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LETTERATURA"**

RELATORE:

CH.MA PROF.SSA CALOFFI ANNALISA

LAUREANDO: GIUSTO SANDRO

MATRICOLA N. 1063048

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Abstract

Le partnership pubblico-private (PPP) sono uno strumento ora ampiamente diffuso. Dai piccoli servizi comunali alle grandi infrastrutture, il rapporto economico-giuridico che le PPP instaurano tra ente pubblico e società privata porta ad uno scambio di risorse che, se controllato ed eseguito correttamente, può produrre significativi surplus sociali ed economici. Questo lavoro si pone come primo obiettivo quello di presentare un panorama aggiornato sulle possibili forme che possono essere assunte in una PPP; inoltre, nella presente tesi trova spazio anche un'analisi sulle principali caratteristiche che formano questa particolare forma di appalto. Tutto ciò è diretto a delineare il vero e proprio fulcro della tesi: una meta-analisi sui casi di PPP riguardanti infrastrutture o servizi legati alla costruzione o al mantenimento di esse, che sono stati descritti dalla letteratura rilevante, allo scopo di comprendere quali sono le determinanti del loro successo. In particolare, scopo principale di questa analisi è verificare l'impatto di determinate caratteristiche della PPP sulla probabilità di ottenere un risultato positivo in termini di sostenibilità economica, sociale, ambientale e performance innovativa. Attraverso la creazione di un *data set* dettagliato, comprendente tutti i 43 casi analizzati, selezionati a partire dalla letteratura inclusa nel database ISI Web of Science, il più comunemente usato dalla letteratura scientifica, a partire dagli anni '90, si è arrivati alla definizione di una serie di variabili caratteristiche delle PPP, che possono spiegare lo sviluppo positivo delle *partnerships* a partire dagli anni Novanta. I dati sono un insieme di variabili *dummy* (assenza/presenza). Essi sono stati processati eseguendo una regressione logistica. Successivamente, i risultati ottenuti sono stati commentati e rivalutati sulla base delle previsioni emerse nel capitolo iniziale e hanno portato a buone considerazioni soprattutto nella valutazione della sostenibilità economica delle PPP. I risultati dell'analisi mostrano che le variabili che abbiamo individuato sono in grado di identificare alcuni ingredienti che definiscono la probabilità di successo economico delle PPP. In particolare, troviamo che la struttura della SPV (*special purpose vehicle*), del finanziamento e della forma contrattuale alla base del progetto sono positivamente correlate con la probabilità di ottenere un risultato economico positivo. Non si identificano, invece, delle variabili in grado di spiegare le ragioni della sostenibilità sociale o del potenziale innovativo delle PPP. Questi probabilmente sono dovuti a fattori idiosincratici che è più difficile cogliere con delle variabili uniche.

1. Public Private Partnerships (PPPs)

1.1 Introduction

During the last twenty years, some countries have seen a significant increase in cooperation between the public and private sectors for the development of infrastructures within several economic contexts (European Commission, 2003). This phenomenon is mainly due to the diffusion of some particular instruments, such as the Public Private Partnerships (PPPs) arrangements. This first part of the work aims to introduce the concept of PPPs, in order to create a solid theoretical structure for the following two chapters.

This concept is a fuzzy one, as it does not exist a unique definition. PPPs have been defined in several ways by different researchers, with each definition varying slightly from each other. However, PPPs share some common aspects.

From a geographical point of view, PPPs were first developed in Anglo Saxon countries like Canada, Australia, South Africa and UK. However, nowadays they are increasingly used also in developing countries such as Brazil, India and China (see the paragraph 1.6 “PPPs in the developing countries”) because, as I will describe later, PPPs currently represent a strong and effective response to the low financial capacity that some countries or regions must face during different stages of their development.

From a technical point of view, PPPs are an instrument supporting a deep collaboration between public and private sector. This strong collaboration constitutes the most relevant difference between PPPs and the more traditional forms of public procurement. The basic idea behind a PPP is that all the main phases, or large part of them, of the life of an infrastructure (designing, financing, building and after-construction management) are all in one hand: the private sector. Private investors have the burden to accomplish the project, and after the mere construction of the public good, they have to manage it for a long period (on average 20-30 years). In general, the public good is created by the private agent without the presence of a direct public financing. Instead, there is the concession of use of infrastructure granted to a private part, which on the other hand brings its financial capacity and knowledge in the delivery of the project (building and managing). Furthermore “at the end of the concession period, the private party transfers the facility to the public sector” (Grimsey and Lewis, 2004, p. 172).

We can define PPPs by focusing on their three main specific aspects (Iossa and Martimort, 2008):

- I. Bundling, because PPP generally involves a set of phases (design, building, finance and management of the project) that are developed by a consortium of private firms or by a single firm. The degree of bundling depends on the size of the infrastructure and on the duration of the contract. The creation of a huge infrastructure would require the mobilization of a large amount of material and immaterial resources and skills, which are rarely owned by a single firm. Therefore, the larger the number of stages that are bundled together by the contract, the higher is the probability that PPPs are participated by a consortium of different firms, and not by a single firm.

- II. Risk transfer, as risk is typically transferred to the contractor. Government empowers the private party to get the control and the responsibility over the work. This particular aspect gives some degrees of freedom to the private party in the performance of operative tasks, which are necessary to achieve good results in terms of costs, quality and sustainability. With risk on their shoulders, private companies are pushed to maintain high standards.
Nevertheless, in some cases, risk is shared between two parties, in particular when the infrastructure is really complex in terms of finance and fulfillment.

- III. Long-term contracting, as a PPP contract has an average duration of 20-35 years. The period includes both the construction period, and (especially) the management one. During this latter period, private party benefits of the return of the investment by managing the infrastructure, thanks to the payments made by simple public users of the facility, or in some particular cases by the government (especially in the case of PFI projects).

Some of these specific aspects will be developed in the next chapters: risk management, legislation background, type of PPPs, performance of PPPs, are only few issues that make use of this kind of instrument complex, particularly in countries where there is not an efficient economic and juridical background.

1.2 Main differences between PPP and common procurement

A starting issue is represented by the difference between the traditional forms of public procurement and PPPs, in terms of economic performances, technical advantages and disadvantages.

The first difference is related to the nature of these two forms: through traditional procurement, governments can assign all the main phases of building, to several (different or in some cases identical) private companies. So for example to build an hydroelectric power central, the public sector can contract a sector-specialized firm to design and plan the structure, another specialized firm for the construction of the building, and also another one for the management and so on. There can be also a service or management contract with one further private company to deliver the facilities. All these private companies are paid with public funds and they are selected in order to guarantee the best quality and performance with respect to costs.

This fragmentation does not occur in PPPs, because all the phases are sorted in only one contract that is actually the combination of separate contracts which are necessary in the traditional procurement. For this reason PPPs are addressed to one private entity, that, once selected, has to project, design, build and especially finance the creation of the public infrastructure.

This shows that these two types of procurement (traditional and PPPs) can get to similar final results (the infrastructures), although adopting very different approaches: while in traditional procurement there could be a natural dispersion of finance and a weak sense of responsibility in managing public finance. Instead in the PPPs the private party can efficiently control the total works duration and reduce wastes in terms of finance and time since the financial effort generally is sustained by its own finance.

The first prejudicial phenomenon is due to the risk of wrong valuation of the investment in terms of economic impact and to hazy lines of accountability, both linked to low competences in some public sector (Grimsey and Mervyn, 2004). The natural consequences of entrusting all these performances to private sector is the creation of higher standards of building quality and management, still considering costs and duration of the contract (MacDonald, 2002).

Under PPPs there is a sort of initial safety in building the infrastructure. This is made possible by the following aspects:

- Private party is fostered to chase an efficient design and a greater attention during the construction phase, in terms of materials and projects since it is not only a mere

builder, but it uses its private finance to create an infrastructure which will be managed by the same firm in the future;

- During the design phase, contractor can follow the work and integrate the planning of the structure from a logistic point of view with respect to the future management;
- In general there is a more precise valuation of the contract value before getting to construction phases;
- From the point of view of the public sector, the possibility of transfer part of the risk to the private sector allows bidders to concentrate on creativity and quality standards in designing and building phases.

It is important to underline that for acquiring all these preventive opportunities there should be high skilled specialists in the public sector, in order to guarantee a correct approach to the PPPs. Also for this reason it is required a great governments' ability and it is clear that PPP could be a great opportunity only if it is managed with technical skills.

On the other hand, in traditional procurement, government can easily steer all the operations because these are based on singular contracts, and because the public sector is the commissioner of the infrastructure, so it plays an important role in the design of the facilities. Besides all the main phases of the procurement are not strictly linked to specific standards of quality, so bidders could have lower interest in building a great infrastructure if they are not involved in a future management of it. So even if they can be controlled in a stricter way, the risk is that they may work by assuming low standard materials, weak project or overestimated costs since they may not have any future interest.

In few words, PPPs are a type of procurement with a high level of risks, but they can bring to higher performances in phase of construction and design. By contrast, traditional procurement is easier to manage and allows public sector to have a “stronger voice” during the operational phases. However, procurement is a relatively narrow instrument that, especially in some sectors, leads to lower standards of quality than PPPs, because of the ability and specific skills of the private sector in building, designing and managing the infrastructure.

The difference between traditional procurement and PPPs becomes more evident in the managing phase. Indeed, PPPs have a strong capacity to reduce cost in the long period, and on average they allow public sector to reach the two main goals of procurement: avoiding delays and cost overruns.

Several studies were made to underline this evidence:

HM Treasury (2003) studied 61 PPP projects. The final result was that over 89 per cent of them were delivered on time or early, and all projects were within public sector budgets (see also Grimsey and Lewis, 2004).

Stronger evidence comes from the UK National Audit Office (Nao, 2003; 2005) that compares the different performances of traditional procurement and PPPs. This study clearly demonstrated that conventional projects were on time only in 30 per cent of the cases, and even worst results come from a budget point of view, only 27 per cent of them was concluded within budget constraints. Instead, PPPs were delivered on time or early in 76 per cent of cases, and they respect the budgetary standards in 78 per cent of the cases.

Actually, not always PPPs represent the best choice, or at least the cheapest one. In fact, evidence on PPP performance remains mixed (Iossa and Martimort, 2008). This contradiction is based on deep differences in the countries where PPPs are developed. This is principally because government plays a strong role in the final result, and in general the economic and juridical background can have a strong influence on the development of the procurement. Procurement's performance is higher when the legal framework is effective. On the contrary, it is hampered by a muddled institutional system. PPP can also be positively integrated with part of public finance or simply blocked because of public finance insolvency. As mentioned before, the performance of PPPs is influenced by the quality of human capital working in the public sector, probably more than that of the private sector.

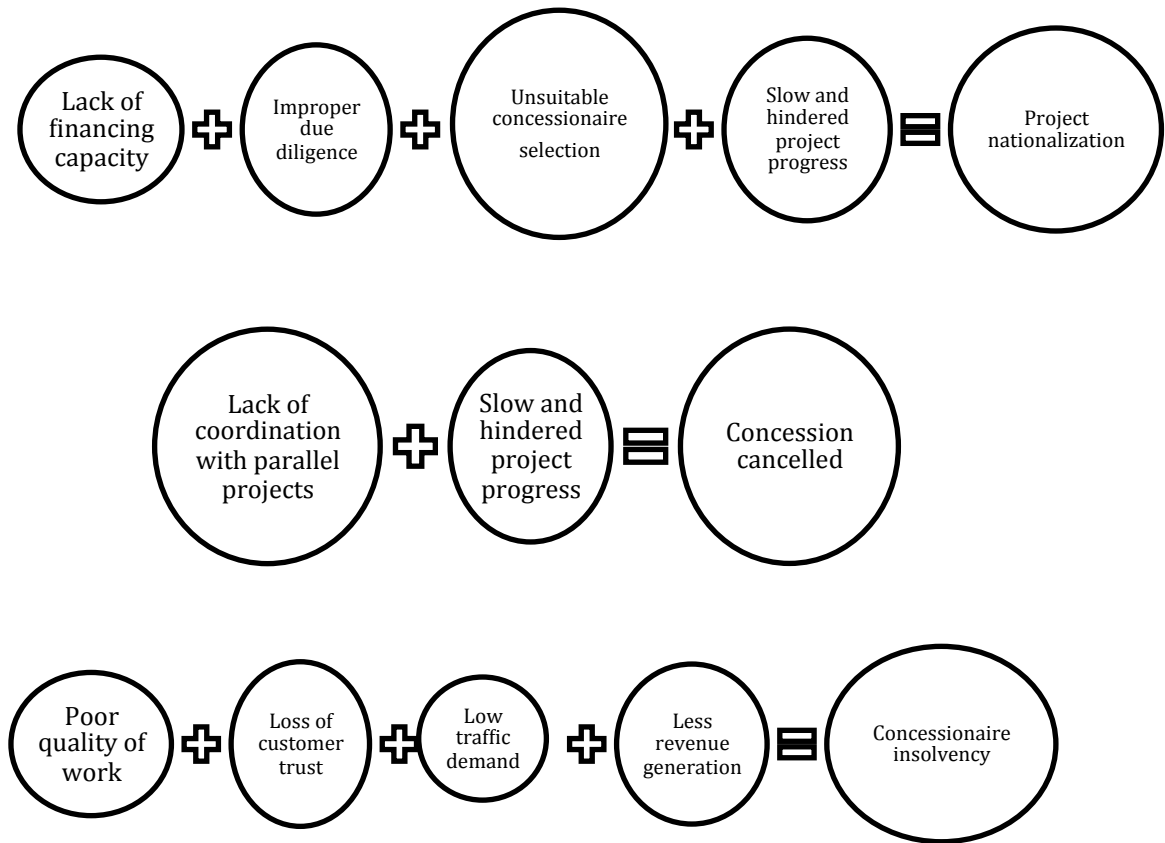
If the country is not able to integrate, stimulate and then control this kind of procurements, the final results of PPPs will not be better than the traditional procurement compared to costs.

In France, for example, PPPs tend to be more expensive than traditional procurement (Saussier, 2006). In Central and Eastern Europe, PPPs seem to be less successful than in the other parts of Europe (Brench et al., 2005).

This evidence is not only linked to the institutional conditions of the country, but it appears also in some specific sectors and it is more evident also in case of conflict during the execution of the procurement: often instances for governments' failure in respecting the terms of the contract, bring easily the project to a premature end (Guash, 2004).

A detailed research in this sense was performed by Soomro and Zhang (2014), who studied a large number of PPP failures. The authors "demonstrated many problems and partnership failures, where both the public and private sectors suffered huge losses" (Soomro and Zhang, 2014, p.1). The authors of the paper find several ways by which PPP may fail. The most common and important mechanisms are displayed in the following figure.

Figure 1 Some typical failure mechanisms in PPP development



Source: Soomro and Zhang (2014)

These cases represent only few examples of how wrong evaluation made by private party involved in the project, can bring to cost overruns and delay or, in the worst case, to the premature end of the project.

Another similar argument is widely discussed by the relevant literature: can PPP's be considered as a form of privatization?

The first evidence is that in the case of privatization, the private company assumes totally the service (and the use of the infrastructure) and there is no risk sharing: private firm is the first responsible of the correct delivery of the service.

Moreover, private company that acquires a public company through a privatization process can be strongly influenced by industrial and pro-competition policies. In fact, the rules of service delivery can be modified by the government that can impose some particular regulatory regime over price or rate of return (Grimsey and Lewis, 2004).

Instead, PPPs are "formal business arrangements" between the public and the private sector, so every detailed aspects of the economic life of the arrangement (the nature of the business activity, the outcomes required, the prices paid for the services, and all the aspects related to the general rights and obligations) are specified and negotiated in the contract. Therefore, the

management of the PPP during all its life cycle is the direct result of the contract, and it is not linked to unstable forces.

The contractual base of a PPP allows the private party to rely on a strong institutional structure during all stages of design, build and management of the public good.

Table 1: Advantages and disadvantages between contractual and institutional PPP

	Contracts (case-specific)	Legislation (general obligations)
Advantages	<ul style="list-style-type: none"> Can impose more specific obligations than general laws May provide a 'road map' for the implementation of new techniques Commitment to sustainable development goals can be criterion for selection 	<ul style="list-style-type: none"> Enjoy democratic legitimisation Parties know obligations beforehand (argument of legal security)
Disadvantages	<ul style="list-style-type: none"> Enjoy only indirect democratic legitimisation Requires specific skills of negotiation and drafting Can be difficult to enforce May conflict with general laws or legal principles Contractual negotiations always involve an element of power; planning authorities are not necessarily the most powerful party 	<ul style="list-style-type: none"> General obligations may not be suitable for a specific case General obligations may result in minimum standards that are not high enough for a specific case General obligations may result in ways of compliance that are in fact law evading Cannot require that non-existent but better performing techniques will be used in the future

Source: Panayides M., et al, 2014

In conclusion, the peculiarity of PPP in the procurement scenario is quite evident, and great part of the difference is given by the country in which PPP is developed, and the specific economic and legal background that is involved in its development.

