GALVANISING INFRASTRUCTURE PROJECT ORGINATION

(Research Proposal)

Stimulating Quality Investment in Energy Infrastructure Projects by Investigating Solutions to Two Problems in Energy Project Origination.

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November 2020

Introduction

There is high demand for infrastructure finance deals but there is an underinvestment in project preparation,[1] which stymies the ability governments have to build sustainable urban infrastructure [Diop, 2019; Ebobisse, 2019; Walter et al., 2019[2]]. In addition the academic consensus is that governments are underinvesting in infrastructure for their future populations leading to an "infrastructure gap" [Swiss Re[3]].

There is a switch to renewable power taking place in the developed world. Whilst this takes place utility and energy companies that were once the largest companies in the world are suffering, which creates a conflict between opposing government goals: energy security versus a reduced dependence on fossil fuels [Tulloch et al. 2017[4]].

New renewable energy project development does not satisfy long-term goals:

[1] Project development, project origination and project preparation are synonymous terms.

[2] "The project investment side when deals are already bankable is overcrowded while the project preparation side is underfunded. We would ask the private sector to contemplate doing business on the project preparation side." Makta Diop, VP of Infrastructure at the World Bank, speaking at *The Infrastructure Revolution: Integration, Investment and Innovation conference,* October 17, 2019, Preston Auditorium, World Bank Headquarters, Washington DC.

"The [amount of investment] that we see today [in Africa] is good but it needs to be scaled up significantly, and one area [where I see an opportunity to scale up] is called… project preparation… These are all the activities, which are early stage activities, which move the project from a concept phase to a bankability phase where private investors would be willing to invest in the project and there is a lot of money, which is sitting on the sidelines to invest in those projects but we need to get those projects to the bankability phase." Alain Ebobisse, CEO of African development bank *Africa 50.* This is a transcript of his words, which were spoken at the following conference: *The Infrastructure Revolution: Integration, Investment And Innovation,* World Bank Headquarters, Washington DC, October 17, 2019.

"There is a worldwide scarcity of viable project and infrastructure finance deals." *The Infrastructure Challenge* (2016), edited by Ingo Walter, p. 101.

"..Infrastructure developers, investors and financiers have recognized the dearth of bankable projects as the major constraint to getting more infrastructure services to more people in developing countries, and that more emphasis must be placed on project preparation. Proven global platforms like the Global Infrastructure Facility (GIF) are catalysts that deploy these principles into action." Taken from *https://www.swissre.com/risk-knowledge/risk-perspectives-blog/countries-must-seize-the-opportunity-to-build-back-better.html*

[3] "The World Bank estimates that developing countries need to invest around 4.5 percent of GDP to achieve infrastructure-related Sustainable Development Goals and to stay on track to limit climate change by no more than 2 degrees Celsius. Studies from the G20's Global Infrastructure Hub, the United Nations, and McKinsey & Company confirm that the infrastructure financing gap is huge, standing in multiples of trillions per year." Taken from *https://www.swissre.com/risk-knowledge/risk-perspectives-blog/countries-must-seize-the-opportunity-to-build-back-better.html*

[4] The impact of liberalization and environmental policy on the financial returns of European energy utilities, 2017, Tulloch, DJ., Diaz-Rainey, L, Premachandra.

Global investment in power generation doubled between 2005 and 2015 and reached $420 billion per year of which 70% was renewable power [IEA, 2016[5]]. The 2 °C goal likely required an additional $250 billion in spending per year.[6] This proposed research aims to study the ways in which investment in energy project development can be stimulated.

Small wind projects started by project developers may dominate new renewable energy investment in developed countries:

There is evidence to suggest that small wind investments by project developers dominate new renewable energy projects in developed markets. Steffen conducted a study of all new non-hydro renewable energy generation projects that have been connected to the German grid[7] during the time period from 2010 to 2015. The category of renewable energy with the largest number of new projects was wind. Solar powered projects came in second. Project developers were the sponsor-type that had the largest number of new projects for both wind and solar power.[8] In this study there were also a large number of smaller projects, with 290 projects in the 10 to 50 MW range and only 29 projects exceeding 100 MW in size [Steffen 2017[9]].

