can be arranged in many other ways too: for example, through availability payments, fixed or volume-based fees, exclusive monopoly positions, etc. Typical for these alternative arrangements, or arrangements that one way or the other supplement end users' payments, is the public intervention in guaranteeing the revenues for the investors that provide the initial capital outlay in order to build and run the physical facility offering the service in question. Indirect financial assistance includes low-return capital infusion of the public side, tax reliefs, grants and subsidies, just to name a few.

The approach of introducing private investors to finance, build and operate a major facility on behalf of the state, city, municipality or some other public entity is globally termed as public–private partnerships (PPPs or 3Ps). The partnership is built on long-term contracts, concessions or leases to enable private investors to construct the facility and provide services to the public according to agreed – and in most cases very complex and extensive – contracts

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(e.g. Runde et al. 2010). The contractual side of PPPs is well covered in the management literature of infrastructure, transport, energy, finance, and public economy, for instance, and good overviews are provided, for example, by European Investment Bank (Uppenberg, Straus, and Wagenvoort 2011), and the World Bank, for example, for transport by Estache, Ellis, and Trujillo (2007) and for water supply in developing countries by Marin (2009) and Cuttatree and Mandri-Perrott (2011) and organization for economic co-operation and development (OECD 2008; Araújo and Sutherland 2010).

Another feature that is quite common for major PPPs, though not exhaustive, is the project financing nature of investment and the whole life cycle of the effort that may extend to several decades. A project company is built up by the investors and the project company starts to prepare for the capital investment and finally for the operating phase of the investment. The reasons for setting up a separate project company are at least twofolded. First, the risks of the investment, of which the investors and the public side of the partnership could have an incomplete and uncertain picture, are hence isolated into a single-project entity and the investors are liable just to the extent of their invested capital to the project company. Second, for the public partners the single-project company represents a more transparent entity which is easier to monitor in terms of performance, service quality and finance than a larger and multi-business-segment entity, where the 'project' represents just one among the many.

Finally, there are legal liabilities as well that can be isolated into the project company which do not then place an excessive burden on the holding companies. Often the legal issues are related to the relationship between public and private sectors and a number of guidelines on how to manage these are issued (e.g. UNESCAP undated; Son 2012), but equally legal liabilities can be shelled in the project entity from the private investors' viewpoint. This latter issue has been less discussed, but would deserve much more attention from the side of the public sector.

The principle features of project financing are as follows (Brealey, Cooperand, and Habib 1996, 25):

- The project is established as a separate company which operates under a long-term contract (a concession) obtained from the host government.
- A major proportion of the equity capital of the project company is provided by the project manager or sponsor, tying the provision of finance to the management of the project.
- The project company establishes comprehensive contractual relationships between the suppliers, customers and host government organizations.
- The project company is highly leveraged financially.

The project cash flows are divided by equity investors, debt investors, contractors and suppliers and users that receive the service. Equity investors are often the founders of the project company (i.e. contractors, developers and public authorities) and financial institutions that seek long-term investment opportunities, such as pension or investment funds and insurance companies. Even individual persons can be equity investors if share issues are made public. Debt investors are usually banks, the aforementioned funds, etc., that operate in the financial market on a routine basis.

This paper forms a generic cash flow model of a single-project company and applies it in a framework where also the public benefits are included. Thus, the model creates an analytical frame where each stakeholder's economic and financial positions can be pointed out and studied in more depth. The model enables empirical data to be fed in in order to research real-world

examples, and hence, it provides a platform for further empirical analysis. The model has been already successfully applied to the first Finnish PPP road project, the E4 between Helsinki and Lahti (Leviäkangas 2007; Leviäkangas, Wigan, and Haapasalo 2013).

This paper is furthermore a theoretical and descriptive analysis more than an empirical one, but the model provided is relatively simple and allows first-step meta-analysis of any large project. However, the model is unable to capture contractual finesses which could have a radical impact on project outcomes from the viewpoint of stakeholders and project partners (Leviäkangas, Wigan, and Haapasalo 2013). Such work can be found in, for example, Hoppe and Schmitz (2010), Froud (2003), and Alonso-Conde, Brown, and Rojo-Suarez (2007). The contractual details, such as options to exit or to defer outbound cash flows, are definitely worth some value for investors as well as other stakeholders, but they do not change the fundamental logic that must be put to work first, and only then consider the fine-tuning of actual contract clauses and options.

Methodologically, this paper falls in the cross-section of cost–benefit and cash flow analysis, bearing therefore an emphasis on investment theory, but both from the economic and corporate finance angles. This attempt to combine the public side's cost–benefit analysis (CBA) and private side's financial analysis is the added value to the body of knowledge. This 'PPP ecosystem' approach hopefully clarifies and simplifies many of the issues raised around PPPs and provides a first-step tool to design these complex projects.

