

-RESEARCH ARTICLE-

## ALLOCATION OF RISK IN PUBLIC PRIVATE PARTNERSHIPS IN INFORMATION AND COMMUNICATIONS TECHNOLOGY

**Danielle Nel**

University of Johannesburg

E-mail: daniellen@uj.ac.za

Orcid ID Number: 0000-001-9896-3566

### —Abstract—

A public private partnership (PPP) is an agreement between a public and a private party to achieve a strategic objective. The PPP model is based on three principles: risk allocation and transfer, affordability, and value for money. Traditionally, PPPs have been leveraged for hard service development such as infrastructure development. The advancement of technology within the context of the Fourth Industrial Revolution (4IR) has created new opportunities and risks for PPPs as important mechanisms for the promotion of development. The 4IR has implications for government service delivery, which have brought about an increased demand for service delivery innovation and the development of information and communications technology (ICT). Although PPPs have traditionally focused on hard services, it is important to consider PPPs for soft service delivery. It is therefore necessary to rethink the role of the PPP model as an alternative service delivery mechanism. The aim of this article is to discuss risk allocation in ICT PPPs. The research approach is qualitative in nature. The research method is based on a desktop analysis of literature and secondary data utilising unobtrusive research techniques such as conceptual and documentary analyses. The article identified various risks and opportunities for PPPs for service delivery innovation. These partnerships are often faced with high levels of uncertainty in terms of funding, level of stakeholder commitment, and complex relationships. Other risks include vendor financing, market risk, intellectual property (IP) risk, data governance, and regulatory risk. The deployment of ICT can reinforce and expand PPPs beyond all previous limitations and boundaries. This research makes proposals for good practices for risk allocation in ICT PPPs.

**Key Words:** public private partnerships (PPPs), risk allocation, information and communications technology (ICT), e-government, blockchain, smart contracts

**Citation (APA):** Nel, D., (2020), Allocation Of Risk In Public Private Partnerships in Information and Communications Technology, International Journal of eBusiness and eGovernment Studies, 12 (1): 17-32. Doi: 10.34111/ijepeg.202012102.

**JEL Classification:** O39

## **1. INTRODUCTION**

The world is currently experiencing dynamic changes due to the Fourth Industrial Revolution (4IR), with the rules of change and transformation being continuously rewritten. This phenomenon fundamentally disrupts and transforms the way the world works. A new rubric of technological innovations is characterised by a fusion of technologies that blur the lines between the physical, digital, biological, and neuro-technological spheres. These dynamic changes exert pressure on governments to reinvent themselves to deliver new services and improve existing ones, while operating more efficiently, with greater transparency and a growing focus on the service user (Balkaran, 2010:1-2). Governments often lack the capacity and resources to stay ahead of technological advancement. The rationale behind public private partnerships (PPPs) is to leverage private sector capacity and resources to assist in delivering certain hard and soft public services. PPPs are contractual arrangements between the public and private sector, which are generally long-term in nature. If correctly implemented, PPPs can mobilise socioeconomic goals. The implementation of PPPs stimulates the delivery of continued, lucrative public organisations or services, by mobilising private sector proficiency and conveying a substantial amount of risk to the private sector towards value for money (Nel, 2014). Information and communications technology (ICT) is often difficult to fit into the PPP model (Delmon, 2009:513). This article aims to clarify the role of ICT in PPPs.

A qualitative research approach was used, analysing literature and secondary data through unobtrusive research techniques. Unobtrusive research techniques are non-reactive and information is gathered through public documents. Three types of techniques are observed, namely conceptual, content, and historical/comparative analyses (Auriacombe, 2016:6-10). The article is conceptual and descriptive in nature, and therefore applied conceptual and comparative analysis of secondary data, scholarly literature, and government reports and policies. The aim of this article is to discuss the role of risk allocation in ICT PPP projects. Firstly, a conceptual clarification of ICT and its role in terms of PPPs is provided. Secondly, the article provides an overview of the risks and opportunities regarding ICT PPPs. Critical success factors (CSFs) in ICT PPPs are outlined, and the various PPP models in e-government PPPs are identified. Lastly, an overview of risk allocation in ICT PPPs is provided.

