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Controlling Corruption in Developing Country Public Sector: A Process Ecosystems Perspective

Short Paper

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Abstract

Public sector organisations in developing countries are in immense pressure to deliver citizen-centric services. While corruption is well recognised as a critical obstruction for progress, it is not well understood. This paper consists of a revelatory case study aimed to explore and conceptualise how corruption takes place and what factors contribute to control corruption. It explains how corruption emerges as ‘parasitic process ecosystems’, innate and cultivated due to inefficiencies in the main processes, and how IT-enabled process transformations can alleviate the existence and impact of such parasitic processes. The process ecosystem perspective used here to conceptualise corruption is novel. Derived from the case evidence and supported by existing theories, a conceptual model of corruption control is presented. Insights extrapolated from the case study are presented as useful normative guidelines for practice. Future research to further build on the outcomes of this exploratory study is proposed.

Keywords: Developing country, Public sector, Corruption, Process eco-systems, Transformations, Parasitic processes.

Introduction

Public sector organisations are continuously under pressure to improve their performance in order to provide effective services (Jurisch et al. 2013). This pressure is high and constantly increasing in developing nations, with funding and other socio-economic challenges (Hope 2013). Government departments in developing countries are increasingly embarking on e-Government initiatives with a strong focus on Business Process Improvement (BPI) and Information Technology (IT) to achieve enhanced service delivery (Rajapakse et al. 2012). However, a high failure rate of these e-Government initiatives (approximately 85% in developing countries) has been reported (Dada 2006; Heeks 2003; Hunter 2009). While these high failure rates are attributed to inefficient bureaucratic processes, legacy technological infrastructure, limited resources (financial and human), socio-political and cultural environment compatibility, and poor performance measurement etc. (Ahmed and Gregor 2007; Nguyen and Schauder 2007), they also suffer greatly from prevalent corruption (Gulledge and Sommer 2002).

Corruption is the exercise of official powers against the public interest or the abuse of public office for private gains (Shah 2006). The corruption syndrome is high in developing countries and is reported as a key reason for e-Government failure (Dada 2006; Olken and Pande 2012). The World Bank (2018) highlights the negative impact of corruption, describing how it is a major barrier to eliminate poverty. Corruption causes service inefficiency, increases cost of public services, creates convoluted processes, and allows officials to embezzle funds and create channels for bribes (Olken and Pande 2012). It is a global

phenomenon, with more than 2/3 of countries suffering with moderate to high corruption (Transparency International 2019). Corruption warrants attention and deeper conceptualisation in order to form mechanisms for better control.

Combining Information technology (IT) and Business Process Improvement (BPI) have been considered as one of the solutions that can bring transparency to address the chronic issue of corruption (Bertot et al. 2010). The IT in the form of e-Government has been used by various developing and developed governments to improve citizen access to public services and process efficiencies (Kim 2014). Corruption is identified as one of the key reasons for e-Government failure in developing countries (Aladwani 2016). The research in the selected domain is primarily focused on the IT aspect with limited explanation of the role of processes. Based on our observations, we suggest addressing the identified research gap and exploring the relationship between IT and processes.

This paper consists of a revelatory exploratory case study aimed to answer the question, “How can public sector organisations control corruption using IT-enabled process improvement?” In the next sections, we first present the applied case study approach and introduce the case. We then present the observations in the form of a case narrative, which forms the evidence-base to the proposed conceptualisation, which is also further supported with eminent theories (as sense-making devises). We conclude the paper with a summary discussion and suggested propositions for future investigations.

Case Study Methodology and Introducing the Case Study

We followed a single in-depth case approach for this paper. Single case studies are known to provide rich insights and be well-suited for exploring a novel and revelatory phenomena (Lee 1989; Yin 2009). The findings are based on a unique transformative initiative that occurred at the Department of Motor Traffic (DMT), in the Western Province of Sri Lanka. The DMT is a case that initially suffered from deeply rooted corruption, which was put under control through a number of innovative IT-enabled process transformations that took place in an iterative manner, making it a rich case. Interviews and document analysis were used to collect the research data. Interviewees were identified using Noy (2008)’s snowballing approach during the case exploration and consisted of key personnel from the DMT and ICTA who were involved in the transformation activities. A few citizens were also approached during the data collection process. Details of the interview participants are provided in Table 1.

