Sustainable Public–Private Partnership (PPP) Projects in Colombia

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Abstract This chapter presents a conceptual model of the sustainable system approach in public–private partnership projects of infrastructure based on the literature overhaul for understanding PPP projects, risk mitigation, and social responsibility. A case study from Colombia gives indications that PPP projects are an effective means of funding infrastructure projects as well as a good illustration of collaboration between governance and the private sector, stating that corporate social responsibility or respectively business ethics is an important issue to avoid bribery.

1 Introduction

Infrastructure projects that attract investors able to provide large-scale financial investments are important in the development of a country's infrastructure. As dynamic systems, infrastructure projects have different possible phases, e.g., the contract negotiation phase; the design, construction, operation, and maintenance phases; and the phase of returning assets to the public sector at the end of the project. All elements such as pricing, procurement, stakeholder interactions, and delivery of material are interdependent. Minor changes in phases and project elements have the potential to affect the entire system (Beer, 1995). For example, unexpected changes during the project construction phase can affect the whole project and the resulting financial difficulties can cause delays and create huge risks for investors and other stakeholders. Public–private partnerships (PPPs) provide options for both risk sharing and cofinancing. Moreover, infrastructure projects are complex and dynamic, and contain complicated, uncertain, potentially elevated risks with profound impact on environment, economy, and society. Therefore, the perspective of corporate social responsibility (CSR) plays an important role within PPPs as it incorporates social and environmental concerns into business decisions and stakeholder interactions to create positive influences on these spheres (Commission of the European Communities, 2001).

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The PPP system is responsible for the social, environmental, and economic concerns of stakeholders including local communities, nongovernmental organizations (NGOs), general public, governments, operators, contractors, designers, suppliers, and employees (Zeng, Tam, Deng, & Tam, 2003). Issues concerning corporate social responsibility must be evaluated in advance according to business ethics, international standards, and local standards in order to avoid corruption. Moreover, the allocation and mitigation of risks in the whole project life cycle should be analyzed from the beginning, as investors in a PPP might be worried about risk exposure or legal costs coming up during the life cycle of the project. This chapter aims to understand the relationship between social responsibility and sustainability, risk allocation, and projects of infrastructure; specifically, the analysis covers public–private partnerships, which can be important alliances to facilitate financial investments and the allocation of project risks. The methodology for this research is a literature overhaul and analysis for understanding PPP projects, risk mitigation, system dynamics, and corporate social responsibility as well as the development of a conceptual model of sustainable PPP infrastructure projects; in this process, a case of study from Colombia is taken into consideration.

2 Part I: Understanding Infrastructure PPP Project Complexity

A PPP is a mechanism for cooperatively developing and financing an infrastructure project. Typically, public entities such as local governments or state agencies provide the opportunity for collaboration with private companies who manage the project. Governments, under this approach, invite tenders for a project and then award a company a long-term concession to finance, design, build, and operate an infrastructure asset. This is expected to lead to collaborations where both public and private sectors bring in their complementary skills, supporting each other. This mechanism of cooperation has often been adopted in international projects, particularly in developing countries although PPP is also used in developed countries, e.g., the UK, Austria, and Colombia. There is also the possibility that not only one but several private companies partner up with the public sector, building a private consortium. This is a joint venture of several organizations as facility managers, banks, investors, and suppliers, which hold a concession contract. As such, the private consortium is a vehicle that uses secondary contracts to finance, design, build, operate, and maintain an infrastructure project during the concession period, after which the project is transferred to the government (Ng & Loosemore, 2007).

Such a private consortium is expected to obtain the appropriate profit and return the asset to the government at the end of the consortium period. PPP vehicles are complex and dynamic systems, consisting of multiple interdependent elements; for that, they involve multiple feedback processes, nonlinear relations, and both soft and hard data (Sterman, 1992). During the construction phase, slight changes in the

project can affect the entire system. For example, delays and cost overruns have significant impacts that result in problems with schedules and budgets. Such increasing costs of course lead to decreasing returns. Cost overruns of 100% to 200% are common and are reflected in low profitability, loss of market share, loss of reputation, costs of rework, increased turnover of managers and work force, lower productivity, and extra costs for litigation (Sterman, 1992).

Due to high risk in infrastructure projects, managers' decisions can decrease or increase project complexity: Problems can occur when managers operate by intuition, using subjective, unsophisticated management methods (Ng & Loosemore, 2007). When infrastructure projects are well managed, they both play an important role in the respective country's development and attract investors (Ng & Loosemore, 2007). In contrast, poor management on infrastructure projects potentially leads to problems. Moreover, those projects have long life cycles: Many PPP projects have concessional durations of about 30 years and high complexity. Due to that, setting up an appropriate concessional contract is crucial.

All investors who apply compete for best offer, best price, and best return. The project proposal should have an appropriate concession price: If the proposal is too high, other proposals are considered; if it is too low, the proposal represents losses for the contractor. The complexity of the tender arrangements and negotiations is the result of large numbers of stakeholder interactions, complex financial structures, and optimistic contracts. This can also lead to high transaction costs, necessary reworks, and significant time losses. In addition, there sometimes is a lack of both transparency and controlling for corruption during the negotiations. An example for the consequences is illegal payments to help a contractor win a certain project. In this case, ethics and norms/laws decrease the PPP system complexity and international principles can help to control corruption and bribery (Aei Agenzie Europea, 2011). Two specific risk areas, namely finance and stakeholders, are described in more detail in the next sections.

