Building dams in Cameroon

Hippos in troubled waters

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This is a text about a dam in the Sanaga river in Cameroon. It is also about the risks that investors in that dam have to manage, how they deal with uncertainty. It is also about the ecological circumstances and possible risks related to the aquatic ecosystem. It might be unusual to look at these different levels of uncertainty at the same time. However, this article tries to do so.

1 INTRODUCTION

Investors constantly grapple with uncertainty. They are on high alert in a world full of shifting tides. They have to navigate both a physical and a numerical world. The risks they face in an investment therefore need to be addressed in both the physical and financial landscapes.

An 'annoying' fact for investors is that dams are disaster-prone and create financial risks. Many dam projects end up with cost overruns, have revenue shortfalls and problems with environmental and social impacts. Neither do dams reckon enough with the impact of climate change. The stream of revenues out of electricity only is guaranteed for a short term, just long enough to be profitable, but after a dam's comes 'the deluge'.

Investors invest in dams, even when prior knowledge is present about their loss-making potential. To convince them reality is manipulated to suit their needs.

As this essay about a World Bank financed dam in Cameroon shows, the unpredictability of markets is being contained in the physical world by channeling and regulating a wild river with dams. In the financial landscape to accommodate investors, a river, is getting redesigned to generate power and to guarantee a continued stream of revenue. The guarantee of a steady income offers a kind of false financial security to investors, or a security only for the short term.

Nachtigal dam

The Sanaga River is the longest river in Cameroon. It acts as a natural boundary between two distinct ecological regions. The rain forests that stretch from the Atlantic coast into the Congo Basin are located to the south of the Sanaga River. To the north of the river are the Guinean coastal forests and a volcanic mountain range that extends from the Gulf of Guinea to Lake Chad.
The Nachtigal dam, which is nearing completion, is part of a series of dams being constructed in the Sanaga region. The dam is in the central region of the country, close to the capital city of Yaoundé. It is situated at the point where the rapids intensify the force of the water. The dams are expected to generate sufficient energy to meet the country's power requirements, particularly for mining-related industries and to feed the regional power grid.

For some time already, there had been plans for building a West-African regional power grid. The World Bank through investment project financing and legal advice to the government of Cameroon introduced private sector participation of the power sector and supported the creation of an electricity market. The electricity produced by Nachtigal will be transported by a transmission-network company that was created and supported by a World Bank project.

The International Finance Corporation (IFC), a member of the World Bank, helped to structure the finance of the Nachtigal dam. In addition to equity and debt financing, IFC provided pre-development equity to fund the planning stage of the project (before the acquisition of permits) and helped put together a (syndicated) loan from development finance institutions and commercial banks. [1]

2 INTERCONNECTED

The reoccurring financial crisis in history show that global finance it self remains a fragile system. The global finance is a complex system, that develops from billions of decisions. Investors in reaction to the complexity of the world use similar financial models to get a grip on reality and they tend to behave in similar ways. Investors as well have become strongly linked to each other, partly through derivatives and trading, partly through the internet (amplifying leading market sentiments).
'In 2008 a relatively minor shock (mortgage defaults in the US) was transmitted and amplified through the entire system, almost bringing it down.' [2]

A transmission network connects a river to the hypersensitive world of global finance. Market sentiments can fluctuate more dramatically and develop less gradually than the water levels and ecological processes of a river basin. In a world where the physical and financial worlds are becoming increasingly intertwined, risk spreading sometimes has the opposite effect of what it was intended to do.
This is compounded by the fact that the effectiveness of risk minimization by use of market tools is reversed by a risk increasing technological development in the world of finance. The nowadays' speed at which computers and the internet organise markets and disseminate information reconfirms beliefs and intensifies market sentiments. Markets sentiments more easily than in the past result in market extremes.
It is more or less known from social media that perceptions of reality, as received through one's telephone, can get more powerful than real reality. The numerical world of finance, can be similarly affected by the virtual reality. The representation of reality through algorithms and the financial translation of that reality, through (mathematical) risk analysis of traders, who try to avoid risk, can take precedence over reality.

Simplifying the complex

Is it possible that the hippopotamus could vanish from the Sanaga River in Cameroon as a result of an extreme drought in Europe, a reform of the pension system in the Netherlands or a decline in the value of the dollar against the euro (or vice versa)? In fact, it is not entirely inconceivable. In a situation where everything is interconnected, both the local economy and the financial sector are part of a global network where forces can have a knock-on effect on each other.

It is therefore possible that the ecology of a river and the financial system suddenly become interlinked. How best to imagine this? An extreme drought, deforestation or local soil disturbance could impact the revenue model for investors in the dams on the Sanaga River. These dams are built to generate and sell electricity. Fluctuations in global energy prices, whether due to political instability, a harsh winter or an incident at a nuclear power plant, could cause corresponding shifts in the river's water level.