Table 1. Interview Participant Profiles			
Participant	Assigned Code	Role	Duration
Commissioner-DMT	CM-DMT	Transformation Leader	3 x 90 min
Director-DMT	DR-DMT	Internal Stakeholder	1 x 60 min
Finance Officer	FO	Team Member	1 x 90 min
Counter Clerk	C-Staff	Internal Stakeholder	1 x 60 min
IT Manager	IT-Staff	Team Member	1 x 90 min
ICTA Programme Manager	ICTA-PgM	Programme Manager	1 x 90 min
ICTA Project Manager	ICTA-PM	Project Manager	1 x 60 min
Citizens (x 2)	Citizen #1, #2	End User	2 x 30 min

Interviews were open-ended, extrapolating the interviewees’ perspectives of the pre- and post-transformation conditions and outcomes. A range of official documents (inter-organisation reports, process and system studies, solution designs, as well as reports publically published by the ICTA and DMT) were collected and analysed to augment observations from the interviews. Interview data was transcribed, verbatim coded, and analysed using NVivo (a qualitative data analysis software). The data was analysed iteratively using Dubois and Gadde (2014)’s systematic combining approach where key factors that helped to control corruption were inductively identified and analysed (with further insights from literature) to form the conceptualisation of IT-enabled process ecosystems to control corruption.

The DMT issues and renews vehicle revenue licenses (a receipt of road tax) in Sri Lanka. As of April 2019, there are 7,727,411 registered vehicles in Sri Lanka, out of which the Western Province constitutes approximately 30% of the registered vehicles (MoTCA 2019). The department issues approximately 1.2 million vehicle revenue licenses annually (Bhatti et al. 2014), with a total earning of 10.6 billion Sri Lankan Rupees (US\$ 93 million) in the year 2017 through the taxes and levies on vehicles (MoTCA 2017; MoTCA 2019).

The transformation efforts were originally initiated in 2003 by the DMT staff to overcome the paper-based and inefficient processes to improve the service requirements of the citizens. Multiple initial attempts were unsuccessful and consequently in 2006, the e-Revenue Licence (e-RL) project was conceptualised and implemented by the DMT and the Information Communication Technology Agency (ICTA). ICTA is Sri Lanka's apex government agency that leads public sector BPI and IT-enabled transformation. Initially, a client-server based system to digitally print the license was implemented at the DMT head office and later, extended to its 29 branches in the Western Province. Next, in 2008, an innovative "On the Wheel" revenue license process was introduced to further improve service delivery. The next improvement was in 2015 when an online e-Revenue License service (eRL) was launched to improve the citizen access and the efficiency of licensing services. These initiatives were designed to fully automate the revenue license issuing process using centralised databases to facilitate renewals. Though it was not the prime focus, these changes enabled the DMT to contain corruption by facilitating the process efficiency, sustainability, and ease of service access to the citizens.

Case Narrative and Emerging Findings

In the case of the DMT, corruption emerged due to inherent process inefficiencies fuelled by the prevailing socio-political and socio-economic conditions of the country. Prior to the implementation of the e-RL, vehicle registrations followed a manual, paper-based process. A citizen was required to physically visit the DMT office where the first revenue license was issued. Stepping into the DMT during the work hours of 9am to 3pm was chaotic. Queues of people lined up to renew their revenue licenses; with many complaining of delays and inefficiencies for their service requirements. The process, in most cases, took two days to complete. Staff were over-burdened with trivial clerical work, which resulted in other important work being delayed. Citizens were sent to several service counters to complete their work. A citizen had to stand in three separate queues for verification of documents, for payment, and finally, for issuing of the license to complete the process. Furthermore, different vehicle classes had dedicated counters. A customer who wished to obtain licenses for different vehicle classes had to approach the separate counters to complete the process for each class of vehicle, resulting in much longer waiting periods.