2.1 Risk Area: Finance

One specific risk of infrastructure projects, especially of civil infrastructure, is that they end in tremendous cost and time overruns representing an extremely significant danger for investors. There are several phenomena favoring such developments: knowledge decrease due to the "lower price principle," high expenses for claim and anti-claim management, growing number of disputes, distrust between clients and contractors, dissatisfied clients, low rates of return, and considerable risks of business failure for contractors (Riemann & Spang, 2014). In addition, during the project execution, sometimes the relation between the client and contractor is not cooperative, and the partners do not work together. Another complex problem of infrastructure project is that the expenditures might be too high for the private sector; this together with the risk of lower returns may lead to the need for the public sector to guarantee minimal returns (Ng & Loosemore, 2007).

2.2 *Risk Area: Stakeholders*

Additionally, complex situations within infrastructure projects might arise from difficult interactions between stakeholders and other actors; this has been reported as a main reason for project failure (El-Gohary, Osman, & El-Diraby, 2006). One way to decrease this complexity of the project is balancing the interests and involving all stakeholders in the decision-making process. Normally, the stakeholders (e.g., governments, operators, contractors, designers, suppliers, employees, investors, customers, and communities) are the actors who have direct or indirect relationships with the project; thus, solving their needs and demands is crucial to increase the probability of success in a project. The stakeholder concept became popular in management literature at the Stanford Research Institute in 1963; from the perspective of sustainability and corporate social responsibility, it is relevant to balance the interests of multiple stakeholders (Friedman & Miles, 2006). Corporations have obligations to both stakeholders and the society in which they operate (Hoffman, Frederick, & Schwartz, 2001).

According to the European Commission, sustainability is "when companies decide voluntarily to contribute to a better society and a cleaner environment" (Commission of the European Communities, 2001: 4) by integrating "social and environmental concerns in their business operations and in their interaction with stakeholders" (Commission of the European Communities, 2001: 6). Project managers should try to make the right decisions rather than making the easy decisions when they face situations of dilemmas in their decision-making process (Hoffman et al., 2001). The complexity of a project of infrastructure, especially organizational and environmental issues, brings challenges for sustainability and responsibility (Miller & Hobbs, 2005). Business ethics is a good framework for acting right, bringing transparence, and avoiding corruption in the decision-making process (Hoffman et al., 2001).

3 Part II: Colombian PPPs and the Conceptual Sustainable Model

Corporate social responsibility is gaining importance among corporate operations: a tendency of an organization to incorporate social and environmental considerations in its decision-making process and in the relation with the stakeholders (International Organization for Standardization, 2010). The stakeholders in PPP projects include NGOs, governments, operators, contractors, designers, suppliers, employees, investors, banks, insurers, and the general public (Zeng et al., 2003). These are multiple interdependent actors and can affect the entire systems' and the subsystems' dynamic at any time. It is an error to think that one element can be isolated. Complex systems have increasingly become a part of executive debate and dialog to help avoid judgment biases and systematic errors in business management decision-making (Senge & Sterman, 1994).

The World Commission introduced the first and most used definition of sustainability or sustainable development with the Brundtland Report in 1987: to fulfill the needs of the present generation without compromising the ability of future generations on meeting their own demands (World Commission on Environment and Development, 1987). The purpose of the World Commission was to address concerns about the deterioration of environmental and natural resources due to economic and social developments. Moreover, business decision-making processes sometimes open space for bribery, to which CSR frameworks can bring mechanisms of control and transparence to avoid corruption (Hoffman et al., 2001). There are many scandals about corruption in infrastructure projects: for instance, a scandal of the Brazilian construction company Odebrecht in 2017 in the Colombian infrastructure project Ruta del Sol, Sector 2, involving commission payments (Semana, 2018). CSR may help to prevent a disaster, to mitigate the risk, to control the pollution, and to create mechanisms of anticorruption (Crowther & Aras, 2008).

3.1 PPP Infrastructure Projects in Colombia

Colombia's PPP program, begun in 2010, is likely to start a new era of innovatively funded infrastructure projects (Gagan & Buendía, 2012). PPP projects are helping the country to develop infrastructure and to attract investors. Colombia utilizes some ideas from the UK in the creation of PPP projects. The British government, the second largest overseas investor in Colombia, has had extensive experience in PPP projects since the 1990s, including complete or partial privatization and joint ventures. In terms of financing, PPP contracts in the UK are made between public sectors and a special purpose vehicle, which brings together a group of private sector companies (often from the construction industry), including facility managers and financers. Financing is typically composed of 90% debt and 10% equity provided by the member companies. Bank financing is more common for small projects, and bonds issued with AAA rating are more common for big projects. In the PPP, the private sector provides better defined contracts, contract management, and design innovation, as well as long-term supervision of contractors (Spackman, 2002). A 2005 survey of risk allocations for UK PPP construction projects showed that macro- and microlevel risks usually are retained in the public sector or shared with the private sector, while the middle-level risks should be allocated to the private sector. However, there are some risks where the unilateral allocation is difficult to determine (Bing, Akintoye, Edwards, & Hardcastle, 2005).