PPP single-project companies are often referred to as *special purpose vehicles* but not as ecosystems, which they can equally well be defined. Business ecosystems work for incorporating next round of innovations (Moore 1993) bringing synergies of different companies and public actors together towards a common innovation. A single-project company's ecosystem works for a (more or less) predictable project over its life cycle, including execution and operation. The common grounding of both ecosystems is the shared fate of the involved actors and the need to understand an organization's own role in the ecosystem (Iansiti and Levien 2004).

This paper advances the discussion on working ecosystems of PPPs from financial and economic viewpoints. It shows in practice in the light of cash and other monetary flows how the money is distributed in a PPP project-company ecosystem and what are the prerequisites for each ecosystem actor to gain from the project by placing simple decision-making rules for both public and private investors. These actors have their own preferences of risks and management of uncertainty. The model presented allows risk factors and premiums to be included in different ways, for example, by introducing subjective risk variables or simply by adjusting their discounting rates as preferred.

However, it should be noted that many other drivers affect the behaviour of both public and private sector managers and investors. Our model captures only non-behavioural variables, that is, it strictly deals with real cash and economic flows excluding behavioural elements of risks and uncertainties. These may, though, be supplemented to the model introduced.

The actual cash and economic flow model is defined in Section 3, while the previous section discusses the related literature touching PPPs. The model is presented in the form of a table. Section 4 positions the ecosystem stakeholders with regard to financial and economic flows according to the model, and simple decision-making rules are derived from the model. Two rules are introduced: one for the investors of both debt and equity, and one for the public side taking into account possible externalities. A short discussion on implications of risk follows this. Finally, the practical implications of the analysis are discussed in Section 5 and conclusions drawn in the last section.

2. Motivation (and demotivation) for PPPs

The infrastructures for transport have always been both public and private, starting from the early civilization. The current term PPP was introduced during Margaret Thatcher's regime in the UK as part of her political private finance initiative. The wave of neoliberal reforms took place in the UK, such as privatization of transport assets and infrastructure among many other sectors as part of new type of public management, where the corporate sector would assume a greater role in service provision and corporate management models would be more widely adopted by the public sector. Discussions on the backgrounds as well as more recent issues are provided, for example, by Gruening (2001), Hood (1991), Boyne (2002) and (Hodge and Greve 2007), among the very many. In essence, PPPs came about as an embodiment of a larger wave of a proposed new paradigm that suggested the superiority of corporate management and private sector models over existing public administration and bureaucracy. Transport infrastructures and PPPs became an integral part of this agenda.

A grand prospect of enhancing the growth of any nation while at the same time putting private capital to work for public benefit entered (with no surprise) the political dialogue and projects started to emerge. The European Investment Bank approximated that for 2006–2009 on average about 3.9% of Europe's GDP was invested in infrastructure projects – including transport, health, education and utilities (electricity, gas and water supply) – in the European Union by old member states and about 5.1% by the new member states (Wagenvoort, de Nicola, and Kappeler 2010). These figures show how significant amounts are at stake.

Investors have been keen on infrastructure assets, but distinctive differences are within different classes of infrastructures (Inderst 2010) as well as there are differences between investing in infrastructure funds and direct investing in specific projects (Bitsch, Buchner, and Kaserer 2010; Offutt, Runde, and Selinger 2012). This paper deals with the latter alternative, that is, direct investment in a single-project company.

PPPs have been endorsed owing much to their ability to clean governments' balance sheets. However, the new rules set in Europe by Eurostat in 2004 have taken partly away this advantage: any public sector commitments made towards PPP projects are now accounted as public obligation and recorded in national accounts accordingly, but yet depending on the level of risks borne by the private sector investors (Posner, Ryu, and Tkachenko 2009). The situation is not necessarily the same across the globe, though, and in some countries PPPs probably continue to work as an effective off-balance sheet financing tool for the national and/or local government.

However, as experiences were gained, the shortcomings of PPPs also became more visible. Shaoul, Stafford, and Stapleton (2012) paint a very blunt picture of the UK PPPs in transport sector. According to their studies, the PPPs have turned out to be expensive and not necessarily delivering the value for public money. They state that transport projects are too capital intensive and financially risky, and not sufficiently cash generative. And this is the reason why states have traditionally provided them.

A number of analyses and market intelligence reports conclude that in the USA, the use of PPPs have been with much less volume and intensity than in Europe and Asia (e.g. Engel, Fischer, and Galetovic 2011; Istrate and Puentes 2011). The most likely reason for this is the simple fact that PPPs started from the UK, at least on a larger scale under the reign of Prime Minister Margaret Thatcher. However, PPP type of arrangements has been used for decades and much before Thatcher, for example, in Norway to finance major road projects. These projects just never gained any greater curiosity among the public sector agents – neither in Europe nor anywhere else.