These conditions provided opportunities for local area residents belonging to the low social-income class to act as 'brokers' to assist citizens by offering their services as workarounds (i.e. standing in queue, photocopying documents, and filling forms etc.) for a mutually agreed fee. These brokers recognised the citizens' reluctance to spend time and effort as an economic 'opportunity', and collaborated with few internal staff in exchange for shared financial incentives, leading to the emergence of corruption (in the form of bribes). Brokers also started to print out forged revenue licenses and were issuing the documents to the citizens for a fee, causing significant losses to the government (in the form of road tax); *"A parallel system (unofficial) existed outside the DMT office that was operated by many brokers. They were running their business using the opportunity that currently existed due to the inefficient situation in the office"* (CM-DMT). These forged licenses were quite a lucrative source of income for the brokers. At the same time, because these brokers were stationed in very close proximity to the DMT premises, citizens wrongly assumed that their licenses were original. The only time a citizen realised their mistake was when they came back the next year to renew their licenses and received penalty charges for deferred renewal; *"Upon receiving the payment from a citizen to provide their services, the brokers came into the office, and got counterfeit licenses made for the citizen instead of the original license"* (CM-DMT). Apart from inefficient processes and long waiting times, citizens were also concerned with the deteriorating security situation of the country. Sri Lanka was facing a civil war, and terrorist attacks on government offices were common. The fear for their safety acted as an enabler and motivated the citizens to spend less time at DMT by getting their revenue licenses using brokers. The brokers recognised this opportunity and created various methods to maximise their income; *"One of the reasons behind the corruption was the terrorist activities in the country in that era. The government offices were potential targets for the terrorists and people were*

concerned about their own safety. These concerns made citizens tolerant of the brokers' fraudulent activities to save time and reduce risks" (CM-DMT).

In 2006, a new head of department (the Commissioner) joined DMT. He immediately recognised the severe inefficiencies and citizen problems. As the first step, he did walkthroughs of every citizen-serving process to understand the ground realities; *"For three months I examined the office to understand the issues behind high process inefficiencies and the prevalent corruption; I also joined the queues along with the citizens to understand the problems the citizens faced when they came to the office to pay their dues to the Government"* (CM-DMT). The efforts resulted in a clear understanding that the critical issues were related to extremely inefficient processes. As the next step, the Commissioner identified a few staff members who also shared his vision, and had the passion to improve the situation. Organisational culture and inter-departmental coordination were also contributing to the inefficiencies. Initial efforts to streamline the processes were met with stiff resistance from certain staff at different levels who were engaged in corrupt practices. They feared that process improvement efforts would result in financial losses; *"they used to earn plenty of commissions (in the form of bribes); by evening they used to have enough money to lavishly spend in hotels and restaurants"* (FO). The transformation proposals were also blocked by the administrative and bureaucratic barriers; *"we came across resistance from red tape and bureaucratic rules and regulations and the officers (Staff) of the department who had benefitted by this situation"* (CM-DMT). These internal issues further benefited the brokers.

However, as a result of the Commissioner's persistent personal efforts and appeals to higher authorities, an approval to initiate the process reforms as a pilot project with limited resources was received from the Chief Minister of the Western Province. The digitally-printed license format was introduced to replace the manual pre-printed license books. Multi-purpose one-stop service counters were created for citizens to renew any class of vehicle license. A custom-built IT system was implemented to record license details in a centralised database. Counter staff were empowered to authorise documents as well as issue new licenses. To motivate the staff, a commission-based financial incentive scheme was also introduced. As a result, the process cycle time was reduced to 5 minutes from 2 hours, and brokers were unable to forge the licenses anymore.