The land area of Colombia has a surface area of 1.14 million km^2, approximately five times the size of the UK, and includes high mountainous areas (Gagan & Buendía, 2012). These factors impact the planning and design of infrastructure projects. Despite some security problems during the 50 years of conflict prior to the signing of the 2016 peace agreement, the country has had good infrastructure development. Since 2010, there have been important developments in the infrastructure sector, e.g., in 2010, the country passed a $90 billion measure to build

infrastructure projects (Rodriguez, 2014). In 2011, Colombia initiated the fourth generation (4G) program to develop infrastructure. In 2017, the government awarded a concession for construction of La Linea, a tunnel connecting cities on the east and west sides of the Andes Mountains according to the Chamber of Infrastructure of Colombia. During the coming years, additional 46 concession projects using the PPP vehicle will be financed jointly by governments and private investors (Rodriguez, 2014). Building of infrastructure development will be a key driver in the next step of economic development. The Colombian economy, designated as a good performer, grew by 4.9% in 2013, with similarly robust growth forecast over the next 5 years (World Bank, 2017). Furthermore, Colombia is incorporating high policy standards for infrastructure, human rights, and investments. Since May 2018, Colombia is part of member states of the Organization for Economic Cooperation and Development (OECD) (OECD, 2018) In that way, Colombia is showing to the world that the country has high international institutional, economical, and social standards that give trustworthiness for foreign investors (Gomez, 2018).

Colombia has a well-defined scheme of national infrastructure PPPs. For instance, in the approval process for technical projects the Agency of National Infrastructure (ANI), a government agency, which is part of the Ministry of Transport and in charge of concessions through public–private partnerships, for the design, construction, maintenance, operation, and administration of the transport infrastructure in Colombia, has clear responsibility for risk valuation, monitoring of payments, and others. The agency works collaboratively with the Department of "Planeación Nacional" (National Planning) and the Transportation and Finance Ministries, which have responsibility for managing contingency funds and conducting tax analysis (Rodriguez, 2014). In terms of legislation, the Colombian government has developed new laws governing PPP infrastructure projects: Law 1508 regulates PPPs, presenting on 10 January 2012 an integral framework for PPP and establishing that a contract only can last up to 30 years, including extensions (Rodriguez, 2014). Table 1 gives an overview over the different regulative frameworks relevant for PPP projects.

Table 1 Additional frameworks of regulation (Cámara Colombiana de la Infraestructura, 2019; Departamento Nacional de Planeación, 2018)

Regulative framework	General description of the regulative framework
Law 1882 (2018)	Supporting strong public contracts and procurement
Resolution 1464 (2016)	Establishes requirements and parameters to be followed by the public entities responsible for the project development
Law 1753 (2015)	Issues the national plan for development 2014–2018
Law 1682 (2013)	Adapted dispositions for transport in infrastructure projects and granted new faculties
Resolution 3656 (2012)	Parameters and mechanisms to evaluate and to execute projects of public and private partnership

In terms of financing, Colombia is creating innovative products like financial asset portfolios to mobilize international actors. For the construction of 4G projects, mechanisms are developed to include the use of both US Dollars and Colombian Pesos (Youkee, 2018). Since December 2017, the Financiera Nacional de Desarollo (FDN), a national development bank, has approved 1.8 trillion billion Colombian pesos ($600 million) for different toll roads. In addition, the Colombian Development Bank opened a credit line of 250 billion pesos ($83 million) for the Spanish state-owned bank (Instituto de Crédito Oficial). Also, agreements with other lenders, including the Inter-American Development Bank and the China Development Bank, for Peso-dominated credit lines concerning to finance infrastructure projects have been signed (Youkee, 2018).

Moreover, Colombia is working with Goldman Sachs and the World Bank on developing financial instruments to cover extreme risks of devaluation. New products are expected to be ready by the end of 2019. Other financial instruments and diverse sources will be used from international banks and pension funds (Youkee, 2018).

According to the World Bank, Colombia has high standards of PPP operation and policy frameworks but needs improvements in the financial management and the definition of contracts regarding distribution and risk allocation (Youkee, 2018). Colombia has improved the expansion of the road network through the fourth generation (4G) projects. However, additional improvements are needed to balance risk allocation, and to initiate the development of the fourth generation concession, based on Law 1508, which has captured the interest of international investors (Neves, 2018). Infrastructure projects include airports, schools, the Bogotá-Metro, and extending the busses of public transportation, a metro bus system called Transmilenio. Colombia intends to work following the appropriate examples of UK PPP projects, which are created for the city and government, where projects are guaranteed to continue until the end of their construction, even if the government changes in between. For financing PPP projects, in general, Colombia wants to focus on financial markets and insurance issues to attract investors (Youkee, 2018).

A PPP project structure is based on eight basis steps (BSPPP) that facilitate project operation: (1) conceptual idea of the project; (2) feasibility studies if initial indicators are positive; (3) assignment of social and economic issues; (4) technical, financial, and legal structuring; (5) value analysis (supervised by the Minister of Finance and National Planning Development); (6) initial bidding process initiation; (7) finance budget analysis if the project is requesting fiscal endorsement (public funds); and (8) start of the PPP bidding process (Gagan & Buendía, 2012).