1.3 A short history of PPPs

Collaboration between public and private sector has a very long history, which start can be pointed in 1663 with the first construction of turnpike in England (Grimsey and Lewis, 2004). The idea of involving private forces for building large-scale infrastructures was determined by the absence of operative competences in the public sector.

But it was only in the eighteenth century that PPPs were established from an institutional point of view, by giving to specific local bodies the duty of maintain and manage some roads. The input was immediately received by the private sector, and several Acts bring to the creation of as many “turnpike trusts”. In these early forms of PPPs it is possible to see already some crucial aspects of the modern agreement: the building and the project of the road was left to the ability of local units. Also the well-defined time duration of the contract is another aspect that will be used in modern PPPs in the future, and finally the research of private funds from the users or from the contractors for building and maintaining the infrastructure.

With this system, roads in England had an impressive development, and the following diffusion in the United States was only a natural consequence of this success.

Another embryonic example of PPP, more recent, is represented by the construction of London Underground, for which a competitive selection of private companies was organized. Between 1894 and 1907 there was a national selection for the best bidder, which brought the English government to start the work for the underground in collaboration with several private companies (Grimsey and Lewis, 2004). This trend did not stop with the conclusion of the works, but it continued with the widening and improvement of the service through years (Currie and Teague, 2015).

This evidence proves the quality and the safety of PPP in England. Anyway, since 90's no institutional legacy was made in order to institutionalize PPPs as an ordinary instrument for infrastructure construction. The first country in Europe that created a specific legislation for PPP was the United Kingdom, where Private Financing Initiative (PFI) was officially introduced in 1992. From this first PFI on, the number of PPPs has constantly increased, and before the recent financial crisis, the number of such initiatives amounted to 794, for a global capital value of £ 55 billion (CBI, 2007). From 1992 to 2006 PPPs arrangements have spread around Europe (Germany, Belgium, Ireland, the Netherlands and Spain especially), and at the same time, they reached the USA, where they are currently the most used contract for the construction of highway and road transportation, rail, and water supply and waste water treatment (CBO, 2007).

PPPs have a strong diffusion also in the developing countries (see paragraph 1.6), where they

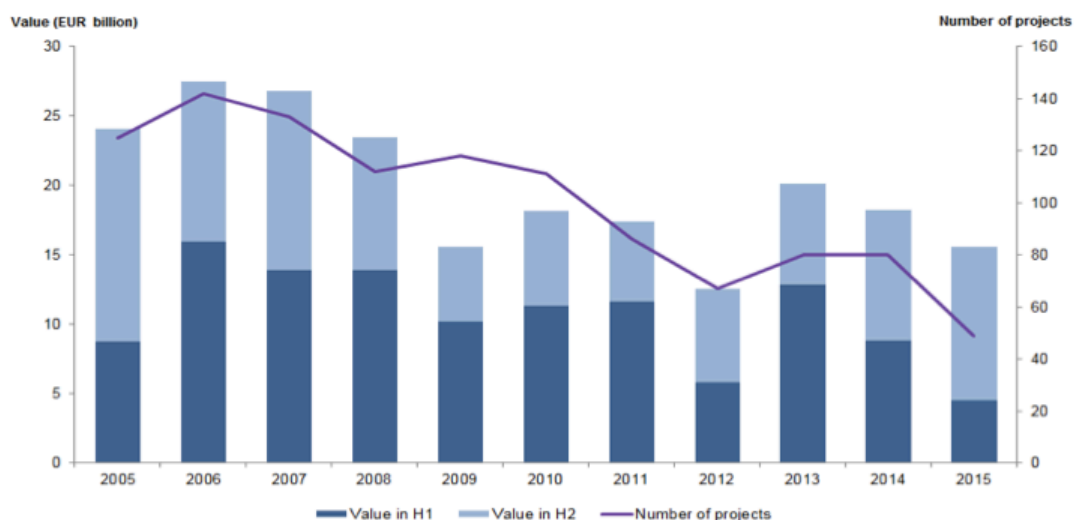
are basically used for the building of infrastructures in those contexts in which the public sector lacks both financial resources and technical competences. Chile and Mexico were pioneers in the use of PPPs (Iossa and Martimort, 2008).

Following the 2007–2008 global financial crisis there has been an increasing interest in the adoption of PPP policy by governments in both developed and developing countries. This controversial tendency is largely due to the governments’ trust in the ability of PPP to raise additional finance in a context of budgetary constraints. This aspect is summed up by the possibility to make the best use of private sector’s technical knowledge in order to reduce costs, increase quality of the public good/service and speed up their development.

In spite of the huge interest in PPPs by governments around the world, its implementation is still hampered by many obstacles. The latter include high transaction costs, long procurement processes, and lack of appropriate skills, unattractive financial market, incomplete risk transfer and higher end user charges. This strong country-variable is the cause of deep differences in the structure of PPPs all over the world. As told before, for PPPs to be successful, an effective legislative and control framework is required both to public and to private agents to recognize the objectives and needs of the other.

The alternate use of PPP in Europe is well underlined by the following chart, which reports the value in EUR billion of PPP (H1 in the chart, dark blue bars) and the number of PPPs concluded year by year (H2 in the chart, light blue bars).

Figure 2: European PPP market 2005-2015 by value and number of projects



Source: European Expertise Centre

The “crisis effect” is well reported by the drop in terms of value and number of PPPs in the period 2009-2012. Instead the following slight growth tendency testifies the return to a growing economy in Europe, and in particular the strength of such procurement in situation of low financial means.

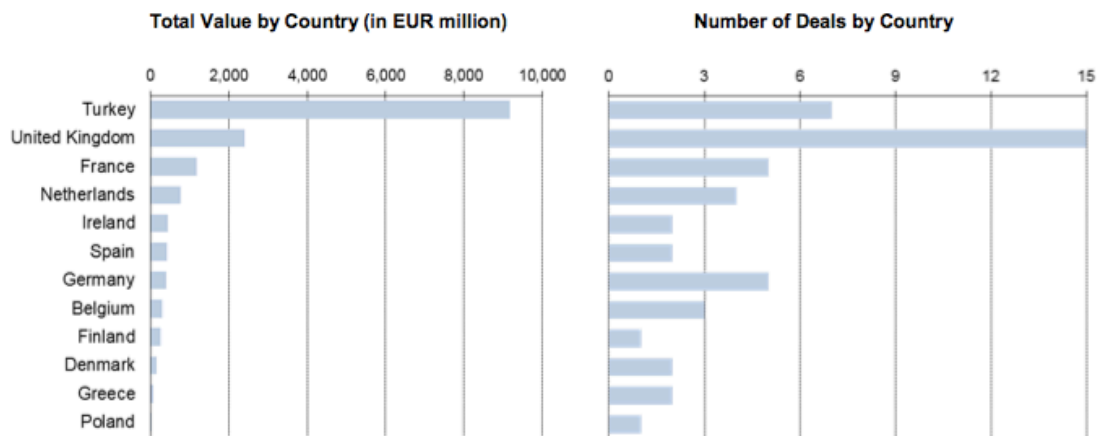
For proving this slow growth in PPP realization in Europe, always from the EPEC (European PPP expertise center) it is possible to compare the number of large transactions (deals exceeding EUR 500 million), which in 2015 was only five, compared to 11 in 2014. Anyway their aggregate value amounted to EUR 9.6 billion, representing around 62% of the total market value. The five largest transactions reaching financial close in 2015 were:

- I. The third Istanbul airport (EUR 6 billion) in Turkey;
- II. The Etlik-Ankara health campus (EUR 1.1 billion) in Turkey;
- III. The Bilkent health campus (EUR 1.1 billion) in Turkey;
- IV. The Calais and Boulogne-sur-Mer port (EUR 863 million) in France;
- V. The IJmuiden sea-lock (EUR 508 million) in the Netherlands.

This growing tendency of PPP in emerging European economies, is confirmed also in the following figure 3, which reports the distribution of huge infrastructure PPP in Europe, by number of deals and by total value in EUR million. UK is the first in number of deals, and this observation confirms the historical tradition of PPP in the United Kingdom. Long experience and consolidate institutions are the guarantee for a constant use of partnerships. Anyway, this large use of PPPs in the country is not balanced by a large amount of financial flows. Turkey has the record in this sense. In fact with few but impressive projects, Turkey has the best financial use for PPPs.

This aspect remarks the differences that each economic backgrounds can bring to PPP diffusion or restriction, evidence that is even stressed in Europe, where countries have deep differences each other.

Figure 3: The distribution of PPPs and their total value by country in Europe in 2015.



Source: European Expertise Centre

In conclusion, PPPs are experiencing an ongoing transformation. In some cases, their application has required a substantial reform of legal and financial systems. Specific actions are needed to define the role of the public sector, to build an institutional capacity at all levels, to include the allocation of qualified and motivated staff to specialized PPP units, the reduction of market risks through user-oriented strategic approaches and the development of private sector investment facilitation mechanisms.

1.4 Technical contents in a typical PPP and some possible PPP structures

In order to talk about the technical contents of PPPs, we need first to describe the birth of a generic PPP, i.e. what is its starting point and which are the parties involved in the first part of the project.

PPPs often start from the initiative of the public agents, and more precisely, from a specific need of the public sector about the creation of infrastructures, or services, that – either for financial or for technical causes - has to be structured with the help of private agents. These needs normally emerge in some specific fields, which are summarized in the following Table 2.

Table 2: Sector and specific object of PPP

Sector	Specific use of PPP
Transport	Roads, bridges, highways, railways, metro lines, airports. This field is historically the most common and used for PPP.
Technology and telecommunications	Government funding for private R&D, innovation centres, laboratories, transmitting devices, internet network. There is a strong link between PPP and innovation.
Water	Wastewater treatment systems in particular, but also sewers and drain systems.
Prisons	Not only the mere construction of the facilities, but also the maintenance and the logistic aid of the structure after the conclusion of the works
Health and welfare	Hospitals, schools and university are only the first three fields that are involved in this case. Hundreds of sub-structures in this sector are involved in PPP agreements.
Energy solutions	Power plants of different types: solar, hydroelectric, thermal and so on. But also R&D in this field is deeply fostered by PPPs

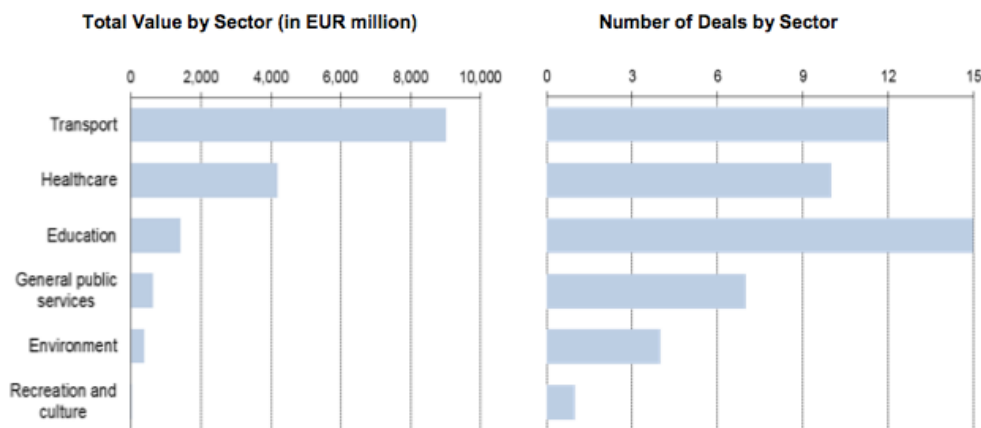
Urban regeneration

Re-planning old part of a town, create some new structures from the old ones, use the space for new design and projects

Source: Grimsey and Lewis, 2004

This distribution has obviously different weights between each sectors. As it is possible to see from the following chart, taking the European scenario as example, transport remains by far the largest for total money value. With more than EUR 9 billion worth of transactions, transport represents around 60% of the total market value in 2015. However, the number of deals closed in the sector decreased significantly (12 compared to 23 in 2014). Instead education involves the largest part of number of PPP signed in 2015.

Figure 4: Sector breakdown by value and number of transactions on 2015



Source: European Expertise Centre

It is important to underline that PPPs are not always related to the creation of a new infrastructure, but they can be created also for the implementation of a previous structure or facilities.

After the identification of the need, the public sector is only at the first stage of a very complex process in which it will be always involved with different degree of action and different aims.

Immediately after the identification of the need, there must be a valuation of the impact of the project in terms of financial weight and of operational risks. The valuation should consider all the possible alternatives to PPPs and, all the possible technical forms that a PPP can assume. Correlated to this stage there is a more specific economic-oriented stage, an ex-ante evaluation of all the economic returns of the investment, the possible cost-structures, and a funding research has to be created. At this point, all the features of a PPP regarding public, private or shared financing are discussed and valued.

In the first stage, public sector moves with network planner and internal audit, but in subsequent stages, a new actor appears in the process: a project manager, which is needed to structure the project that will be presented in bid stages. The role of the public manager is fundamental, because the result of his work will be “the request” from public sector to private party. This last one will embrace or not the project, and its choice is based in large part on the project plan exposed by public sector. More precise and detailed the project is, more it will approachable by the private sector.

The next step is the bid, which can assume various forms: it can be public, strictly directed to some selected parties, international or national, based on costs or performances criteria. All these aspects have to be fixed before launching the bid, because after this operation the public sector can only evaluate the bidders and their proposals.

After the choice of the winning bidder and the agreement, public and private parties start the real partnership, and the project is finalized according to both parts’ requirements. In this stage, all the main policy issues and the general features of the infrastructure and the future management are specified and integrated by both parties. The final negotiation brings the project to its realization, and the PPP enters its operative stage. The construction stage can last for years, with different and various implications on both parties.

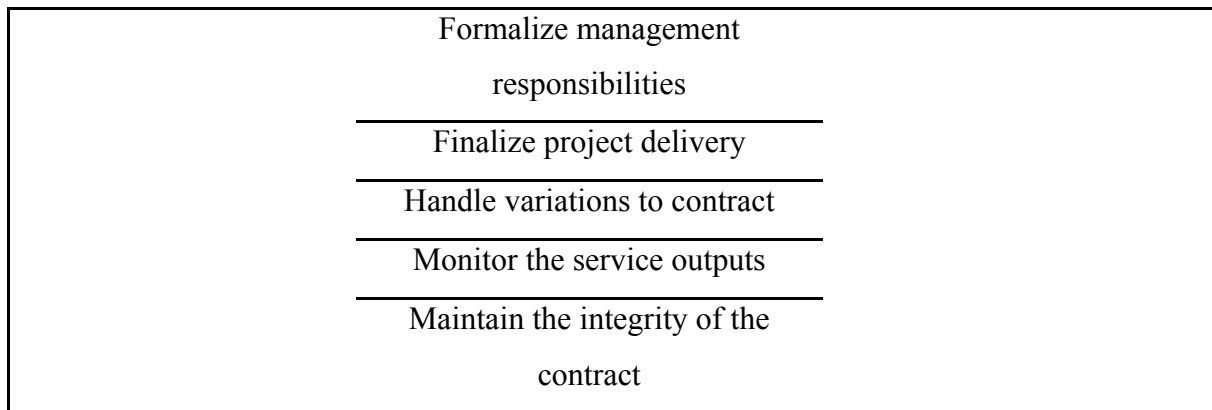
The post-construction management can be defined either ex-ante, by the first contract, or in a later moment, with another specific arrangement. Examples of the first category are the BOO, BOT or BOOT types of PPPs that include, by definition, the operational stage. Therefore, private companies signing these types of contracts will be the same in both construction and managing stages.

In the post-construction management stage, responsibility in the service delivery, costs and quality of the performances are the main themes discussed in the phase of contract for the concession.

In conclusion, public sector is the “first mover” in the creation of a PPP, but it has to follow all the stages of a PPP by maintaining a strong relationship with the private party. The following table summarize all the main actions that may occur during the main stages of a PPP realization. It is focused on public sector side, where a series of specialised figure work for the fine realization of the project during its advancement.

Table 3: Main stages of a PPP from the public sector point of view.

