

# Chapter 1

## Corruption Networks: An Introduction



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Just as it is impossible not to taste the honey or the poison that finds itself at the tip of the tongue, so it is impossible for a government servant not to eat up, at least a bit of the king's revenue

—Kautilya (*Arthashastra*), c. 350-275 BC

**Abstract** To understand corruption, scholars cannot only analyze the details. We need to see the features, the agents, the interactions, the structure, and the dynamics. One way to get the whole picture is to model the corruption processes and systems as a network. This chapter is an introduction both for the corruption networks modeling and the rest of the book. It covers some of the earlier developments from social sciences and complexity that form the foundation for the more specialized topics of the other chapters.

### 1.1 Corruption as a Social Problem

In a boundary dispute between Damascus and Sidon in Ancient Syria circa AD 30, Agrippa, one of the advisers of Governor Lucius Pomponius Flaccus, accepted a bribe to use his influence to support Damascus interests in the dispute. However, this episode was not an isolated event. Various politicians, advisers, and thinkers in Ancient Egypt, Ancient Greece, Ancient India, the Roman Empire, Imperial China, or later in Renaissance Italy had noticed acts of corruption in some institutions of their governments. Thus, corruption is part of humanity and is not an exclusive problem of modernity or the result of the rise of capitalism. Nor is the result of ethnic origin, educational level, or the economic situation of a population. However, modernity

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has eventuated in forms of social disorganization has included escalating levels of violence, corruption, and ecological degradation [1].

Corruption has been analyzed from various areas and approaches, mainly from ethics, morals, and law [2, 3], since it is a behavior that goes beyond the simple application of the law and the obedience to law is not taken for granted [4]. Likewise, corruption has been analyzed by anthropology [5], political science [6–11], sociology [1, 12, 13], philosophy [14, 15], and economics [16–18]. The social sciences perspective has established that corruption affects society from different fronts, but always with social costs [19]. The approaches of these sciences have been fundamental to investigate various elements, especially qualitative ones that are necessary to understand the phenomenon of corruption. Additionally, several academics have defined this phenomenon based on the inequality trap and the theory of injustice as part of its advance [20–22]. From economics, the validation of corruption impact has also been analyzed from inequality and poverty perspectives. Additionally, corruption affects economic freedom [23, 24], economic growth [25, 26], investment processes [27, 28], and economic development [29–31]. These arguments have defined that corruption is deeper in countries with economic difficulties, which in several cases is true [32–34]. However, empirical evidence had shown corruption in countries with high levels of foreign investment, economic growth, and economic development, as well as income equality [35]. Corruption is not a phenomenon exclusive to developing countries or those mired in poverty, corruption is more visible in those countries because it is not possible to understand how in these countries with problems in the provision of utilities, education, and health, a public officer enjoy privileges that his salary would not allow. Likewise, although some authors mention that countries with high economic freedom are less prone to corruption, it does not mean that they are exempt from it. Furthermore, the corruption from the organizations is a relevant element in corruption processes [36, 37].

It seems that our society has become accustomed to a corrupt framework since corruption acts are more frequent at various levels. From billionaire public contracts to everyday life where small corruption processes arise in exchange for paying a few coins. Those macro and micro corruption processes have accompanied our society with different manifestations that lead to other crimes such as discrimination, influence peddling, fraud, tax evasion, or money laundering, to list a few. The corruption framework has gone so far that, in some countries, the only way to win a contract or obtain a public document is by somehow paying a benefit to an official. Every corruption act needs the procedures to achieve its final purpose: economic benefit.

Does a great concern arise on why people do not stop at any conflict of interest? Could the path to corrupt actions make more difficult? Interest conflicts are not corrupt's concern, and they accelerated the intention to obtain benefits from them without any qualms. Namely, corruption has progressed smoothly to convert on a systemic phenomenon in which particular interests outweigh collective interests. Corruption arises as part of the human condition and is connected with the capacities to do something, as Arendt [38] argues when referring to the human capacity for thought. However, with its advances, corruption is closer to being an attribute of the human-animal, i.e., corruption is a part of human essence and daily life. This

conclusion may be simple speculation, but after more than 2,000 years of documented corrupt acts, corruption is part of humanity to the full extent of the word.