The finding regarding the size of projects certainly underlines the point made by several scholars that there is a decentralization of power generation taking place, due to the fact that many smaller renewable projects are being built [Realising Transition Pathways Engine Room, 2015[10]; Seyfang et al., 2013[11]]. This will necessarily focus attention on localised energy, which will require different regulatory approaches [Busch, 2014[12]] as well as a reconfiguration of the grid to aid in connecting more geographically dispersed power generation facilities [Zhao et al. 2018[13]].

Private investment is important:

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5 IEA, 2016a. World Energy Investment 2016. (Paris).

6 IEA, 2016b. World Energy Outlook 2016. (Paris). https://doiorg/10.1787/weo-2016-en.

7 Only projects that were larger than 10 MW were included in the research.
8 Citizen-owned wind projects formed a group that also contained a large number of new projects.
9 The Importance of Project Finance for Renewable Energy Projects, Bjarne Steffen, p. 289.

10 Distributing power, a transition to a civic energy future: Report of the Realising Transition Pathways Research Consortium 'Engine Room', Barton et al., 2017.

11 A Thousand Flowers Blooming? An examination of community energy in the UK, 2013, Gill Seyfang, Jung Jin Park, Adrian Smith.

12 Local power: exploring the motivations of mayors and key success factors for local municipalities to go 100% renewable energy, 2014, Henner Busch" and Kes McCormick".

13 Critical factors affecting the development of renewable energy power generation: Evidence from China, 2018, Zhao and Chen.

Private sponsors are very important for renewable energy development. In Germany, 85% of investments into renewable power plants was made by private investors in 2012 [Trend Research, 2013[14]]. Wind energy is seeing the most activity because it is more economically profitable than other renewable energy sources [Devine-Wright, p. 2005[15]].

Project finance is the vehicle of choice:

Steffen's study showed that project developers use project finance 95% of the time and concluded that governments need to accommodate that finance vehicle from a financial and regulatory standpoint. For global asset financing of new investment in renewable energy generation the use of a project finance vehicle has increased from 16% to 52% between 2004 and 2015 (FS-UNEP, 2016[16]).

The development of renewable energy deals is driven by subsidies:

Let's take the United States market as an example. The number one driver of renewable power capacity between 2001 and 2003 was states' Renewable Portfolio Standards (RPS), which is a state policy that requires electric utilities to source a portion of their energy needs from renewable energy resources. 30 states currently have such a policy. The second driver was state Renewable Energy Funds (REF) financed by a small surcharge on retail electricity bills. These funds are the second largest driver of new capacity. Wind power accounted for more than 80 percent of the utility-scale renewable capacity supported by these funds in 2005. [Bolinger et al. 2005.[17]][18]

Galvanising infrastructure project origination:

As stated before, the goal during this PhD will be to find ways in which energy infrastructure investment can be stimulated.

There are two important questions developers must ask themselves:

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[14] Trend Research, 2013. Definition und Marktanalyse von Burgerenergie in Deutschland.

[15] Devine-Wright P. Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind Energy. Wind Energy 2005; Devine-Wright P.

[16] Global Trends In Renewable Energy Investment 2016, Frankfurt School-UNEP Collaborating Centre.

[17] An Overview of Investments by State Renewable Energy Funds in Large-Scale Renewable Generation Projects, 2005, Mark Bolinger, Ryan Wiser, and Garrett Fitzgerald.

[18] An important note for developers is given in this report: "state funds are becoming increasingly stringent about awarding grants and production incentives only to relatively mature projects, in response to early experience with a number of project failures. This is accomplished in part by requiring funded project developers to post bid bonds, meet strict construction milestones, and either have a power purchase agreement in hand or be engaged in contract." Taken from *An Overview of Investments by State Renewable Energy Funds in Large-Scale Renewable Generation Projects*, by Mark Bolinger, Ryan Wiser, and Garrett Fitzgerald.