Stage	Main Tasks	Government role
Define service need	Identify service needs	Customer, network planner
	Determine outputs	
	Consider network effects	
	Allow scope for innovation	
Appraisal	Examine various alternatives	Network planner, protector of environment, representative of public interest
	Evaluate financial consequences, risks and other impacts	
Business case	Quantify risks and costs, establish net profit	Network planner, founding
	Cost-benefit analysis	
	Obtain founding and project approval	
Project development	Assemble project resources	Project manager
	Create a project plan	
Bidding process	Develop an issue expression of interest invitation	Concession grantor
	Evaluate responses and prepare shortlist	
	Issue Project Brief	
	Evaluate bids	
Project finalization review	Confirm value for money and achievement of policy intent	Network planner, representative of public interest
Final negotiation	Establish negotiation framework and team	Concession grantor, funding
	Probity review	
	Execute contract	
	Financial close	
Contract management	Handover to contract management responsibilities	Inspector, overseer, contract manager



Source: Grimsey and Lewis, 2004

After this presentation of the process, it is important to introduce some of the possible structures of a PPP, because the choice of the most suitable type of PPP can deeply influence the final performance of the infrastructure. PPPs can assume many different forms, which can vary from country to country. However, most of them can be summarized in the following list, (Grimsey and Lewis, 2004):

- Public provision of collective goods
- Service provision contracts
- Outsourcing/contracting
- Design and construct (D & C)
- Sale and leaseback
- Operate and maintain (O & M)
- Operate maintain and manage (OM & M)
- Build operate transfer (BOT), this is a frequently used type of PPP, in which the private sector maintains a strong responsibility. Financing, designing, building and coordinating the project are all duties of the private sector. Only control and formal ownership of the infrastructure is in the hand of the public sector.
- Build lease transfer (BLT)
- Build lease transfer maintain (BLTM)
- Build own operate remove (BOOR). This arrangement is particularly suited for a temporary infrastructure or service. It is generally driven by a SPV (Special purpose vehicle), a company that is specifically created for the realization of the project;
- Build own operate transfer (BOOT)
- Lease renovate operate transfer (LROT)

- Design build finance operate (DBFO). This is a ‘complete’ type of PPP, in which the private party is responsible for all the stages of the process, from the first steps (design) to the conclusion and administration;
- Design construct manage finance (DCMF)
- Design build finance operate manage (DBFOM). As suggested by the acronym, this type of PPP covers all the relevant stages of the process, from the first design phases to the management of the public good. A transfer phase (to the public agent) is not present;
- Build own operate (BOO). With this kind of PPP, the control and the ownership of the infrastructure remain in the hand of the private party, which must finance, design, build and manage the facilities;
- Franchise
- Concession
- Joint venture (JV). This is the most common example of PPP, in which private and public parties share the risks, and take joint decisions over every operations;
- Regeneration partnership
- Outright privatization

This list is not exhaustive, but includes all the most common types of PPPs. In particular, arrangements like BOO, BOOT, BOT and DBFO represent nowadays the most common type of arrangements.

Indeed, these latter can vary from country to country, depending on the different institutional frameworks. As it will be shown in the empirical analysis, this instrument is strictly linked to the background in which it is developed.

1.5 Risk management and governance of partnerships

As it happens in the case of public procurement, all stages of PPPs are characterized by the presence of risks. However, these latter are here divided between the public and the private agents. This raises different concerns in the two parties.

The main issue concerns public agent who has to monitor the activity of the private agent and the definition of the value for money that was predetermined by achieving public funds. This last term is interpreted rarely in the sense of direct public incentives, which are infrequent in PPP as we saw before. Instead in PPP, the term “public funds” has to be meant as the concession of the infrastructure to private party, and the economic revenue cashed in the management of the project by private sector.

Actually the “need for infrastructure” arises from a social necessity and the born of the project has to respond to a general social utility in terms of economy sustainability and social result. For this reason public sector has the necessity to guarantee an effective use of public finance in the realization of a PPP and that its realization goes to a fine solution. As it will discussed in the following chapter, PPP can bring typically three kind of results:

1. Economic sustainability;
2. Social sustainability;
3. Innovation and environmental effect.

These goals can be achieved only “by integration of an asset design, construction techniques and operational practises, and by the transfer of key risks in design, construction delays, cost overruns, and finance and insurance to private sector” (Grimsey and Lewis, 2004, p. 171).

Private party obviously is the second fundamental party of the procurement. It has similar worries about adequate address of its finance to the project,

Actually, the risk of a “wrong address of finance” is not the only worry on private party’s shoulder because private company generally has the burden to complete the realization of the infrastructure and then manage it. So a large scale of operative and technical risks is within the private party. By using the theoretical base of the work of Grimsey and Lewis (2004, p. 172), a list of nine categories of risk that every project may face, could be developed as following:

1. Technical risk, due to mere engineering mistakes and design underestimations. These mistakes can easily bring the project to delays and cost overruns;
2. Construction risk, which is usually linked to the previous type of risk. It can compromise the life of the project and, unfortunately, that of the workers, due to weak

- work safety practices and low quality materials. Delay, cost overruns and disappointing performance are the possible consequences;
3. Operating risk. This category includes the risks that relate to operating and maintenance of the infrastructure;
 4. Revenue risk, due to future managing failures in delivering the services at right prices and with appropriate quality standards. This can bring result in revenue deficiencies;
 5. Financial risk, due to inadequate hedging of revenues streams and financing costs. Level of interest rates and inflation are the critical factors;
 6. Natural cataclysm, which can compromise or even interrupt the construction of the infrastructure or its management;
 7. Regulatory or political risks, which relate to changes in policies or institutional structures. Especially in countries or regions in which there is not a strong and consolidate presence of the public hand, this can lead to changes in the contract;
 8. Environmental risks, occurring in sectors such as energy and water treatment in particular, due to adverse environmental impacts and hazards;
 9. Project default, as a consequence of any of the above.

Bearing in mind these risks, the parties involved in the project try to find the best distribution of responsibilities. This negotiation mechanism is a fundamental stage in every kind of PPP, and it has to be run by experts in order to find the best risk-sharing structure for the parties involved.

Such negotiation is based on three specific issues (Grimsey and Lewis, 2004):

I. The detailed description of service obligations

A central feature of PPPs is that the public sector plays a relatively passive role in receiving services, as it does not procure any asset. This happens in the most common cases of PPP, in which the private party is responsible for the management of the infrastructure and the delivery of the services. This implies that all the legal aspects related to the future management have to be evaluated by both parties during the negotiation stage. In particular, government has to include its desired level of risk transfer. The level of accuracy of this contract will deeply influence the service delivery by the private company, and, furthermore, the managing of the structure during the operative phases and the future transfer of the utility to the public party. As Grimsey and Lewis (2004, p. 177) state: “Government’s only concerns are, first, to satisfied that the engineering solution is sufficiently robust [...] and second, if the

asset is to return to government with a useful life beyond the contract term, that it is suitably maintained during the contract term.”.

In conclusion, if government fails in defining a well-structured service delivery regulation, it may involuntarily take the risk of acquiring a badly managed infrastructure, or, even worse, a bad long-term contract for the delivery of the service. Both cases are examples of the risks that must be faced by the private party as the only deliver of the service and head of infrastructure management

II. The pricing structure

The creation of an appropriate payment mechanism is fundamental for allocating the risk during the finalization of the project, and encouraging the private sector to maintain high-level performances in service delivery (Grimsey and Mervyn, 2004).

Without a precise pricing structure, private party may not be incentivized to adopt the behavior expected by the public party. According to this principle, payments could follow a “service-based” mechanism, for which payments are based on specific features of the service (in general: availability and simple performance), which are evaluated by some specialized government institutions. This system is typically used in accommodation services, “where usage may be variable but availability is a pre-requisite” (Grimsey and Mervyn, 2004).

Another typical payment mechanism could be the transaction- or usage –based one, which is based on the level of usage of the infrastructure by users. The use of this variable can allow taking into accounts also the quality of the service.

The last mechanism is based on benefits, in which specific organizational structure and management group evaluate the improvement made by the private party. In this case payments are linked to words like “more efficiency and safety” or “new business model”.

In all these three different systems, it is clear that private parties are involved in the project in relation to the quality of its presence in the relationship, and a perfect incentive to achieve good performance in the procurement is to establish a precise payment mechanism.

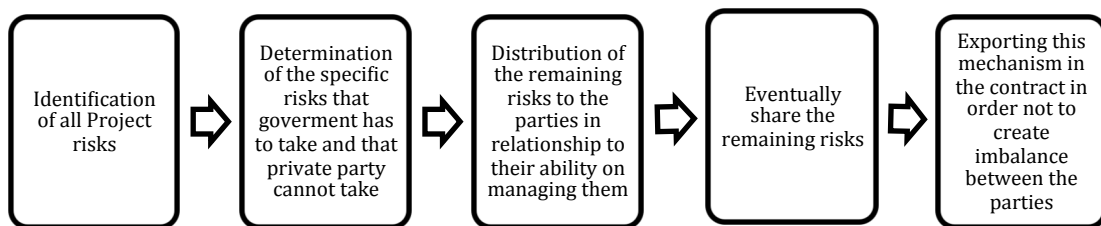
III. Specific contractual provisions which can have an implicit risk allocation structure

The basis presented in previous points represent a rigid view of risk allocation management, in practice, risk allocation in a PPP is more flexible and at the same time is more complex: broadly the goal is to entrust risk to the party which will be the best manager of it. Actually risk management depends on the type and the object of the project (which infrastructure is involved in the project? Which are its dimensions in terms of economic investment and engineering size?), it depends on the type of PPP (for example if the selected PPP includes or

not the “operate” term in its natural contract) and finally of course it depends on the characteristics of the parties involved in the project (their financial structure, their experience in procurement like PPP, their ability in managing this kind of project, and so on).

This partition generally follows a “risk matrix” where the basis could be the previous presentation of the nine categories of risks, specified in relationship to the specific features of the project, and for each voices presented in the matrix, parties define a precise responsibility, which can normally assumed four kind of responses: public sector, private sector, shared, external (insurers, external investments and sponsors).

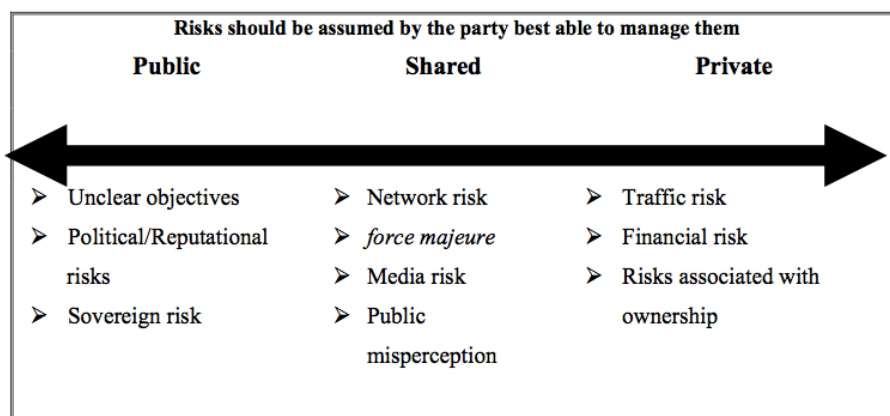
A general step-process scheme could be as following:



Assuming this general scheme is fundamental in risk management and the fine realization of the whole project is clearly linked to this part of the work.

The final result of this process can be summarized by the following table, which describe a possible best-ratio distribution of all the types of risks involved in a PPP:

Figure 5: Risk sharing scheme



Source: Chung D. et al., 2009

Even if it is clear that this specific distribution can deeply differ from case to case, it testifies the large size of possible risks, and consequently the importance to define a proper allocation between the two parties.

Risks linked to the government of the country in which PPP takes place should be on the shoulder of the public party (political and sovereign risks), as well as the risk of giving no clearly defined rules to the project in all its phases, from the bid to the post-construction management.

Instead private party generally assumes risks associated directly to the mere execution of the PPP, in this case financial and governance risks are two illustrative examples of risks on the hand of private company.

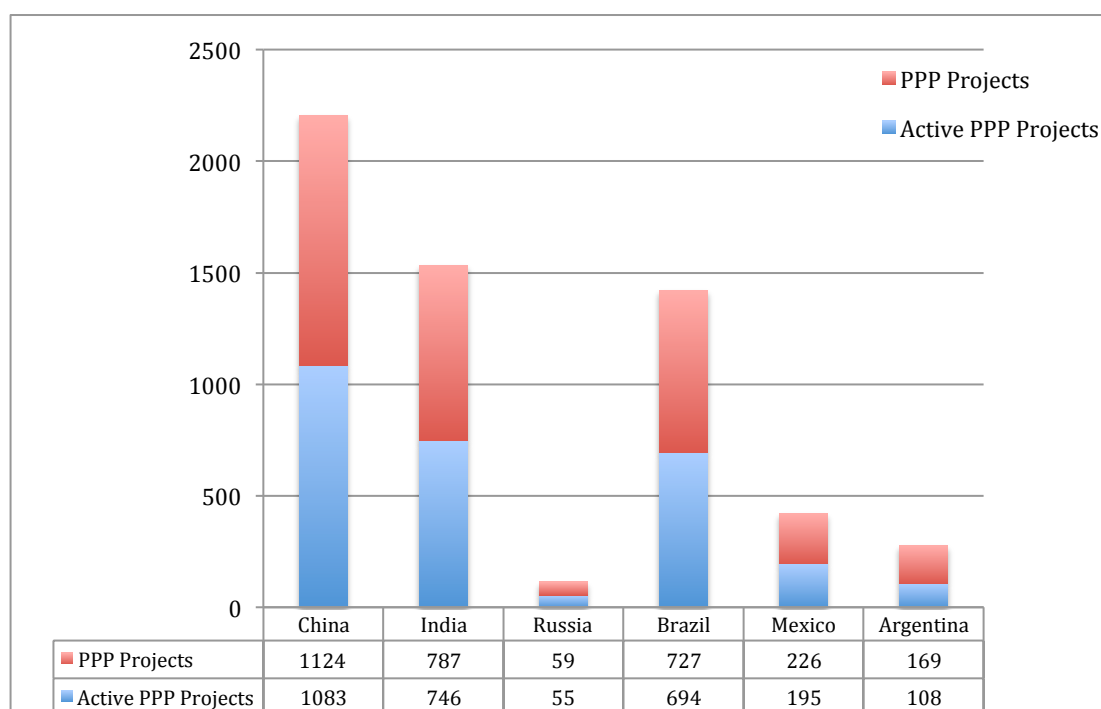
In the middle of the distribution it is possible to assign a shared risks area, in which compares a mixed effect class of risks, from natural cataclysm to media risk, there are all the risks not directly linked to the responsibility of the parties. So in this case it is natural to think about a shared risk class in which responsibilities are divided between public and private parties.

1.6 PPPs in the developing countries

Form the latest research developed by PPP Knowledge Lab in 2015, it is possible to understand the impact of this kind of instrument in the developing countries, where the lack of specific capability in the public sector, may be balanced by a strong use of PPP, which involves also international companies and responds to the enormous infrastructure needs (Grimsey, and Mervyn , 2004).

This is the cause of the success of PPP in China for example, where the economic expansion fosters this kind of agreements, and specialized companies all over the world are requested for the construction and the design of huge infrastructures.

Table 4: the distribution of PPP's and PPP's potential projects in developing countries in 2015



Source: PPP Knowledge Lab

Only in Russia the diffusion struggles to have a great success, that is probably due to the impressive rules for international trading and the heavy of institutional system in the economic development (Russia is 170/189 in “Doing Business” chart for the voice of “trading across borders” and 119/189 at the voice “Dealing with construction permits”, where 1 is the best position worldwide, according to the studies in the site www.doingbusiness.org).

The Russian case represents the best example of what is called “institutional risks” (Miller and Lessard, 2001). In fact even if in PPP there is a strong responsibility assumed by the private sector, as explained largely in the previous chapters, this incentive is not the only responsible in the fine realization of a PPP. Law and regulations imposed by governments can support the project or actually stress its difficulties. Property right, industrial policies, sovereign risks, warranties in loan are only some elements that are involved in this specific issue.

Another secondary aspect is related to the “absence of what might be called a PPP culture in emerging markets” (Grimsey and Mervyn, 2004, p.220). Poor experience in managing this instrument and natural lack in legal framework are included in this factor, which in several cases is added to a socialist legacy (of course this can be more or less evident in the countries taken for example) which can overestimate the impact of PPP in the economy or even block the diffusion of the instrument in the country.

In contrast with this negative aptitude there are some evident commercial benefits in adopting PPP in emerging markets, part of them are naturally some classic PPP’s benefits, but others are also specific benefits arising from PPP in developing countries (Grimsey and Mervyn, 2004). These advantages can be summarized in the following list:

1. Ensuring that the PPP facilitates technology transfer from the foreign investors to the local public sector;
2. The possibility to select projects that promote competition and market-based mechanisms, skills and innovation in sectors underdeveloped in relationship with the worldwide average;
3. Massive share between private and public sector in learning experience;
4. Global reform of public sector as a result of gaining new commercial skills, freeing ideas from capital constraints, and working with the latest technological know-how.

Another issue affecting the diffusion of PPP in emerging markets is the environment impact of this kind of instrument in the management of energy solutions. Crucial activities like conserving water and other resources, minimizing waste, enhancing biodiversity and controlling pollution, are all fundamental (Grimsey and Mervyn, 2004). All these arguments are clearly important worldwide, but they assume a stronger meaning in countries where usually there is not an effective policy in order to guarantee a global conformity to the recent dispositions in terms of environment.