### **1.1. Conceptualising public private partnerships (PPPs)**

A PPP is defined as “any contractual or legal relationship between public and private entities, aimed at improving or expanding infrastructure services” (Delmon, 2011:2). PPPs have become significant mechanisms to address the shortage of government resources and public sector inefficiencies (Kwofie, Afram & Botchway, 2015:59). The benefits of PPPs include accelerated infrastructure development, improved service quality, affordability, sharing of risk, and value for money (Bwanali & Rwelamila, 2016:116). Albertus (2016:25) identified three critical areas of management challenges in PPPs, namely achieving public value and return on government investments, risk sharing and risk management, and PPP governance and public accountability.

## **2. PPPs AND INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT)**

Limited literature is available on ICT for public service delivery, or ICT PPPs, particularly in developmental and emerging countries (Albertus, 2016:16). Governments should seek to increase connectivity through large bandwidth and technological innovation (Delmon, 2011:174). ICT PPPs have been adopted in developed countries since the late 1990s (Albertus, 2016:17). Africa has ICT infrastructure challenges; an alternative for the lack of investment in ICT infrastructure in Africa is the use of PPPs (Bwanali & Rwelamila, 2016:114). A number of fibre optic backbone systems have been developed by PPPs. Traditionally, PPPs in ICT have focused on fibre optic networks, satellite systems, mobile mast networks, local loop unbundling, securitisation, and video and telecommunication services (Delmon, 2009:514).

A rapidly changing environment due to the 4IR has created new markets in ICT. In addition, the increased demand for technological innovation has exceeded funding and commercial activity available from the public sector (Delmon, 2011:173-174). Most PPPs in the field of ICT have been driven primarily by mobile applications and Internet access (Witters, Marom & Steinert, 2012:84).

### **2.1. ICT**

Albertus (2016:17) defines ICT as “technologies such as the Internet, Intranets, Extranets, ERP and other such technologies, which serve as basic infrastructure for a variety of services and service improvements facilitating effective and efficient public management”. The deployment of ICT is essential for development (Haenssger, 2018:358). ICT policies should be geared towards universal access and the capacity to develop an ICT-driven economy, which

would in turn lead to economic development (Williams, 2012:65). The application of ICT through PPPs can address the speed and access of service delivery (Sharma & Seth, 2011:15). E-government stresses ICT development in government service delivery (Kaliannan, Awang & Raman, 2010:210). More recent PPPs have focused on e-government, management and information systems, broadband, and the introduction of blockchain technology.

## **2.2. E-government**

E-government relates to the manner in which governments make use of ICT to deliver electronic services (e-services) to citizens in an efficient manner (Irani et al., 2012:299). E-government is central to transforming public governance. There is an increased focus on how ready governments are to benefit from ICT development. Innovative e-government initiatives should be sought, incorporating e-readiness performance indicators (Potnis & Pardo, 2010:345). An example of the most e-ready countries include Estonia and Singapore. Estonia has been recognised as the leader in technology and e-government, and as the most tech-savvy society in the world (Schulze, 2019:1; Mumbai, 2013:1).

The advancement of e-government is a move away from traditional procurement mechanisms to a greater reliance on collaborating (Allen et al., 2005:370). The development of e-government is reliant on available technical skills; governments often do not possess the technical capacity to develop such initiatives, which makes PPPs in ICT essential. Narasimhan and Dasa Aundhe (2014:2197) argue that PPP is an “appropriate model for ICT adoption in an e-governance context, especially when the scope and innovativeness of the project is high”. Risk sharing in these projects can be beneficial to their success, because these projects are “typically fraught with challenges and uncertainties on the account of the novelty of the project, demanding new ways of thinking and acting” (Narasimhan & Dasa Aundhe, 2014:2197). Nasim and Sushil (2010:344) argue, “A PPP in offering e-government services is a viable alternative towards sustainability and faster growth of e-government initiatives”. A move towards digital government is required for governments to fully adapt to the 4IR. Digital government is “the state-of-the art paradigm in public administration science, it entails the provision of user-centric, innovative and agile public services” (Allessie, Sobolewski & Vaccari, 2019:10).