An example of a highway infrastructure PPP project to promote economic development is Ruta del Sol, both the first and the second parts (now called Puerto Salgar-San Roque) along with the third and final section for which the Colombian government awarded a $2.7 billion concession for the construction and expansion (Gagan & Buendía, 2012). The 1071 km Ruta del Sol highway connects the capital, Bogotá, with other large urban areas of the country's interior and the Caribbean Coast. When completed, Ruta del Sol is planned to foster the country's competitiveness in these sectors and improve road and travel conditions for passengers and

goods. Ruta del Sol, initially defined by the government as a single project, was later divided into three concessions to allow adaptation to market conditions, in order to facilitate construction and financing, and to mitigate single-operator risk. The winner of the sector 1 concession is responsible for building a new 78 km double four-lane highway in mountainous terrain and for 7 years of maintenance. The winners of concessions for sector 2 (528 km) and sector 3 (465 km) will undertake road rehabilitation, the expansion to a double carriageway, and maintenance and operation for up to 25 years (Gagan & Buendía, 2012). The Public–Private Advisory Infrastructure Facility (PPIAF) and the IFC (International Finance Corporation), a member of the World Bank Group, will provide funding (Gagan & Buendía, 2012).

As bidding result, sector 1 was awarded to the Consortium of Vial Helios led by Colombia's Grupo Solarte and ConConcreto in partnership with Argentina's Lecsa. The contribution requested from the government was $770 million, 20% less than the maximum approved government contribution. Sector 2 was awarded to the Consortium of Ruta del Sol, led by Brazil's Constructora Norberto Odebrecht and the Colombian financial group Corficolombiana. The net present value of revenues requested totaled $1047 billion, which represent 6.5% less than the maximum allowed bid value. Sector 3 was awarded to Yuma Consortium, led by Italy's Impregilo and including Colombia's Bancolombia and the Proteccion Pension Fund. The net present value of revenues requested totaled $1039 billion for Sector 3, 9.5% less than the maximum allowed bid value (Gagan & Buendía, 2012). When the project concludes satisfactorily, it will provide significant results such as: (1) reduction of travel time, costs, and accidents; (2) linkage of agricultural, industrial, and urban centers with Caribbean ports to promote the country's competitiveness; and (3) serving as a model for future road and other infrastructure concessions in Colombia (Gagan & Buendía, 2012).

Recent scandals in the Brazilian Odebrecht construction company for bribery and corruption affected the project, and generated delays (almost one year) and cost overruns. An additional 100,000 million Colombian pesos (approximately $33 billion) were designated to restart the project in 2018, resulting in increased social and economic costs (Portafolio, 2018). In addition to the scandal of Odebrecht in sector 2, the project had difficulties with the Magdalena Medium-Commsa concessionaire terms in the technical issues (due to the difficult geography and heavy rainy season in the country) and operations during the execution of project, which according to Semana (2018) was due to lack of clarity and transparency in the contract. At the end of 2017, after nearly a one-year delay, the project restarted with a plan to carry out the work using five public tenders (Londoño Vélez, 2017). Reinforcement of ethics and the incorporation of CSR are integral to PPP schemes. Moreover, ethical principles (trust, trustworthiness, and cooperativeness) provide a significant competitive advantage (Jones, 1995).

In a public–private partnership fourth generation (4G), the World Bank's Transport Practice and the International Financial Corporation's Advisory Services in the World Bank are leading an effort to help Colombia address institutional challenges by strengthening legal and institutional frameworks to improve sustainable PPPs. The bank is also helping to improve the tender process by increasing transparency. To reduce the number of contracts, to prevent renegotiations, and to establish high

standard for contracts, road construction, and service quality, the PPP 4G is working to improve risk allocation and to align incentives for all participants. Other key factors to the success of Colombian future infrastructure projects will be reasonable timelines, quality control, careful selection of technically viable projects, coordination through multi-stakeholder steering committees, and global promotion as a country that is open for business (Neves, 2018).

To improve the PPP vehicle for infrastructure projects in Colombia in terms of risk allocation, project pricing, financing, relations of public and private sectors, controlling bribery and corruption, this chapter proposes a conceptual sustainable system PPP project based on (1) balancing public and private sector interests; (2) risk allocation and mitigation classification; and (3) ethics/CSR/sustainability dimensions. In Colombia, there is a "Regional Developing Plan of Integration," which focusses on environmental and social issues to cover objectives of the Sustainable Millennium Developing Plan from the UN (Orozco, 2018).