A specific attention in designing the infrastructure, the respect of global rules in the use of sustainable materials in phase of construction and finally the collaboration between local

companies and foreign companies, more specialized in this kind of infrastructure, can help the diffusion of an environmental sustainability also in the developing countries.

In conclusion of this first chapter we have seen the dualistic aim of PPP: on one side the importance of fostering the partnership between public and private sector, in order to guarantee the exchange of financial, technical and management capabilities. On the other side the difficulties in developing this kind of agreement, which can emerge in some particular economic and social context, and the crucial issue of risk management.

All these aspects combined, make the following analysis even more interesting. We will see how, certain factors can influence positively and negatively the final result of the PPP. Result divided in four macro-categories, which cover all the aspects discussed before: economic sustainability, social need, environmental sustainability and innovation.

2. Empirical Study

2.1 Introduction to Meta-Analysis and meta-regression analysis

The final objective of this work is to create an overview of the phenomenon of PPP through an extended selection of specialized papers. Literature on this subject is very ample and each work gives somehow a different point of view of the matter.

Empirical evidences, as emerged from the scientific papers, are quite case-specific and in some cases also contradictory. This difference is more evident when authors analyse the result of each PPP, because the analysis is often mixed with analytic methods (budgetary or economic standards) and personal impressions. If we add the complexity given by the economic and social background where each PPP is developed, we assume a large amount of variability to the characteristics that can influence the final result of the partnership.

The goal of the analysis is exactly to create a statistical structure that should be able to establish some correct relationships between these variables and the final result of the partnership and in other words, to understand which variables can easier influence a positive final result, and which a negative one.

As mentioned before, variables have been taken from different scientific works and papers, in which the authors choose different methods and point of views to analyse the phenomenon. For these reasons, from the first steps, it was clear that for establishing a relationship between the variables, the best statistical instrument for achieving the goal of the entire work, was the meta-analysis. In particular, we use the most used form of investigation in economic empirical research: Meta-regression analysis (Stanley and Jarrell, 1989; Jarrell and Stanley, 1990).

We need to introduce this particular quantitative method in order to understand the results that will be presented in the in the following chapter.

As in every statistical model, also in meta-regression analysis there are two main groups of variables:

- Dependent variable, which is a regression parameter that results from each study included in the analysis;
- Independent variable, which “may include characteristics of the method, design and data used” (Stanley, 2001, p.132).

Therefore, meta-regression analysis can be a perfect instrument for combining different results and giving a general view and explanation of the phenomenon.

As explained by Stanley (2001) meta-analysis has five main phases and each of them helps to understand the whole process behind this statistical instrument:

I. “Include all Relevant Studies from a Standard Database”.

The importance of including all the studies regarding the same subject can help the analyst to reduce the possibility to introduce potential bias. The research has to be careful and analytic, with the inclusion of all the information of each single paper used for the analysis. For this phase is advised to include all studies, also when there is a doubt about the content or the method used in (Stanley, 2001).

II. “Choose a Summary Statistic and Reduce The Evidence to a Common Metric”.

The natural following step of the creation of the database is the identification of some common characteristics of the studies and the process of coding them. This phase can be very long and costly in terms of time (Hunter and Schmidt, 1990) but it is necessary to create the statistical structure.

In this phase two distinctions are introduced: summary measures and effect-size. The first one is used for a preliminary summarization of the set of observations, with the aim of communicate the largest amount of information as emerged from the studies. The effect side instead is the result of the necessity of transforming “the summary statistics to a common and comparable metric” (Stanley, 2001, p. 135). This process of integration between different findings, passes through a statistical method which can be understood as explained by Stanley when defines effect size as “the average outcome of the treatment group minus the average outcome of the control group, divided by the standard deviation of the control group” (Stanley, 2001, p. 135).

This statistic, once it had been transformed in a common metric, will be used as the dependent variable.

III. “Choose Moderator Variables”.

Every possible variable that can be useful for describing the subject of the analysis is called “moderator variable” and for this reason the group of “moderator variables” represents the set of independent variables.

They should be generally consequential and presented as dummy variables in order to permit an easier study-to-study analysis (Stanley, 2001).

IV. “Conduct a Meta-regression Analysis”

Once the two groups of variables were structured and well defined, data set is ready to pass through the real meta-regression analysis. This process allows the analyst to arrive to an explanation of one study-to-study variation as raised from empirical literature previously analysed (Stanley, 2001). In other words the process allows the researcher to define the impact of the independent variables on the dependent variables, and actually if there is or neither correlation between them.

This part of the work is the cornerstone of the entire process and the results deriving from meta-regression analysis can also find new interesting patterns and relations that can deeply help to understand the phenomenon. And if this result of a certain variable is particularly important and solid, the same variable should be included in future studies.

V. “Subject the Meta-regression Analysis to Specification Testing”

Meta-regression analysis does not avoid the risk of revealing errors or failures in the results. The risk can be resolved thanks to specific statistical tests (Stanley, 2001).

2.2 Methodology

We will apply the meta-regression analysis technique to a particular case. Indeed, the literature on PPP is descriptive and based on case studies. This literature tries to establish logical cause-effect links between the characteristics of the observed PPPs and their results, which are presented and discussed in qualitative terms. We therefore do not have any parameter to be entered in a meta-analysis, as usually happens with meta-analyses, but we only have descriptions. Thus, the first step was to extract from the cases analyzed in the literature some relevant information that could be used to build the variables (mainly expressed in the form of presence/absence) that could enter into a regression analysis.

Our meta-regression analysis tries to understand whether some types of results (social, economic, in terms of innovation) that the PPPs can achieve are significantly correlated with some of the PPP characteristics. The variables were chosen based on the availability of information in all cases presented in the literature, as well as on the basis of the importance assigned to them in the various literature review that we have consulted.

By referring to the main steps identified by Stanley (2001) and described in the previous section, we comment below what have been our main steps.

1. “Include all Relevant Studies from a Standard Database”.

Our starting point has been a search on the Scopus database, through which we have collected all articles published in academic journals from 1985 to 2015 that have PPP* (or public-private partnership*) in their keywords, abstract or title.¹ After having cleaned our database, excluding those cases in which the term public-private partnership is anything but a generic form of (desired or actual) collaboration between public and private actors, we got 1764 articles, published in 643 journals.

In order to describe the content of the literature on PPPs and procurement, we have focused on keywords that authors have used to describe their work. By reading the articles' keywords, we have identified the articles that referred to PPPs in the public works sector and those that reported evidence about specific case studies. We thus selected 22 articles. By carefully

¹ The search was performed in January 2016. We searched for regular journal articles or reviews that are written in English, and which belong to the subject areas ‘social sciences’, ‘business’ or ‘economics’. Note that the subject area ‘social sciences’ includes environmental and planning studies, decision sciences and others). In addition, we considered different spellings for public-private partnerships (e.g.: singular or plural, with or without a hyphen, short-term or extended term). We have chosen the database Scopus because its relevance has increased in the last years, and because it covers a wide variety of quality journals. It is available at: <https://www.scopus.com/>.

reading such articles, we further selected those papers that presented a full description of the case study, including all the relevant information. To identify the most relevant features of PPP, we referred to the study of Graeme A. Hodge et al., (2010) and the work by Carbonara (2013).

2. “Choose a Summary Statistic and Reduce The Evidence to a Common Metric”.

PPP can be judged at the conclusion of the partnership or during its development. In both cases what arises from the papers, is that not all the PPP's bring to equal results. Actually not all the cases can be assumed as a positive impact on social-economic context.

For these reasons in this part of the work, the effort has taken two distinctive directions: the choice of four main types of positive results, and the distinction between success and failure in each case.

For the first objective, four big results have been selected (economic and social sustainability, innovation and environmental sustainability). Economic and social sustainability have been selected because they represent the foundation of every PPP. In fact the creation of an infrastructure and its use, have to respond to a public need and to specific budgetary standards. Moreover they are undoubtedly the most studied and analysed in the papers used for this specific data set.

The last two result-variables instead have been selected for the increasing tendency to evaluate these projects also for their impact on environmental background and on innovation.

All these variables have been selected and organized with dummy variables, which include three kinds of results: positive =1; negative =-1; neutral (or no evidence in the text) = 0.

3. “Choose Moderator Variables”.

The choice of this kind of variables represents the heart of the analysis, because the impact of them in the PPP can deeply influence the success or neither of the projects. They incorporate all the main characteristics of a PPP, from financial structure to the management, so the choice of them responds to the specific aim of observing the impact of these variables in the entire project.

As for the previous category, they have been arranged with dummy variables and they take the value of 1 if the specific characteristic has been observed, and the value of 0 if there is no evidence of its manifestation or if the author does not take it into account for the analysis.

4. “Conduct a Meta-regression Analysis”.

With the aim of concluding the statistical analysis, we choose to elaborate data set with a Logit-regression model. This regression model is frequently used with categorical dependent variables. So in this particular case, with the total presence of dummy variables, it immediately seems perfect for this specific goal.

What rises from the analysis will be exposed in the next chapter, in this section it is sufficient to know that some variables have been simplified in order to obtain an easier interpretation of some kind of results. It is the case, for example, of variables including *bundling level* which have been grouped in two main variables: high bundling (including PPP integrated from design to manage) and low bundling.

In general this approach gave us good results, and for most of the variables is now possible to understand and calculate their weight on the success of PPP.

5. “Subject the Meta-regression Analysis to Specification Testing”

In order to examine the analysis it was necessary to apply to the regression some tests, which should prove the significance of the results. We choose to use a z-test and Log likelihood. The first one is simply the ratio between the coefficient and its standard error, and it represents the approximation by a normal distribution of the original distribution, under the null hypothesis. Log likelihood measures the inference of each parameters, and if it is combined with z, can give us a general degree of significance of the regression model to the observations.

The list of the variables is presented in the following table (table 5), in which each variable is described and associated to its significance in dummy variable. Average and Standard Deviation for each variable are reported next to the description.

Table 5: variables tables

Variable		Description	Mean	Standard Deviation
Result Variables	Social sustainability	Dummy variable taking the value of 1 if evident result in terms of social utility appears from the research. It takes the value of 0 if no evidence appears from the work, and finally it can assume the value of -1 if the result is negative or damaging	0,7	0,64
	Economic sustainability	Dummy variable taking the value of 1 if the project respects its financial and economics previsions. It takes the value of 0 if no evidence appears from the work, and finally it can assume the value of -1 if the PPP meet cost overruns or financial failures	0,53	0,67
	Environmental sustainability	Dummy variable taking the value of 1 if the PPP respect specific environmental standards. It takes the value of 0 if no evidence appears from the work, and finally it can assume the value of -1 if the result is negative or damaging for the environment	0,19	0,45

		Innovation	Dummy variable taking the value of 1 if some procedural or material innovation takes place from the developing of the project. It takes the value of 0 if no evidence appears from the work, and finally it can assume the value of -1 if the entire project is even timeworn in respect to contemporary standards	0,26	0,49
Control Variables	Country Variables	UK	Set of dummy variables taking the value of 1 if the empirical case presented in the paper refer that specific country (or geographical area)	0,16	0,37
		Spain		0,07	0,26
		Netherlands		0,16	0,37
		Other in Europe		0,14	0,35
		U.S.A		0,07	0,26
		Canada		0,02	0,15
		Australia		0,3	0,46
		Other around the world		0,07	0,26

Sector Variables	Energy solution	Dummy variable taking the value of 1 if the PPP is related to one of the following sectors	0,09	0,29
	Transport		0,42	0,5
	Social commodities		0,49	0,51
Article Variables	Years of publication	The year an article is published	2009,56	3,67
	Economics	Dummy variable taking the value of 1 if the article is published in a journal in the area of Economics (ISI Web of Science classification)	0,3	0,46
	Management	Dummy variable taking the value of 1 if the article is published in a journal in the area of Management (ISI Web of Science classification)	0,3	0,46
	Planning and public administration studies	Dummy variable taking the value of 1 if the article is published in a journal in the area of Urban planning or public administration paper (ISI Web of Science classification)	0,4	0,49

Moderator Variables	Contract Type	Contractual PPP	Dummy variable taking the value of 1 if the legal ground of the PPP lies in one or more contracts signed by the parties	0,77	0,43
		Institutional PPP	Dummy variable taking the value of 1 if the legal ground of the PPP is not constituted by one or more contracts signed by the parties.	0,23	0,43
	Years of PPP	80s	Dummy variable taking the value of 1 if the PPP has been implemented (and completed) in that decade	0,02	0,15
		'90s		0,37	0,49
		2000s		0,6	0,49
	Time Horizon	Medium term (less than 25 years)	Dummy variable taking the value of 1 if the concession duration lasts less than 25 years.	0,37	0,49
		Long term (more than 25 years)	Dummy variable taking the value of 1 if the concession duration lasts more than 25 years.	0,63	0,49
	SPV ownership	NO SPV	Dummy variable taking the value of 1 if the PPP is not implemented through the creation of a SPV (special purpose vehicle)	0,49	0,51

		Totally Private company	Dummy variable taking the value of 1 if the SPV is present and if it is composed entirely by one or more private companies. If there is not SPV or if it is not composed by private companies, it takes the value of 0	0,26	0,44
		Sub-Private SPV	Dummy variable taking the value of 1 if the SPV is present and if it is composed in part by private companies and in part by public sector. If there is not SPV or if it is not composed in this way, it takes the value of 0	0,23	0,43
	Number of partners	Two parties	Dummy variable taking the value of 1 if in the relationship between public and private, there are only two main parties.	0,58	0,5
		More than two	Dummy variable taking the value of 1 if in the relationship between public and private, there are more than two main parties.	0,42	0,5
	Risk allocation	Shared between public and private sectors	Dummy variable taking the value of 1 if the risks is shared between the parties.	0,67	0,47
		Private sector	Dummy variable taking the value of 1 if risks are only on the private party responsibility.	0,16	0,37
	Forms of financing	Fully private	Dummy variable taking the value of 1 if the whole	0,49	0,51

			financing derives from private capacity.		
		Partly private	Dummy variable taking the value of 1 if the private financing is integrated by some forms of public incentives or direct financing.	0,44	0,5
	Bundling level	DBOT	Dummy variables taking the value of 1 if the PPP is developed on the basis of the specific bundling level	0,16	0,37
		BOT	Dummy variables taking the value of 1 if the PPP is developed on the basis of the specific bundling level	0,12	0,32
		DBMFO	Dummy variables taking the value of 1 if the PPP is developed on the basis of the specific bundling level	0,21	0,41
		Service provision	Dummy variables taking the value of 1 if the PPP is developed on the basis of the specific bundling level	0,02	0,15
		BFOMT	Dummy variables taking the value of 1 if the PPP is developed on the basis of the specific bundling level	0,05	0,21
		BOO	Dummy variables taking the value of 1 if the PPP is developed on the basis of the specific bundling level	0,02	0,15
		DBFO	Dummy variables taking the value of 1 if the PPP is developed on the basis of the specific bundling level	0,28	0,45
BOOT	Dummy variables taking the value of 1 if the PPP is developed on the basis of the specific bundling level	0,09	0,29		

		DBFM	Dummy variables taking the value of 1 if the PPP is developed on the basis of the specific bundling level	0,05	0,21
	Governance	Private governance with public supervision	Dummy variable taking the value of 1 if the governance of the infrastructure is fully private, although with a public external supervision.	0,4	0,49
		Mixed public-private governance	Dummy variable taking the value of 1 if the governance of the infrastructure is given by a mixed public-private management	0,4	0,49
	Bid Shape	Public and best offer choice	Dummy variable taking the value of 1 if the bid is made by public demand	0,58	0,5
		Limited to a specific numbers of participants	Dummy variable taking the value of 1 if the bid process is made by inviting a limited number of participants.	0,19	0,39
		Aimed to one private company	Dummy variable taking the value of 1 if the bid is addressed to only one specific private company or consortium.	0,07	0,26

2.3 Variables explanation

In order to establish a correct relationship between each variable that we will use in the meta-analysis, it is important to understand fully the meaning of them and this part of the chapter has this goal.

First of all we have to underline that the work and the method are partially inspired by a previous paper made by Carbonara (2013) in which the author presented a general scheme of classification of PPP with a cross-country and cross-sector analysis. With this work as a solid theoretical base, the analysis here is developed by taking into account 22 specialized papers. The table where data set has been structured is well suited for the aim of the work. In fact variables have been selected as the most important components in the developing of a PPP.