## **3. RISKS AND OPPORTUNITIES**

Nel (2014:46) identified a number of barriers and risks to the successful completion of PPPs in general, namely that there is a lack of government support

for private providers and a lack of oversight; the quality of projects is not ensured; there is a lack of transparency in PPPs; the market of private providers is underdeveloped; there is a lack of buy-in from constituents, public awareness and understanding, and political commitment; inconsistent implementation of legislation; limited programme activity; ineffective procurement; and a lack of emphasis on the environmental performance of PPPs.

Typical risks in ICT include market risk, technology, intellectual property (IP), regulation, and vendor finance. The single most challenging aspect in terms of managing risk in ICT PPPs is the dynamic and changing nature of technology and the industry itself. This risk factor has a spill-over effect; flexibility is therefore key throughout the project life cycle. Possible changes need to be anticipated in advance. The competitive nature of the ICT sector makes it difficult for lenders to obtain revenue certainty. Financing ICT on a limited recourse basis results from the rapidly changing nature of the industry. IP is difficult to manage when changes occur, such as royalty payments increasing or when relevant rights are no longer available. Project specifications will also change when new technology is implemented. A regulatory system is needed that is stable yet flexible enough to protect the integrity of the project. Governments may struggle to keep up with the changing pace in terms of developing and implementing policies to provide a conducive environment for the successful execution of PPPs (Delmon, 2009:513-516).

Delmon (2011:3) identified a number of lessons learned for effective preparation and implementation of PPPs. Firstly, PPPs prepared in a hurry do not receive sufficient technical assistance. A thorough feasibility study is therefore required to determine affordability, value for money, and risk allocation. Secondly, PPPs should be developed as strategic policy projects, aligned to sectoral development strategies. Lastly, the government should play a key role in monitoring the performance of the public and private partners, project implementation, and contract administration (Delmon, 2011:3). Challenges experienced in PPPs include lack of clear government policy, lack of political buy-in, weak public sector capacity, and lack of robust feasibility studies (Bwanali & Rwelamila, 2016:112).

### **3.1. Risk allocation and sharing**

Mouraviev and Kakabadse (2012:264) emphasise that “risk should be transferred to the party best able to manage it with the lowest cost”. Risk allocation entails an agreement to deal with certain risks through a specified mechanism, which may involve sharing the risk or the management of the penalties related to the risk

(Albertus, 2016:xvii). Risk allocation has a direct financial impact on the success or failure of a PPP project. Risk allocation could result in lower overall project costs and provide enhanced value for money when compared to traditional procurement options. The allocation of risk should reflect the specific context and characteristics of the project, as well as the strengths of each party (Albertus, 2016:154).

Depending on the type of PPP, risk allocation in PPPs is treated on a case-by-case basis because circumstances, context, and resources differ from case to case (Nel, 2014:81). For instance, civil law PPP contracts differ from common law contracts in that administrative law generally governs them. Furthermore, it seems that the differences between common law and civil law do not play a significant role when it comes to general risk allocation. In this context, an individual country’s background and political objectives are probably more important (Global Infrastructure Hub, 2016:5-6). A successful PPP project must have a workable, commercially viable, and cost-effective risk-sharing approach. The risk-sharing approach is an essential aspect to include in developing the PPP agreement, to ensure that the contractual document creates a bankable risk allocation (Delmon, 2011:95).

PPPs are not homogenous in terms of structure, organisation, and risk allocation (Latteman, Stieglitz & Kupke, 2009:368). There is no one-size-fits-all approach; each individual PPP will have its own way of documenting general risk allocation. The risk allocation summary suggested in Table 1 may provide useful applications for risk allocation in ICT PPPs.

**Table 1: Risk Allocation for ICT PPPs**

<b>Risk</b>	<b>Appropriate Party</b>	<b>Factors</b>
<b>Planning or Statutory</b>	Public	Planning and statutory process undertaken in advance of tender.
<b>Political</b>	Public	Events of war, civil unrest, change in law, and failure and delays by public sector entities.
<b>Completion</b>	Private	Completion of design, construction, and installation, including the adequacy of the design works, nature of technology to be used, and resources available.
<b>Currency</b>	Public	Monetary regulations and market conditions can limit the extent to which local currency can be converted to foreign currency.