Social sciences have identified reasons and consequences of corrupt actions with more than 10,000 articles and technical documents. However, it is necessary to identify the dynamics of corruption since they go beyond the interaction of a couple of persons or the dominant position that induces this type of action. Likewise, it is necessary to identify the evolution of corruption since it is an action that is increasing and is repeated generation after generation, expanding more and more at different levels of public and private contexts. However, corruption tries to go unnoticed, unidentified, to hide in changing scenarios and different temporalities. In other words, corruption is a complex system with open and adaptive features, which for its analysis requires a group of tools in permanent transformation.

## 1.2 Corruption, Complexity, and Networks

Several authors of complexity science have approached the analysis of social problems. Corruption emerges as part of a human social environment, and it requires the complexity profile proposed by Bar-Yam [39] as a mathematical tool to characterizing the collective behavior of a system. Additionally, since corruption tends towards a progressive appearance of collective behaviors of ever-larger groups of people, it becomes a system that grows in complexity but also in adaptation, i.e., adaptive complex systems [40–42]. Thus, unlike Agrippa's case in Ancient Syria, where his corrupt actions involved only him, in the 21st century, corruption integrates increasingly large groups of people, possibly due to the actions that must be carried out to obtain the benefit.

The discouraging reports of Transparency International [43, 44] and international organizations as the United Nations, World Bank, and International Monetary Fund, as well as the corruption problems in different countries like Brazil, China, Colombia, Haiti, India, Italy, Mexico, Nigeria, Philippines, Venezuela, and a long list of countries, have increased the interest of scholars of complexity. From approaches with applied perspective or pure theoretical perspectives [45–54], the corruption studies have won new investigations in the last years that identify corruption as a complex system where statistical mechanics, nonlinear dynamics, complex networks, artificial intelligence, and other methodologies consolidate new approaches to social problems like sociophysics [55], but also a combination of methods.

Complex systems consist of diverse elements that self-organize, driven by their random interactions, into ordered systems that exhibit feedbacks and nonlinearities. Complex systems are exposed to perturbations but also some features that emerge from the interaction with the context. Thus, we need to understand corruption networks as a complex networks [56–60]. First, corruption networks are involved with the randomness of interactions that create an evolutionary process. Second, corruption networks evolve when they do not have limits, generating cascading processes that affect public and private resources. Third, the diffusion process of corruption

can accelerate the collapse of institutions and organizations. Fourth, the policies and tools to fight corruption are urgent because if corruption networks elevated to greater diversity (more agents and interactions), the higher is its survival probability. Fifth, if we understand the dynamics of corruption networks, the tools, and hence the policies, should be to restrict the dynamics and openness of the corrupt system. Sixth, if we identify the feedback process of corruption networks, the tools could limit it to reduce the consolidation of the corruption complex system.

I have given an overview of the corruption networks. Furthermore, I have explained the challenges in extending the corruption analysis to a multidisciplinary framework because that phenomenon is not an issue of one discipline, the corruption is a human problem that needs an elite group of diverse methods that create tools to fight it. The challenges to study corruption are intellectually fascinating, but also they have social retribution since useful tools are waiting to apply in different places of the world. However, many challenges remain. The studies of corruption and related crimes as tax evasion and money laundering need a dynamic perspective of methods to identify the evolution of these phenomena. Network science, complex systems, dynamic systems, statistical mechanics, topology, geometry, artificial intelligence are several methods to fight corruption evolution, a social problem that social sciences have fought for years. Those methods are a methodological complement to social science to reach a phenomenon that has taken us a great advantage. Future works range to fight corruption effectively as how to use geometry to identify corruption cycles and how to make simulations of corrupt systems to create public policies. Hence, this book is the first result of a group of scholars that needs other scholars that join this enterprise to solve a problem that could be as big as climate change.