PPPs are seen as a key to increase efficiency in service delivery, due to the hypothesis that private sector is more efficient in providing services for consumers or citizens than the public sector (see, e.g. Alfen et al. 2009; UNESCAP 2011), although truly empirical findings are scarcer – and some early experiences are controversial and the final truth seems to be highly contextual (Burger and Hawkesworth 2011). Engel, Fischer, and Galetovic (2010) argue that higher costs often encountered in PPP projects are not as such an argument in favour of public provision as these costs could imply deficient contract design rather than high costs per se. Contrary to some witnessed abnormal returns (see Shaoul, Stafford, and Stapleton 2004), in some parts of the world the returns of investors have proved to be reasonable (see e.g. Sirtaine et al. 2005).

3. Single-project company ecosystem – cash flows, benefits and costs

The single-project company design is shown in Figure 1. Its stakeholders include the aforementioned investors (debt and equity), the state, users, and suppliers and service providers. There are real cash flows between the project and its stakeholders and then there are less tangible benefits for the users, which do not necessarily account for cash flows but are nevertheless significant with regard to the project's socio-economic appraisal. For example, transport projects' safety and travel comfort do not in all cases transfer to cash flows, but are still relevant criteria for the project to be accepted by the political decision-making machinery and general public.

The aforementioned conceptual model can be translated into an analytical one following the procedure reported in Leviäkangas (2007), but the underlying principles can be found in any corporate finance textbook. To start with, the symbols presented in Table 1 are used.

Only corporate tax is assumed, and any other taxes excluded, such as taxes of bondholders and equity holders. It is further assumed that the project company distributes immediately all the net cash flow earned to shareholders as dividends. This is a reasonable assumption since the whole

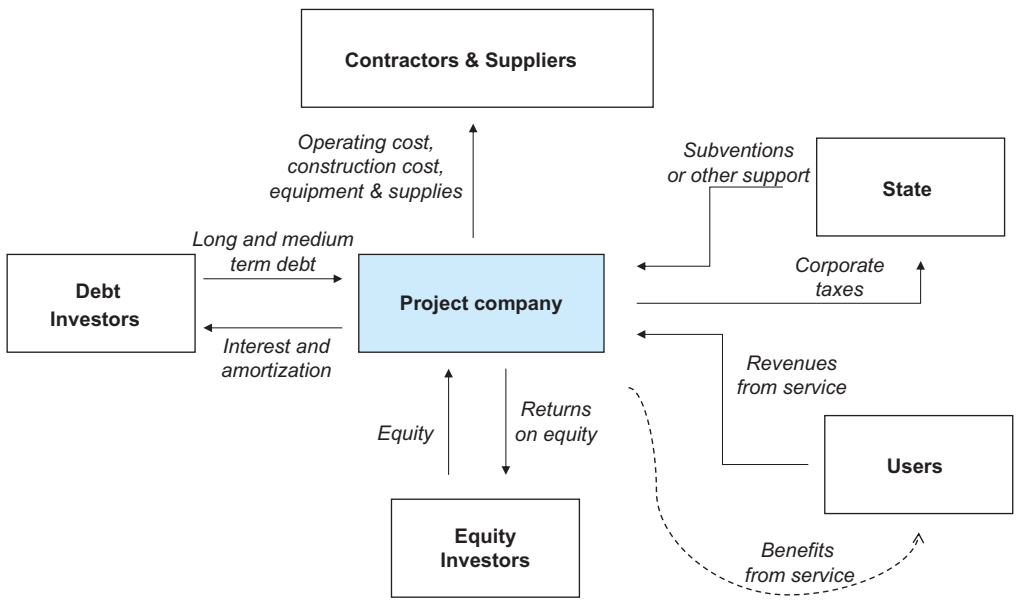

Figure 1. A simplified single-project company ecosystem (modified from Leviäkangas 2007).

Table 1. The symbols used in equations.