- What projects should they develop? (Viability)
- How should they go about developing them? (Process)

The first question deals with gauging the viability of energy projects. The second deals with understanding the process of energy project development. I wish to study both subject areas.

1. The Energy Infrastructure Development Process

Frameworks have been suggested for the structure of the infrastructure planning process. Driessen et al. suggested a "management model for interactive policy-making" consisting of six-stages: Exploration; Initiative; Common perception; Joint Problem-Solving; Decision-Making; and Implementation (Driessen et al. 2001).[19] Zhou et al. suggested a planning process, which is broken down into four stages: Preparation; Review; Coordination and Final Approval.[20] Karadimitriou (UCL) breaks down the planning process into five stages: conceptualization of the project; linkage to a funding source; conduct of feasibility studies (legal economic, financial etc.); acquisition of approval from a constellation of applicable authorities; and conduct of community stakeholder consultations (not necessarily in that order). Enevoldsen and Sovacool break down the process of developing a wind project in France into three phases: Screening (getting the local mayor's approval); Securing (acquisition of land); and Permitting (public enquiry round). Other costly financial and technical steps have been omitted [Enevoldsen and Sovacool, 2015[21]].

A lot of academic work in the area of energy project development focuses on public opinion and public participation in the development process. Jami and Walsh cite a case study and posit that if a different process of public participation had been chosen the project would not have been abandoned. The study suggests a suitable process for public participation [Jami and Walsh, 2014].[22] Cotton et al. discuss leading discourses on the subject of sitting new transmission lines in the UK [Cotton and Devine-Wright, 2010[23]].

Ensuring that the time and energy invested into a project is not laid to waste, often ends up hinging on breaking a stalemate.

1. Enevoldsen et al. report that social acceptance of wind is a major constraint in France because local inhabitants need to be in favor of a wind project for it to move forward.[24]

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[19] Interactive policy-making — a model of management for public works, 2001, Peter P.J. Driessen, Pieter Glasbergen, Co Verdaas.

[20] Ibid., Planning Modes for Major Transportation Infrastructure Projects (MTIPs): Comparing China and Germany, Zhou, Tan and Sedlin, 2018.

[21] Examining the social acceptance of wind energy: Practical guidelines for onshore wind project development in France, 2015, Peter Enevoldsen , Benjamin K. Sovacool.

[22] The role of public participation in identifying stakeholder synergies in wind power project development: The case study of Ontario, Canada, 2014, Anahita A.N. Jami, Philip R. Walsh.

[23] Discourses of energy infrastructure development: a Q-method study of electricity transmission line siting in the UK, 2010 by Matthew Cotton, Patrick Devine-Wright.

[24] Ibid., Examining the social acceptance of wind energy: Practical guidelines for onshore wind project development in France, Peter Enevoldsen , Benjamin K. Sovacool.

2. A 50 MW wind farm would have produced enough energy for 10,000 homes in Ontario. The developer Brookfield Power was unable to acquire the necessary permits to construct the project within the timelines imposed by the energy purchase contact and after two years the project was abandoned. An opposition network thwarted progress on environmental grounds.[25]

Therefore an important consideration in this study relates to the approaches taken in order to reach an agreement. To cite some examples, methods fall under the headings of: alternative dispute resolution (Bacow and Wheeler, 1984;[26] Bingham, 1986;[27] Carpenter and Kennedy, 1988[28]); analysis of interconnected decision areas (AIDA) (Friend and Hickling, 1987[29]); consensus mapping (Hart et al., 1985[30]); delphi (Rauch, 1979[31]); and stakeholders analysis (Mitroff, 1983[32]).

Research Questions:

NEW:

What are the stages involved in developing a project until it receives building permits, in the area of wind and solar project development in OECD markets?

When developing projects until they receive building permits in the aforementioned sectors, what processes have led to the best outcomes?

OLD:

How do we best define the stages leading up to the approval of building plans for energy infrastructure?

