

Infrastructure project failures in Colombia

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9 August 2018

Question

What factors influence the reoccurrence of infrastructure project failures in Colombia? Why don't public procurement checks and balances function properly?

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1. Overview

Due to poor civil engineering practices, corruption, natural disasters, the sabotage of infrastructure associated with Colombia's armed conflict, and the politicisation of large infrastructure projects, Colombia is spending a significant amount annually on improving and rebuilding relatively new infrastructure. As the country's population and economy continue to grow, so do its economic losses. This rapid literature review synthesises findings from academic, practitioner, and policy literature published in the past five years that discuss the factors that influence the reoccurrence of infrastructure project failures in Colombia and the public procurement checks and balances that been adopted to reduce their likelihood. It draws on English and Spanish language sources. The five main reasons identified in the literature for the failure of Colombia's infrastructure are:

Poor civil engineering is associated with inadequate initial design and design changes, an insufficient initial budget, lack of supervision, unexpected events, a lack of professional experience and competence, inadequate quality of work, poor budget and resource management and a lack of knowledge of construction and planning policy (Forcada, et al., 2017). In some cases, policies of social inclusion have resulted in the employment of local inexperienced contractors and workers. These major defining characteristics lead to a high rate of reconstruction and unnecessary effort in repeating poorly completed or incomplete work resulting in budget overruns. In ageing infrastructure, a preference for new construction over maintenance has resulted in increasingly deteriorated existing infrastructure, further increasing failure rates.

Natural disasters are mostly associated with extreme rainfall events and earthquakes and can cause frequent flooding and landslides which impact important transport corridors. Heavy rainfall further complicates the maintenance and operation of surface transport by inhibiting repairs and upgrades (Wettling, et al., 2015).

Corruption is a serious hurdle for the government and companies operating or investing in Colombia's infrastructure. Various factors contribute to corruption including organised crime, drug trafficking, a lack of government transparency, and weak regulations for securing investments and their monitoring. To address this the Government of Colombia (GoC) is trying to improve transparency and access to information and to strengthen the legal framework and government structures (International Monetary Fund, 2018).

Infrastructure sabotage mainly perpetrated by guerrilla forces and criminal groups (the "BACRIM", formerly the paramilitary groups)¹, during the course of Colombia's 50+ year armed conflict, has resulted in frequent attacks on oil and electricity infrastructure.

The politicisation of large infrastructure projects. An ongoing series of papers by IABD (2018, forthcoming) on megaprojects in Latin America highlight how infrastructure megaprojects tend to be politicised – whereby political criteria and elections often dominate decision-making.

¹ The BACRIM (*Bandas criminales*) are groups mainly made up of former paramilitaries who were officially demobilised from 2006. The term describes many different criminal groups and enterprises, including the third generation of Colombian drugs traffickers (McDermott, 2014; Herbert & Menocal, 2014).

Meanwhile, prefeasibility studies, feasibility studies and evaluations are often dominated by political actors and processes, and by the construction companies or the financiers of the projects.
























Colombia's gross domestic product (GDP) has tripled over the past decade, however inadequate and insufficient infrastructure is a major threat to its economy, and improving its infrastructure is needed to boost the country's competitiveness. Although significant investment in infrastructure has been taking place in Colombia, infrastructure project failures are severely constraining the impacts of these investments.











The literature suggests that corruption is the major reason for the ineffectiveness of public procurement checks and balances. Efforts to improve public sector organisation by ring-fencing agencies/activities historically prone to corruption has been led by a number of government anti-corruption initiatives including the establishment of the National Infrastructure Agency (ANI).

2. Background

Colombia ranks 66th overall out of 137 countries in the World Economic Forum's (WEF) Global Competitiveness Index 2017–2018. For infrastructure its position falls to 87th out of 137 countries. There has been significant investment to address the lack of infrastructure provision. However, Colombia, compared with most other emerging economies has a large gap between existing infrastructure provision and that which is required to support the economy. This is due to a fragmented institutional and regulatory framework, low technical capacity and low levels of strategic management and vision.

Figure 1: The WEF Global Competitiveness Index in detail: Colombia

Index Component	Rank/137	Value	Trend
 1st pillar: Institutions	117	3.2	
1.01 Property rights	99	3.9	
1.02 Intellectual property protection	74	4.0	
1.03 Diversion of public funds	131	2.1	
1.04 Public trust in politicians	124	1.7	
1.05 Irregular payments and bribes	96	3.3	
1.06 Judicial independence	111	3.0	
1.07 Favoritism in decisions of government officials	119	2.2	
1.08 Efficiency of government spending	129	1.9	
1.09 Burden of government regulation	123	2.6	
1.10 Efficiency of legal framework in settling disputes	122	2.7	
1.11 Efficiency of legal framework in challenging regulations	105	2.6	
1.12 Transparency of government policymaking	86	3.8	
1.13 Business costs of terrorism	132	3.0	
1.14 Business costs of crime and violence	128	2.9	
1.15 Organized crime	131	2.9	
1.16 Reliability of police services	114	3.4	
1.17 Ethical behavior of firms	113	3.3	
1.18 Strength of auditing and reporting standards	59	4.8	
1.19 Efficacy of corporate boards	44	5.1	
1.20 Protection of minority shareholders' interests	69	4.0	
1.21 Strength of investor protection 0-10 (best)	13	7.3	