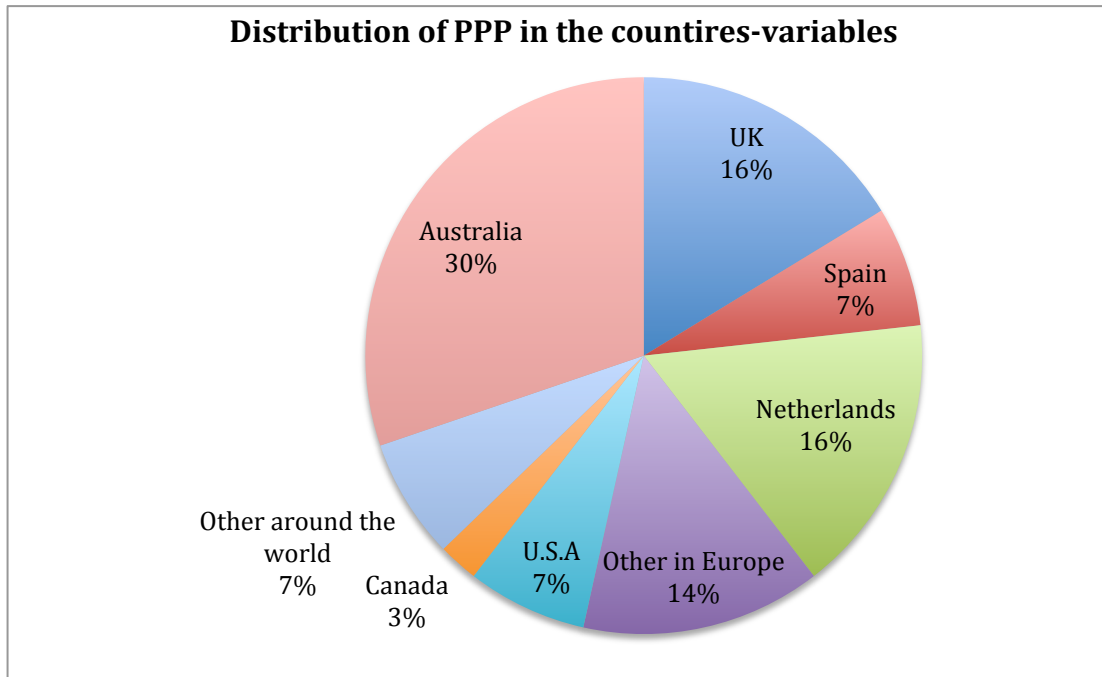
They can be summarized and developed in five groups:

- I. **ID AND TITLE OF THE PAPER**, for a mere classification and recognition of each single work.
- II. **COUNTRY VARIABLES**, for a first geographical localization of the PPP. In this section some countries with a strong and enduring tradition in PPP realization, have been selected as main variables. As for example the Anglo-Saxon group represented by *UK, USA, Canada and Australia*. *Spain and Netherlands* are the only specific representatives of continental European countries.

Finally there are two generic variables, which include all the *other countries in Western Europe and around the World*.

As it could be easy to foresee large part of PPPs taken into account in this work, is born and developed in country with a long tradition with this kind of procurement, so it is not a case that the distribution of the cases through countries has a stronger representative in the UK and other Anglo-Saxon countries. In the case of the UK for example the impact of the PFI program has an historic impulse to PPP approach (Rosario M., et al, 2015). Also for this reason we expect to see more positive result in PPP developed in countries that have already a funded tradition with PPP. Anyway the distribution is well pictured in the graph below.

Australia and UK with 20 out of 43 represent almost 50% of the total. In Europe, excluding the UK, the most frequent country in the research is Netherlands with 7 complete cases.



Source: Authors' elaboration

III. **THE SECTOR OF APPLICATION OF EACH PPP**, represents another general group of variables. As presented in the previous chapter, there are some typical sectors which traditionally attract PPP and these sectors are summed up in the following list of variables:

- ✓ Transport: this is historically the first sector of use in PPP (D. Grimsey and M.K. Lewis, 2004) and also for this reason it represents large part of the cases. Huge infrastructures as highway, toll road, bridges, but also secondary service structure and tunnels are some typical examples of infrastructures involved in this sector. In all these cases it is clear that the ability and competences of private party in design and build the structure may have a strong and effective impact on the final good realization of the project.

Moreover, for this group of variables, we expect to find a direct link to the result-variable of *economic sustainability* because we suppose that large part of them requires heavy financial resources for the realization. Especially in this case, private party should keep high quality standards for accountability and financial risk in order to effort such huge infrastructures.

Another secondary link to “result-variable” in this sector, may be the *environmental success*, because every implementation and new infrastructure in transport field, should have the burden to improve the circulation of vehicles and consequently to reduce the level of CO2 emission deriving from traffic.

- ✓ Energy solution: in this group are included of course all the kinds of powerhouses, but also recycling centre and energy storages. Also for these infrastructures, private party’s competences in engineering may have a central role in the final realization of the project.

Besides recent global awareness in theme of *environmental sustainability* of energy production has nowadays a strong impact also in the judge of PPP involved in this sector. So it is normal to expect a positive relationship between *environmental sustainability* of the project and its final success in this sector.

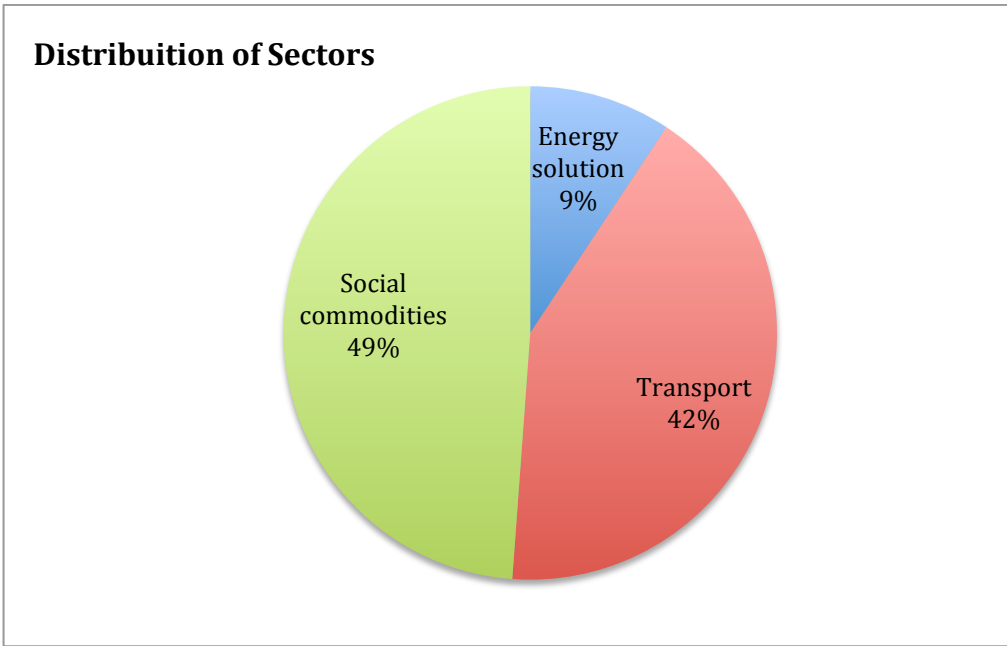
- ✓ Social commodities: this is probably the largest category taken into account for number of possible infrastructures and services, thanks to its large range of application: from hospitals to prisons, from schools to urban reclassification, in this field PPPs are always largely used.

Post-construction managing has a stronger role than in the previous two categories because this kind of infrastructures needs a specialized and continuous managing.

In this category all the result variables should be taken into account because of its large range of application.

In the graph below it is possible to see the distribution of the cases taken into account. *Transport* and *social commodities* have the largest part of the cases (18 cases for the first variable and 21 for the second one), instead only four cases in this study are linked to infrastructures in the field of energy production.

This tendency is anyway confirmed thanks to the large use and the solid tradition of PPP in the creation of transport and social infrastructures. In these fields, economic sustainability should be evident and positive.



Source: Authors' elaboration

IV. PROJECT DESCRIPTION, actually it represents the largest part of the work in data collection, because through these variables the intent is to describe and identify as better as possible every single project. As it will be soon presented, these groups of variables cover some of the most important characteristics of PPP, in terms of time horizon, financial impact, bid form, governance, risk sharing, contractual or institutional framework, and specific form of PPP.

Data has been collected as following:

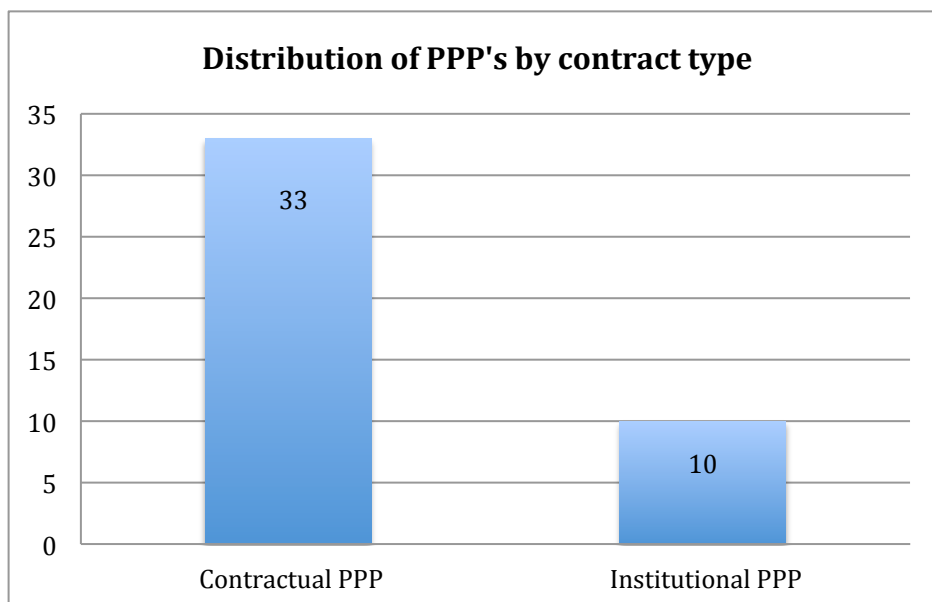
- ✓ Contract type: the distinction in this case is represented by *contractual and institutional PPP*. As seen in the previous chapter (Table 1 in the first chapter) differences are evident, and their effects on the final result of the project may be as important as large. An *institutional PPP* generally is more integrated in the economic and social system of the country, it has a solid juridical base and public party supports it with special propose laws and in some cases also with direct subsidy. Private ability and economic effort are combined with a strong public presence. For this reason we expect to see a general good final result in this kind of procurement.

On the other hand *contractual PPP* has on its nature a risky approach different from the previous. In this case in fact private party normally has the burden to assume a riskier position from a legal and economic point of view. Because essentially we suppose that the absence of *institutional PPP* implies that there is not (or it is in way of developing) a tested PPP approach in the country. Consequently public sector may

be more adverse in supporting part of the financial effort of private party. The only juridical base for the entire work is the contract signed by the parties.

This aspect is anyway balanced by the possibility to create a specific-project context by *contractual PPP* and in this way to create a more detailed and specialized legal framework. In other words, if the contract is well suited to the situation, it is possible to create a positive background for the partnership.

From a statistical point of view, *contractual PPP* has a stronger presence in the data set because it represents the first choice for a partnership, for its utility. From a literature point of view, *contractual PPP* is more frequent and it is easier to study and classify. The graph below reporting the findings of the research, confirms this tendency.

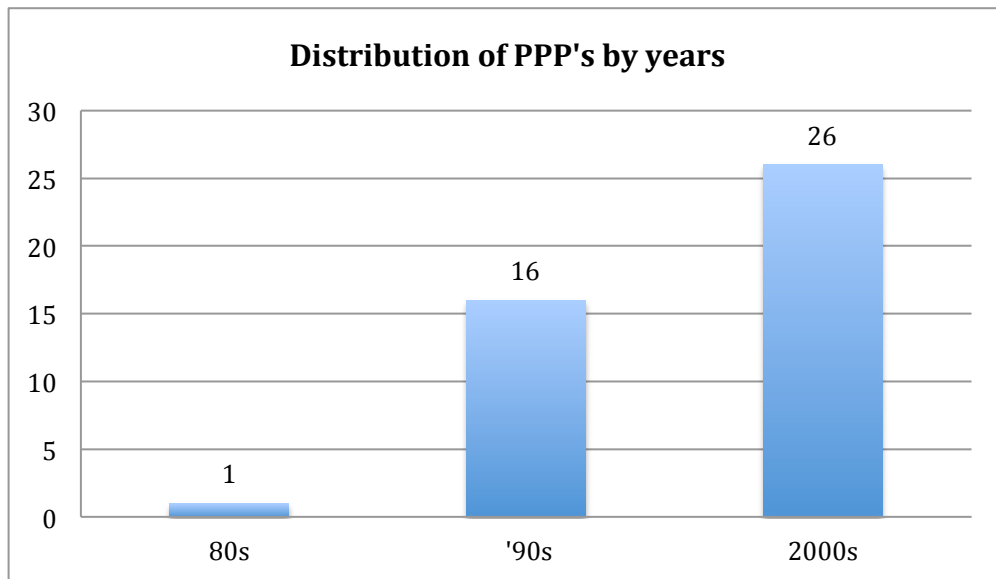


Source: Authors' elaboration

- ✓ Years of realization of the PPP: this is a mere time localization of the project. We choose to divide all PPPs taken in the analysis, in three chronological segments. From the first attempts of regulated PPP in the 80's to the cases grew in the 90's. The last segment is obviously represented by all the cases stipulated from 2000 to nowadays. The link with the result-variables is mixed, because these series of data have a more descriptive nature. Even though these aspects, it is anyway important to study the distribution of PPPs collected, to have a general impression of the period mainly pictured in this analysis.

The graph below responds to this need and lets us to see that the stronger concentration of PPP analysed is developed and finished in the 2000's (26 out of 43

cases). This evidence is explicable thanks to the growing literature that starts to study the phenomenon of PPP from the beginning of the 2000's, in correspondence to the outbreak of the use of PPP worldwide.

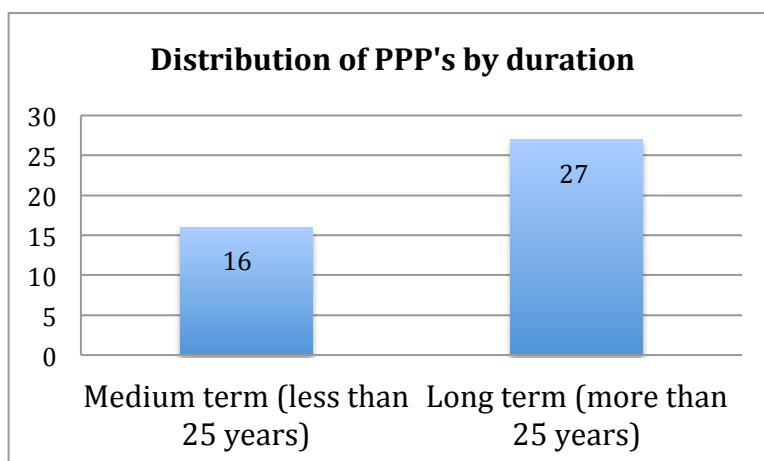


Source: Authors' elaboration

- ✓ Time horizon: as in the previous group of variables, even this group is referred to a time-variable, but actually it describes the duration of the PPP taken into account. It is divided in *medium or long term contract*, and the distinction is made if it lasts more or less than 25 years.

The duration of the PPP may have various effects on the management of the whole life cycle of the project, and its influence on the final result of the project can be mixed.

Anyway it is important to understand the duration of the partnership to have a better idea of the results obtained since the beginning of the project and to weigh the results to the duration of the PPP.