The main office issues 1,200 licenses each day, with an approximate number of 200,000 licenses annually. The redesigned and improved processes and IT system brought about a major paradigm shift within the staff. Staff were able to work more productively, and were also happy in their empowered roles. However, the brokers were still able to contact their counterpart staff and entice them to expedite the process for their clients by offering financial incentives. To contain the corruption, the Commissioner introduced directives to restrict the brokers entering the office and communicate with the staff; *"I made a rule that the officers could not issue licenses to the brokers, and the brokers could not come inside the office and contact the officers for any reason"* (CM-DMT). This step created a number of issues for the DMT staff. The brokers' network reacted, as the Commissioner's decision severely affected their economic well-being. A delegation of brokers met the Commissioner to complain; *"A brokers' delegation visited me and mentioned the negative effects on their livelihood and income, that they were poor people and had children to look after. They offered to carry on their service and solicit with people and requested permission to come inside the DMT office only to submit the application form and to deliver the renewed license to the citizen once the process is complete"* (CM-DMT).

The Commissioner was well aware of the brokers' socio-economic issues. To create a win-win situation, the brokers were allowed to provide services with some level of legitimacy by introducing a 'registered broker model' to allow their entry into the office and also to charge a reasonable amount from the citizen who opted to get broker-services. However, the citizens preferred getting the services directly from the office due to improved efficiency of formal processes. The brokers' network reacted violently and resorted to creating new concerns for citizens. Citizens were worried about the safety of their vehicles parked outside while they obtained their licenses. People were being swarmed by brokers who constantly patrolled the car park to extort money from citizens in return for procuring the revenue license. Once a citizen file was taken over by a broker, legal actions could not be taken against the brokers, as the citizen's presence to obtain the revenue license was not mandatory. Furthermore, staff who refused to collaborate with brokers were receiving threats, putting them under constant pressure; *"Citizens who had refused the broker services started complaining about their vehicles getting damaged and parts being stolen. The broker gangs had started to charge extortion money from citizens who parked their vehicles and started causing damage and stealing parts of those who refused to pay the money. There were threats to the officers from the 'thugs'*

who were running their illegal operations outside of the DMT office. So I had to contact the police and got their involvement whereby there were a few thug arrests by the police” (CM-DMT).

This critical situation and concern for the staff and citizens’ wellbeing motivated the Commissioner and his team to think outside the box and launched one of the most innovative ideas in the Sri Lankan public sector. In keeping up with the latest technology and process-benchmarking against McDonald’s for customer service, the DMT implemented a swift “Revenue License On-the-Wheel” process. This is a drive-through system where the motorists could obtain their revenue license in two minutes by simply handing over the completed documents to a special counter while seated in their vehicle. The main objective of the drive-through license process was to prevent the involvement of third-party brokers in obtaining revenue licenses. Furthermore, it also addressed the safety concerns of the citizens. “Revenue License On-the-Wheel” was made available at the main office in Colombo, which handles the bulk of the transactions in order to serve the public more effectively. Around 80 to 300 licenses per day are renewed using this process.

In a bid to effectively manage the service demand, the Commissioner contacted the Secretary of Public Administration to gain approval for increased service time from 8.45 am to 4.00 pm, instead of the usual 9.00am to 3.00pm followed by all public sector offices in Sri Lanka. This enabled the DMT to provide their services at more convenient hours to the public. As a result, there was a drastic improvement in service delivery and containment of corruption. The brokers were unable to find much opportunity to interfere with the new processes and IT systems introduced by the DMT; *“As an outcome of these steps, day by day, the number of brokers started to come down” (C-Staff).*

The technology-enabled process innovations continued at the Department. As a final solution, an Online Revenue License System was implemented by ICTA in consultation with DMT staff. The system allowed citizens to apply and pay for the required license without visiting the DMT offices. The introduction of the online service resulted in complete elimination of the brokers’ illegal network by blocking their interference with the staff and operations. The success of the DMT was immense, leading to many other departments following suit. Today, all DMT branches in the Western Province run the new system. This is also the only province that dramatically cut costs by redesigning the digital revenue license template.

Summary Discussion

We observed key factors that create opportunities for corruption in our analysis. The inefficient processes, absence of adequate technology, and terrorism concern for citizen safety were the key factors that instigated citizens opting for corrupt practices as an alternative option; *“So with such barriers in getting efficient services from the department, there was a tendency from the general public to do something or give something (in forms of bribes) to get things done fast. This led to corrupt practices and lack of integrity in the department” (DR-DMT).* The salary level in the public sector is generally considered lowly by the staff. The economic benefits were the main cause that enticed the staff to collaborate with the brokers. These factors provided rich conditions that led to the emergence of close-knit broker-staff coalitions that introduced and sustained their workarounds and malpractices, forming a parallel ecosystem. The initial efforts to ‘cure’ the corruption were not successful.