3.2 A Conceptual Sustainable PPP Model for Infrastructure Projects

PPP projects are dynamic and complex systems due to multiple interdependent elements and stakeholders, including multiple feedback processes, involving nonlinear relations, and relying upon both soft and hard data (Sterman, 1992). New modeling approaches for infrastructure projects are required to effectively identify, collect, and understand all levels of project information (Costanza & Ruth, 1998). Behavioral models of complex systems frequently are used to support decisions on environmental investments and projects. The dynamic model is a tool for crossing the spatial gaps among decisions, actions, and results (Costanza & Ruth, 1998). These complex, interdependent characteristics furthermore are present in project subsystems such as negotiations, design, construction, operation and maintenance, and return of the assets to the public sector (Ng & Loosemore, 2007). The conceptual model must represent a system with these characteristics of complexity, clarify problems, highlight hidden assumptions, and make effective choices among alternative possible actions. In consequence, conceptual models represent the reality of a situation and describe (usually qualitatively) relationships between a few important variables. They simplify relationships and/or reduce resolution. For example, the ecological economy model of Brown and Roughgarden 1992 contains only three state variables (labor, capital, and natural resources) (Costanza & Ruth, 1998).

3.3 Components of the Model

To represent Colombian PPP projects, a conceptual model is proposed that focuses on three components: (1) balancing the interests of private and public sectors;

(2) allocating and mitigating risks; and (3) insuring an ethical business foundation based on international principles referring to CSR. Normally, an infrastructure project in Colombia is compounded by five phases, namely negotiation and tender price, design, construction, operation and maintenance, and return of the asset to the public. In these five phases, the three components are the umbrella of the project and promote a better decision-making process. The project is dynamic due to the system changing during time and the duration of such projects of at least 30 years. In this period, there are many interactions among stakeholders and many risks. The stakeholder interest satisfactions and risk allocation are crucial to control complexity. To reduce complexity, the key factors of success according to Zhang (2005) can be used. Moreover, the information from the Colombia case shows that the framework and regulation for PPPs is crucial to determine proper operation, correct risk allocation, and financing funds. In general, the country is using PPP vehicles as a suitable scheme for collaboration, putting together the expertise from both public and private sectors to work on infrastructure projects. Thus, this case study confirms that not only financing is important in PPPs, but also reinforcing ethics with international principles to avoid bribery and corruption is crucial.

3.3.1 Component 1: Balancing the Interests of Public and Private Sectors

Stakeholders are individuals or groups that can be affected positively or negatively by project success (Freeman, 1984). Stakeholders are increasing their awareness of the project's effects, and as a result are asking corporations to enhance CSR actions that can benefit society and the environment (Schneider, Stieglitz, & Lattemann, 2008). Nowadays, CSR practices recommend that companies identify key stakeholders and incorporate their needs and expectations into the corporation's strategic goals and decision-making processes (Hartman, Rubin, & Dhanda, 2007).

Problems concerning stakeholders' roles are a primary reason for PPP project failure (El-Gohary et al., 2006); stakeholders are involved in multiple feedback processes and increased project complexity due to interdependent components (Sterman, 1992). Balancing the interests of the stakeholders is highly important in achieving cooperation among the public and private sectors; important synergies can be created through issues such as community and environmental impacts, end-users' satisfaction, investors' profitability, design quality, time performance, contract management, and monetary costs, to improve efficiency (El-Gohary et al., 2006). Understanding stakeholders' input–output feedback is highly important in the project development process. Effective strategies are collecting stakeholder concerns and opinions as well as effective, trustworthy, and clear communication and interactions. A lack of transparency diminishes effective communication (El-Gohary et al., 2006); a lack of rigorous control systems may lead to bribery and corruption as shown in the scandals of the Brazilian construction company Odebrecht.

Depending on the specific requirements of the PPP project, administration can be the responsibility of the project owner (i.e., the public sector), designers, or the

contractor (El-Gohary et al., 2006). Transparency and trust in PPP projects are vital for the success (El-Gohary et al., 2006). A primary stakeholder's interest in the private sector is to achieve a return on investment to generate sufficient cash flow to cover initial capital costs and finance charges so that adequate funds are available for investment in future projects and for payment of shareholder dividends. The main interest of the public sector is to ensure a high level of service that is also timely and efficient. The financial risk of obtaining the appropriate profit decreases by balancing the interests of stakeholders (Ng & Loosemore, 2007).

The model considers trust, cooperation, transparency, and two-way feedback (Sterman, 1992) in balancing the interest of public and private sectors, focusing on long-term relationships in the states of the system. For instance, the participation of all stakeholders during the construction phase: The regional and local design and construction stakeholders are concerned with the influence of activities of construction in their daily routine. Additionally, the controlling group is interested in evaluating and monitoring the entire project. On the other hand, in the planning and design phase of the project, all stakeholders are concerned in improving information and obtaining feedback. Thus, the communication regarding the feedback should be handled in two ways: (1) general process information should be shared with the team (for instance ideas about problem-solving), and (2) communication channels with local communities should be established if the construction activities affect them (El-Gohary et al., 2006). The creation of a proper contract based on cooperation, transparence, and feedback from the beginning, and defining clear responsibilities could minimize the misunderstanding among stakeholders and generate trust in the project.

3.3.2 Component 2: Risk Allocation and Mitigation

Project complexity increases the potential for significant risks in obtaining the expected results and outputs. The allocation of the relevant risks can be classified as project risks or general risks (Ng & Loosemore, 2007): Project risks are a responsibility of the project management team and include natural hazards, technical problems with the design plans and equipment, material procurement, organizational difficulties with subcontractors, manpower disputes with unions, contractual disagreements, and environmental drawbacks. General risk usually is the result of natural, political, regulatory, legal, and economic events in the general microenvironment and around the project. Standard & Poor's includes risks that can affect the creditworthiness of PPP projects, including credit risk of the public sector entity, construction risks, revenue structure, operating risks, and financial and legal structure that insures payback of borrowed funds (Ng & Loosemore, 2007). Grimsey and Lewis (2004) additionally mention public risk, assets risk, operating risk, sponsor risk, financial risk, and default risk.