↑↑ 2nd pillar: Infrastructure	87	3.8	
2.01 Quality of overall infrastructure	109	3.1	
2.02 Quality of roads	110	3.0	
2.03 Quality of railroad infrastructure	96	1.5	
2.04 Quality of port infrastructure	77	3.8	
2.05 Quality of air transport infrastructure	81	4.1	
2.06 Available airline seat kilometers millions/week	37	721.5	
2.07 Quality of electricity supply	79	4.8	
2.08 Mobile-cellular telephone subscriptions /100 pop.	68	117.1	
2.09 Fixed-telephone lines /100 pop.	74	14.2	

Source: World Economic Forum (2018, p.93)

Many infrastructure projects in Colombia suffer construction and maintenance delays, leading to contract renegotiation or termination (World Bank, 2011). A lack of supervision, design changes, unexpected events, lack of experience and inadequate quality of execution, poor budget management and resource management, errors, and lack of valuable knowledge of construction and planning policy, cause infrastructure expenditure in most cases to exceed project budgets (Forcada, et al., 2017).

The renewal and rework of failed infrastructure projects increase construction costs and the duration to complete projects (Ashwell, 2018) (Forcada, et al., 2017). A recent example was the failure of the Chirajara suspension bridge, which collapsed during its construction phase due to a lack of reinforcement in the cross-beam. The bridge is part of the main thoroughfare connecting Bogota to the south east city of Villavicencio (Ashwell, 2018).

Therefore, Colombia is facing infrastructure shortage; improvements in strategies and policies are needed in order to maintain, develop and operate its infrastructure system to manage demand and mitigate against unexpected events. Notwithstanding the strong economic performance, there is a gap in infrastructure provision needs and a lack of the availability of capital resources for financing these requirements.

Infrastructure gap

The Government of Colombia (GoC) has implemented a number of reforms to its institutional and regulatory system to improve the investment level and enhance the role of Public Private Partnerships (PPPs). For example, the *Agencia de Infraestructura* (National Infrastructure Agency, ANI) was created to oversee the structuring and management of road concessions and the *Financiera de Desarrollo Nacional* (FDN) was created to provide the infrastructure sector with long-term funding and innovative financial products (World Bank, 2014a). A number of public agencies were given a mandate to provide project structuring services to develop a pipeline of projects and the 2013 Infrastructure Law was designed to tackle some of the most pressing transport bottlenecks that have historically led to cost-overruns and delays in transport projects (World Bank, 2014a).

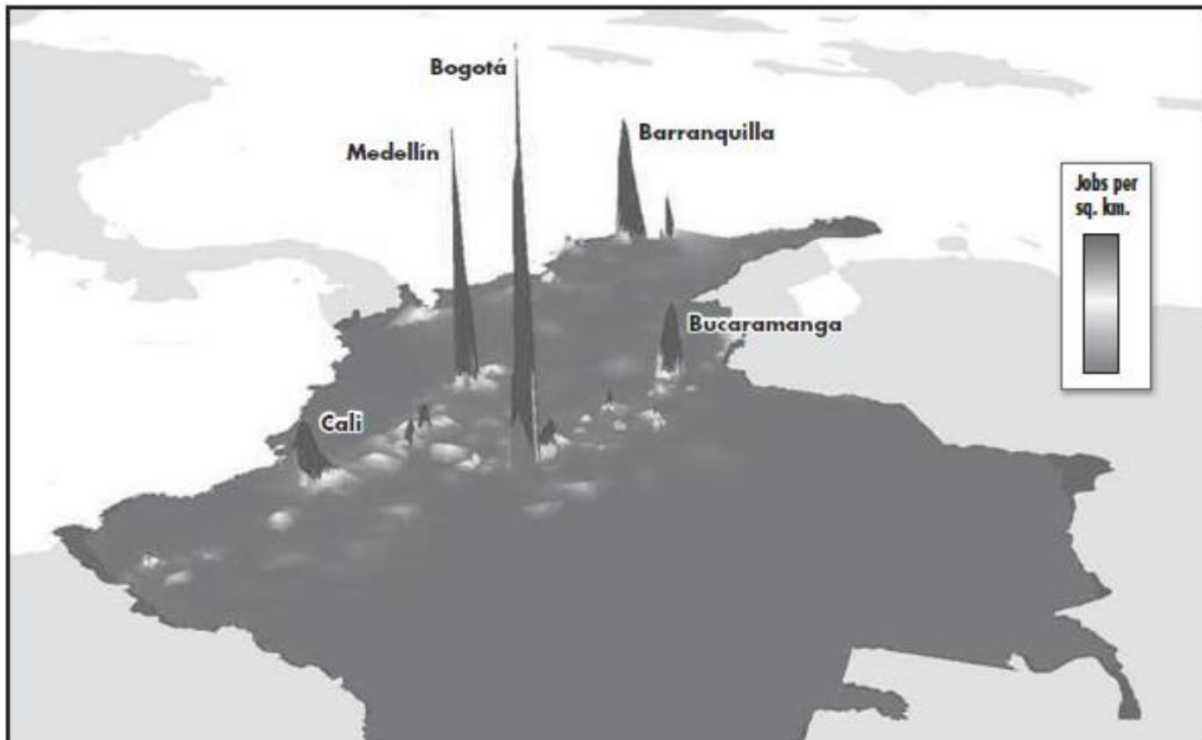
Despite these achievements, an infrastructure gap still persists, rooted in fragmented institutional and regulatory framework and low levels of investment that lack a strategic vision. Colombia's transport infrastructure lags behind other countries, particularly its roads where it has 26% less kilometres of roads than a country with similar characteristics (Yepes Ramírez & Villar, 2013, p.1; Deloitte, 2017). Colombia's road infrastructure is 214,400 kms long, but only 12% is paved

(Wetting, et al., 2015) and a large part of its secondary and tertiary road are in average or poor condition. Colombia's low levels of transport infrastructure investment is aggravated by problems with the poor quality of its infrastructure, as demonstrated by its low ranking in the WEF's Global Competitiveness Report (Yepes Ramírez & Villar, 2013, p.2). This is because the transport sector has been characterised by inadequate policy and planning capacity, a lack of a multimodal policy, short-term and reactive management, and a shortage of technical personnel in agencies and volatile budget allocations (World Bank, 2014a). These have impeded a long-term maintenance strategy which implies that higher financial requirements are needed to overcome the resulting backlog of deferred maintenance.