The steps taken to provide a legitimised status to the broker’s network did not produce long-term results without addressing the process inefficiency issues. The absence of an attractive financial incentive scheme to address the legit economic concerns of staff negatively affected the steps taken to block the brokers’ access. The parallel ecosystem responded by adopting different approaches (by extortion and threats to the citizens and staff who refused to collaborate with them) to maintain its sustenance. The issue of process inefficiency and the resultant corrupt alliances were strongly emphasised in the data; *“there was corruption and lack of integrity that occurs when systems don’t help the people to get services in an efficient manner; it is either because the system makes it difficult leading to corruption, or the system itself is designed to be difficult and complicated that results in corruption” (CM-DMT).* The case findings also highlight the importance of in-depth understanding of socio-economic factors that catalyse the development and sustainability of these parallel process ecosystems. The DMT leadership was quite effective in identifying the key social issues associated with the brokers’ network; *“We also need to understand the social background of these people who were acting as brokers around the office. The office was surrounded by the people who were resettled in the area from the poor suburbs of Colombo. With limited*

education and job skills, these communities found brokering an avenue to generate income. And it was a very difficult task to get rid of them” (CM-DMT).

Through our data analysis, we observed that corruption transmutes its form, behaviour, and intensity as an outcome of different steps undertaken to curb it. The ultimate solution was a simple yet innovative IT-enabled process design, and an effective organisational culture change that completely eliminated the process loopholes and ceased access to the opportunities for exploitation by the brokers' alliance.

While 'stakeholder analysis' has been emphasised as a critical factor for process improvement initiatives by many, the diverse stakeholder groups that impact these initiatives are often misunderstood (Hailemariam and vom Brocke 2010). For effective process improvement, all the different stakeholder groups need to work toward the target outcomes as a coalition. Hence, it is important to identify all the groups and their needs in process re-design and implementation. In addition to the traditionally acknowledged process stakeholders such as employees, service/IT contractors, and customers, this case study illustrates how there can be other stakeholders and potential risk elements. For example, the interests of the brokers that created the parallel ecosystem had to be appropriately considered in designing processes and IT systems. Not understanding their interests and acknowledging their existence would open up opportunities for processes and system exploitations.

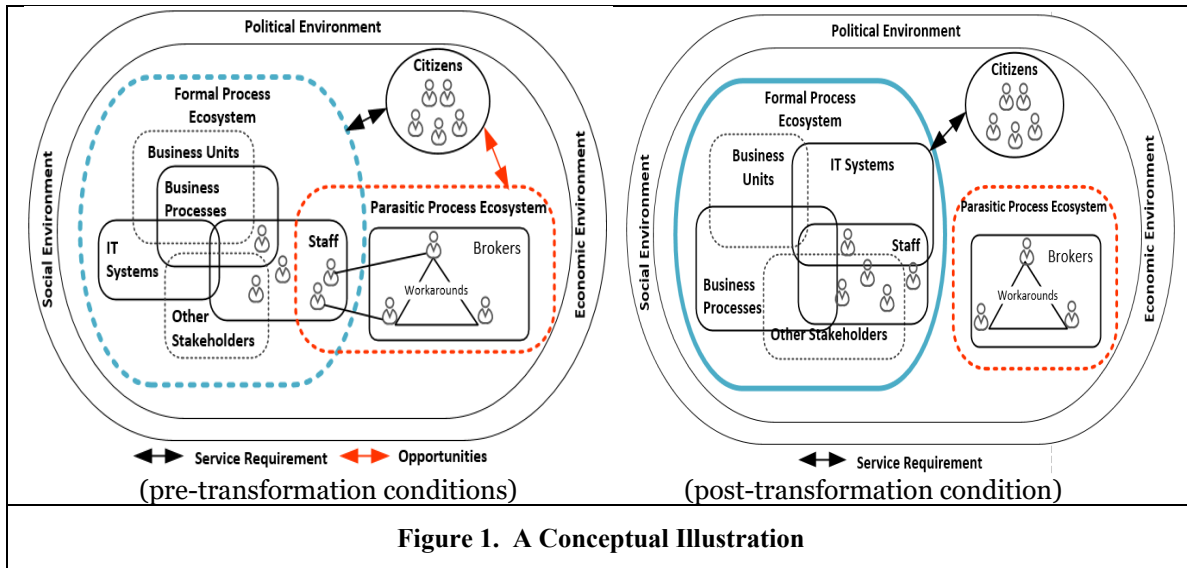
The credit of this success story is mainly attributed to the mindfulness, innovative thinking, process-awareness, and able leadership of the Commissioner; *“the key factor is the champion at the department, and if it wasn't for him we wouldn't have achieved the success”* (ICTA-PM). His hands-on 'lead by example' approach, persistence, and can-do attitude not only motivated the staff of the department, but was well-appreciated by the citizens and other public sector officers. The steps and strategies adopted by the Commissioner provide an excellent example of constraint-based innovation (Agarwal et al. 2016) that is especially relevant to resource-scarce government contexts. The case study highlights the importance of developing a sustainable process-aware culture in public sector organisations. The details shared provide valuable lessons on how process thinking and innovative IT-enabled process design can be used to effectively overcome prevailing corrupt practices and resultant parallel process ecosystems.