Typically, the public sector partners define how the risk will be allocated among the parts of the PPP project. A recommended risk reduction strategy is to have the risk undertaken by an entity fully aware of the risk that possesses the authority to

Table 2 Types of risk (Grimsey & Lewis, 2004; Ng & Loosemore, 2007)

Risk type	Source of risk
Site risk	Site conditions, site preparation, and land use
Technical/construction risk	Cost overruns, delay in completion, and failure to meet performance criteria
Operational risk	Delays or interruptions and shortfall in the quality of services
Revenue risk	Increase in input services; changes in taxes, tariffs, and demand for output
Financial risk	Interest rate and inflation
Force majeure risk	Natural disasters
Regulatory/political risk	Changes in law, political interferences
Projects default risk	Bankruptcy
Assets risk	

manage the risk effectively and efficiently, has the capability and resources to cope should the risk occur, wants to undertake the risk, and is charging an appropriate risk premium (Grimsey & Lewis, 2004; Ng & Loosemore, 2007). This model takes into consideration the relevant risk for PPP projects proposed by Grimsey and Lewis (2004) and Ng and Loosemore (2007). Table 2 presents the respective types of risk.

Other additional sources of technical construction risks that could affect the PPP are: inefficient work practices, wastage of material, and delays in approval (Grimsey & Lewis, 2004). The risks are shared between investors, contractors, insurance companies, the public sector, and other stakeholders (Grimsey & Lewis, 2004).

The risk assumed by companies and investors is for instance revenues risk, which increases in input prices and contractual violations (Grimsey & Lewis, 2004). Normally, financial and operational risks remain with the public sector. In the PPP model, there is a purchase of a relatively risk-free long-term service and the government accepts no assets-based risk and does not pay or can reduce payments and compensations if the services are not delivered with appropriate quality and the standards defined in the agreements. The risk is distributed and shared by public and private sectors; the final risk allocation is reached along the general contract agreements: the risk shared between the public and private partners and risks retained by public client.

There are important instruments to decrease the financial risk at the level of the European Union, which could be considered in Colombia. For an overview, please see Table 3.

3.3.3 Component 3: Corporate Social Responsibility

Corporate social responsibility is practiced internationally and becoming a different alternative for conceiving and doing responsible business. As a result of the Lehman Brothers collapse in 2008 combined with the general financial crisis, a call for ethical actions has become more important for organizations and individuals, despite the

Table 3 European financial instruments (European Investment Bank, 2019)

Financial instruments	Description
EU 1.TEN-T	Funding opportunities that are also explicitly open to public–private partnerships (European PPP Expertise Centre, 2011)
EIB cofinancing	One of the largest EU sources to promote PPP projects for transport infrastructure is the European Investment Bank (EIB). The EIB is an EU long-term lending, not-for-profit institution owned by the member states that supports projects of European interest. All projects financed by the EIB must meet strict environmental and social standards and be tendered according to the rules presented by the EU (European Investment Bank, 2004)
EU innovative instruments	Currently, the Commission has set up a number of instruments aiming at supporting the provision of important transport infrastructure and addressing the financing gaps. The beneficiaries of these instruments are PPP projects facing difficulties in becoming bankable. In the last few years, the Loan Guarantee Instrument and the Marguerite Fund (MF) are very important examples

lack of a standard definition (Crowther & Aras, 2008). Although not a new concept (Carroll & Shabana, 2010), the modern era of CSR started in the 1950s with Howard R. Bowen's definition of social responsibility and its importance in guiding business in the future (Carroll, 1999). The CSR concept was improved in the 1960s with the birth of the environmental movement (Visser, 2010). Modern definitions view CSR as an answer to the effects of globalization. It is expected that capitalism will play a social role where the owners of organizations are not the only ones that can obtain benefits (Wanderley, Lucian, Farache, & de Sousa Filho, 2008).

CSR requires a long-term commitment because external circumstances are always changing, and stakeholders' priorities can vary (Cohen, 2010). It is a continuous commitment to behave ethically and contribute to economic development while improving the quality of life of people. CSR can bring tremendous benefits to companies and projects; while many view CSR as an added cost, integrating CSR practices in long-term strategies can bring a competitive advantage (Porter & Kramer, 2002) by diminishing the risk, creating client and employee loyalty, cost reduction, and long-term sustainability (Cohen, 2010). Social responsibility is defined by the International Organization for Standardization (ISO) as the "responsibility of an organization for the impacts of its decisions and activities on society and the environment, through transparent and ethical behavior that: contributes to sustainable development, including health and the welfare of society; takes into account the expectations of stakeholders; is in compliance with applicable law and consistent with international norms of behavior; and is integrated through the organization and practiced in its relationships" (International Organization for Standardization, 2010: clause 2.18, p. 3).