<b>Risk</b>	<b>Appropriate Party</b>	<b>Factors</b>
<b>IP</b>	Public/Private/ Shared	Issues relating to the ownership of IP, including commercialisation, patents, and proprietary information.
<b>Off-Take</b>	Shared	Reduction in and failure of the use of the services provided by the facility.
<b>Misspecification of Output Requirements</b>	Public	Information and resources relevant for output requirements.
<b>Performance</b>	Private	Works adhere to contract specifications regarding performance.
<b>Financial</b>	Private	The private party undertakes the investment and is responsible for the financing of capital expenditure.
<b>Design</b>	Private	A degree of risk sharing can take place, where the public partner has an informational advantage.
<b>Construction</b>	Private	Private sector performance is contractually binding. A degree of risk sharing can take place where the public partner has an informational advantage.
<b>Operation</b>	Private	Private sector performance is contractually binding. A degree of risk sharing can take place where the public partner has an informational advantage.
<b>Utilities</b>	Private	Utilise due diligence and contingency plans as mitigation measures.
<b>Demand</b>	Public	Government provides guarantees.
<b>Sub-Contractor</b>	Private	As mitigation measure, utilise professional indemnity insurance.
<b>Time Schedule</b>	Private	Private sector performance is contractually binding.
<b>Latent Defects</b>	Private	Likelihood or impact can be mitigated through efficient environmental assessment and due diligence.
<b>Maintenance</b>	Private	Efficient facilities management, sub-contractor agreements, and contingency funds can aid risk mitigation.

<b>Risk</b>	<b>Appropriate Party</b>	<b>Factors</b>
<b>Exchange Rate</b>	Public	Government provides guarantees for fixed real exchange rate, hedging of costs, and indexing tariffs.
<b>Changes in the Needs of the Wider Public</b>	Public	The government has the informational advantage and the needs of the public are often affected by policy.
<b>Social</b>	Public	The reaction and interaction between the project and society at large.
<b>Cost Overrun</b>	Shared	Significant percentage should be carried by the private partner, taking into account the economy, efficiency, financial management, and subcontracting arrangements.
<b>Environmental</b>	Public	The reaction and interaction between the project and the natural environment.
<b>Technology</b>	Private	The loss resulting from technological changes or failure.
<b>Legislative or Regulatory</b>	Shared	Neither the public nor private partner has influence over changes in national legislation.
<b>Interest Rate</b>	Private	Apply denomination tools for bargaining.
<b>Residual Value</b>	Private	Ultimate reimbursement to the private partner based on the condition of the facility.
<b>Availability</b>	Private	Penalties applied as risk mitigation if the private partner does not meet output specifications.

Source: Adapted from Delmon (2011:98-112), Nel (2014:80-81), Delmon (2009:190), Iossa Spagnolo and Vellez (2007:4-15) and International Monetary Fund (IMF, 2004:18,31).

Risk should be allocated to the party who is more capable of controlling the risk and who is less risk averse. Furthermore, the roles of the various partners in the PPP will influence the risk allocation. For instance, the issue of ownership of IP rights will be determined by the roles of the various counterparts in the PPP. Typically, the PPP exists to draw on a private sector party's depth of expertise in technology management and in product development, and this is a key factor in determining ownership of IP rights. Agreements generally specify who should own the developed IP because of the activities undertaken within the framework of the agreement. The IP could be owned either by the public partner, the private partner, or it could be shared (Taubman, 2004:17). The risk allocation will also



depend on the PPP model that is followed. Table 2 outlines the various PPP models relevant to ICT.

**Table 2: E-government and ICT PPP models**

Type of Contract	Duration	Nature of Contract	ICT PPP Example
Service Contract	1-3 years	Technical service	Website design and management, ICT capacity building
Management Contract	3-8 years	Manage operation of government service	Call centre staffing
Lease	8-15	Manage, operate, maintain, and invest in a service	Land for ICT infrastructure development, online registries
Build Operate Own (BOO) or Build Operate Own and Transfer (BOOT)	15-25	Construct and operate facilities necessary for service provision	ICT infrastructure, e-procurement systems, e-business portals, network of kiosks
Concession	15-30	Manage, operate, repair, maintain, and invest in public service infrastructure	Telecom operations and expansion; toll road, bridge, or airport facilities management

Source: Adapted from The Institute for Public Private Partnerships (2009:7)

