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# KAKISTOSCRYPTOCRACY

Srirath GOHWONG<sup>1</sup>

1 Faculty of Social Sciences, Kasetsart University, Thailand; fsocsrg@ku.ac.th

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## Abstract

Sovereignty is one of the most important characteristics of the state. However, it is in tension because new players are emerging that are not subject to the jurisdiction of the state. These players include cryptocurrencies, underground websites (including deep web and dark web), and pirate organizations. Srirath Gohwong invented the term "kakistoscryptocracy" to describe this occurrence. The key objectives of the study were to investigate the state of the art of kakistoscryptocracy and to seek initial solutions for this phenomenon. In the study, documentary research was done. The findings showed that the kakistoscryptocracy framework consisted of state-based, stateless-based, and net states-based areas for both actual and virtual worlds. Non-state actors anarchically did all affairs and transactions within and across borders of the state by using Inagaki's strategy of weeds. Last, tech ambassador and corsair were two alternatives for the formation of kakistoscryptocracy.

**Keywords:** Kakistoscryptocracy, Net States, Metaverse

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## Significance of Problem

Sovereignty is the most important component of the state according to Article one, three, and eight of the Convention on Rights and Duties of States (inter-American) on December 26, 1933, that state as an international actor, run by its own government, is concerned to secure its integrity and independence, make available for its conservation and prosperity, and manage only its own internal and external affairs (Convention on Rights and Duties of States, 1933). The government, in general, usually uses a set of generic policy tools via fiat currencies for correcting market and government failures such as legalization, privatization, and government-based cryptocurrency (Weimer & Vining, 2011, Gohwong, 2020). Though the state with the use of its policy tools has a high expectation that it mainly controls its own internal and external affairs in the actual world, it partly controls all affairs and transactions across its border due to the emergence of non-government-based cryptocurrencies, underground websites like deep webs and dark webs, and pirate organizations, and net states.

Unfortunately, the emergence of a virtual world like metaverse since 1992 increases the complexity of a state's sovereignty. It has become one of the hottest issues for a state in the actual world, especially Facebook's rebranding as Meta in 2021 (Stephenson, 1992; Meta, 2021). However, the metaverse is not a word invented by Meta Company. In fact, it has been invented by Neal Stephenson in his 1992 science fiction, named *Snow Crash*, as a three-dimensional virtual reality-based computer-graphics community for electronic-image players, called avatars. According to fiction, a dual world exists simultaneously-both actual and virtual worlds. In the actual world, all central governments have lost most of their power to a number of giant companies due to the collapse of the world economy. In the virtual world, its area is called the street with 65,536 kilometers, set by the Association for Computing Machinery's Global Multimedia Protocol Group (GMPG). The street as a digital space in the metaverse is a grand digitized boulevard that includes an amusement park, shops, offices, and entertainment centers. In addition, the rich with good-quality equipment can access every area whereas the poor with low-quality equipment could visit some areas only (Stephenson, 1992). After that, 30 years later, some metaverse components has already existed as follows: The GMPG, formally founded its website [<https://www.gmpg.org/>] in March 2003 by Tantek Çelik, Eric Meyer, and Matthew Mullenweg, as an informal group, which invented XHTML Friends Network (XFN) and XHTML Meta Data Profiles (XMDP); extended reality (XR) devices as connecting devices instead of fictional devices (such as personal terminals, goggles, and earphones for colorful appearance and cheap public terminals for black-and-white appearance), including augmented reality (AR), virtual reality (VR), and mixed reality (MR) (Tromp et al., 2020; Marr, 2021); avatars and digital clothing and accessories in Roblox, Microsoft's "Minecraft" or Epic Games" "Fortnite" (Loguidice, 2019; Mojang AB & The Official Minecraft Team, 2022); and non-government-based cryptocurrency instead of encrypted digital money and its deposit in the GMPG's trust fund (Gohwong, 2018). This phenomenon is a new issue that the government has never encountered before because the metaverse is a parallel world with the actual world with the same set of economic transactions and websites (including surface webs, deep webs, and dark webs). By creating and/or using non-government-based cryptocurrencies on the surface and underground web, including the deep web and dark web, for their own advantage outside of the purview of the state, actors in both the private and public sectors can now rule the virtual world. In fact, this phenomenon is called "kakistoscryptocracy", coined by Srirath Gohwong. Therefore, the paper has two main objectives to study the state of the art of kakistoscryptocracy, and to seek initial solutions for this phenomenon.