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[25] Ibid., The role of public participation in identifying stakeholder synergies in wind power project development: The case study of Ontario, Canada, Anahita A.N. Jami, Philip R. Walsh.

[26] Environmental Dispute Resolution, **Bacow,** Lawrence S., **Wheeler,** Michael, 1984**.**

[27] Resolving Environmental Disputes: A Decade of Experience, Gail Bingham, 1986.

[28] Managing Public Disputes By Susan L. Carpenter, W.J.D. Kennedy, 1988.

[29] Planning Under Pressure: The Strategic Choice Approach, John Kimball Friend, John Kimbal, Friend, Allen Hickling, 1987.

[30] Managing Complexity Through Consensus Mapping: Technology for the Structuring of Group Decisions, Stuart Hart, Mark Boroush, Gordon Enk and William Hornick, 1985.

[31] The decision Delphi, WolfRauch, 1979.

[32] Stakeholders of the Organizational Mind: Toward a New View of Organizational Policy Making (The Jossey-Bass Management Series) Hardcover – October 3, 1983, by Ian Mitroff, 1983.

Can we determine empirically whether particular processes have been more successful than others?

Methodology:

All relevant literature will be reviewed. Then interviews with professionals involved in the process will be conducted to determine what process is/was followed in selected countries and for selected projects. A database of private sector project developers, financial investors, government planners and other people that are involved in energy infrastructure project development, have already been amassed for the purposes of this project. Other project databases can be used (see Appendix A.) Steffen began with a comprehensive and public list of hundreds of projects that had been connected to the German grid and was able to find the name of the project owner in the case of 80% of projects.[33] A framework for the structure of the planning approval process, will be decided upon based on frameworks suggested in the literature and based on the empirical data.

1. Comparative studies will be undertaken to show differences between processes versus outcomes in different countries and projects.

2. If data from enough countries can be amassed to give statistically significant results, a study can be conducted to find correlations between processes and energy industry performance, by cross-referencing data from GI Hub (Infracompass, GI Hub[34]). The following data points are given for each country in GI Hub's Infracompass 2020 database: Electricity supply quality and Electricity access.

3. Alternative approaches should also be considered. For example one may wish to turn to the domain of product (versus project) development and look at areas such as Engineering Change Management (ECM) or continuous factory planning [Koch, Gritsch, and Reinhart. 2016[35]], which offer valuable insights. A comprehensive analysis of these areas of research may guide a process of producing detailed analyses of project stages, structured sets of project processes and process requirements.

[33] Ibid., The Importance of Project Finance for Renewable Energy Projects, Bjarne Steffen, p. 286.

[34] GI Hub has amassed an enormous amount of infrastructure performance data for 80 countries, which can be found at the following link after clicking on the "download data" button: https://infracompass.gihub.org/.

[35] Koch, J., A. Gritsch, and G. Reinhart. 2016. "Process Design for the Management of Changes in Manufacturing: Toward a Manufacturing Change Management Process."

Anticipated Outcomes:

The study may reveal examples of energy project developers that pursue project development in a scheduled, iterative way, which allows the decision-making process to proceed within a reasonable timeframe and which produces better front-end and back-end results in terms of cost, time, usage and so on. These processes can be highlighted as *Best Practices.*

2. Project Viability

A preliminary investigation has revealed that there may be a dearth of studies covering Critical Success Factors (CSFs) in the area of energy project development in the developed world. Conversely studies have been found, which reveal CSFs for renewable energy projects in the developing world [Zhao et al., 2018[36], Holland et al., 2011[37]]. Since project developers are being approached in order to study the energy project development process, we are well positioned to gather data regarding CSFs from these developers. If it is found that specific studies regarding CSFs in this subject area are indeed rare we can look to other resources (and to the developers themselves) to try and compile our own list of CSFs. One example of a useful resource is a detailed guide for developers of wind projects that has been produced by the Ontario Sustainable Energy Association [OSEA, 2005[38]].