A Novel Conceptualisation of Corruption Control

Organisations are 'systems' that utilise people, processes and resources to deliver products and services (Robbins et al. 2004). Organisations develop a variety of business processes enabled by information technologies with the desire to create efficient, effective and sustainable outcomes. Although no organisation will consciously design their processes to be inefficient and under-optimised, due to the dynamic nature of organisations and interactions with a number of environmental and contextual factors, organisations have to continuously redesign and innovate their processes. In the public sector, these process transformations are planned, designed, and implemented within complex networks involving human and non-human actors (i.e. Systems) with multiple stakeholders (Syed et al. 2018), requiring ecological thinking and organisational ecosystems (Mars et al. 2012).

In natural sciences, an ecosystem is defined as *“an assemblage of organisms and the biotic and abiotic environment in which they occur... within an ecosystem, multiple species interact with each other, both directly and indirectly, via their shared environment and resources. The structure of the ecosystem and the many species interactions within it determine the abundance and dynamics of each species, the flow of energy through the system, and ecosystem functions such as stability and productivity”* (Rynkiewicz et al. 2015, p. 212). Whereas, a process ecosystem is explained by Vidgen and Wang (2006) as a framework that incorporates 'business users, processes, technology, and software'. They describe how mutual adaptation takes place between these four components with a complex network of relationships in a process ecosystem. They also state that *“the business process core ecosystem does not have a hard boundary with its environment; rather it will have a close relationship with other systems, entities and stakeholders ... with which it will co-evolve”* (Vidgen and Wang 2006, p. 264). We position the form and behaviour of the brokers' network and their workarounds as parasitic in line with the definition provided by Price (1977, p. 405) which states that a parasite is *“an organism living in or on another living organism, obtaining from it part or all of its organic nutriment, commonly exhibiting some degree of adaptive structural modification, and causing some degree of real damage to its host...parasites are specialists in a host environment with close co-evolutionary ties.”*

Inspired by Vidgen and Wang (2006) and Rynkiewicz et al. (2015), we adopted a ‘parasite process ecosystem’ view to explain the phenomena observed (Figure 1). We define a ‘parasitic process ecosystem’ as the ‘existence of ad-hoc and illegitimate network agents who create workarounds and continually seek opportunities to thrive on the inefficiencies and ineffectiveness of a formal process ecosystem’.