## **Literature Review**

The basis of the literature review is Gohwong's paradigm of public governance by major non-state actors (such as pirate organizations, non-government-based cryptocurrency, and net states), Weimer and Vining's Generic policy tools in public service provision, and a set of setting-based topics (Bertalanffy's Open system, metaverse, starfish organization, the strategy of weeds, and tech ambassador). The linkage among these issues is that a state uses many policy tools with legitimated sovereignty according to Weimer and Vining's Generic policy tools (such as privatization, legalization, and direct supply of Government-based cryptocurrency) for ruling all affairs under its jurisdiction. Unfortunately, the setting of a state becomes much more complex due to the appearance of key non-state players with their strategies (including starfish organization and the strategy of weeds), and metaverse as a disruptive technology. The loss of absolute sovereignty of a state is an inevitable consequence. In other words, the state partially exercises its power because the advancement of IT allows its former governed entities, including firms, citizens, criminals, and pirate organizations to arbitrarily do their own stateless-based affairs such as human trafficking, terrorism financing, and illegal money-based affairs (e.g. money laundering, tax evasion).

### **Gohwong's Public Administration Paradigm**

According to Gohwong's study, there were three paradigms as follows: state-based Public Administration, stateless-based Public Administration, and the mixture. First, the first one was based on mainstream Public Administration that mainly focuses on the state and its jurisdiction such as public service provision, partnership with the private sector and people sector, good governance and its extension-data governance in the public sector, fiat currency, and government-based cryptocurrency (also known as CBDC). Next, the second one comprised three entities-underground websites (including deep web and dark web, accessed by TOR, I2P, and Freenet), non-government-based cryptocurrency, and pirate organizations. This paradigm was beyond the state's jurisdiction. Last, net states, coined by Wichowski (2020), as the last paradigm, are a set of giant international tech companies that had an active role in public service provision with high influence on their users as their digital citizens. Microsoft, Google, Facebook, Tesla, Apple, and Amazon were good examples of net states. In general, they supported the state by complying with laws, especially local laws. However, sometimes they violated local laws (Gohwong, 2020).

### **Metaverse**

Metaverse, coined by Neal Stephenson in his 1992 science fiction-*Snow Crash*, was a term with no consensus among business owners and developers on its definition. It was a Web 3.0-based concept dedicated to a virtual world in three dimensions where users around the globe can join it via the Internet by impersonating their electronic-image avatar or hologram in order to coexist and do any transactions among applications in the virtual community only, not in the actual world. Therefore, the metaverse provided its users with direct control, exchange of information, and transaction with each other in form of decentralized finance (DeFi). Transactions in the metaverse were made by users via both government-based and non-government-based cryptocurrencies. Three core technologies in the metaverse were the extended reality (XR)-including virtual reality (VR), augmented reality (AR), and Mixed reality (MR); blockchain and cryptocurrencies-both government-based and non-government-based money; and the Internet. Two general ways to enter and access metaverse were the use of specialized devices (such as headsets, glasses, and Neural Interface EMGs for controlling and commanding AR glass) and/or the use of your usual IT equipment (such as notebooks, smartphones, and tablets). In addition, value assets in the metaverse were both tangible in the real world and intangible in the real world. The tangible value assets in the metaverse were delivered through conventional delivery (e.g. Grab) and high-tech printers (e.g. 3D-printed salmon fillets using nuts, seaweed, and vegetable oil as the main ingredients). The intangible

value assets in metaverse such as electronic-image avatar characters, virtual fashion, virtual houses, virtual cars, and non-fungible tokens (NFTs) were used in games and/or online meetings, or virtual environments. However, metaverse was currently in the experimental stage because doing transactions among applications had not yet occurred. Hence, jobs in metaverse might be as follows: metaverse creation-related jobs (e.g. XR hardware engineers, XR software engineers, metaverse data scientist, metaverse cybersecurity, blockchain engineers), service-related jobs (e.g. virtual tour guide, virtual stewards), real estate-related jobs (e.g. virtual real estate agents, metaverse construct architects), fashion-related jobs (e.g. metaverse stylist, virtual clothing designer), and business-related jobs (e.g. metaverse lawyers, metaverse marketing specialist) (Accenture, 2022; Blake, 2022; Chuanwei et al., 2022; Davis, 2021; Doolani et al., 2020; Ejike, 2022; Peters, 2022; Russel, 2021; Sonvilla-Weiss, 2008).