A financial crisis could even cause the river's ecosystem to reach a tipping point. This could adversely affect some of the plant and animal species in the river. A financial system is actually of a smaller order and has a shorter life span than the ecosystem. However, if the ecosystem is already under pressure, a financial crisis could be severe enough to cause lasting change.

[1] Cameroon's Nachtigal Taps New Possibilities for Clean Power, IFC, 2019. https://www.ifc.org/en/stories/2010/nachtigal-cameroon-hydropower-plant-clean-power

[2] page 30 in Regenesis of George Monbiot, 2022. For the text of this paragraph I am indebted to the text on com-plex systems in Regenesis.

3 RISK

The Sanaga is of particular interest to investors as a source of energy that generates megawatts, providing a reliable stream of revenue. It is a paradox that in the calculations of project developers – such as those for dams, which often involve risk assessment – the physical world, which can be touched, remains invisible. The primary focus of calculations for infrastructure development is on the financial risk for investors. A state participation, insurance, participation through shares or the issuance of financial securities, which distribute the profits or losses among multiple holders, can facilitate the approval of a project's business plan by investors. The location and landscape barely matter, and the fish and algae are not even mentioned. Even the potential extinction of large animals such as the hippopotamus and the manatee is not factored into the financial calculations, with the focus instead on the strength of the concrete or the volume of water.

3.1 RISK MANAGEMENT TOOLS

1 Risk spreading

Financial markets have a history of recurring crises, and therefore over decades very different instruments are used to spread risks. In the global food trade, financial products such as options have ensured that the price of most traded grains is less volatile than the weather. The price of the grain is set before the delivery date. The same is done with electricity.
Options are just one example of how uncertainty in the physical world can be addressed by a financial product. The options for making multiple combinations and for 'hedging' the risk of losses with futures have become more diverse over the years.

In addition to being an instrument to distribute electricity, (seen from the perspective of investment bankers) a power grid it self offers a physical way to spread risk. It can draw electricity from different sources. This, in turn, makes it possible to develop a spot market for electricity, where daily electricity prices are set. These prices will then depend on factors such as the level of water in a river for hydroelectric power, the presence of wind for wind power or the price of crude oil, alongside the market sentiment or the psychology of participants. The shocks that extremes in energy supply can cause can be mitigated by pooling energy production from different sources. The financial risk to a borrower or investor is reduced in markets by spreading the risk across many players.

Whether it is power pooling in the physical landscape, or commodity futures in the financial landscape, market based techniques are increasingly accepted in the world of development cooperation. Complex financial products

are designed to address the financial concerns of wealthy individuals and large institutional investors, such as pension funds. The latter operate in capital markets on behalf of a large number of clients. To attract large investors, such as pension funds, for development cooperation, the World Bank and other international financial institutions have started to work with the new financial products of investment bankers to dilute and minimize risk.

Spot markets, options and other financial assets may present conclusive answers to financial risks on the computer screen. However, financial markets and products may only appear to offer stability on the computer screen. After all, the ground realities must drive the formulation of risk strategy and policies. In the long run phenomena in the real world, which include extreme weather events, the extinction of species and the spread of viruses confront us with the physical reality that might make the dams obsolete.
The woes of each financial crisis and the fear of every next crisis in the end already in the short run might leave a trail of unused or underused infrastructure across a ruined landscape.

2 Risk shifting

In contrast to risk spreading, where the weight of the risk is reduced by spreading it over multiple partners, risk shifting is another form of risk strategy. In this, a risk is transferred to third parties instead of being shared.

A dam needs financial backing. The money needed to build the dam can be a loan or an investment. But investors also want a guarantee that they will not lose their money. In liability law, the principle is that everyone bears their own losses.
Nachtigal needs a steady supply of water over several decades to generate electricity. This is regulated by an upstream dam called Lom Pangar. The water supply to Lom Pangar must remain sufficient to regulate the downstream dams. The Nachtigal Dam does not need a massive water reservoir as long as Lom Pangar fulfills that role. Lom Pangar is state-owned. Lom Pangar takes on the high risks associated with a reservoir for Nachtigal. Nachtigal is a run of the river dam, whereby little water storage is provided and the environmental costs stay 'acceptable'. The construction of Lom Pangar caused significant environmental damage. The reservoir has disrupted the habitat of gorillas, chimpanzees, forest elephants and pangolins. The most valuable timber has been sold, but the vegetation left behind in the water-filled gap has begun to rot. The rain is no longer captured by the forest but is disappearing into the reservoir.