Business ethics acting with international principles and values are crucial in the decision-making process as a good framework for acting responsibly, enhancing transparency, and avoiding corruption (Hoffman et al., 2001). This concept

interweaves policy, corporate governance, government regulations, international norms, and principles such as OECD, ISO 14000, ISO 26000, and the United Nation principles (Aei Agenzie Europea, 2011). For example, the ISO 26000 refers to principles in seven different categories, including organizational governance, human rights, labor practices, environmental concerns, and community involvement. Those international conventions with the following criteria of social responsibility practices ensure an equitable balanced participation of the stakeholder groups in infrastructure projects:

- Human rights refer to fundamental principles of right at work issues about gender equality at work, discriminations, and vulnerable groups.
- Labor practices talk about conditions of work and social protections, social dialog, health and healthy working places, human developing and training plans in the work place.
- Environmental issues refer to water consumptions, energy and emission indexes, environmental management systems or certification to environmental, prevention of pollution, sustainability resource use, climate change adaptations and protections of the environment, restorations of the natural habitat and the topic of biodiversity (International Organization for Standardization, 2010). In projects, the constructor's environmental performance and strategic management are influenced by corporate policy (Zeng et al., 2003).
- Fair operating practices point out the topics of anticorruption, fair competitions, supplier selection and evaluation, fair trade and promoting CSR with their suppliers (International Organization for Standardization, 2010).

The model in Fig. 1 presents the conceptual approach of sustainability for PPP in infrastructure projects, where terms such as sustainability, CSR, and business ethics are used interchangeably. The model is an approximation to visualize graphically the components of the PPP systems to understand the interaction between the elements. For the specific case of Colombia, the distribution of the risks and the interaction between elements may vary upon the owner and the private sector. The model includes the three components with different characteristics: (1) Balancing public and private sectors includes variables of trust, cooperation, transparence, and feedback (the self-correction and self-reinforcing for prevention of safety hazards to community, harmonious communication, and good information disclose with the public (Sterman, 1992)); (2) allocation and mitigation of risks for appropriated distribution of risk between public and private sector (Grimsey & Lewis, 2004; Ng & Loosemore, 2007); (3) CSR/sustainability component refers to values, principles, corporate governance (Zeng et al., 2003) and integration of the international principles such as ISO 26000 and OECD guidelines to balance stakeholder interaction, and focus on environmental protection issues, green design-construction of infrastructure, and pollution treatment (Aei Agenzie Europea, 2011).

These components are represented in the model by light blue ovals and are involved during the different subsystems of the project and connected by arrows to indicate the flow of the system. In Colombia PPP project regulation is very strong and clear; the country has a framework of operation of OECD principles. Moreover,

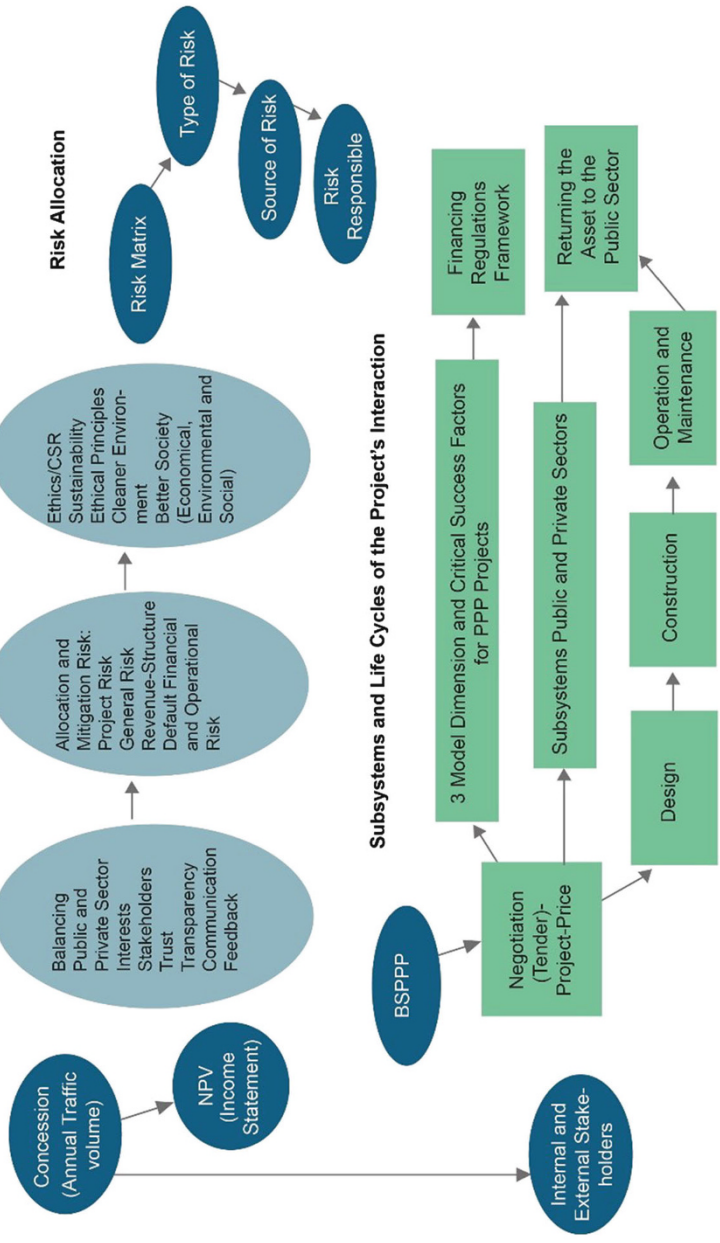

Fig. 1 Conceptual sustainable system PPP model (CSSPPPM)

the model conserves and takes the Basic Steps for a PPP in Colombia, as mentioned in Part II (Gagan & Buendía, 2012).