The practices of brokers fit the definition of workarounds which are the variations from standard business processes and can affect the performance of an information system (IS) negatively (Alter 2015; Röder et al. 2014). Essentially, we position corruption as parallel ‘parasitic’ workarounds that thrive off the weaknesses (i.e. inefficiencies, lack of governance, lack of conformance) of the formal processes and IT systems. These weaknesses enable and create opportunities for parasitic elements to exploit the vulnerabilities of formal process ecosystems and to find ways to infuse themselves with the process ecosystems through potential access points (i.e. by identifying vulnerable staff and citizens, poorly design processes etc.). These interventions to the formal processes are ‘parasitic’ as they ‘drain’ critical essence (i.e. cash flow, integrity, quality etc.) and weaken the performance of the formal processes and IS. The case depicted how the parasitic elements intervene with the formal process via corrupt agents (i.e. corrupt staff) and gained illegitimate access to the formal processes. Inefficient, ineffectively designed, poorly controlled processes, and citizen’s at risk acted as easy targets (i.e. opportunities for corrupt practices) that led to the creation of workarounds by the parasitic elements as an alternative to offer quick solutions to process users (i.e. the citizens) for a financial incentive. Furthermore, the case also depicted how surrounding social and economic factors (i.e. poor economic conditions of staff and brokers, political conditions such as vulnerability to terrorism, or red tape that blocks positive changes) also play a key role that fertilises corruption. These socio-economic and socio-political factors are common in public sector organisations, especially in developing countries, which makes them attractive ‘breeding grounds’ to parasitic ecosystems. Cohen and Felson (1979) explained that the key focus for corruption containment should be on guarding the access points or the insufficiently protected conditions and targets. Through the case findings, we illustrated how corruption transmutes its form and sustains itself if stakeholders develop preventive measures by only using either process-improvement activities or managerial controls. We concur that effective control of the parasitic elements is possible by an effective and innovative combination of robust organisational change supported by top management, well designed IT systems and innovative processes to guard the access points to enable the formal process ecosystems to prosper, free from ‘parasitic’ interventions from other parallel process ecosystems. Our findings extend the Vidgen and Wang (2006) statement that a process ecosystem does not have a hard boundary; we assert that in case of parasitic ecosystems, IT can be effectively used as a hard boundary to isolate and shield the formal ecosystems against parasitic ecosystems. Furthermore, providing a secure and direct interface to organisational processes through IT systems can completely eliminate the citizens’ needs to seek workarounds offered by the parasitic ecosystem leaving them in a dormant status.

Conclusion

The study provides a novel, theoretically grounded, and empirically supported explanation on how corruption occurs and how it can be managed. Using a rich case from a developing country public sector context, this paper describes corruption as parallel 'parasitic' process ecosystems. These parasitic process ecosystems emerge due to opportunities created by inefficiencies of formal processes and are further fueled by socio-political and socio-economic conditions. Once formed, these parasitic process ecosystems are resilient; continuously transmuting to counteract restraining mechanisms. Findings depict how parasitic process ecosystems can be better contained by the effective use of IT-enabled process transformations to reduce the opportunities by guarding the access points. The case also pointed to the critical role that effective change management and leadership played in 'making things happen'.

The paper points to a number of normative guidelines for transformation champions (especially in contexts prone to corruption, such as developing country public sectors) to consider. A shift from a simple process view to a process ecosystem's view is highlighted, and the need to analyse the situation beyond the traditional boundaries of processes and systems is denoted. This also means that stakeholder analysis for IT-enabled transformations should hold a broader perspective to include potential parasitic ecosystems. Methods of process analysis and design should be deployed to identify and manage potential access points that parasitic processes can use to intervene with the formal processes. Innovative IT systems supporting the business processes can act as the citizen interface by guarding all potential process vulnerabilities. Thus, the design, deployment and continuous maintenance of IT systems should incorporate effective controls to quell parasites.

The insights of this exploratory case study can be developed with further research. A more comprehensive conceptualisation of parasitic process ecosystems, with an enhanced definition, multiple examples and a typology of parasitic process ecosystems will be helpful. Given that access points facilitate the coevolution of parasitic workarounds, further research is needed to systematically identify the attribute of 'access' points and their vulnerability factors. Furthermore, studying how parasitic ecosystems evolve, transmute and create workarounds, and the rate at which these workarounds transmute in response to controlling interventions could present novel insights useful for process innovations.

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