Lom Pangar intentionally was planned to contribute to a risk shifting for Nachtigal in the interest of private investors. Nachtigal is owned by a consortium that includes the state, Electricité de France and the World Bank. Electricité de France, General Electric, Chinese investors or the World Bank are the usual suspects involved in similar dam projects, whether in the Amazon, the Mekong or the Congo.
The amounts and risks involved in building and operating dams are simply too great for most private investors . But unlike Lom Pangar, Nachtigal also has some private investors: in particular, the local branch of France's Société Générale and the electricity company ENEO, which Nachtigal supplies, are in public-private hands. The British investor Actis is the majority shareholder.

A Public-Private Partnership is created through a Special Purpose Vehicle to develop the Nachtigal Dam. Loan revenue guarantees, concession agreements, power purchase agreements, payment guarantees, and financial and economic equilibrium clauses that eliminate risks for investors. These are all terms taken from the Nachtigal Dam's business plan. They are financial jargon, which is complex and difficult to render in everyday language.

Because of the triple-A status that a dam investment has as a result of the involvement of the above-mentioned parties, financing can also be attracted by issuing infrastructure bonds or green bonds, which bundle investments in infrastructure, including combinations of more and less risky investments. Such bonds are attractive to institutional investors. This makes the dam financing saleable on financial markets, but what does the triple-A rating ultimately mean for the river and its people? The calculations made for investors create their own logic. As governments hedge any potential debt, it seems like a risk-free investment. However, the fact that risks such as habitat loss and the river drying up have been left out of the financial calculations does not mean they do not exist.

3 Interchangeable nature

Indications of a growing risk of collapse are not fully addressed in the financial landscape yet, but there are certainly attempts to make the financial world cover biodiversity loss.

Some people in the village communities near the dam suffer from river blindness. The parasite that causes this disease is transmitted by black flies. Black flies live on plants near fast-flowing water. Some villagers suspect a direct link between the dam's construction and infections. As with many situations like this, stories have been circulating. However, recent research (2021) shows that breeding sites have fewer black flies and lower infection rates compared to recent entomological reports in Cameroon. The presence of river blindness may be related to the previous loss of forests and the disrupted ecological relationships this causes. The near disappearance of the hippopotamus could be a further indication of this. These indications of a growing risk of collapse are not fully addressed in the financial landscape yet.

The once continuous forest cover along the river banks is no more. The river now flows past a number of plantations, small industrial facilities and villages. There is the rural sprawl that is found on degraded land in so many countries. A few groves still grow at the river's edge, providing an important habitat for animals on the bank. These are also places where villagers gather medicinal and edible plants. Apparently, someone was attacked by a hippopotamus there recently. Nevertheless, the environmental impact report for the dam does not mention hippos among the flora and fauna. On 31 May 2023, Abubakar Ali Shidiki, Tessa Medong Rosalie and Donfack Azabjio Ulrich published the study Status of Hippopotamus, Hippopotamus Amphibius L., in the River Sanaga of the Centre Region of Cameroon. [3] As it turns out, several hippopotami do still live near the Nachtigal Dam. The presence of footprints, feeding marks and faeces are clear evidence of this. The most compelling evidence is a photograph of several animals, including a young hippopotamus curiously looking at the hidden camera. In other words, that list of rare animals and plants is inaccurate. Included on the list, though easier to overlook, is the small aquatic plant Ledermanniella sanagaensis. [4] It grows only in this river and is at risk of extinction as a result of the dam's construction.

Market based policies, promoted by such institutions as the World Bank, attempt econometrics to steadily encroach on the domain of nature. The ecology is becoming tightly coupled to the financial sector and biodiversity parameters and indicators are being developed to integrate ecology in the financial models. When expressed in mathematical formulas, even complex concepts such as ecology (or weather or the climate) can be broken down into elements that are a function of other elements. By breaking down risk into its constituent parts, it becomes possible to trade and pool these elements.

Locally specific elements can even become internationally interchangeable through trade in equivalents. The more abstract the definition of equivalence, the more interchangeable the Sanaga ecosystem is with that of another river. It may be possible to offset the loss of forest in the Sanaga Basin by planting trees elsewhere. [5] Such equivalents could provide a mathematical escape route for the endangered hippopotamus. You could then compensate the loss of a wild river by creating additional space for nature for the hippopotamus along another river, in another location. Ultimately, from the perspective of finance, it may be necessary to assign a value to the hippopotamus in order to ensure its survival. This would at least make the hippopotamus more visible to potential investors.

Climate crisis

A hippopotamus may be offered a mathematical way out, but can the all-encompassing climate crisis in equivalent ways be addressed?