Lack of investment in infrastructure

Lack of investment in infrastructure has occurred due to Colombia having a complex geography with populated areas that are distant from one another (see Figure 2), an extreme climate and also due to historically low levels of public investment (especially in the 1990s), and institutional weaknesses in stimulated private investment. The low levels of public investment suggest a lack of value given to: (a) productive investment compared to social investment; and (b) medium and long-term capital investments compared to the political economy of public spending. For example, transport infrastructure is 'the first thing to be cut in a crisis and the last thing to be increased during phases of growth' (Yepes, Ramírez & Villar, 2013, p.3)

Figure 2: Distance of populated cities in Colombia



It will take a big effort to close the gap in infrastructure investment. However, it has been improving. Between 2001 and 2009, 0.8% of GDP was invested in transport infrastructure. This increased to 1.25% of GDP in 2010 and 2011. One of the recent successes in attracting private

investment into infrastructure has been the development of the *Asociación Público Privado* (APP) and the creation of the National Infrastructure Agency (ANI) (Deloitte, 2017).

Institutional problems

Institutions are particularly critical for the infrastructure sector as the sector requires the permanent interaction of public and private agents, and investment in the long term, which means confidence is of central importance (Yepes, et al., 2013, p.60). Yet, Colombia's transport infrastructure sector has a low level of institutional development (Yepes, et al, 2013, p.60). While the government has made progress on institutional reform in recent years (e.g. creating the ANI), it has not been sufficient.

Yepes, et al. (2013, p.60) compare the successes of Colombia's energy infrastructure institutions post-1990s, against the weaknesses of its transport infrastructure institutions. They find that regulatory reforms to the energy infrastructure sector improved the credibility of its institutions and this supported Colombia to turn into an exporter and a successful investor in other countries. These reforms were enacted without large public funds, but with substantial financing and administration from the private sector.

3. Factors that contribute to infrastructure failures

3.1 Poor civil engineering practices

The major factors associated with poor civil engineering practices resulting in the failure of infrastructure projects include inadequate initial design and design changes, an insufficient initial budget, lack of supervision, unexpected events, a lack of professional experience and competence, inadequate quality of work, poor budget and resource management and a lack of knowledge of construction and planning policy, find Forcada, et al. (2017). In many of these cases, repeating construction work is not formally measured or acknowledged as there is a negative perception that admission would damage the contractor's corporate reputation (Forcada, et al., 2017). The findings from this study include (Forcada, et al., 2017):

- **Inadequate initial design and design changes:** poor documentation and technical designs/specifications, particularly when there is a lack of on-site technical inspection and validation, can result in scope and associated budget modifications. These significantly increase construction costs and can delay the programme of project milestones. The knock on effect of an inadequate initial design is increased pressure on consultants to complete revised in a short time period leading to mistakes and further design issues.
- **Insufficient initial budget:** consequences of an inaccurate budget are uncertainty due to frequent changes, a significant increase of work with available resources and overall confusion about the termination of works.
- **Lack of supervision:** project supervision is required to ensure that projects are built in accordance with the requirements in contract documentations, specification and standards. This is often missing due to a lack of required specific expertise. A lack of technical visits by the municipality when defining the project's scope and end users' (community) inexperience in defining project needs also contributes to extra work during

construction. Many infrastructure projects are divided into different subprojects and carried out by independent contractors with a lack of coordinated supervision and independent milestones (Forcada et al., 2017). For example, the 1,000 km *Ruta del Sol* highway project, connecting Bogotá to other urban areas of the country and the Caribbean coast, was initially conceived by the government as a single project but it was later divided into three concessions to ease its construction and financing and to mitigate risk (World Bank, 2014b). The construction of the road was awarded to the Brazilian engineering firm Odebrecht and local partners. However, due to alleged bribery of Colombian officials the project was initially suspended and then cancelled (World Bank, 2011).

- **Inadequate quality of execution:** rework costs because of poor project execution and management problems are incurred by the contractor, whereas rework costs due to scope modifications are incurred by the client but have to be allocated in the awarded budget. Constant modifications and scope changes created by poor execution and the client's inability to finish the project on time are the most important factors of cost increase.
- **Unexpected events:** the poor understanding and knowledge of the nature of unexpected events leads to the underestimation of risks. Undertaking design reviews and verifications is the first step in minimising the potential impact of uncertainties, although they will not prevent errors from occurring.
- **Lack of experience and competence:** the inexperience and incompetence of contractors results in substandard work. A lack of professional experience and competence hinders scope development, increases workload, and subsequently reduces the time available to consultants to complete their work on time causing design errors and omissions within contract documentation. This is primarily because technical visits, reviews and verifications are not undertaken. If such errors and omissions are not identified until construction is being undertaken a significant amount of design modifications will arise.
- **Inadequate quality of work:** unviable work appears when a project or an activity could not be performed according to the contract content because of errors in the design documentation or a lack of resources allocated to that activity or project. This is exacerbated by a lack of adequate supervision.
- **Budget and resource management:** the poor financial position of many contractors can be aggravated by inadequate budgetary management when allocating material and equipment resources among the various projects. Thus, resources shortages may occur, which result in delays and work having to be redone increasing cost.
- **Lack of knowledge of construction and planning policy:** a lack of professional experience in construction imposes pressure on workers to complete the work and causes inconsistencies between actual work and specifications stipulated in the contract documentation.