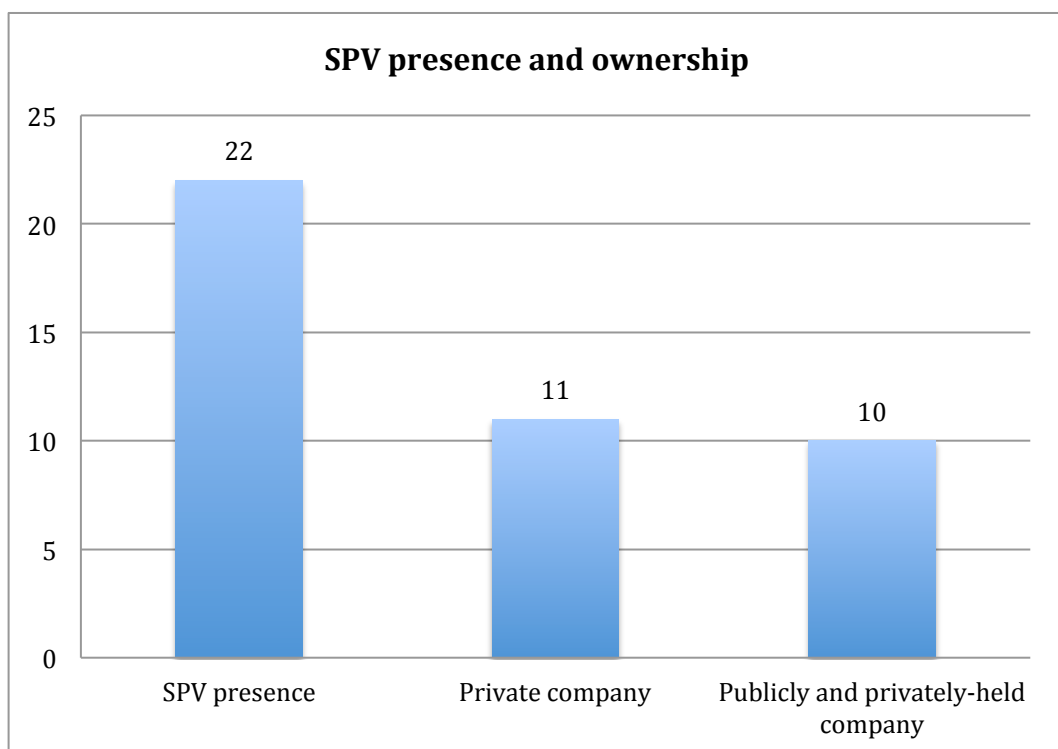


Source: Authors' elaboration

✓ SPV ownership: this is a specific category composed by three variables. The first is the simple presence or neither of a *special propose vehicle (SPV)* in the PPP. As seen before in the work, some PPP grows up around the creation of this special kind of legal entity, which generally stops its legal life with the conclusion of the project. In order to specify the characteristics of the SPV, we choose to assign to this category, other two variables relating to the nature of the ownership. Two main situations have been taken into account: *totally private SPV* and *partially private SPV*.

In both cases all the parties which enter in the SPV are collected in a “consortium” which can be composed totally by private firms or by private firms and public institutions. The aim is to cover all the phases of the PPP by collecting for each phase at least one specialized firm.

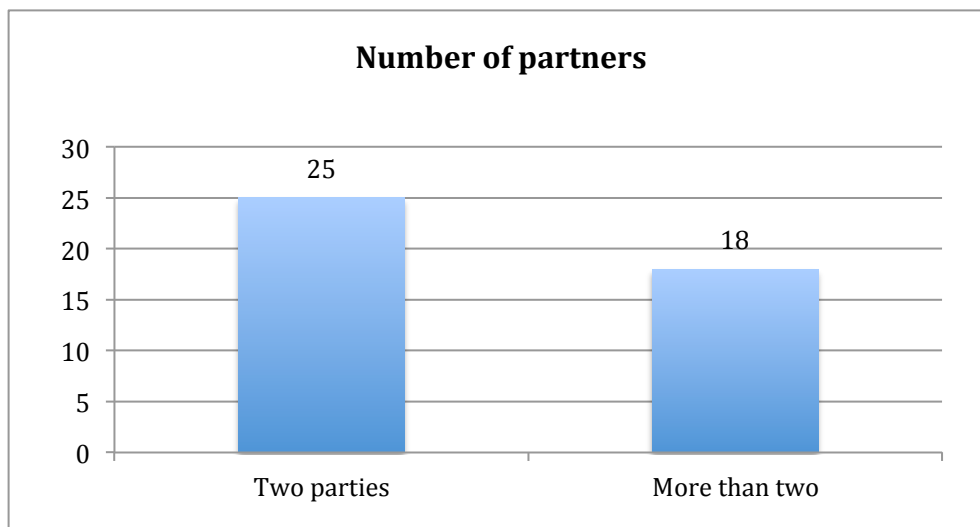
In this study in particular, there is a first attempt to understand from which party derives the will to create the SPV and the impact of this choice in future successes or failures of the project.



Source: Authors' elaboration

- ✓ Number of partners: this couple of variables allow us to understand the complexity and the size of the project. PPP is generally based on a direct correlation between private party and public party, this is the case of simple PPP in which there are only these two parties involved. But especially for huge infrastructures and for extended contract, the realization of the project requires more than two main partners. University, banks and financial groups are only some examples of other kind of partners that may be necessary for the good realization of the PPP.

This case is captured by the second variable: *more than two parties*. As it is possible to see from the graph below, the distribution of the cases is quite balanced, even because in some case it is difficult to understand fully the complexity of the PPP and not all the papers are focused on this particular aspect of the issue.



Source: Authors' elaboration

- ✓ Risk allocation: as seen in the previous chapter, the issue of risk allocation between the parties is crucial for the final fine execution of the PPP. For this reason we identify two main variables related to this aspect: the most common form of risk management scheme is the *public-private share*. This particular form can assume infinite combinations of different distribution of each risk's category.

On the other side we have an extreme form of risk management: risk allocation *totally on private party*.

As it is possible to see also from the graph below, the most common choice is to distribute all the risks between the two parties and only in alternative to entrust the risks on the private party. This series reflect one the most founded strength of the PPP: the distribution of risks lets the parties to have a better coverage in case of

difficulty and permits to create a positive allocation of each responsibilities and duties between the parties.



Source: Authors' elaboration

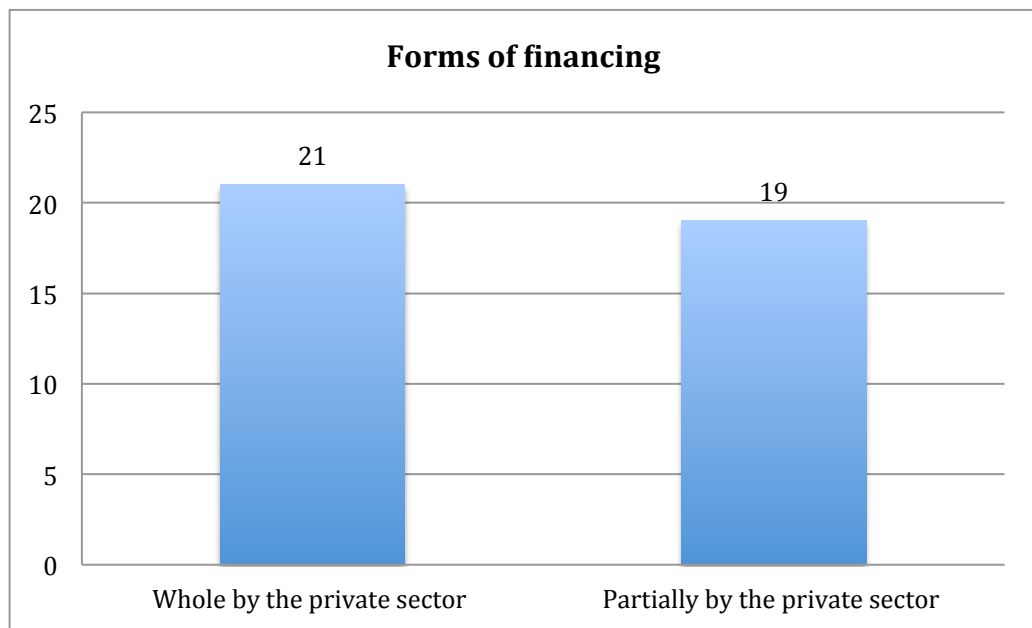
- ✓ Forms of financing: different forms of financing represent the first purely financial and economic set of variables.

This group follows somehow the previous scheme of variables: there is a case in which both private both public parties finance the project and a second case in which private party is the only financier of the PPP.

In the case of *totally private financing* we expect to see a positive correlation with the economic sustainability of the entire project thanks to the entrepreneurial aim of private party in PPP (A.M. Reynaers and S. Grimmelikhuijsen, 2015). In fact with its own finance involved in the realization of the project, private party should be more precise and careful in respect to budgetary limits and it may be more prepared and specialised in managing this kind of situation.

Clearly the other case, *financing partially by the private sector*, gives to the project another structure from this point of view, the financial help derives directly from the State, which can choose to sustain the project with direct finance or with subsidy.

As it is possible to see in the graph below, in the cases analysed in this data set, the forms of financing are almost equally distributed in the two variables chosen.



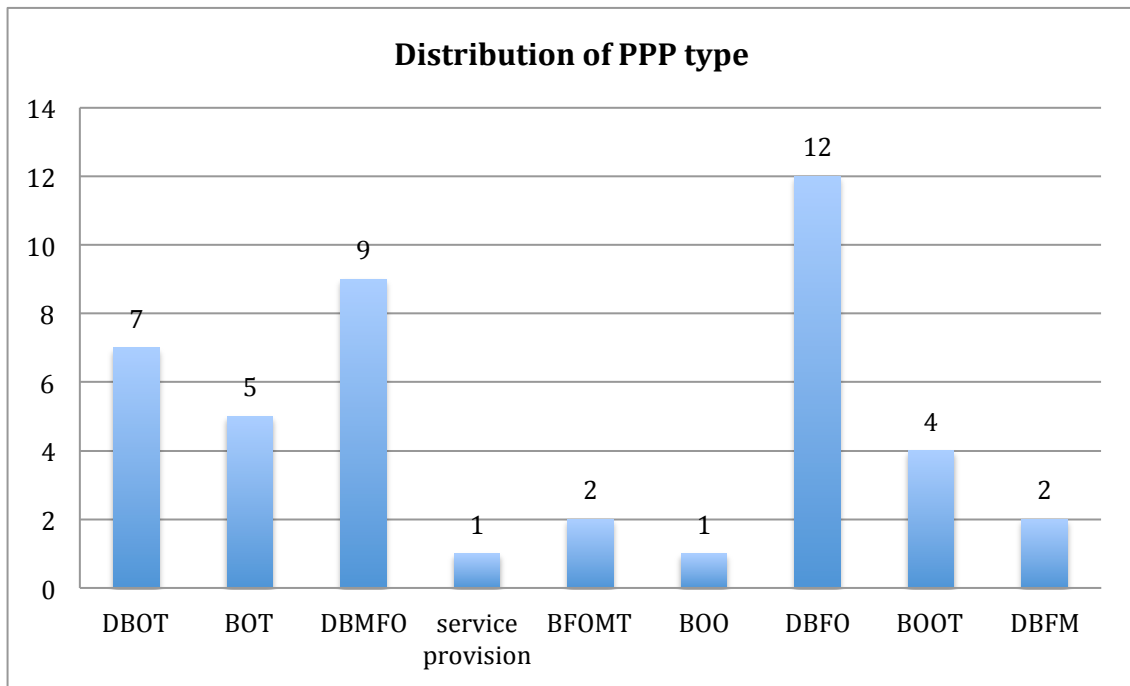
Source: Authors' elaboration

- ✓ Bundling level: this is the central part of the section because large part of the previous information can be summarized with the simple identification of the project and in other words, with its bundling level.

In this set of variables it is possible to see a general classification of all the kinds of PPPs, for the description of each of them we refer to pg. 23 of this work. In this moment it is sufficient to underline the different nature of each PPP's type. From the most complete and deep form of partnership (DBMFO) to its slight and hybrid form (service provision).

Different forms of PPP entail different expectations in final result, so each of these variables may have a strong impact on the final result and the correlation with the *result-variables* can be mixed.

The first evidence is the largest presence of PPPs like DBFO and DBMFO, which both represent a classical operative scheme, since they both start from design and they include financing and managing processes. This kind of PPP is one of the most used and complete forms.



Source: Authors' elaboration

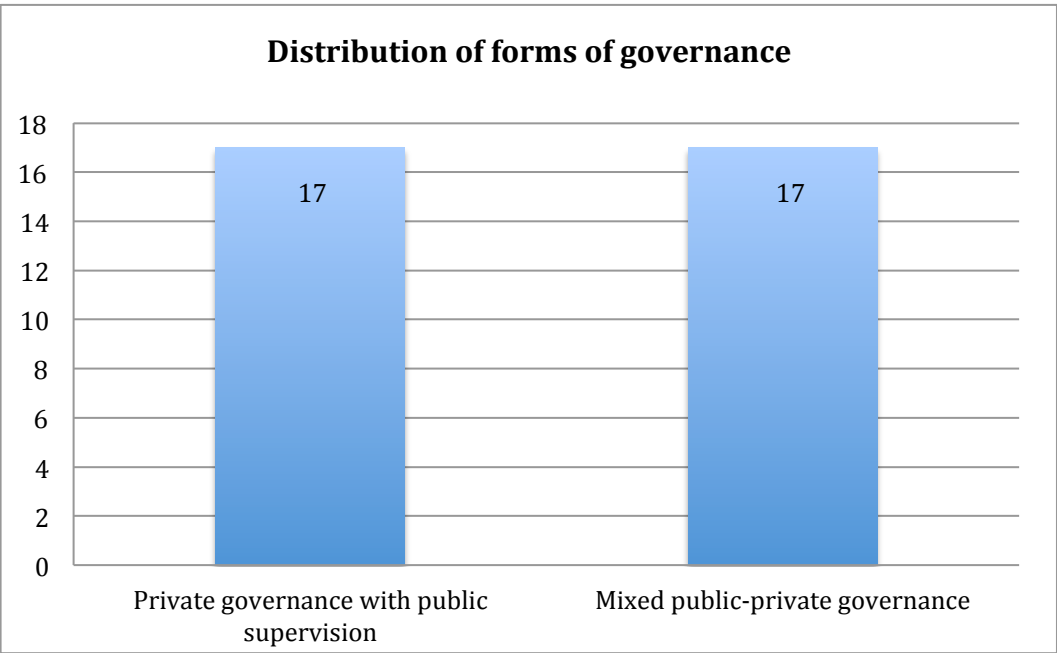
- ✓ Governance: this group represents another important set of variables and the only one specific also to post-construction period and management.

The most common form of governance, in particular in huge infrastructure, is the “mixed-scheme” with a management composed in part by representatives of private party and in part by representatives of public party.

The total private party governance with the supervision of a public party representative represents a variation of this system.

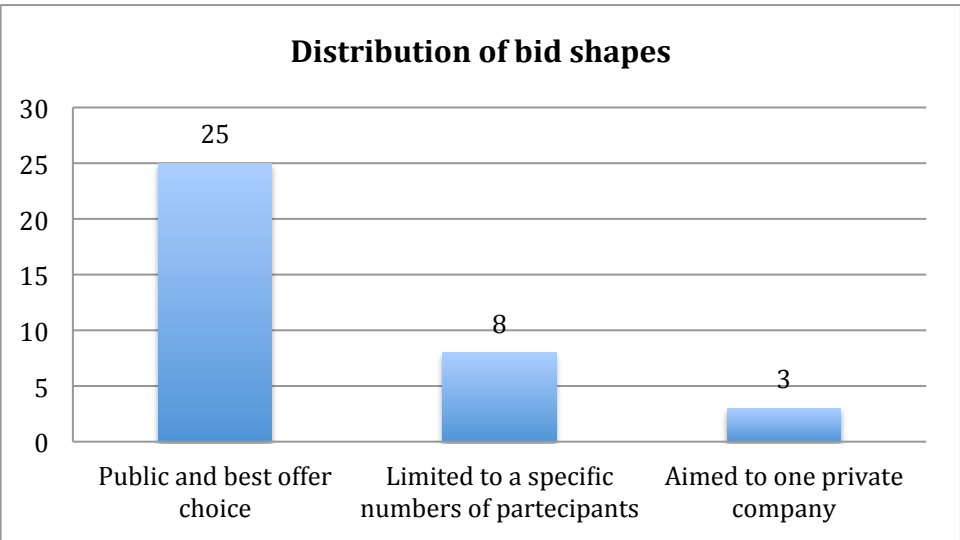
In the cases observed in this work the distribution of these two variables is perfectly balanced between the two forms. Anyway it is important to underline that in this case, as in some other more specific variables, data taken from the papers not always is completed, because the governance of a PPP is not always object of study in every papers.

Anyway it is clear that the management of the infrastructure may vary significantly in relationship to these forms governance, and it can be itself a strong variable for the success or the failure of a PPP.



Source: Authors' elaboration

✓ **Bid shape:** bidding process represents the most important aspect of a PPP's starting. Three different forms of bids are included in this set of variables. The first and probably the most common is the public bid with a selection of one winner. The choice is normally made for specified standards of quality of the project, value for money and warranties. With the same method, the bid can be lunched to a limited numbers of private companies or it can be made exclusively to one private party. Clearly this last form lets public party to address its request to a best-wanted bidder, so we expect for this situation the achievement of the goals researched.



Source: Authors' elaboration

V. **ARTICLE SPECIFICATION**, this part of the analysis is created for examining in depth the characteristics of the paper from which each data is extrapolated. It is composed by only two groups of variables. They are presented as following:

- ✓ Year of publication: it is simply the year of publication of the paper, in order to prove if the paper has an historical point of view of the PPP, or if it has a contemporary look at the phenomenon.