The water in the Sanaga River (stream flow) is fed by rain and the forests in the north-east and east of the country. Due to the decline of the forest, which retains water, and more extreme droughts, the river's catchment area is losing water. Hydrological data show that the river's level has been steadily dropping since 1970. [6] The weather and its impact on the climate crisis are almost impossible to control, unlike the flow of a river. Cameroon has a dry season and a rainy season. Water that falls during the rainy season is collected in a large reservoir and then released during the dry season. This regulates the amount of water and therefore the amount of electricity produced throughout the year. This works for the annual shifts between the dry and rainy seasons. But will it still work over the lifetime of a dam at a time when the earth is in a climate crisis and the river continues to dry up?

3.2 MARKET CONCENTRATION

In the end the risk shifting came under the shadow of the nowadays dominant form of risk aversion around the globe. In addition to risk spreading and risk shifting, there is the tendency in markets of companies merging and an accompanied growing concentration of market power to minimize risk.

The environment of bankers and major investment banks is very international, but the small number of participants in large infrastructure projects and the stories that go around in the 'milieu' also makes it a small village. As in the villages around the dam, there are many beliefs circulating in the village of bankers and money markets, but in its own jargon. For example: the World Bank intended to introduce a 'cascade approach' for the financing of development: only where market solutions are not possible through sector reform and risk mitigation would official and public resources be applied.

Building dams and other energy infrastructure has long been a public enterprise. The electricity generated was for the public good and thus a government responsibility. In recent decades, however, economists have argued that market forces should discipline government or corporate spending. Public utilities, such as dams and power plants, would require public-private cooperation or even outright privatisation to reduce costs. But even for private investors, the cost of building a large infrastructure project like a dam takes a long time to pay off. For all the talk about the role of market forces, governments still play an important role in the long-term financing of these projects.

The risk of a loan or investment not being repaid is reduced by a guarantee given to the investors. In this case, a guarantee is given by the developer to Electricité de France, Société Générale, the IFC, the World Bank, the African Development Bank, the European Investment

Bank and the FMO. These public banks belong to governments and cannot collapse. The participation of public banks, and the guarantees they offer to investors, provide a last resort in case the company developing the dam were to go bankrupt. However, there is no such thing as a free lunch in the world of banking. The World Bank has an indemnity agreement with Cameroon, and thus ultimately, the government of Cameroon will bear the cost of any losses.

3 Status of Hippopotamus, Hippopotamus Amphibius L., in the River Sanaga of the Centre Region of Cameroon,
Abubakar Ali Shidiki, Tessa Medong Rosalie and Donfack Azabjio Ulrich in Sustainable Wildlife Management, 2023.
https://www.intechopen.com/chapters/84123

4 Nachtigal Hydropower Project : environmental assessment : Stratégie des mesures d'accompagnement pour la con-servation de Ledermanniella sanagaensis et Ledermanniella thalloidea, World Bank 2015

5 For the text in this paragraph I was inspired by the book Streams of revenue, the restoration economy and the eco-systems it creates, Rebecca Lave and Martin Doyle, the MIT press, 2020.

6 River Research and Applications 27(6):754 – 771, Jean Guy Dzana, Jules remy Ndam Ngoupayou, Paul Tchawa, 2011.

4 CONCLUDING REMARKS

Building a dam involves many calculations. Ecology largely falls outside the physical calculations of mass and energy. A structure needs mass to hold back the water of a large, powerful river. This requires a lot of concrete and iron. The metrics of a river's gradient, water velocity and the megawatts of energy it generates are the hard data needed to participate in the volatile energy and financial markets. It is not just calculations of water volumes, gradients and energy that are needed to make the river viable for the financial sector, but also calculations of costs and returns on paper, as well as risks and financial feasibility. These are the indicators that make a financial rating possible.

A dam that supplies electricity to a city or a mine generates revenue for a power company. Banks and private investors see the steady stream of revenue from the sale of electricity as the underlying security for their loans and shares in the power company. The loans themselves can be resold as collateral for derivatives. You can even trade risk based on high or low expectations of something else.

The creation, exchange and circulation of money in markets is complex, but ultimately it pales in comparison with the variation, relationships and complexity among biological species in ecological systems. The assumption of market economists is that competitive markets are the norm and that the increasing complexity of financial markets, driven by inter-dependencies, will ultimately reach a state of equilibrium. The trading of equivalents provides a solution to the preservation of unique species and landscapes.

However, it is unlikely to halt the major changes currently taking place in ecological systems, as well as in atmospheric and ocean currents. Systems can tolerate a certain degree of change, but beyond a tipping point, the self-regulating properties of a system can cause the opposite effect. A small change can then cause an entire system to collapse. It is difficult to reverse such a change once it has occurred. The future of the hippopotamus at Sanaga, and not of the hippopotamus alone, is cast in troubled waters.

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