Examples

The Chirajara Bridge – located between Bogotá and Villavicencio collapsed in 2018 because of the poor design of its beams and bracings (Aguilar, et al., 2018). The investigations by different companies (some contracted by the agency in charge of the project – Coviandes) found the

collapse was due to a combination of 'design errors', and not the climate nor any other external factors (Aguilar, et al., 2018, p.9). A technical article by Aguilar, et al. (2018, p.10) found that retrospectively that the design errors could have been avoided if tests on resistance and tension had been taken into account, and that these were not taken in account when the bridge was being built.

They conclude that as Colombia has a broad variety of geological conditions, topologies and environments, it is important that standards should exist for all types of projects – including both new projects and repairs. These standards should have a list of minimum requirements for design and construction, and should be applied rigorously to make construction projects more reliable (Aguilar, et al., 2018). Standard tests should be undertaken to understand how the materials will behave under different conditions (Aguilar, et al., 2018).

So far there is little analysis on the relationship between the Chirajara Bridge collapse and the management and procurement of the project. However, there was a debate in the congress about it in April 2018 which raised many interesting questions.² The costs of the reconstruction of the bridge will be paid by the insurers (Garcia Sierra, 2018; 2016).

Space – a high rise building in the city of Medellin, collapsed in 2013 because of design and construction failures. Investigations by different groups of experts concluded that if Space had been designed complying with all of the applicable requirements of the 1997 Law 400 and its regulations (NSR-98), it would not have collapsed (Universidad de los Andes, n.d.).

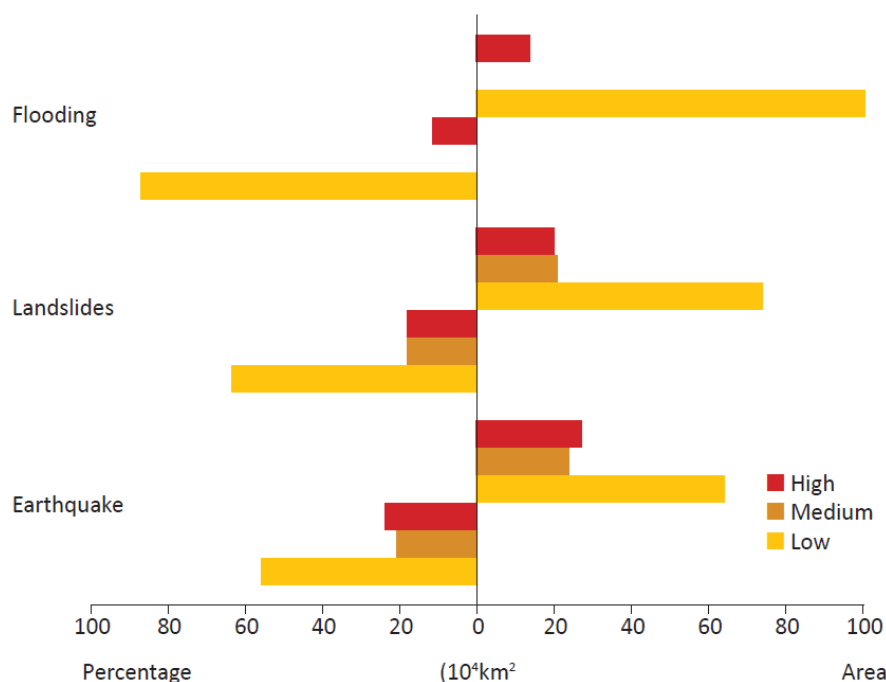
3.2 Natural disasters

Colombia has one of the highest recurrence rates of natural disasters in Latin America and has on average 600 such events each year; disasters resulting from natural hazards represent an important challenge for Colombia's fiscal sustainability and stability (World Bank, 2016a; Hoyos, et al., 2012). Floods and landslides are the major damaging events to infrastructure (Hoyos, et al., 2012). For example, heavy floods during the construction of Colombia's largest hydroelectric dam project in north-western Colombia, resulted in thousands of people having to be evacuated and the destruction of two bridges, two schools, and a health centre. The situation has been exacerbated by the failure of large pumps and poor disaster management.³ Heavy rains further complicate the maintenance and operation of surface transport by inhibiting repairs and upgrades and cause frequent landslides on important routes (Wettling, et al., 2015). Figure 3 illustrates the distribution of exposure of Colombia's land mas to flooding, earthquakes and landslides.

² See – <http://190.26.211.101:8080/comisionquinta/index.php/orden-del-dia/ordenes-del-dia-anteriores/ano-2018/306-orden-del-dia-martes-24-de-abril-de-2018/file>

³ The Guardian (2018) Colombia: tens of thousands ordered to evacuate after floods at dam. The Guardian. <https://www.theguardian.com/world/2018/may/16/colombia-tens-of-thousands-of-ordered-to-evacuate-after-floods-at-dam>

Figure 3: Area exposed to floods, landslides, and earthquakes



Source: World Bank, 2016a

The Lizama 158 well in the northern Santander department had a crude oil spill starting in March 2018. It took the company around three weeks to react to the leak, by which time huge amounts of oil had damaged the environment, killing animals and displacing communities.