The BSPPP circle is part of the negotiations subsystem (where the procurement and contract are set up), which is represented by the first square in the lower left side and is an input for the system and needs to be checked in all cycles. The other squares show the additional subsystems: design, construction, operation and maintenance, and returning the assets to the public sector. They are connected among them by linear arrows to indicate the time order of the process. These subsystems represent the state of the system. In the subsystems, the feedback represents a process of learning among the stakeholders. In the superior part, the concession price diagram is located which has complex variables, huge data such as interest rate, loan interest, loan principles, construction investment, operating cost, minimal of attractive rate of return, concession period total income, advertising income, tax rate, governmental subsidy, and annual traffic volume (Yelin et al., 2012).

These variables are considered mainly in the negotiation cycle but need to be controlled and inspected also during the entire project because of the dynamics and complexity and the possible changes that may occur in the system (delays, overruns, etc.) and the fact that these variables can have significant impact on costs. Due to the infrastructure project including large scale of engineering and construction components, the model could assist the project management to reduce complexity and to manage the system more effectively. By avoiding errors early or identifying them in advance it is possible to prevent overcost, the costly rework, overtimes, hiring, schedule delays, or reduction of scope and quality. The consequences of these difficulties include poor profitability, loss of market share and reputation, increasing turnover in management and work force, lower productivity, higher costs, and costly litigations between customers and contractors over responsibility for overruns and delays (Sterman, 1992).

To create a sustainable infrastructure project, the model takes into consideration the critical success factors and sub-factors proposed by Zhang (2005). The critical success factors are favorable investment environment, economic viability, reliable concessionaire consortium, sound financial package, and appropriate risk allocation. A favorable investment environment is based on a stable political system, a favorable economic system, an adequate local financial market and predictable currency exchange risk, reasonable legal framework, government support, as well as a supportive and understanding community: *In the Economic viability success factors*, in the long-term demand for product or services, a generation of enough revenues and long-term cash flow is expected especially affecting the liquidity of the project. Another important critical success factor is a: *reliable concessionaire consortium with strong technical strength*. In this part the appropriate organization structure, good relationships and technical skills of the work team and the stakeholders such as government authorities are crucial. Other success factor is *the financial package* that considers the sub-criteria of financial analysis, investment, payment, schedules, and appropriate toll/tariff in others. Additionally, the proper risk allocation will establish the concession and shareholder agreements, and the guarantees from the public sector that will facilitate the execution of project (Yelin et al., 2012).

4 Part III: Conclusion

The Conceptual Sustainability Complex System model for PPP Projects is based on three components/dimensions: (1) balancing stakeholder's needs; (2) risk allocation and mitigation; (3) an ethical/CSR/sustainability foundation. As it was illustrated by the experience in PPP project infrastructure in Colombia, and the critical success factors for PPP projects suggested by Zhang (2005), infrastructure projects are very dynamic due to multiple stakeholders which can include local communities, NGOs, public entities, governmental organizations, operators, contractors, designers, suppliers, and employees (Zeng et al., 2003). Interactions of the stakeholders change over time and any changes affect not only the output but the entire system. The system manages high amounts of data and typical projects' lifespan of 30 years. If the model is considered, some other benefits can be accrued, including: (1) development of stakeholder's consensus and client ownership, leading to shared commitment and decision-making; (2) becoming a learning organization leading to better decision-making; and (3) improved project execution and lessened risk.

Additionally, the Colombian case study demonstrates that strong regulation of operations combined with well-structured financing instruments is crucial to build the project. The Colombian experience has shown that PPP projects are an effective means of funding infrastructure projects and that corporate social responsibility and principles are fundamental in avoiding corruption and bribes, especially because this unethical behavior causes big social and economic impacts (El Espectador, 2018). In the allocation and mitigation of risk component, some financial instruments that were developed by the European community and the UK could be useful in the funding process for the project. PPP collaboration and inclusion of PPP expertise is resulting in greater likelihood of project success.

The corporate governance, regulations, policy, strong legal framework, international principles' focus on human rights, transparence, and available information are the foundation of the system, a fundamental part to avoid and fight corruption and bribery, as well as external auditing. Ethical principles such as trustworthiness, transparence, and cooperation can result in significant competitive advantages (Jones, 1995). The establishment of very strong risk classifications for the project and appropriate risk allocation lead to better execution and more sustainable projects. The government is the owner of the project asset and is responsible for the guarantee of project implementation with excellent quality promoting transparence and access to information; the private sector should guarantee quality construction. The conceptual sustainable system PPP model is very convenient to build and finance the project sharing a risk and getting convenient reward. For future research work, software will be implemented to facilitate the management of PPP system dynamics.

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