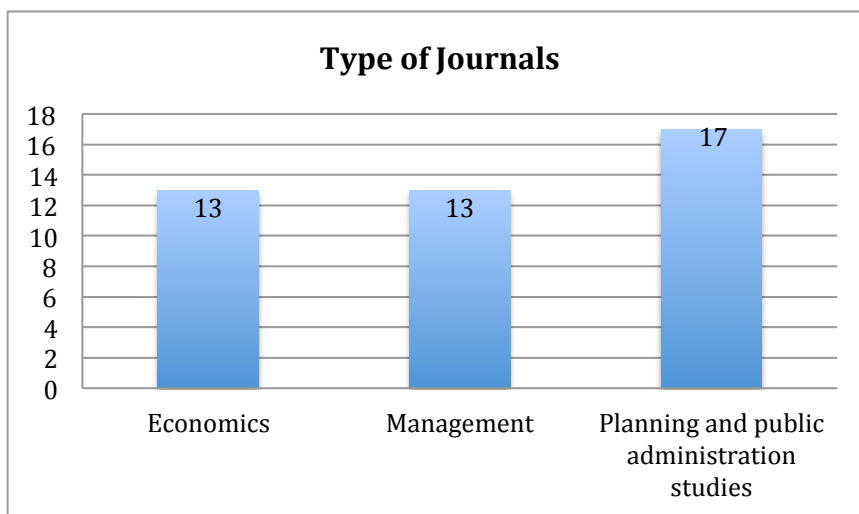
Articles chosen for the analysis are on average quite recent; in fact the mean of the year of publication is 2009. So they all present a modern point of view of PPP and the large majority of the empirical cases are developed between ‘90s and ‘00s.

- ✓ Type of Journal: this set of variables declares the nature of the paper. We distinguish at least three big categories of journal: *economics*, *managerial* and *planning/urbanization*. Obviously this distinction is based on different approaches that each paper gives to the PPP analysed inside. With an economics paper we expect to have more information about the *economic sustainability* of the project.

A managerial paper could give a more focused view on the real management of the project, or some detailed examples of risk management or finally, some about the phases of bid and administration.

The last type of journal can appear as more architectural, but it generally gives a lot of information about *environmental sustainability* and the global *social impact* of the project on the country. All these information are crucial for establishing the success or insuccess of every single PPP.

Here below we have the distribution of the paper analysed by the type of journal.



Source: Authors' elaboration

VI. **PROJECT'S RESULT**, this is the last category of variables chosen for this work, but it is the cornerstone of the entire analysis because with this set of variables, it is possible to understand if the project has (or had, if it is already concluded) responded positively to the “need” that is at the base of every partnership.

The nature of this set of variables is a mix of qualitative and quantitative analysis. They are all based on the authors' opinion or research. The judge on the utility and the efficiency of an infrastructure can be qualitative, instead if the project is interrupted for a financial crisis, the failure is clear besides the author's opinion.

For this aim, four variables have been selected:

- ✓ Social sustainability: to analyse the impact of medium and large infrastructures in urban and social system. This very complex and large field of study allows a lot of specific points of analysis.

First of all this variable tries to test the real social utility of the project. As told largely before in the text, all PPPs are created for responding to a “need” in public policy and welfare and this need has to be filled by the success in the realization of the infrastructure (S. Verweij, 2015). New hospitals have to work correctly and maintain high standards of quality for the wealth of its patients, new roads have to facilitate the circulation in the area of realization, and so on. Some secondary analyses are contended in this set of variables anyway, because new infrastructures create effects not only for their users, but also for external users (P. M. Panayedes et al., 2014). So it is important to analyse the impact of the realization of these infrastructures or services also in the social texture around them. Some specific aspects linked to this issue can be: the impact of the project in local and external job occupation, the integration of the structure with the existing social background and the facilities of use and admission to the new service (D. Chung et al., 2009).

PPPs in which all these aspects or at least one of them are underlined and confirmed, have been selected as a positive example of success in social sustainability.

- ✓ Economic sustainability: central role in the success of the PPP is clearly the economic viability of the project. One of the first causes of failure or delay is the end of capitals or the wrong evaluation of the financial exposure (M. A. Soomro et X. Zhang, 2015). So it is natural to think about this variable as an

“economic rating” of the project. Financial structure, costs analysis, budget limits, are only few methods used by the authors of the papers with the aim of studying PPP from a pure economic point of view.

If budgetary standards are respected and financial estimates were sufficiently correct in the first phases of the realization of a PPP and if above all, the return of the investment is effective and lets private party to manage efficiently the structure, the project can be considered a success in economic sustainability.

- ✓ Environmental sustainability: this aspect covers a central role in projects that grow in deep correlation with environment. Climate change, clean energy and recycling centre are some key words related to this field (K. Eckerberg et al, 2015).

When a PPP is finished complying with these values, the project can be associated to a success in environmental sustainability.

- ✓ Innovation: a PPP brings innovation to the area in which is developed, when new technologies have been tested and used successfully for its realization or when in the period of managing, the infrastructure allows the users to research and find a new technology.

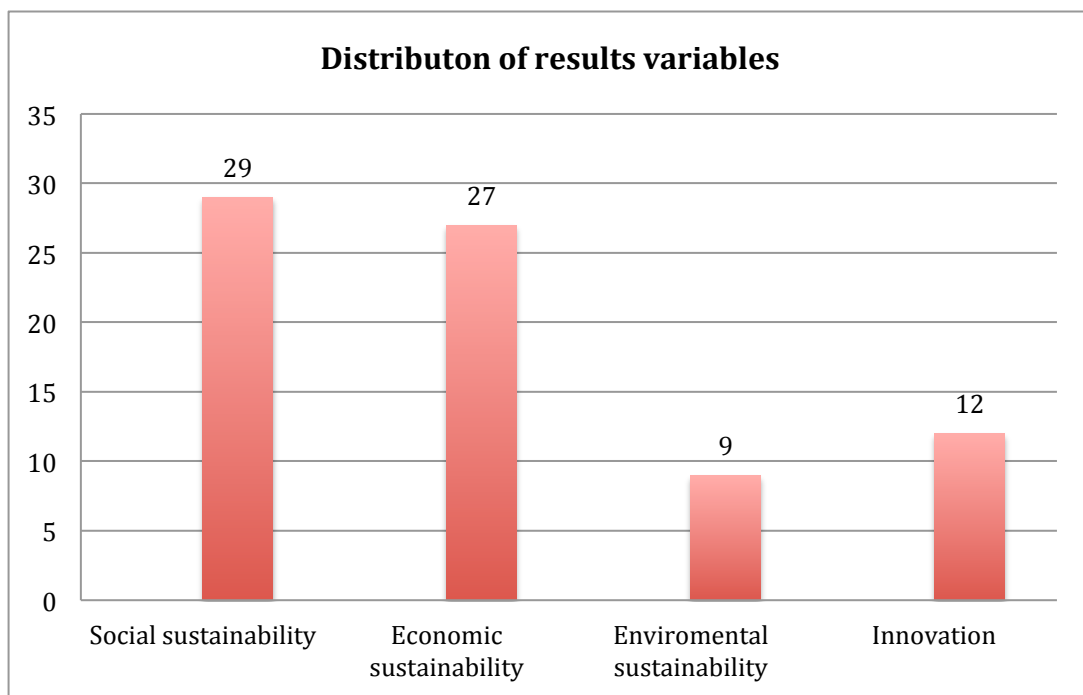
Other important fields of innovation may be the use of a new legal framework for the realization of new PPP or a new way of managing an infrastructure. So in general when something in the realization of the partnership is changed and when this change implicates a possible future adaptation of the same new method in other PPPs.

Now, from a numeric point of view, the graph below shows us that large part of the PPP taken into account for this analysis, has had at least one evidence in the result-variable, with two peaks in social and economic sustainability (29 out of 43 in the first case, and 27 out of 43 in the second case). What appears from the research is that some cases achieved three of these results, but none arrives to reach all the four results. A smaller part of them achieved positive results in environmental and innovation field (9 out of 43 for the first case and 12 out of 43 for the second).

The distribution of these results suggests us a first conclusion. On one side the focus of specialized paper is clearly oriented to analyse the two “primary” tests of the PPP, which are naturally the social utility and the economic impact and sustainability.

On the other side evident manifestations of environmental success and innovation are possible only if the project is directly oriented to achieve this kind of results. As seen before with the introduction of the *sector variables*, large part of the cases analysed in this data set is linked to *transport* and *social commodities*. So it is evident that for example, a PPP agreed for the construction of a new prison, has to respond first to the social utility of the structure. Instead a particular recycling centre may have as primary objective the *environmental sustainability* of the project.

Another important characteristic of this data set is that some cases reached negative results in these categories, and for this reason, this set of variables is the only that includes also the “negative” effect. As it will possible to see later in the text, all the variables presented above, are reported in the table as dummy variable with two possible values (0 and 1), but only in this case the dummy can assume three values (1 for the success, 0 if the data is not observed by the paper, and -1 if the PPP failed in that specific field).



Source: Authors' elaboration

2.4 Literature summary

Literature and its choice is clearly the cornerstone of this work. Theory about PPP, its history, its implementation, could be only a way to describe the phenomenon, but not a way to understand fully the impact of some characteristics on each project. For this reason we choose to collect a series of different papers for the analysis which will be soon presented.

The first big choice was made in the direction of infrastructure PPPs. In other words the analysis is based on projects, which have the creation of an infrastructure or the management of it, as the principal objective. A lot of papers describing exclusively the service provision of a PPP have been excluded. Instead others, which describe the process with a good level of focus, have been included.

It is important to remember that the large number of variables used for the data-set is probably the first reason of the relatively small number of papers used in confront of the total number of papers have been searched. At least four out of five papers were excluded for these two reasons: lack of information or out of theme.

With this premise, it is normal to expect a large variability in the literature used. Some papers like *“Transparency in public–private partnerships: not so bad after all?”* (A. M. Reynaers and S. Rimmelikhuijsen, 2015) and *“Using contracts to promote sustainable complex urban projects”* (M. Van der Veen and W. K. K. Altes, 2015), represent clearly a kind of work with a precise urban planning view. These kinds of papers are perfect for analysing the impact of the PPP in the social and environmental contexts: if the infrastructure was really necessary and if its construction respects precise environmental laws. Besides they generally offer an accurate description of PPPs with high level of bundling, because these partnerships include also the design and construction phases that are for definition the most important issue for an urbanization focus.

Another big distinction, which appears from the selection of the papers, is that one regarding pure economics papers and managerial papers. The difference between these two categories is well defined by the presence in each of them of some typical arguments used for each analysis.

Economics papers use balance sheets, financial exposures, economic indexes on investments, and generally the PPPs’ analysis is spotted on the economic equilibrium of the partnership. They keep the focus on the return on investment for both public and private parties, because the fundamental point of economic sustainability for PPPs is clearly the necessity of absorbing the initial investment and respecting the limits of the contract in terms of time and budget. The best examples in this sense could be the papers *“A critical financial analysis of*

the Private Finance Initiative: selecting a financing method or allocating economic wealth?” written by Jean Shaoul (2003) and the critical paper “*Driving Alone- Sydney’s Cross City Tunnel*” by Peter Phibbs (2007). The first one assumes a financial methodology for analysing the impact of the construction of new hospitals in the UK under project finance, and the second one testifies the negative result in terms of economic sustainability of the project of Sydney’s Cross City Tunnel. In both of these examples, authors reveal a deep economic aim on their works, with the use of specific tools they reach the goal of “testing” the PPP under an economic review. Clearly these kinds of papers focus their attention on our more economic variables, like *financial structure* and *SPV*.

Managerial papers instead are probably the widest kind of paper. This characteristic is the consequence of the strategic importance of management in the entire process of a PPP. Starting from the *bid*, passing through *risk allocation* and arriving to the *composition of the governance*, management has a strong weight on every partnership. So it is natural that managerial papers have the highest impact on the determination on the variables used for this data set.

Perfect examples in this field are the papers “*Alternative Contractual Arrangements for Urban Light Rail Systems: Lessons from Two Case Studies*” written by Carlos Oliveira Cruz (2014) and “*Risk allocation in the private provision of public infrastructure*” by A. Ng and Martin Loosemore (2006). In both works there is a strong managerial component which allows us to understand fully the case studies present in the text in particular for what concerns government and bid process in the first case, and risk allocation in the second one.

Finally some works has not only one specific aim, but rather they are a mix of the three different aspects previously presented. Anyway if they are part of the selection, it means that they present enough information to complete most of the variables requested.

3. Results and comments

3.1 Presentation of the data included in the model

This final section of the work is dedicated to the explanation of the statistical analysis and its final results. Before commenting what derives from the analysis, it is useful to explain some decisions made in the regression.

As we told before, we choose to apply a logit-regression model to the data set and even if this choice may be natural because of the large presence of dummy variables, it forces us to make some simplification of the data set. In fact we decide to gather some variables, which have too infrequent observations, in order to avoid possible bias and to amplify the precision of the regression.

This operation is summed in the following table including the variables as they have been used for the regression:

Table 6: variables used for the meta-regression analysis

uk_australia	This is the first simplification made. This group includes the cases of PPPs developed in these two countries. We gather UK and Australia because they present some typical and similar features in the economic and legal background for PPP, and because they represent the majority of the cases taken into account (46% of the total).
Transport	In this group are included only the cases of transport infrastructures, instead the other two categories (energy solutions and social commodities) have been considered together. This choice is similar to the previous one: great tradition of PPP in transport sector and higher presence of this kind of infrastructure in the cases analysed.
Contractualppp	This is the variable of contractual PPP, in opposition to institutional PPP. This division does not pass through any simplification.

2000's	PPPs started after 2000 have been included in this group.
Mediumterm	PPPs made with contractual duration of more than 25 years. This division does not pass through any simplification.
SPV	This variable includes the presence of a SPV in the partnership.
pub_priv_spv	This variable includes the possible scenario of a SPV made in part by private companies and in part by public sector.
more_two_partners	This variable studies the impact of a partnership if essentially more than two partners make it. In opposition to the case of a strict PPP developed by only two distinctive partners.
shared_risk	This variable includes the possibility to afford the PPP by sharing the risk. The opposite case is the possibility to have a PPP in which only private party assumes all the risks.
whole_priv_funds	This variable includes a total-private financing scenario, in opposition to a shared financial position between private and public parties.
high_bundling	This is the third big simplification. In this important group have been included all the most integrated PPPs, in other words, all the cases in which the partnership starts with the design of the infrastructure and finishes with the managing of it (DFOMT for example). Other simpler cases (BOT for example) are not included in this group.
mixed_governance	This variable includes the possibility to have governance composed by representatives of both private both public parties.
publicbid	If the PPP is made by lunching a public bid, this case is included in this variable, in opposition to other two cases, gathered together: bid limited to a specific number of participants and bid

	aimed to one private company.
_cons	It is not a variable linked to an observation data set, but it estimates the general distribution of the previous variables, in order to establish a “global view” of the regression.

For each of these variables some typical regression parameters are reported in the following tables (table 7 and table 8). Coefficient is the first one. It describes the direct relationship between the variable taken into account and the result variable. It is higher when this relationship is stronger and statistically proved. It can assume positive or negative values, in relationship with a positive or a negative impact of observations to the final PPP’s result.

Standard Error instead is the general degree of the deviation of the sampling distribution made in the data set. It describes the “distance” between observations and the regression model.

Z-test (or simply z) is the ratio between the previous two parameters (coefficient and standard error) and it describes the approximation by a normal distribution of the original distribution, under the null hypothesis. It takes higher values when the distribution is statistically significant. Instead when it is close to the 0, it means that particular variable may be statistically insignificant.

$P > z$ is the consequence of the previous value and it represents the area under a Normal distribution, in which the value of z or one more extreme is probably to observe. The final two parameters are clearly linked together and they take, with a 95% confidence interval, the maximum deviation of the distribution to the regression model. At the end of each tables there are other parameters, which complete the composition of each result-table. The most important is surely the Log likelihood. This parameter estimates the statistical inference of the variables taken for the analysis, and it will be soon important in the text to understand the significance of some choices made in phase of comments. Finally the number of observations and other three parameters linked to Log likelihood are reported in conclusion of the analysis. The following two tables are the summary of this part of the text, they are the result of the processing of the data set with a logit-regression model and their results will be explained in the second part of the chapter.

Table 7 results for variable env_soc

Environmental and/or social sustainability	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
uk_australia	-21,231	3.956,573	-0,01	0,996	-7.775,972	7.733,510
transport	-1,361	1,482	-0,92	0,358	-4,266	1,543
contractualppp	2,032	1,895	1,07	0,284	-1,682	5,746
2000's	-0,407	1,515	-0,27	0,788	-3,376	2,562
mediumterm	-0,719	1,628	-0,44	0,659	-3,909	2,472
spv	20,195	3.956,574	0,01	0,996	-7.734,547	7.774,937
pub_priv_svp	-20,466	3.956,574	-0,01	0,996	-7.775,208	7.734,275
more_two_partners	1,892	0,186	1,02	0,308	-1,747	5,531
shared_risk	-1,941	2,093	-0,93	0,354	-6,043	2,160
whole_priv_funds	18,921	3.956,573	0	0,996	-7.735,820	7.773,662
high_bundling	0,216	1,479	0,15	0,884	-2,683	3,116
mixed_governance	-1,443	1,980	-0,73	0,466	-5,323	2,437
publicbid	-0,385	1,452	-0,26	0,791	-3,230	2,461
_cons	3,285	3,135	1,05	0,295	-2,860	9,430

Note to table:

The number of observations is 43.