In an article in the *Universidad Nacional Periódico Digital*, based on doctoral research, Garcia Sierra (2018) argues that the Hidroitungo, Chirajara and Lizama well disasters result from shortcomings in the way decisions were taken about environmental risks. He explains that the proposals and environmental studies for megaprojects in Colombia are evaluated internally, not independently. Those leading the megaprojects – the construction companies or the financiers – are those that select the small group of “experts” to evaluate the environmental risks (Garcia Sierra, 2018).

The environmental studies written by these internal experts dismiss the idea of “unpredictability”, declaring the possible environmental scenarios to be wholly “predictable”, deterministic and resolvable. However, the common thread of these three disasters is that the events that have occurred have been “unpredictable” and difficult to resolve. Following the disaster, many of the experts involved in these projects have attributed the disasters to “unpredictable” situations, which contradicts their original environmental studies that denied unpredictability (Garcia Sierra, 2018).

Policies to manage and mitigate natural disaster risks

The GoC recognises the importance of mitigating natural disaster risks and has taken several steps to mainstream disaster risk management into its policy and programmes, as stated in the National Development Plan, “Prosperity for All 2010 – 2014” and the Ministry of Finance and

Public Credit's (MHCP) Strategic Plan. The MHCP is committed to developing strategies for reducing disaster related liabilities and to manage the fiscal risk resulting from such events (World Bank, 2013). MHCP works with the National Procurement Agency, *Colombia Compra Eficiente* (CCE), the ANI, the Colombian Geological Service (SGC), and the National Disaster Risk Management Unit (UNGRD) (World Bank, 2016a). MHCP identifies three policy objectives to strengthen the management of GoC's contingent liabilities and support macroeconomic stability (World Bank, 2016a):

1. Identification and understanding of fiscal risk due to disasters
2. Financial management of natural disaster risk
3. Catastrophe risk insurance for public assets

Identification and understanding of natural disasters

Identification and understanding of fiscal risk due to natural disasters is the first step in managing natural disaster risks. The damaging effects of extreme events are evaluated by analysing the vulnerability of exposed infrastructure. For example, the amount of land subject to flooding is an indication of degree of exposure (World Bank, 2016a). Exposure refers to the frequency, severity and extent of specific hazard. In addition, resilience of infrastructures to natural disasters is important. Proper risk management plan reduces the vulnerability of infrastructure exposed to natural hazards (Bernal, et al., 2017).

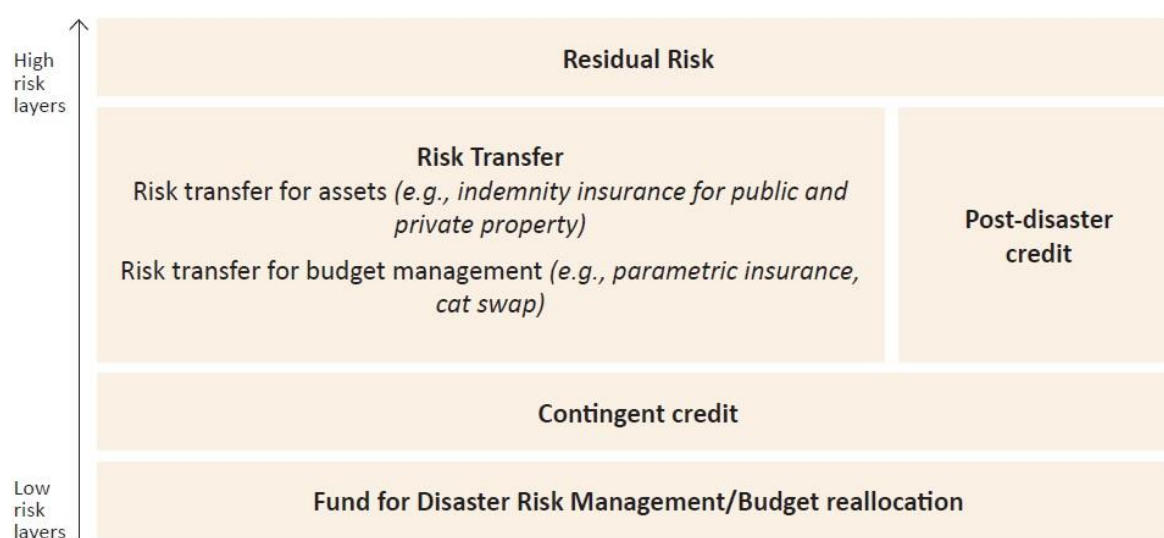
Although the GoC has made progress in assessment of its infrastructure reliability in relation to natural disasters, further analysis is required to refine this assessment. The GoC has only partial information, and the available information is scattered throughout various government entities. In order to improve the understanding of fiscal risk generated by disasters, the MHCP will prioritise the following activities (World Bank, 2016a):

- **Improve information on the exposure of infrastructure to natural disasters, as well as historical information on disaster losses to the public sector.** In particular the MHCP needs to better understand the potential losses in the case of disasters, to inform decision-making on investment in disaster risk mitigation and in new assets, and to improve insurance coverage for its existing assets.
- **Use and promote the use of financial decision-making tools.** These tools help MCHP assess its financial response capacity post-disaster and to improve decision-making on its disaster risk financing. This also enables the MCHP to design an optimal combination of financial instruments through cost benefit and dynamic financial analysis.
- **Evaluate and adopt tools to assess possible increases in natural disaster risk generated by new public works and public-private partnerships (PPP).** The MHCP applies risk assessment tools to evaluate the contributions of proposed new investments to final risk, including those made through PPPs. One important aspect of this work is the MHCP's improvement of insurance requirements for concessionaries. The MHCP and ANI, with technical support from the World Bank, have jointly established standard terms and conditions and minimum requirements that meet international insurance market practice and must be included in new concessions contracts.