### 3.2. Critical success factors (CSFs) for ICT PPPs

Research on CSFs for ICT PPPs is limited; however, case studies from Singapore indicate a number of CSFs, and Taher, Yang and Kankanhalli (2012:3) identified CSFs in e-government projects in Singapore. The CSF concept is a systematic way of identifying the key areas that require management’s constant attention, monitoring, and management in order to achieve the strategic objectives of the PPP (Babatunde, Perera & Zhou, 2015:82). The findings from these case studies reveal that best practices include the government’s partner’s commitment to deploy ICT innovation and re-engineer business processes in response to the new ICT, and the implementation of state-of-the art technology requires management of fault tolerance (Taher et al., 2012:5-6). Table 3 provides a summary of CSFs that can serve as best practices in terms of managing and implementing ICT and e-government projects. The first column outlines the CSF and the second column outlines where in the project life cycle the CSF is relevant; during establishment, development, or all stages.

**Table 3: CSFs for e-government PPPs**

<b>Project Life Cycle Stage</b>	<b>Factors</b>
<b>Establishment</b>	Feasibility study Systematic evaluation of partners Clear definition of roles and expectations Establishment of key performance indicators and performance monitoring system Risk allocation to the relevant parties Strong and robust agreement Formation of PPP structure Adoption of the appropriate project funding structure Securing project buy-in from all stakeholders and establishing a common vision Clear definition of customer segments and branding and marketing Incentivise stakeholder commitment Public agency to take joint responsibility for overall business development
<b>Development</b>	All stakeholders should be involved in the review and re-engineering process Consolidate and integrate cross-agency requirements Revolutionary business process change Undergo pilot trials and learn from past experience Adopt a phased approach to make vital adjustments and mitigate risk Supportive management with high fault-tolerance in the use of state-of-the-art technologies Commitment of government partner to continuous ICT innovation and service excellence
<b>All stages</b>	Eco-centric leadership structure Commitment from all parties to allocate, time, resources, and efforts Willingness to adapt and change mindset

Source: Adapted from Taher et al. (2012:5-6)

### **3.4. Opportunities for PPPs: Blockchain and smart contracts**

Blockchain is the most innovative technology to be considered under the new digital government paradigm (Allessie et al., 2019:10). Blockchain is a novel digital concept for storing data by decentralising and securing trust between parties wishing to perform a transaction (Norberg, 2019:3). Transactions between parties usually take place through a centralised method that involves a third party such as a financial institution, which could result in security risks and financial costs (Alharby & Van Moorsel, 2017:125). The blockchain system works on a peer-to-peer system by combining a high-level of security based on cryptography (Magnier & Barban, 2018:189). It provides a number of benefits. Firstly, it reduces economic costs, time, and complexities in executing information exchange and administrative functions. Secondly, it reduces fraud, bureaucracy, and corruption via smart contracts. Furthermore, it offers increased automation, transparency, efficiency, integrity, security, and auditability. Lastly, it contributes to increased public trust due to effective record keeping and information availability (Allessie et al., 2019:10). Blockchain provides the opportunity to enlarge the contracting space in PPPs through smart contracts (Cong & He, 2019:1754). Blockchain technology processes currency transactions and ensures that transactions comply with programmed rules through smart contracts (Karamitsos, Papadaki & Al Barghuthi, 2018:177).

A PPP is based on the foundation of a solid agreement and contractual arrangement. A contract is a binding agreement between two or more parties. The digital revolution has introduced new opportunities to formalise and operationalise relationships and contracting (Sadiku, Eze & Musa, 2018:538). Smart contracts provide a digital workflow process, whereby a series of binding steps need to be undertaken before an outcome is reached, and the contract ends after the completion of this process. Smart contracts can provide the public sector the ability to ensure certainty and transparency in transactional processes. Over 46 countries across the globe have launched 200 blockchain initiatives (Berryhill, Bourgerly & Hanson, 2018:19-20). Smart contracts reduce transaction time and costs as the contracts execute themselves by integrating the Internet of Things (IoT) into the blockchain. Contractual fraud is easily detected, thus enhancing the security of contracts (Min, 2018:35). Solarte-Vásquez and Rungi (2018:34) describe smart contracting as “a proactive contract management approach that highlights the value-creation potential of collaborative contract negotiation design and techniques”. Smart contracts offer a mechanism for smart partnering, which will enhance the efficiency of PPPs, which could increase efficiency in setting clear agreements, automating contract administration and management, and