Symbol	Definition
Rev	Revenues of the project company; the revenues are divided into revenues from users and revenues from the state: $\text{Rev} = \text{Rev}_\text{U} + \text{Rev}_\text{S}$
Ope	Operating expenses of the project company; these are mainly all-year-round road maintenance and operating costs
ES	Equipment and supplies costs needed for the build-up of the facility, running costs of materials, etc., are included in operating costs Ope
Con	Construction cost, that is, the expenses of constructing the facility
C	Total life-cycle monetary before-tax costs for the project company; $C = \text{Con} + \text{ES} + \text{Ope}$
Tax	Corporate taxes paid by the project company
E	Equity capital invested in the project company
D	Debt capital raised by the project company
iD	Interest on debt capital
A	Amortization of debt
Dep	Depreciation of the project company's assets
T_c	Corporate tax rate
Ben	Benefits accrued to the users in socio-economic CBA
Ext	External costs related to the project, included in CBA

idea of the project is to generate adequate and as-early-as-possible cash stream to investors. This at least partly removes the need for other tax considerations, as it is assumed that investors' net cash flows are treated according to other tax regimes, that is, as personal income or corporate taxes of other owner entities. All cash and other monetary flows are shown in present value form, discounted by the rate of return each actor prefers and over the time of each project's life cycle (or analysis horizon, which may be longer or shorter than the project's technical life). Thus, the same flow, for example, outflow of the state and inflow of the project company, is not of same present value in absolute sense.

The free cash flow to investors (FCF) is the measure of wealth increase for them. This surplus is available for investors after their initial capital outlays (E, D). The free cash flow for shareholders, which is after-tax net cash flow plus tax advantages from depreciation and interest payments, is given by

$$\begin{aligned}\text{FCF} &= (1 - T_\text{c})(\text{Rev} - \text{Con} - \text{ES} - \text{Ope}) + T_\text{c}\text{Dep} + T_\text{c}\text{iD} \\ &= \text{Rev} - \text{Con} - \text{ES} - \text{Ope} - T_\text{c}(\text{Rev} - \text{Con} - \text{ES} - \text{Ope} - \text{Dep} - \text{iD}) \\ &= \text{Rev} - C - \text{Tax}\end{aligned} \tag{1}$$

because taxes paid by project company must be

$$\text{Tax} = T_\text{c}(\text{Rev} - \text{Con} - \text{ES} - \text{Ope} - \text{Dep} - \text{iD}). \tag{2}$$

The calculus is done in present value terms and the costs of construction, equipment and materials, Con and ES, equal Dep and should not be double-counted. Therefore, we can simplify, because Con, ES and Dep occur in different accounting periods but must approximately at the end of the day equal, and since operating expenses are as well tax deductible, the equation is as follows:

$$\text{Tax} = T_\text{c}(\text{Rev} - C - \text{iD}). \tag{3}$$

The total cash flows to single-project company equity holders are defined as after-tax net revenues minus costs and expenses less the initial equity outlay, deducted further by debt service payments (amortization and interest):

$$\mathrm{TCF_E} = (\mathrm{Rev} - C - \mathrm{Tax} - \mathrm{iD} - A) - E \tag{4}$$

and the total cash flows to debt holders is the debt raised by the project company from the debtors plus the received debt service payments:

$$\mathrm{TCF_D} = (\mathrm{iD} + A) - D. \tag{5}$$

Summing these two form, the total cash flows of the single-project company is given by

$$\mathrm{TCF_E} + \mathrm{TCF_D} = \mathrm{Rev} - \mathrm{C} - \mathrm{Tax} - (E + D) = \mathrm{FCF} - (E + D), \tag{6}$$

which states that the incremental value produced by the single-project company to its owners is the free cash flow minus the initial capital outlays of equity and debt – as should be. The sum of owners' cash flows represents the project investors' investment's net present value followed when their invested capital is subtracted from present value of the project company's cash flows.

The market value of the project company is the present value of free cash flows, that is, the initial capital outlays plus the incremental value:

$$V_\mathrm{p} = \mathrm{FCF} = E + D + \mathrm{TCF_E} + \mathrm{TCF_D}. \tag{7}$$

Depending on the leverage ratio of the project company, the market value is different for the equity and debt. The market value of debt is the initial debt outlay plus the incremental value available to debt holders:

$$D_\mathrm{m} = D + \mathrm{TCF_D} = D + (\mathrm{iD} + A) - D = \mathrm{iD} + A. \tag{8}$$

The market value of equity is the initial equity outlay plus the incremental value available to equity holders:

$$E_\mathrm{m} = E + \mathrm{TCF_E} = E + (\mathrm{Rev} - C - \mathrm{Tax} - \mathrm{iD} - A) - E = \mathrm{FCF} - \mathrm{iD} - A = \mathrm{FCF} - D_\mathrm{m}. \tag{9}$$

The market value of the single-project company may then be written as

$$V_\mathrm{p} = E + D + \mathrm{TCF_E} + \mathrm{TCF_D} = (E_\mathrm{m} - \mathrm{TCF_E}) + (D_\mathrm{m} - \mathrm{TCF_D} + (\mathrm{TCF_E} + \mathrm{TCF_D}) = E_\mathrm{m} + D_\mathrm{m}. \tag{10}$$

4. Stakeholders' economic and financial positioning

4.1 *Financial and economic flow matrix*

Table 2 shows the flows of cash, benefits and costs between stakeholders. The matrix indicates that it is fairly straightforward to calculate each stakeholder's net financial position, column by column. The non-cash items, that is, the benefits and external costs generated by the project can usually be monetized according to standard CBA. The problem in many countries is that the standard does not exist, whereas for transport infrastructure projects the CBA is relatively well standardized (Mackie and Worsley 2013). For many other marginal system improvements, the situation is not necessarily so. For instance, the meteorological services are regarded highly beneficial for the society and users of services, including both private citizens and organizations,

Table 2. Cash flows, costs and benefits of PPP project (modified from Leviäkangas 2007).