Financial management of natural disaster risk

Natural disasters can generate fiscal volatility as a result of sudden, unexpected expenditures required during and after disasters. In the aftermath of disaster, the government requires timely access to financial resources required for an effective emergency and recovery response (World Bank, 2016a). In 2012 and 2013, the MHCP has made significant progress in designing a comprehensive strategy for the financial management of disasters (World Bank, 2016a). The MHCP strategy considers ex-ante and ex-post instruments, such as contingent credit line and insurance, in order to complement ex-post financial resources that will be accessed after a disaster. The MHCP promotes a multi-risk layering strategy for financial management of disaster risk based on the assessment of its contingent liabilities, as illustrated in Figure 4.

Figure 4: Multi-layer financial strategy for disasters resulting from natural hazards



Source: World Bank, 2016a

The layers of MHCP financial strategy (see Figure 4) are explained below (World Bank, 2016a):

- **National fund for disaster risk management:** The GoC will determine its level of risk retention through the National Fund for Disaster Risk Management (FNGRD). The budget allocations to the FNGRD are the first source of financial resources to be used in the case of a disaster. The FNGRD must first be operationalised and strengthened. When FNGRD resources are exhausted, and additional budgetary resources are not available or a more severe disasters occur, the government will access its second layer of risk retention contingent credit.
- **Contingent Credit:** In the case of a severe natural disaster, the MHCP can immediately use part or all of the Catastrophe Deferred Drawdown Option (Cat DDO) to fund emergency relief and recovery efforts.
- **Evaluation of risk transfer instruments:** These instruments aim to improve the Colombian government's disaster response capacity in case of infrequent but potentially devastating and costly natural disasters by providing access to immediate liquidity post disaster.

Catastrophic risk insurance for public assets

The MHCP aims to reduce the government's contingent liabilities related to natural disasters through a combination of risk mitigation investments and the provision of catastrophic insurance for public assets (World Bank, 2016a). The strategy aims to improve the coverage and price of catastrophic insurance for public assets and road infrastructure (particularly priority transportation infrastructure, one of the sectors to have been most severely affected by disasters).

The GoC will implement the following to improve its strategy of insurance of public assets (World Bank, 2016a):

- **Information system on public buildings:** the MHCP is gathering additional information of assets as well as existing insurance policies. More detailed information on public assets will allow the private insurance industry to offer better coverage and prices, based on improved quantification of risk.
- **Collective approach to insuring public buildings:** the GoC is evaluating the implementation of a collective approach to insurance of public buildings. This approach will allow the GoC to take advantage of risk diversification benefits.
- **Improvement of insurance of transport infrastructure through PPP scheme:** with international support from the World Bank, the Colombian government has developed a document of technical guidelines for infrastructure insurance based on international market standards. The document has been used to develop the technical requirements for concessionaries for the latest generation of infrastructure investment.
- **“Best Practice” insurance guidelines for subnational entities:** The MHCP is building on its recent experience with developing a collective insurance scheme and PPP's insurance requirements to develop guidelines on strengthening insurance of public assets for subnational government entities.

3.3 Corruption, transparency and the politicisation of infrastructure

Corruption costs the country \$7.2 billion annually which adds up to nearly 10% of the government's 2017 budget (International Monetary Fund, 2018). In the Transparency International's 2012 Corruption Perception Index, Colombia received its worse score in ten years and was ranked 94 out of 176 countries (Gutiérrez, 2013). Due to corruption, public works are often unfinished or abandoned, wasting government and tax payer's money (International Monetary Fund, 2018).

Policies to reduce corruption

The GoC has introduced the following to reduce corruption (International Monetary Fund, 2018):

- **Comprehensive anti-corruption legal framework:** in 2013, Colombia joined the Convention on Combating Bribery of Public Officials to provide a framework to fight transnational offenses and sanctions related to public contracting. Other recent measures include a decree establishing the list of politically exposed persons who would be subject to additional surveillance. In May 2017 Colombia obtained the accession approval from Organisation for Economic Cooperation and Development (OECD) Public Governance

committee which oversees issues related to governance structure, transparency and accountability.

- **Improvements in the legal framework and wider access to information and organisational changes within the public sector:** the Transparency and Access to Information Law (2014) defined a set of public sector employees and entities that are obliged to publish information. The Citizen Participation Law (2015) sets organisational principles to guide community selection and planning of public investment projects. Other publicly available data sources include the public contracting information system which has helped identify instances in which public contracts are illegally modified. Furthermore, the agency ANI is helping deal with a key source of corruption (public contracting/procurement) and represents an example of the efforts to improve the public sector organisation e.g. by ring-fencing agencies/activities historically prone to corruption.

Although Colombia has strengthened its anti-corruption legal framework and data transparency and organisational changes as discussed above, some indications suggest a weak perception of corruption. Surveys suggest that corruption has remained in the top two of the most problematic factors for doing business in Colombia since 2012, and Colombia's trust in politicians has worsened reaching a score of 1.7 (out of 7) in the WEF's 2017-18 report (International Monetary Fund, 2018). For example, the Fourth Generation (4G) infrastructure agenda suffered delays in 2017. During 2016, about eight 4G projects reached financial closure and some started the building phase (International Monetary Fund, 2018).