improving risk allocation. The smart partnership concept shifts the attention from procurement and compliance to collaborative management practices (Saidel, 2017:124). Smart contracting is a proactive approach to operationalising contract theory and to seamlessly integrate operational and financial systems (Solarte-Vásquez & Nyman-Metcalf, 2017:208; Sklaroff, 2017:263). The open sharing of information and open innovation is an effective way of boosting partnership success (Wermeille et al., 2015:4).

#### **4. CONCLUSION**

The use of PPPs for ICT and e-government development offers a number of opportunities. The public sector does not have the capacity to fully participate in the 4IR, while PPPs offer the government affordability, value for money, and risk-sharing opportunities in order to develop its digital capabilities to improve service delivery. The deployment of PPPs can improve service delivery and contribute to development. In order for governments to fully participate in the 4IR, robust strategies for ICT PPPs need to be developed. Risk allocation and sharing frameworks can assist in the effective management of PPP agreements. CSFs were identified in this article for consideration in structuring future ICT PPPs. Lastly, recent trends and opportunities to improve PPPs were identified, including the use of blockchain and smart contracts to establish smart partnerships.

#### **REFERENCES**

- Albertus, R.W. (2016). Public Private Partnership Contract Management Failure in Information Technology Service Delivery: A Qualitative Inquiry into the South African Department of Labour ERP Implementation Project. Doctoral Dissertation. Cape Town: University of Cape Town.
- Alharby, M. & Van Moorsel, A. (2017). *Blockchain-Based Smart Contracts: A Systematic Mapping Study*. <https://www.semanticscholar.org/paper/Blockchain-based-Smart-Contracts%3A-A-Systematic-Alharby-Moorsel/5a0e7eebceec42686d39b42de17820f0781a61aa>. Accessed 2019/05/12.
- Allen, B., Juillet, L., Paquet, G. & Roy, J. (2005). E-government and public private partnerships: Regional challenges and strategic direction. In M. Khosrow-Pour (Ed.) *Practicing E-Government: A Global Perspective* (pp. 364-382). London: Idea Group Publishing.
- Allessie, D., Sobolewski, M. & Vaccari, L. (2019). *Blockchain for Digital Government: An Assessment of Pioneering Implementations in Public Service*.

<https://joinup.ec.europa.eu/sites/default/files/document/2019-04/JRC115049%20blockchain%20for%20digital%20government.pdf>. Accessed 2019/07/10.

Auriacombe, C. (2016). Towards the construction of unobtrusive research techniques: critical considerations when conducting a literature analysis. *African Journal of Public Affairs*. 9(4), 1-19.

Babatunde, S.O., Perera, S. & Zhou, L. (2015). Methodology for developing a capability maturity levels for PPP stakeholder organisations using critical success factors. *Construction Innovation*, 16(1), 81-110.

Balkaran, S. (2010). *The Fourth Industrial Revolution - Its Impact on the South African Public Sector*. [https://www.academia.edu/22826511/THE\\_FOURTH\\_INDUSTRIAL\\_REVOLUTION\\_ITS\\_IMPACT\\_ON\\_THE\\_SOUTH\\_AFRICAN\\_PUBLIC\\_SECTOR](https://www.academia.edu/22826511/THE_FOURTH_INDUSTRIAL_REVOLUTION_ITS_IMPACT_ON_THE_SOUTH_AFRICAN_PUBLIC_SECTOR). Accessed 2019/02/02.

Berryhill, J., Bourgerly, T. & Hanson, A. (2018). *Blockchains Unchained: Blockchain Technology and Its Use in the Public Sector*. [https://www.oecd-ilibrary.org/governance/blockchains-unchained\\_3c32c429-en](https://www.oecd-ilibrary.org/governance/blockchains-unchained_3c32c429-en). Accessed 2019/03/02.

Bwanali, S. & Rwelamila, P.D. (2016). *The Role of Public Private Partnerships in the Provision of Infrastructure Projects*. <http://openbooks.uct.ac.za/cidb/index.php/cidb/catalog/download/3/1/121-4>. Accessed 2019/07/02.