Equity investors	Debt investors	Project company	Users	The state	Contractors and suppliers	Notes and explanations
$-E$		$+E$				Equity investors invest E in the project company
	$-D$	$+D$				Debt investors invest D
		$-\mathrm{Con}$			$+\mathrm{Con}$	Project company constructs the facility and pays to the contractors the expenses Con
		$+\mathrm{Rev_U} + \mathrm{Rev_S}$	$-\mathrm{Rev_U}$	$-\mathrm{Rev_S}$		Project company receives revenues from the state or from the users
		$-\mathrm{Ope} - \mathrm{ES}$			$+\mathrm{Ope} + \mathrm{ES}$	Project company pays contractors for the operating (e.g. maintenance) and suppliers for the deliveries (e.g. equipment)
	$+\mathrm{iD}$	$-\mathrm{iD}$				Project company pays interest on debt
	$+A$	$-A$				Project company amortizes the debt
		$-\mathrm{Tax}$		$+\mathrm{Tax} = T_c\,(\mathrm{Rev} - C - \mathrm{Dep} - \mathrm{iD})$		Corporate taxes after expenses, depreciation[a] and interest
$+[(1 - T_c)(\mathrm{Rev} - C) + T_c\mathrm{Dep} + T_c\mathrm{iD}]$		$-[(1 - T_c)(\mathrm{Rev} - C) + T_c\mathrm{Dep} + T_c\mathrm{iD}]$				The surplus cash flow available for shareholders, paid by the project company[b]
			$+\mathrm{Ben} - \mathrm{Ext}$			The state accounts for benefits of users and third parties, that is, the external benefits, as well as external costs

[a]Depreciation (Dep) equals the cost of depreciated assets (C); it is a matter of depreciation technique, existing accounting regulations and, to a certain extent, a managerial choice of how much of the incurred construction and equipment expenses are activated immediately in the income statement and how much are kept in the balance sheet as deferred expenses to be activated later as depreciation; at the end of the day, C must equal Dep and they must be accounted only once per accounting period.
[b]The available surplus for investors after interest and taxes $= (1 - T_c)(\mathrm{Rev} - \mathrm{Con} - \mathrm{ES} - \mathrm{Ope} - \mathrm{Dep} - \mathrm{iD}) = \mathrm{Rev} - C - \mathrm{Tax} =$ Free cash flow (FCF).

but their benefits are studied seriously only recently (see e.g. Leviäkangas 2009; Leviäkangas and Hautala 2009). The benefits of any service provided by PPP projects, be they financial (cash) or otherwise monetized (non-cash), are highly depending not only on their recognition but also on the valuation techniques applied (Leviäkangas 2009).

Benefits that are usually non-cash but still paramount as socio-economic gains vary according to project type:

- transport infrastructure projects: typically accident cost savings, time cost savings
- water supply projects: health impacts
- energy projects: economy-wide external benefits.

What is furthermore typical for these types of PPP projects is that some of them involve the direct collection of revenues based from the users of the service and possibly also from the public client – here it is referred to as 'the state', but it could be any public agent working on behalf of the community and/or society. It is an inescapable fact that without these hard cash revenues from end users and/or public sector any PPP is impossible to implement and the business case for private investment is missing.

The rules to satisfy different stakeholders' economic rationale are as follows. The shareholders of the project company must receive enough cash flow in order to cover their initial equity capital investment plus the interest they have placed on their equity:

$$(1 - T_c)(\text{Rev} - C) + T_c\text{Dep} + T_c\text{iD} - E > 1 \Leftrightarrow (1 - T_c)(\text{Rev} - C) + T_c\text{Dep} + T_c\text{iD} > E \Leftrightarrow \text{FCF} > E. \tag{11}$$

This states simply that after-tax net cash in present value terms (discounted by required return on equity) after all costs in the project, and after interest and depreciation tax benefits (because these are tax deductible) must be greater than the initial equity placement.

In fixed period concessions, the project company is left in the end with empty pockets and liquidated after it has fulfilled its task of delivering the service. When the project company is expected to continue its existence over an indefinite period of time, the shareholders must consider the liquidity position of the company and other long-term obligations, such as pensions and re-investments.