The unfolding of the Odebrecht scandals (a giant Brazilian engineering and construction organisation which bribed \$27 million to Colombian officials to win Ruta del Sol road building contract), led to the annulment of a project that was not part of the 4G agenda, but nevertheless created legal uncertainty about liquidation values in cases of corruption. In response to the scandal, banks tightened credit conditions to infrastructure projects (International Monetary Fund, 2018). Moreover, the FDN received a capital injection and facilitated the diversification of infrastructure funding away from local banks. Due to FDN efforts, the 4G agenda has received funding from other local and foreign sources (International Monetary Fund, 2018). About two thirds of the financing so far has been local which includes mostly equity and local bank loans. Debt and equity have attracted funding from local and international institutional investors. Furthermore, 4G projects have issued some global bonds as well as received foreign equity and bank loans (International Monetary Fund, 2018).

3.4 Infrastructure sabotage

Infrastructure sabotage associated with Colombia's ongoing conflict armed conflict can cause large economic losses and disruptions of service (Beittel, 2015). Historically, infrastructure sabotage has been carried by different guerrilla groups, BACRIM, and paramilitary groups over its 50+ years of conflict. The conflict also led to widespread damage to infrastructure (not through sabotage), and the Colombian state has been a key actor in that. Colombia's conflict has gone through many different phases over the course of 50+ years, and today's conflict (including sabotage and damage to infrastructure) is greatly diminished compared to other points in history (notably the peak in violence and conflict activity around 2002) (Herbert & Menocal, 2014).

Drugs trafficking has been an important cause and dynamic in Colombia's conflict - among other things, it has been a key source of funding for many of the armed groups associated with

violence focused on infrastructure sabotage (Herbert & Menocal, 2014; Beittel, 2015). For example, in 2015, the vandalism of two fibre optic cables caused disruption to one of Colombia's biggest internet service providers (Beittel, 2015).

Although it is difficult to avoid these events or predict when and where acts of sabotage will occur, a quick assessment of the situation can help operators take appropriate actions to avoid cascading events and the resulting partial or total infrastructure failure (Corredor & M.E, 2011). For example, the mechanical failures that result from malicious attacks on a transmission line are basically the same as those that occur when extreme natural events affect a portion of the transmission line (Corredor & M.E, 2011). Thus, any analysis conducted in respect to natural events can also help in taking preventive and corrective action when acts of sabotage are directed at the infrastructure.

The current peace agreement between the GoC and the *Fuerzas Armadas Revolucionarias de Colombia (FARC)* is probably the most important opportunity to foster inclusive growth and close the regional disparities Colombia has had for decades. Agreed investments will cover more than half of the nation's territory and a third of its towns with much needed infrastructure and social spending. Implementation of the peace agreement is expected to gain momentum throughout 2018 as the programme's institutional capacities are strengthening (International Monetary Fund, 2018).

3.5 The politicisation of infrastructure

An ongoing series of papers by IADB (2018, forthcoming)⁴ on megaprojects in different Latin American case study countries highlight how infrastructure megaprojects tend to be politicised. This means that political criteria often dominate decision-making, and that projects influence, and are influenced by the election cycle. The IADB (2018, forthcoming) case study on Colombia focusses on the development of the *Transmilenio* and the *Sistema Integrado de Transporte Público (SITP)* (Bus rapid transit (BRT) system) during 2001 to 2015. It charts the history of the project, against the political context, and finds that over the course of the megaproject, political agreements constantly influenced the technical solutions that were developed, and what was approved – e.g. in every stage of the development process different levels of depth in the prefeasibility and feasibility evaluations, and during Enrique Peñalosa's first six months tenure as mayor no prefeasibility or feasibility studies were commissioned (IADB, 2018a, forthcoming).

Doctoral research by Garcia Sierra (2016) focusses on decision-making and finds that megaproject infrastructure proposals and the accompanying environmental studies are often evaluated internally, and not independently. The internal studies are often carried out, commissioned or led by the construction companies or the financiers of the projects (García Sierra, 2018). The process of selecting the "experts" for evaluations is often slow and thus becomes economical only for the big companies to do. These biases lead to weak decisions.

⁴ Based on draft version of the IADB (2018, forthcoming) paper

4. Lessons and recommendations

This section summarises lessons and recommendations presented in the literature.

Improve decentralisation to improve road infrastructure

Yepes et al. (2013) recommend focussing on improving decentralisation in Colombia to support the structuring of projects at the local level in the construction and maintenance of secondary and tertiary roads. They argue that the process of decentralisation of Colombia's road infrastructure, initiated properly in 1991 and 1993, has been 'incomplete', badly designed, and has not worked well (Yepes et al., 2013, p.41). While the division of competencies is in theory clear, in practice it is ambiguous. There is no stable flow of resources for construction, rehabilitation and maintenance of the secondary and tertiary roads. For this reason, maintenance is done in a reactive way, not a preventative way. And there is sometimes a lack of connection between the way the funding is generated (e.g. a tax on diesel and gasoline) and the way that funding is spent (in this case, on road maintenance). (Yepes et al., 2013).

Most of the local entities do not have the capacity for planning and management of infrastructure investment projects. This particularly affects the abilities of the local entities' ability to identify and structure medium and long-term plans and that take advantage of economies of scale in maintenance (Yepes et al., 2013, p.53) and problematic incentives are generated by the lack of precise inventories, and the lack of clear guidelines on the type of road (national, department or municipal) (Yepes et al., 2013, p.53).