As explained before the effect of public participation (or lack thereof) on wind projects has been widely covered. The related factors are CSFs themselves. Pasqualetti et al. believe that the success of wind projects depend on how the public are incorporated into the decision-making process [Pasqualetti, et al. 2002[39]]. In Ontario, Canada's leading province in installed wind facilities, several large-scale projects have been cancelled or delayed due to community opposition and the future of wind power is in question.[40] Wind project developers need to address the public early and find ways to address the strong networks of opponents [Corscadden, 2012; Mclaren, 2007[41]].

Mclaren studied wind energy planning in 18 projects in England and found the following CSFs[42]:

- The involvement of a full range of potential stakeholders;
- Minimizing the involvement barriers (e.g. time and location of public meetings);

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[36] Critical factors affecting the development of renewable energy power generation: Evidence from China, 2018, Zhao and Chen.

[37] Decentralised Rural Electrification: The Critical Success Factors, [Experience Of TDC], 2011, By Ray Holland, Lahiru Perera, Teodoro Sanchez, Dr Rona Wilkinson.

[38] OSEA, Ontario Landowner's Guide to Wind Energy, 2005 First Edition.

[39] Wind power in view: energy landscapes in a crowded world. San Diego: Academic Press; 2002, Pasqualetti, MJ, Gipe P, Righte RW.

[40] Ibid., The role of public participation in identifying stakeholder synergies in wind power project development: The case study of Ontario, Canada, 2014, Anahita A.N. Jami, Philip R. Walsh.

[41] Social license and consultation criteria for community wind projects. Renew Energy 2012, Corscadden K, Wile A, Yiridoe E.; Wind energy planning in England, Wales and Denmark: factors influencing project success. Energy Policy 2007, Mclaren Loring J.

[42] Ibid., Wind energy planning in England, Wales and Denmark: factors influencing project success. Energy Policy 2007, Mclaren Loring J.

- Collaborative decision-making by planners and local community members;
- Financial ownership of the project (by the local population);
- Initiation of the project by a local group or individual instead of an outsider;
- A strong relationship among actors within a network (this is applicable for both supporters and opponents);
- Excellent communication within the network;
- Charismatic critical actor; and
- Positive media coverage that could be directed by both supporters and opponents.

Research Questions:

NEW:

What are the major CSFs for successful project development, in solar and wind projects in OECD markets?

Can a model be built that predicts the viability of solar and wind projects in OECD markets with statistical significance?

OLD:

What empirical work has been done to determine CSFs in the area of energy project development?

Can we gather enough data to create a simple predictive model for energy project development viability?

Methodology/Empirical Studies:

The most important CSFs will be gathered based on exhaustive literature analysis whilst cross-referencing fundamental knowledge areas of Project Management PMBOK.[43] Dealing with these qualitative CSF values will require judgments based on strategies for qualitative research [Corbin and Strauss, 1990[44]] [Silverman, 2013[45]]. The goal will be to cover over 100 projects in order to be able to provide statistically significant data. There is a trade-off between covering lots of projects and covering lots of CSFs. The more CSFs you add the fewer projects you can cover in your study due to the analytical work involved. For this reason it would be wise to limit the

[43] www.pmi.org

[44] Grounded theory research: Procedures, canons, and evaluative criteria, Juliet M. Corbin R.N., D.N.Sc. & Anselm Strauss 1990.

[45] Doing Qualitative Research: A Practical Handbook, Silverman, D. 2013.

CSFs and ensure quality over quantity. Each time a CSF is added to the model the predictive power can be re-tested and this value should improve with each new CSF.

Anticipated Outcomes:

Our model may prove superior to alternative models in terms of ease of use, cost and performance.

Timeframes

A thorough review of existing research on the topics should be complete by the end of the first year. The data collection process (surveys and interviews) can take place simultaneously with the first six months dedicated to affirming participation with the right parties.

The aim should be to collect data from 100 + projects within 18 (ideally) to 24 months.

The writing should begin at the beginning of the second year at the latest. The writing relating to the empirical results should start at the beginning of the third year at the latest.

Endnotes