### **Weimer and Vining's Generic Policy Tools**

Weimer and Vining presented generic policy tools in order to correct market and government failures in public service provision as follows: markets-based tools (e.g. deregulation, legalization, privatization, and new marketable goods), incentives-based tools for subsidies and taxes (e.g., output taxes, commodity taxes, tax expenditures, regulations), nonmarket mechanism tools for goods provision (e.g. direct supply by government), and insurance and cushions insurance provision-based tools (e.g. subsidized insurance and cash grants) (Weimer & Vining, 2011).

### **Tech Ambassador**

Tech ambassador was one of the most innovative initiatives in the civil service system, political science, and public administration for the fourth industrial revolution by linking between the governments and high-tech companies. It firstly was invented by the Denmark government in mid-2017 in order to wisely cope with net states as powerful non-state actors through technological diplomacy rather than any outdated law enforcement-based mechanism. The Danish Tech Ambassador offices were in Copenhagen, Silicon Valley, and Beijing. Mr. Casper Klynge was the first tech ambassador of Denmark and the world. There were tech ambassadors in Denmark, Estonia, and Australia for example. Tech ambassadors had three basic responsibilities-technological change monitor; marketer and negotiator for seeking the mutual interest of net states, government, and society; and strategist who promoted technology and digitization in the national economy (Cabrera, 2018; Klynge et al., 2020; Wichowski, 2020; Office of Denmark's Tech Ambassador, 2021).

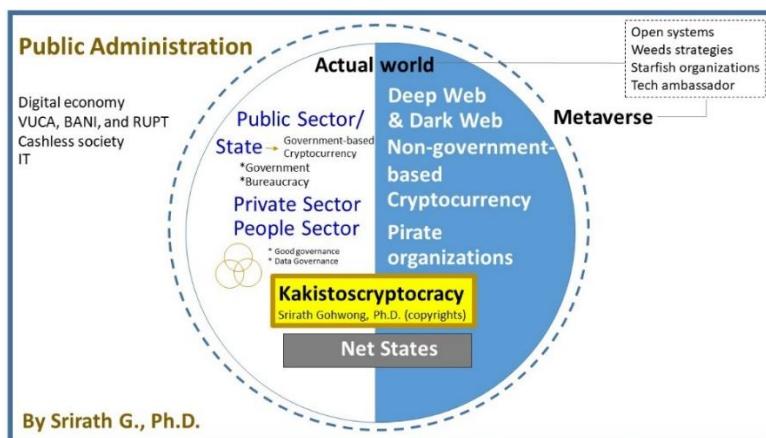
### **The Strategy of Weeds**

Hidehiro Inagaki studied a set of niche strategies for weeds under tough environments where weeds survived in lots of unpredictable changes occurred, especially in the VUCA world. He applied the 1974 John Philip Grime's three strategies of plants in his weeds-based strategies for the purpose of survival of small enterprises under any hyper-competitive markets-the competitive, stress-tolerant, and environmental adaptation-based ruderal strategies. He clearly proposed the weeds-based strategies for surviving any drastic changes as follows: understanding and evaluating your weaknesses for building the strengths of your business, simplification for creating new suitable values for your business (e.g. flexibility, speed, and tolerance), avoiding fighting as much as possible by continuously monitoring changes in the environment with opportunity seeking, making more limited good places for your business to fight rather than seeking choices as many as possible, and value-creating diversification rather value dependence on organizational size and quick responses. In addition, he also proposed six special weeds-based strategies-dominant, cosmopolitan, rosette, allelopathy, parasite, and liana strategies. Last, he revealed that the Japanese have used weeds in a various way. For example, Sagittaria sagittifolia was used as Omodaka kamon, a family crest for Japanese warlords as a symbol of victory plant (Inagaki, 2020).