Cong, L.W. & He, Z. (2019). *Blockchain Disruption and Smart Contracts*. <http://www.zhiguohe.com/uploads/1/0/6/9/106923057/bdsc.pdf>. Accessed 2019/05/03.

Delmon, J. (2009). *Private Sector Investment in Infrastructure: Project Finance, PPP Projects and Risk*. (2<sup>nd</sup> ed.) AH Alphen aan den Rijn: Kluwer Law International.

Delmon, J. (2011). *Public Private Partnership Projects in Infrastructure: An Essential Guide for Policy Makers*. Cambridge: Cambridge University Press.

Global Infrastructure Hub (2016). *Allocating Risks in Infrastructure Projects*. [https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/GIHub\\_Allocating\\_Risks\\_PPP\\_Contracts\\_EN\\_2016.pdf](https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/GIHub_Allocating_Risks_PPP_Contracts_EN_2016.pdf). Accessed 2019/06/12.

Haenssger, M. (2018). The struggle for digital inclusion: Phones, healthcare and marginalisation in rural India. *World Development*, 104, 358-374.

- International Monetary Fund (IMF) (2004). *Public-Private Partnerships*. <http://www.imf.org/external/np/fad/2004/pifp/eng/031204.htm>. Accessed 2019/06/12.
- Iossa, E., Spagnolo, G. & Vellez, M. (2007). *Best Practices on Contract Design in PPPs*. <http://www.docstoc.com/docs/79764790/Best-Practices-on-Contract-Design-in-Public-Private-Partnerships>. Accessed 2019/06/12.
- Irani, Z., Weerakkody, V., Kamal, M., Hindi, N.M., Osman, I.H., Anouze, A.L., El-Haddadeh, R., Lee, H., Osmani, M. & Al-Ayoubi, B. (2012). An analysis of methodologies utilised in e-government research: A user satisfaction perspective. *Journal of Enterprise Information Management*, 25(3), 298-313.
- Kaliannan, M., Awang, H. & Raman, M. (2010). Public-private partnerships for E-government services: Lessons learned from Malaysia. *International Journal of Institutions and Economics*, 2(2), 207-220.
- Karamitsos, I., Papadaki, M. & Al Barghuthi, N.B. (2018). Design of the blockchain smart contract: A use case for real estate. *Journal of Information Science*, 9, 177-190.
- Kwofie, K.N., Afram, S. & Botchway, E. (2015). A critical success model for PPP public housing delivery in Ghana. *Built Environment Project and Asset Management*, 6(1), 58-73.
- Latteman, C., Stieglitz, S. & Kupke, S. (2009). Impact of PPPs to broadband diffusion in Europe. *Transforming Government, People, Process and Policy*, 3(4), 355-375.
- Magnier, V. & Barban, P. (2018). *The Potential Impacts of Blockchains on Corporate Governance: A Survey on Shareholders' Rights in the Digital Era*. <https://hrcak.srce.hr/file/312259>. Accessed 2019/06/07.
- Min, H. (2019). Blockchain technology for enhancing supply chain resilience. *Business Horizons*, 62, 35-45.
- Mouraviev, N. & Kakabadse, N.K. (2012). Conceptualising public private partnerships: A critical appraisal of approaches to meaning and forms. *Society and Business Review*, 7(3), 260-276.
- Mumbai, A.A.K. (2013). *How Did Estonia Become a Leader in Technology?* <https://www.economist.com/the-economist-explains/2013/07/30/how-did-estonia-become-a-leader-in-technology>. Accessed 2019/05/02.
- Narasimhan, R. & Dasa Aundhe, M. (2014). *Explanation of Public Private Partnerships (PPP) Outcomes in E-Government: A Social Capital Perspective*.

<https://pdfs.semanticscholar.org/b4c2/6e80479fbc54001a74aa7f911c3578f7ea91.pdf>. Accessed 2019/04/02.

Nasim, S. & Sushil, S. (2010). Managing continuity and change: A new approach for strategizing in e-government. *Transforming Government, People, Process and Policy*, 4(4), 339-364.