For debt investors the rule is equally simple: the debt allowed to the project company must be paid back in full with required interest. Hence the interest and amortization cash flow in present value terms, discounted with required return of the debt holders, must exceed initial debt outlay:

$$\text{iD} + A - D > 0 \Leftrightarrow \text{iD} + A > D. \tag{12}$$

For suppliers and subcontractors, the case of a project's profitability is of secondary importance as long as their contracts with the project company are economically worthwhile.

4.2 *Cost–benefit rule*

And it is now when the picture becomes more blurred: the net benefits that are received by the users and society (or community) as a whole must exceed the payments made to the project

company, that is,

$$\mathrm{Ben} - \mathrm{Ext} > \mathrm{Rev_U} + \mathrm{Rev_S} - \mathrm{Tax}, \tag{13}$$

which is in fact the comparison of benefits and costs of the project, and the aggregate benefit–cost ratio is then simply

$$\frac{(\mathrm{Ben} + \mathrm{Tax})}{(\mathrm{Rev_U} + \mathrm{Rev_S} + \mathrm{Ext})}. \tag{14}$$

If we assume that the project is equally beneficial as PPP or traditionally procured project (i.e. benefits remain constant), the comparison between PPP and traditional procurement (from the viewpoint of the state) must be done between revenues paid by the state and users and costs of the project. Would the costs be greater with the traditional model than the revenues paid to the project company? Again, the comparison itself is rather straightforward and it brings forth the potential efficiency of the private sector, which on the other side is offset by the higher returns of the private investors.

Since many of the benefits received by the users or by the public can be non-cash, and sometimes very difficult to monetize, there is always room for speculation about the socio-economic profitability of the project. The more there are non-financial benefits to be considered, the more complex, contextual and debatable the picture gets. For example, subjective risk attributes or externalities not represented in the CBA belong to this category. There is also the question of direct user financing and state (public) support and how these are divided between users and the state. The distributional effect is particularly present when projects are financially supported from public funds, be they tax exemptions, grants or direct partial financing, while the benefits are shared within more or less local or regional community. An analysis of public subsidies and how they affect project value is given, for example, by Armada et al. (2012). From users' point of view, there is a crucial difference how significant the public sector's intervention is, since it likely reduces their own payments for the service. The more direct the user benefits are, the more willingness to pay there is from the side of users. So, on one hand, for example, the private healthcare services have always been well off even in countries where public health care is of wide coverage. The basic human need dictates a good business case for such services. On the other hand, it is difficult to picture an entirely privatized health sector that would not lead to severe social problems.

When user benefits are not that directly related to individuals' consumption power or well-being, the willingness to pay is reduced: the willingness to pay for safer travel is probably not significantly higher than the willingness to pay for the mobility service in general. These social benefits sometimes represent a significant sum of the benefits of projects. For example, the Finnish road projects' benefits are dominated by time savings and accident cost savings. The latter item represents on average more than one-third of the total benefits of average road investments (Tervonen, Ristikartano, and Sorvoja 2010).

4.3 *Uncertainty and risk*

When decision-making concerning investments is risk-neutral, the expected values of discounted cash flows and benefits may be used. The problem usually arises when in practice the public sector does not adjust their analysis for risk, whereas private sector does it with great piety. One place where this makes the difference is the discounting rate that the different parties use. The risk-adjusted rates of returns for private investors are by and large higher than those set by public investors. However, this difference has been narrowing to almost non-existing in Europe,

where some governments' credit ratings have been cut down, even to a lower level than that of companies, reflecting the markets' lack of trust.

Private investors are not risk-neutral but risk-averse – no investor wants to take any more risks than necessary. This in turn means that the expected positive cash flows will have less present value than in a risk-neutral case, and their value relative to investment outlay that occurs in the front end of the project will decrease. As the contemporary theory on risk-return trade-off suggests, the investors choose their discounting rates according to the risks they perceive in the investment. For this they can apply, for example, the Capital Asset Pricing Model (Sharpe 1963).

The public sector decision-making is not entirely risk-neutral either. As the managers of public sector compete over investments to be carried out in their mandate, a great temptation is luring when making costs estimates. Flyvbjerg, Holm, and Buhl (2002) and Hufschmidt and Gerin (1970) concluded that public investments' cost estimates are underestimated almost as a rule. By doing so, the internal competition between public administrations' budget allocations takes serious side effects. This could well apply to PPPs as well. The model presented does not hinder such effects still to take place, but it could well provide one tool to increase transparency and rationality, especially if the *ex ante* analysis already adopts the utilization of the model.