### **1.3 The Structure of the Book**

Writing an analysis of corruption represents a challenge for any scientist. How can corruption networks, which make up the subject of this book, be separated from the national environment when corruption advance in many places worldwide, and the suspicious agents used different instruments to hide their actions? What is the exact purpose of this book? This book aims at presenting an overview of the state-of-the-art in corruption networks. Its chapters are contributed by researchers and research teams from a variety of backgrounds, disciplines, and approaches to corruption. Our target has been to cover the emerging field of corruption networks both in breadth and in-depth, and because of this, some chapters are reviews on relevant topics such as social capital and control theory in corruption networks, whereas others provide detailed accounts of investigations building on corruption processes using network science framework, from a local or specific topic or an international network to a new perspective about corruption analysis.

The following chapters focus on different methods for characterizing corruption networks. In the chapter social capital, corrupt networks, and network corruption, Willeke Slingerland presents a different outlook on the link between networks

and corruption. She develops the concept of network corruption, which is the phenomenon of collective acting by networks, which results in corruption even if the individual acting itself is not necessarily corrupt. The concept considers corruption as a social process within networks. This is followed by a chapter that focuses on one of the relevant features of corruption networks, especially those related to control. In the chapter Network controllability metrics for corruption research, Philip Solimine provides us with an account of how metrics of network control theory facilitate understanding the mechanisms by which corrupting actors can perturb nodes' behavior at certain points within a social system, especially the political corruption in a legislative social network. The chapter analyzes as corrupting actors harness perturbations to drive the network to a desirable state where they can amplify the effects of corruption using a social influence network or hierarchy.

Then, in the chapter Predicting corruption convictions among Brazilian representatives through a voting-history based network, Tiago Colliri and Liang Zhao address the voting data concerning almost 30 years of legislative work from Brazilian representatives, focusing on identifying the formation of corrupt neighborhoods in the resulting congresspeople network through a predictive model for assessing the chances of a representative for being convicted of corruption or other financial crimes in the future, solely based on how similar are his past votes and the voting record of already convicted politicians. In the chapter Networked Corruption Risks in European Defense Procurement, Agnes Czibik, Mihály Fazekas, Alfredo Hernandez Sanchez, and Johannes Wachs study Defense procurement to develop an objective corruption risk indicator. They identify that risk indicator is higher for military contracts than for contracts in general, and the corruption risk is significantly higher in the periphery, while in others, it is higher in the center. This chapter connects the corruption networks and economic crimes based on corruption. In the chapter Identifying tax evasion in Mexico with tools from network science and machine learning, Martin Zumaya et al., analyze with those methods more than 80 million contributors and almost 7 billion monthly aggregations of invoices among contributors to identify tax evaders. They build temporal networks where nodes are contributors, and directed links are invoices produced in a given time slice and show that their interaction patterns differ from those of the majority of contributors.

This chapter on tax evasion connects with another economic crime: money laundering. From a legal perspective, Frank Diepenmaat describes in this chapter the international legal framework for the repression and the prevention of money laundering from an existing network in place to fight this crime and initiatives to create new networks with better cooperation between government institutions and private organizations. In a second perspective, Oscar Granados y Andres Vargas analyze the large-scale structure of global financial networks and focus on particular aspects of their characteristics when suspicious activities of tax fraud, corruption, and money laundering could be identified. They reveal that suspicious activities run in small groups, and they emerge around communities of financial intermediaries, non-financial intermediaries, and offshore entities. Finally, José Nicolás-Carlock and Issa Luna present some problems in corruption analysis that need to analyze them as the complexity of the corruption phenomenon itself and its context, the complexity

of the analytical description, and the complexity of the perspectives that different disciplines bring to the table. They argue that the interdisciplinary framework of complex systems and network science represents a promising analytical approach to move a new inter-disciplinary framework for corruption studies: corruptomics. This final chapter is not an epilogue. It is the first input to create an open system where diverse scholars, using methodologies from physics, mathematics, computer science, and social science, are interested in developing tools to help to reduce the corruption of our corporations, institutions, towns, cities, regions, countries, but principally to reduce it on the next generations.

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