Nel, D. (2014). Systematic Risk Management and Strategic Control in Public Private Partnerships. Doctoral Dissertation. Johannesburg: University of Johannesburg.

Norberg, H.C. (2019). *Unblocking the Bottlenecks and Making the Global Supply Chain Transparent: How Blockchain Technology Can Update Global Trade*. [https://www.cgai.ca/unblocking\\_the\\_bottlenecks\\_and\\_making\\_the\\_global\\_supply\\_chain\\_transparent\\_how\\_blockchain\\_technology\\_can\\_update\\_global\\_trade](https://www.cgai.ca/unblocking_the_bottlenecks_and_making_the_global_supply_chain_transparent_how_blockchain_technology_can_update_global_trade). Accessed 2019/07/10.

Potnis, D.D. & Pardo, T.A. (2010). Mapping the evolution of e-Readiness assessments. *Transforming Government: People, Process and Policy*, 5(4), 345-563.

Sadiku, M.N.O., Eze, K.G. & Musa, S.M. (2018). Smart contracts: A primer. *Journal of Scientific and Engineering Research*, 5, 538-541.

Saidel, J. (2017). Smart partnership in contracting: Thriving in a period of intense policy uncertainty. *Nonprofit Professionals Forum*, 8(2), 121-132.

Schulze, E. (2019). *How a Tiny Country Bordering Russia Became One of the Most Tech-Savvy Societies in the world*. <https://www.cnbc.com/2019/02/08/how-estonia-became-a-digital-society.html>. Accessed 2019/05/05.

Sharma, V. & Seth, P. (2011). *Effective Public Private Partnership through E-Governance Facilitation*. <https://pdfs.semanticscholar.org/102d/68bd23dfeda3f4bc4f86c77757c0ea42465b.pdf>. Accessed 2019/04/12.

Sklaroff, J.M. (2017). *Smart Contracts and the Cost of Inflexibility*. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3008899](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3008899). Accessed 2019/06/02.

Solarte-Vásquez, M.C. & Nyman-Metcalf, K. (2017). Smart contracting: A multidisciplinary and proactive approach for the EU digital single market. *Baltic Journal of European Studies*, 7(2), 208-246.

Solarte-Vásquez, M.C. & Rungi, M. (2018). Perceptions on collaborating affecting the viability of the SMART CONTRACTING approach. *Journal of Management and Change*, 36/37, 34-55.

Taher, M., Yang, Z. & Kankanhalli, A. (2012). *Public Private Partnerships in E-Government: Insights From Singapore Case Studies*. <https://pdfs.semanticscholar.org/a394/cc2a75809196642bfd1121d02735c5c79df4.pdf>. Accessed 2019/05/03.

Taubman, A. (2004). *Public-Private Management of Intellectual Property for Public Health Outcomes in the Developing World: The Lessons of Access Conditions in Research and Development Agreements*. [https://www.researchgate.net/publication/323683199\\_Public-Private\\_Management\\_of\\_Intellectual\\_Property\\_for\\_Public\\_Health\\_Outcomes\\_in\\_the\\_Developing\\_World\\_The\\_Lessons\\_of\\_Access\\_Conditions\\_in\\_Research\\_and\\_Development\\_Agreements](https://www.researchgate.net/publication/323683199_Public-Private_Management_of_Intellectual_Property_for_Public_Health_Outcomes_in_the_Developing_World_The_Lessons_of_Access_Conditions_in_Research_and_Development_Agreements). Accessed 2019/05/12.

The Institute for Public Private Partnerships (2009). *Public Private Partnerships in E-Government: Knowledge Map*. <http://www.infodev.org/en/Document.821.pdf>. Accessed 2019/03/05.

Wermeille, A., Chanet, J.P., Berducat, M. & Didelot, D. (2015). Stakeholders' involvement in establishing public-private partnerships through innovation in agricultural mechanisation: A case study. *International Journal of Agricultural Management*, 4(2), 68-71.

Williams, I. (2012). Infrastructure development: Public private partnership path for developing rural telecommunications in Africa. *Journal of Technology Management Innovation*, 7(2), 63-71.

Witters, L., Marom, R. & Steinert, K. (2012). The role of public private partnerships in driving innovation. *The Global Innovation Index*, 2012, 81-87.