Project appraisal processes – on both sides, public and private – involve a number of subjective elements and adjustments that carry more or less behavioural loadings of individuals and interest groups affected by the project. Often these elements are associated with risks and uncertainties. By sticking with objective variables (cash and externalities) used in rational project appraisal, the model will pinpoint any subjective elements used in appraisal.

5. Practical implications

A good project is a good project. Using different financing mechanisms does not change the nature of the project itself. It is a recognized fact that many countries have used PPPs to leverage their infrastructure (and other assets) beyond true needs and hence including projects in their investment programmes that would not have been financed via conventional routes, for example, through state budget. In these cases, these investments have led to excessive infrastructure with poor returns in the end. For instance, a significant share of Portugal's main road investments was carried out as shadow toll (the state pays the toll on behalf of the users) PPPs, which resulted in a severe financial distress of the state (Cruz and Marques 2011). Later, many of these projects were changed into conventional toll roads, where users pay for real. In addition, PPPs have been used as an emergency exit from unsustainable public budget deficit leading to overinvestment or long-term commitments to pay off the private investments that put the state in an even tighter position after the state's payments for the service are due.

Another example comes from Finland. The first PPP project in the country was an upgrading of semi-motorway E4 between Helsinki and Lahti to a full motorway, meaning in essence the building of the second carriageway next to existing motorway and constructing new bridges and levelled intersections. Again, the shadow tolling was used as a financing method so that the state paid 'tolls' for each vehicle kilometre travelled on the road. The project was analysed in detail to the extent that public documents allowed and it was reported that the state paid more for the road in the long run than it would have done applying traditional public project procurement (Leviäkangas 2007). On the other hand, the project was built well ahead of planned schedule and has served the road-using public in an impeccable manner, thus signalling the positive side of the PPP arrangement.

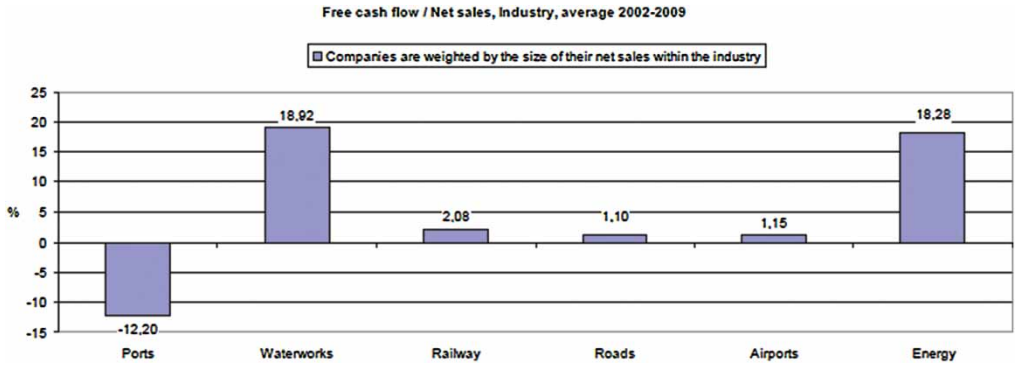

Figure 2. Free cash flows provided by infrastructures to their owners; the sample includes both public and private infrastructures (source Nokkala et al. 2011).

The aforementioned arguments imply that direct user financing is most likely to be a more sustainable financing mechanism than such where the state or some other public intervention is stronger. Projects that often offer the possibility of direct user finance are such where the service is tangible and there is a tradition of paying for it. Electricity, heating, public transport, water, etc., are the kind of services where users already are accustomed to pay, and hence these types of projects are easier to justify and there needs to be less government intervention. Some of these projects can rely on business customers: airports are in the end paid by airlines and ports by shipping lines, because visiting the service (i.e. infrastructure) is not free of charge. Thus, there is a strong link between customers' willingness – and note, tradition – to pay and provide real cash in return for the service. This conclusion was also reached in Leviäkangas et al. (2011) when investigating the returns of Finland's infrastructures (roads, rails, ports, airports, water and energy), the businesses carried around and on them. Especially basic need satisfying services and infrastructures, such as water and energy, proved to be very profitable. It is important to notice, however, that the Finnish analysis did not include any concessions which in turn are typically arranged around special purpose vehicles, that is, project companies (Figure 2).

Some economic studies suggest that private infrastructures can work both financially, from the viewpoint of investors, and economically from the perspective of the society. For the USA, for example, privatization of highway network has been studied by Winston and Yan (2011), but in fact such arrangements are available already today. The Greek and Austrian motorway networks are run by private or semi-public companies and user charges are collected from the entire network (Albalate, Bel, and Fageda 2007).