Log likelihood = -13.273464

LR chi2(13) = 17,57; Prob> chi2 = 0,1744; Pseudo R2 = 0,3983.

Table 8 results for variable Economic sustainability

Economic sustainability	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
uk_australia	-5,600	2,931	-1,910	0,056	-11,345	0,146
transport	1,984	1,895	1,050	0,295	-1,729	5,698
contractualppp	4,928	2,656	1,860	0,064	-0,277	10,134
2000's	0,632	1,566	0,400	0,687	-2,438	3,701
mediumterm	3,106	2,065	1,500	0,133	-0,941	7,153
spv	7,206	3,540	2,040	0,042	0,267	14,144
pub_priv_svp	-7,296	3,557	-2,050	0,04	-14,267	-0,325
more_two_partners	3,949	2,129	1,860	0,064	-0,223	8,122
shared_risk	2,723	2,490	1,090	0,274	-2,158	7,604
whole_priv_funds	3,925	2,350	1,670	0,095	-0,681	8,530
high_bundling	-0,671	1,544	-0,430	0,664	-3,698	2,355
mixed_governance	-2,433087	2,363357	-1,03	0,303	-7,065182	2,199008
publicbid	-4,543566	2,304696	-1,97	0,049	-9,060688	-0,02644
_cons	-5,381236	4,570139	-1,18	0,239	-14,33854	3,576071

Note to table:

Number of observations is 43.

Log Likelihood = -12.917079

LR chi2(13) = 29,78. Prob> chi2 = 0,0051. Pseudo R2 = 0,5355.

3.2 Discussion of results

Before talking about each single result arising from the tables above, it is fundamental to have a first investigation about the four macro-result areas and their implication on the regression.

This necessity is due the fact that not every “target variable” has had a clear evidence, and actually only the economic sustainability has, on its results, an evidence that lets us to complete the analysis with a significant comment.

A first general motivation can be given by the strong presence, in the papers analysed, of economic or managerial works (both together correspond to 26 out of 43 cases). Naturally in this kind of literature, the general structure of the analysis and the point of view of the comment, are based on an economic view. So it is normal to expect a stronger relationship between our “*control or moderator variables*” and the economic result variable.

On the other hand positive results like social and environmental sustainability, and innovation, are more difficult to observe and to judge objectively. This tendency is supported by some statistical evidence: in 27 cases out of 43 analysed, economic sustainability is reported to be a positive success, instead innovation and environmental sustainability for example, combined together have been noted only in 21 cases (9 for environmental sustainability and 12 for innovation).

For passing over this initial consideration, we decide to gather together the results of environmental and social sustainability. What rises from this choice, is the group *env_soc*, which results are summed up in the first table of this chapter (table 1)². Even though this choice, that could reinforce the weakness of both result variables, results are anyway statistically contradictory and weak.

In fact from a statistical point of view, it is possible to support the same reasons by using the tables previously reported. The first evidence is the strong insignificance in particular of some observations taken in the *env_soc* table.

² *Innovation* target has the same impact on the regression, and its results have not been reported in the text, because they would be useless for the goal of this section. The process of data set made for this variable has been anyway important to understand the different variables’ weight on each result-variables.

Table 9 focus on the env_soc bias

env_soc	Coef.	Std. Err.	z	P>z	[95%Conf.]	Interval]
uk_australia	-21,231	3.956,573	-0,01	0,996	-7.775,972	7.733,510
spv	20,195	3.956,574	0,01	0,996	-7.734,547	7.774,937
pub_priv_svp	-20,466	3.956,574	-0,01	0,996	-7.775,208	7.734,275
whole_priv_funds	18,921	3.956,573	0	0,996	-7.735,820	7.773,662

These four variables have been taken for example for their high deviation from the regression model imposed for this analysis. Coefficient and standard error are both too critical, and z-test is even worst, because it is evidently close to 0 (in the case of *whole_priv_funds* is just 0, but it is a simplification of the program, anyway it testifies the same problem).

Some other variables included in the same table have not the same inconsistency (*contractualppp* and *more_two_partners* have good evidence also in this table), but it is clear from these examples that talking about the relationship between the moderator variables and the PPP's result in environment or social sustainability can be approximate in this analysis.

Besides these numerical explanation, there is another theoretical reason: economic sustainability is probably the most objective target variable, and consequently the only variable in which negative and positive results are clear and out of contradiction.

The first aspect was explained before in this work, but anyway it is easily understandable: budgetary standards, financial exposures, return on investment, are only few econometric instruments that gives to the economist a precise method to judge the economic structure of a PPP and eventually to understand the degree of the failure or of the success.

Instead for other result variables, the same process is more difficult. Starting from the different approach to the estimation of a success in social or environmental fields: or it is exclusively the opinion of the author or it is the result of the collection of some interviews. In both cases it is difficult to have a realistic judgment of the partnership.

This general consideration is supported also by the different values that the parameter *Log likelihood* has in the two tables: for *economicsustainability* it takes the value of 12.91, for *env_soc* instead has the value of 13.27. This difference, even if minimum, testifies a stronger statistical inference in the first model, and consequently higher levels of dependability in its variables.

In conclusion of this issue, leaving the side of result-variables, another consideration lets us to understand why only economic sustainability has strong evidence in the regression analysis. This reason is based on the characteristics of the moderator variables. For responding to the general aim of this work, that is clearly marked with an economic planning, the choice of

these variables was made in support of an economic analysis, so it is not a surprise that these variables do perfectly their job, by giving us a good response on the analysis of economic sustainability, but by contrast, they do not reach the same objective as well for the other three target variables.

Probably the integration with more specific variables also for the analysis in these three fields (social, innovation and environment) could give us a more total look of PPP. Anyway the results that will be explained immediately after in the text, support the good realization of the data set and the good choice of the paper analysed. Variables like *bid process*, *financial structure*, *governance* and *risk allocation* give us the possibility to structure a complete and statistically correct, economic review of PPP.

In few words, from a statistical point of view, this work, starting from the research of the papers, and arriving to the statistical analysis, responds to a specific economic review of the phenomenon. Besides it offers just a general look of the impact of the same characteristics to other three big issues of PPP: social, environmental and innovation. With this approach it is possible to elaborate a correct interpretation of the data, and to better understand the impact of some aspects of a PPP to its final success.

3.3 Comments to the results

This final part of the work is a key component in the description of PPP and it includes the most relevant considerations and interpretation of the phenomenon.

As described before economic sustainability is the only *target variable* statistically solid, and the following table includes only the variables with a good deviation from the regression. In other words they represent the only variables that can be interpreted with precision.

Table 10: focus on the most significant variables of economicsustainability

	Coef.	Std. Err.	z	P>z	[95%Conf.	Interval]
uk_australia	-5,600	2,931	-1,910	0,056	-11,345	0,146
contractualppp	4,928	2,656	1,860	0,064	-0,277	10,134
spv	7,206	3,540	2,040	0,042	0,267	14,144
pub_priv_svp	-7,296	3,557	-2,050	0,04	-14,267	-0,325
more_two_partners	3,949	2,129	1,860	0,064	-0,223	8,122
whole_priv_funds	3,925	2,350	1,670	0,095	-0,681	8,530
publicbid	-4,543566	2,304696	-1,97	0,049	-9,060688	-0,0264444

The first result (*uk_australia*) is probably the most contradictory, in fact from the analysis emerges a negative relationship between PPP made in UK or Australia, and a positive economic result. This data is probably derived from four negative evidences in economic results, in three different cases of Australian PPP. One of these is probably the most important example of failure that we analysed in the data set. It is the case of Sydney's Cross City Tunnel (Phibbs P., 2007; Siemiatycki M., 2009), a huge transport infrastructure in the heart of Sydney. This partnership represents a failure because of the under-estimation of the cars flow and the consequent low return on investment. The management of the infrastructure changed several times for financial complications, and even though the structure represents a brilliant example of architecture and engineering, the project was deeply criticized by mass media and specialized papers. Phibbs (2007, pg. 1) introduces his analysis to this PPP with these words: "The cross city tunnel in Sydney has been a fairly spectacular failure as a Public Private Partnership – the operating company has gone into receivership less than 2 years after the tunnel opening in August 2005. The tunnel, built at a cost of about \$800 million failed to attract the traffic required to meet interest payments."

This negative result is amplified by other two cases (A. Ng and M. Loosemore, 2007), which help to understand the negative correlation between *uk_australia* and *economicsustainability*.

Actually this evidence does not mean that PPPs are made with higher economic standards in other countries, but it rather means that literature, for the cases studied in these two countries, is more expanded and in some terms more incisive.

Anyway this data should not be underestimated, because it underlines that also in other countries, out of the UK and Australia, PPPs increase their range of use and they are always better in terms of economic standards and sustainability.

All these considerations are naturally supported by the values reported in the previous table, where the variable *uk_australia* has a good z-test value (-1,91) and low probability to have $P > z$ (5,6%), these results, combined together, testifies a solid statistical evidence that allows us to complete the comment for this aspect.

The following evidence is probably more interesting and it deals with the importance of contractual PPP in confront of institutional PPP. What we can understand from the table is that contractual PPP has more probability to arrive to a positive economic result rather than institutional PPP. The relationship is explained by the positive coefficient calculated (4,98) and by some reasons previously exposed. Surely contractual PPP has, for its nature, a stronger provision for budgetary limits, financial duties and time limit so the private company has the burden to face the partnership only if it sure to respect the contract. Besides contractual PPP is perfect for small or medium projects, in which the contract can assume a central role for defining each obligation and eventually for specifying responsibilities and risks. Standard error and z-test are similar to the previous case (2,656 for the first parameter and 1,86 for the second one), both of them define a good approximation of the model to observations.

Another expected result is that one related to SPV (*special propose vehicle*) and its composition. As it is understandable form the table the presence of a SPV increase the possibility of arriving to good economic results (7,206 is the coefficient), and this evidence is even better if the SPV is composed entirely by private companies. This last element is supported by the result of the variable *pub_priv_svp* which studies the impact of SPV composed partially by private and public parties. It reports a negative correlation (coefficient of -7,269) and consequently it stresses the importance of having a total private SPV for the positive final execution of the PPP from an economic point of view.

Private consortium in this sense is the typical approach of a PPP, because it is the most complete form for assuming all the different phases of a partnership (Carbonara et al., 2013). Typically firms with specific tasks coexist in the SPV in order to complete each steps requested in the PPP, from the design of the infrastructure to the managing.

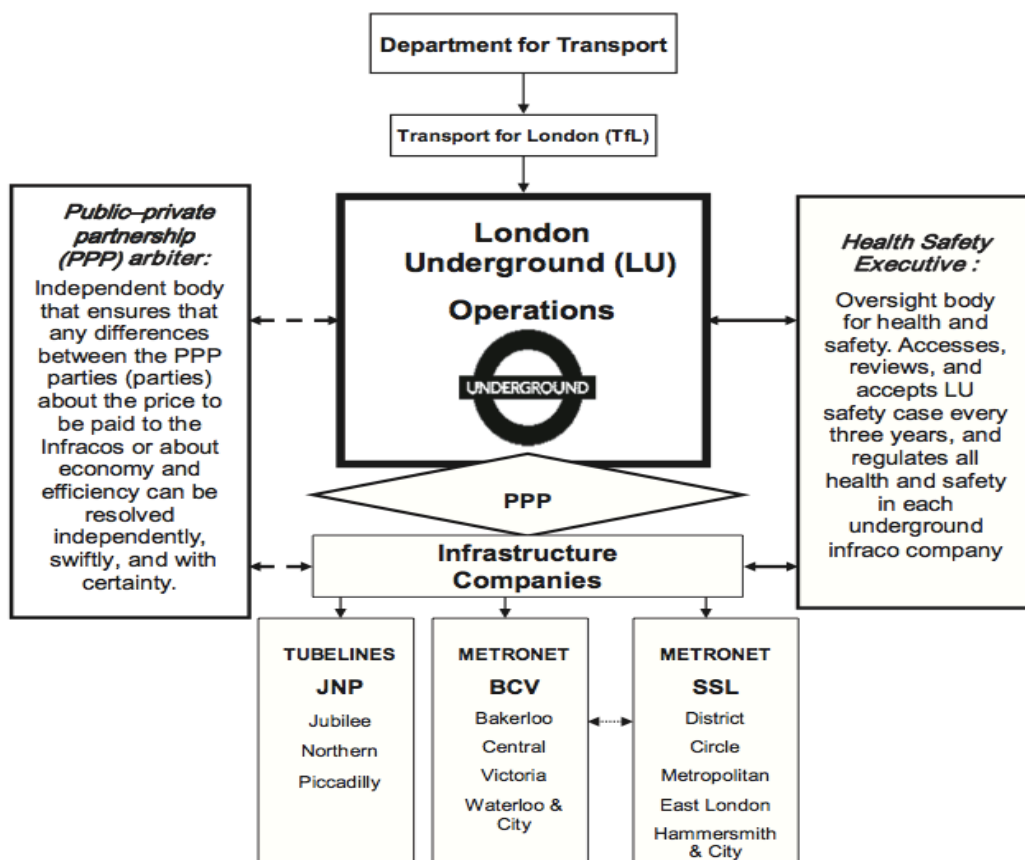
The following result is strongly expected: the positive correlation between economic sustainability and the presence in the partnership of more than two distinctive partners (with

coefficient 3,949). This result is explained by the fact that having more than two partners allows the participants to manage in a better way in particular three important steps of a PPP: risk allocation, activities distribution and financial exposures. “The *right assignment to the right party*” may be the slogan of this consideration. In fact with only two partners there is the negative possibility to observe an overloaded of duties and risks on the shoulder of only one party. Instead with higher number of partners, a balanced distribution may help the management of the project to complete the partnership in respect to economic limits.

Anyway it is clear that having more than two partners can help to arrive to a good realization of the PPP (and actually this is the evidence deriving from our analysis), but it is not enough. It is necessary a good organization and a calculated distribution of each components. An example in this sense is represented by the case study of London Underground (D. Currie and P. Teague, 2015). In this case the presence of more than two partners was forced by the huge dimension of the project (the extension of one line of London Underground).

This case is well supported by the following diagram, which shows the complexity of the PPP and in which way this complexity was distributed through the parties.

Figure 6 London Underground PPP parties' structure



Source: D. Currie and P. Teague, 2015, pg 247.

The most important result regarding the financial structure is represented by the parameter *whole_priv_funds*, which reports a positive correlation with economic sustainability (the coefficient is 3,925). It shows that PPPs have a better probability to arrive to a positive economic result if the financial exposure is totally on the hand of a private party. This consideration is supported by the idea at the base of PPP, which is the great responsibility that derives from assuming the whole financial commitment of the project by private party. This burden brings the private party to place higher attention on economic results, respect budgetary limits, and fulfil financial exposures. All these economic aspects combined together increase the probability to achieve a good final results.

The last parameter analysed is the *publicbid*, which shows a negative correlation with economic sustainability (the coefficient is -4,5435). Like in the first case (*uk_australia*) the negative correlation is the other side of a positive correlation that in this case in particular is more interesting. It is the case of other two kinds of bid, which offer a higher probability to achieve a positive economic result in the PPP: bid for a limited number of participants and bid aimed to one private company.

This result can be explained by the high level of specificity of some PPP and the level of economic and quality standards required for some infrastructures. The lack of proper control in public bids can lead to dispersive processes and to the risk of entrustment of important project to inadequate companies. Instead the other two ways allows a preventive selection of the candidates, and a dedicated attention in assigning the project to a well-structured bid winner.

Conclusions

Empirical analysis has perfectly confirmed the complexity of PPPs. This characteristic is mainly due to the long-term development of the partnerships and to the intricacy of their internal mechanisms. The high number of variables, which deeply influence the global result of a partnership, makes the analyses difficult and in some cases even contradictory. For these reasons, we have run a meta-analysis on the available evidence.

This analysis has shown that a number of variables have a positive influence on the likelihood that the PPP delivers good results in terms of economic sustainability. Most of these variables are related to the degree of involvement of the private partner in the PPP. The more the private party is involved in the different stages of the PPP and the more private capital is used, the more the PPP is likely to bring positive economic results. On the other hand, the analysis has shown that economic-related variables do not have any correlation with the likelihood that the PPP delivers social or environmental sustainability or innovation.

This is probably due to the fact that these variables are likely to be influenced by idiosyncratic features of PPPs, which are not easily captured by the variables that we have tried to define with respect to the case analyzed. More research is needed to understand the reason of the good social and environmental performance of PPPs, which can be the object of more specific researches.

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