Adaption to climate change

Yepes, et al. (2013) highlight that the traditional ways of adaption and mitigation are insufficient in the face of climate change forecasts. Colombia's complex climate – with tropical rain, landslides and mountainous topography – makes building transport infrastructure difficult. The winter floods of 2010 and 2011 saw significant losses to Colombia's transport infrastructure – estimated at \$3.4 billion pesos or 0.62% of GDP in 2010 – which was almost half of the investment in transport infrastructure that year (Yepes et al., 2013, p.28). While it was an 'abnormal' weather event, it highlighted the importance of better planning for extreme weather, climate change and disasters (Yepes et al., 2013). The losses from 2010-2011 were partly due to the long-standing problems of low technical standards used historically to build transport infrastructure, and institutional failures (Yepes et al., 2013).

They suggest: revising the criteria used to make investment decisions; increasing the amount of information available to make decisions including providing a structure for procurement that adequately factors in future risk into the investment decisions; and the creation and updating of maps of vulnerable zones (Yepes et al., 2013).

Rules of contracting

Yepes, et al., (2013) suggest various aspects to improve the rules of contracting, highlighting that that the rules of contracting for big long-term projects should be different to those that govern the purchases of state supplies. There should be a focus on generating the right incentives for contractors to improve the quality of their work and to contribute to their maintenance. This could be by establishing contracts that join construction with maintenance responsibilities. This would

mitigate against the trend whereby contractors engage in continual negotiations with the expectation that even once they win a contract, they can renegotiate it (Yepes et al., 2013). Deloitte (2017, p.43) finds that the 2012 APP law has improved concessional contracts by limiting the capacity of renegotiation and by establishing obligatory processes to include APPs in regional and national plans.

Forcada et al. (2017) suggest that a design freeze should be applied as early as possible to minimise rework occurrence during construction. However, a design freeze is effective only if highly skilled professionals develop the client's project brief to their requirements and effectively communicate this brief to all contractual participants involved. The time to rectify any error can affect the project's milestone, require costly design changes (especially during the construction phase), may lead to unscheduled programme overruns and causes inconsistencies between actual construction work and specifications stipulated in contract documentation (Forcada, et al., 2017).

To conclude, World Bank (2016b) argue there is a need to overhaul technical capacities to strengthen policy-making functions and move away from short-term and reactive solutions and management and a long-term infrastructure investment plan is needed. In addition, contract management functions need to be supplemented by implementing the following (World Bank, 2016b):

- Institutional specialisation in managing pre-defined types of obligations that are present across all concession agreements (insurance requirements, performance bonds, supervision of quality of service)
- Quality certification for policies and procedures to provide a sense of security to private sector participants and infrastructure users
- Intelligent use of outsourcing possibilities for tasks that could be better handled by third parties
- Training and professional development programmes to build a team of experienced contract managers
- A governance structure that shields the function from potential outside interference

In terms of improving the planning and structuring capabilities of transport PPPs, they argue, the government could consider designing and implementing a capacity building programme on PPP's for public structuring agencies (World Bank, 2014a). Such a programme would provide structured training to public sector officials responsible for the preparation and evaluation of investment projects. Refining the PPP project cycle and establishing more detailed guidelines and procedures is also useful (World Bank, 2014a).

If job creation is the reason of contracting unskilled personnel, training must be provided in order to improve work practices. If municipalities do not begin to re-examine their contract clauses and procedures, then there is a danger that errors become more frequent and will adversely impact the overall profitability and the performance of projects (Forcada, et al., 2017). Choosing contractors based on experience and solvency and ensuring that resources are available to undertake the required work are other recommendations to minimise errors and reworks.

Public-private funding

While the lack of private funding is often highlighted as a problem, Deloitte (2017) highlight the challenges of too much private funding. They explain how in 1991 the government ‘practically delegated the development of the national port sector to the private sector’, whereby all of the ports developed after 1991 were the result of private sector initiatives (Deloitte, 2017, p.162). This meant that the ports reflected the specific interests of those actors, but not of the national interest, nor of the market, and there was a lack of overall planning and oversight (Deloitte, 2017, p.162).

5. Acronyms

PPP:	Private/Public Partnership
ANI:	National Infrastructure Agency
FDN:	<i>Financiera de Desarrollo Nacional</i>
MHCP:	Ministry of Finance and Public Credit
CCE:	<i>Colombia Compra Eficiente</i>
FARC:	<i>Fuerzas Armadas Revolucionarias de Colombia Ejército del Pueblo</i>
SGC:	Colombia Geological Services
UNGRD:	National Disaster Risk Management Unit
GoC:	Government of Colombia
Cat DDO:	Catastrophe Deferred Drawdown Option
WEF:	World Economic Forum
OECD:	Organization for Economic Cooperation and Development
APP:	Asociaciones Público Privadas
FNGRD:	National Fund for Disaster Risk Management

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Acknowledgements

We thank the following experts who voluntarily provided suggestions for relevant literature or other advice to the author to support the preparation of this report. The content of the report does not necessarily reflect the opinions of any of the experts consulted.

- Dr Michael Burrow, Department of Civil Engineering, University of Birmingham
- Andrés Pereyra Da Luz, *Banco Interamericano de Desarrollo*
- Dr Rodolfo Garcia Sierra, Independent
- Tomas Sebastian Serebrisky, *Banco Interamericano de Desarrollo*

Suggested citation

Daheshpour, K. & Herbert, S. (2018). *Infrastructure project failures in Colombia*. K4D Helpdesk Report. Brighton, UK: Institute of Development Studies.

About this report

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