Since it is the after-tax net cash flow that dictates the project's financial viability to its owners, and since these revenues must come from the users or the state or both, it is the revenues and generated benefits that dictate almost the whole framework of PPPs, whether they are economically and financially sustainable in the eyes of investors and greater public. Benefits must exceed the revenues (as in our equation earlier) and revenues must exceed all costs and capital repayments. The more there are non-cash benefits, for example, socio-economic returns, the more likely is the state or some other public financing called for, whereas when users receive tangible benefits directly, like water and electricity, the less likely is the need for public intervention.

Benefits such as safety or reliability belong to the category for which the real market-based willingness to pay is highly uncertain. Quite often research is carried out to point out the willingness to pay, but these are typically measured as stated preferences and not truly market tested.

Willingness to pay is ultimately always tested only by the market and if it remains untested, relying on it may be over-optimistic.

6. Conclusions

In sum, the analytical PPP ecosystem model highlights the obvious: private investors must rely on real cash flows and this may be ensured best by putting the service provision under market test and building on direct payments from the users. From the private investor point of view, the difference between state-paid and user-paid revenues is insignificant and if there is a difference, it is likely to be in favour of the state. A state is, in most cases, a less volatile customer than the consumers – provided of course that the government and political context can be regarded as stable. This is also something for the state and governments to recognize: involving themselves in the revenue logic of PPP projects, they should be aware that they lower the risks of investment perhaps considerably – and this of course should be reflected to the returns paid to the investors.

For private finance policy, the aforementioned reasoning seems to imply that only truly good projects with real, tangible service provision should be considered to be implemented as PPPs. Poor projects that do not survive administrations' internal competition are likely not the best projects for PPPs, whereas projects that must rely on market demand are probably the most suitable PPPs. Since PPPs have been applied to hospitals and schools in addition to traditional infrastructure projects, we should carefully distinguish who ends up paying for the project. A hospital may be a good thing, but unless it is completely private from the very start, the full amount of required revenues cannot essentially come from 'customers', that is, the patients, and the public sector must step forward to cover the investment amortization and running costs using tax payers' money. For these cases management PPP type of contracts, where only the facility is built and run by the private partners, but the actual medical and health care is provided by the public side, are probably better suited.

Finally, we should perhaps detach ourselves from infrastructure-related thinking because infrastructures are highly capital-intensive projects where revenues must be substantial in order to cover all costs and returns. Service sector is something where PPPs have been applied much less and where there could be in fact an even greater potential. Services are usually less capital intensive and, moreover, usually more interfaced with direct customers.

Quite a bit has been discussed about public sector comparators (e.g. Quiggin 2004, as one of the first). These are project models that are used in conjunction with PPP projects in order to be able to compare which financing alternative would be better from the public sector's viewpoint. The analytical frame shows that the comparator is perhaps not that necessary, or that at least it is not as difficult to construct as sometimes feared. The subjective elements, such as risk preferences and other behavioural motives, are highlighted as the appraisal of PPP project is based on objective variables. This will enhance transparency in the decision-making. Yes, there can and must be consideration whether the project is PPP or conventional, but in the end only the benefits against costs matter. If public sector can provide the same project effortlessly through its budget and in particular if the project generates a great deal of socio-economic benefits, there are few arguments for PPP as goes without saying. But on the other hand, if the project is able to rely on market demand and real cash flows, there is less case for public investment or intervention. This discussion could be advanced by studying the roles and strategies of public actors as part of their ecosystems beyond the financial perspective. Public actors may have three alternative roles, as do the key companies in pure business ecosystems: a *keystone* who improves overall health of the ecosystem, a *classic dominator* who leaves little opportunity for emergence of a

meaningful ecosystem or a *value dominator* who captures most value for itself, leaving a starved and unstable ecosystem around it (Iansiti and Levien 2004).

Finally, it is to a large extent a question of skills and knowledge when it comes to ensuring successful PPPs. The private sector is most able to analyse their business case, whereas the public sector seems to have less capabilities of doing so – at least so far. Yet also the public sector has (or at least should have) the ability to appraise their projects whether these are generating the necessary benefits for the users and society. These skills are still essential and ensure the delivering of good public services. The simple analytical model derived in this paper shows that the public sector decision-makers indeed do not have a long way to go in order to understand the full picture and different ecosystem stakeholder views in PPP projects.

The different time horizons of private investors, public investors, decision-makers, and even between generations are a part of the complex problem where objective and unbiased models might serve well. Electoral future is different from the discounting future, and some investors have shorter discounting horizons than others. But, in the end and as always, the project bill needs to be paid by someone. When governments and public bodies dig investment capital almost literally directly from their pockets, PPPs are sometimes seen as a way to postpone the bill to be paid while still having a wanted project. However, using the model proposed in this paper reveals some of the problems associated with different behavioural patterns.

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