## Starfish Organization

Starfish organization is a concept on the distributed network organizational model, developed by Ori Brafman and Rod A. Beckstrom in 2006. They preferred decentralized organization, analogized as starfish organization, to centralized organization, analogized as spider organization, due to its quick adaptation to the high turbulent world. They clearly defined a starfish organization in six characteristics -a set of small autonomous units under a decentralized organization with no CEO and hierarchy, a high degree of shared leadership and ownership to drive organizational results, decentralized intelligent open systems with IT, high adaptive intelligent open systems via mutation as harmonization between a decentralized organization and environmental changes, the speedy foundation of a decentralized organization, and profits decline from self-funding of autonomous small units under a decentralized organization. Last, they used the history of the Spanish Conquest of Mexico in 1680s that the Apache as a starfish organization defeated the Spanish army as a spider organization (Brafman & Beckstrom, 2006).

## Findings



**Figure 1** The kakistoscryptocracy framework by Gohwong

Source: Von Bertalanffy (1969), Brafman & Beckstrom (2006), Gohwong (2020), Inagaki (2020), Wichowski (2020), Peters (2022)

The kakistoscryptocracy framework, shown in Figure 1, comprised three areas for both actual and virtual worlds-state-based, stateless-based, and net states-based areas. The first area was the area under state control as the mainstream body of Public Administration-based knowledge. The second one was the area beyond the state's jurisdiction with three non-state actors in the deep web and dark web, non-government-based cryptocurrency, and pirate organizations. The last one was dedicated to net states that had active roles in public service provision. The kakistoscryptocracy framework was much more complex than my Public Administration paradigm by inserting metaverse over the existing actual world in all three areas. There were both legal and illegal affairs and transactions within and across the state's border in both actual and virtual worlds. It should be noted here that state sovereignty was in the most severe trouble in its history. According to Figure 1, the state lost its jurisdiction by having only full control of the state-based area in the actual world and net states-based area under state control in the actual world according to the 1933 Convention on Rights and Duties of States (inter-American). It was one-fourth of the sovereignty here. The rest were as follows-the stateless-based area in the actual world, the net states-based area beyond state control in the actual world, the state-based area in the virtual world, the stateless-based area in the virtual world, the net states-based area under state control in the virtual world, and the net states-based area beyond

state control in the virtual world. These areas were partly controlled by the state in general. In fact, they were anarchic areas where non-state actors, including any individual, firms, and hedge funds, play a big role. They consist of any individual (including general citizens in the actual world, all involving people for firms and/or hedge funds (e.g. stakeholders, employees, customers, clients), individual netizens, and cyber criminals), any firms (including legal firms, net states, pirate organizations or criminal organizations, terrorist organizations), and any hedge funds. They arbitrarily set up their rules and regulations and run all affairs and transactions of themselves and all above mentioned non-state actors under state minimalism.

## **Discussion**

First, the state, according to Figure 1, has now weak sovereignty for state management under a highly turbulent environment (e.g. VUCA, cashless society, digital economy, IT-based setting), where changes are unexpected and unpredictable, for the first time in its own history. Non-state actors who anarchically do all affairs and transactions both within and across borders of the state are “*kakitos*”, a Greek word for the worst (Sabet, 2010). Under the *kakostos*-based setting, People who strongly act as Gods in this lawless manner could do everything according to their own sakes and passion beyond the state’s law and sovereignty such as tax evasion, terrorism financing, drug trafficking, human trafficking, organ trafficking, financial fraud, cybercrimes, and so on. People and other non-state actors set themselves as rulers of a set of new worlds where they are beyond the state power in total or in parts as follows: the stateless-based area in the actual world, the net states-based area beyond state control in the actual world, the state-based area in the virtual world, the stateless-based area in the virtual world, the net states-based area under state control in the virtual world, and the net states-based area beyond state control in the virtual world. That is why I called this regime “*kakostoscryptocracy*” because non-state actors, who believed that they were the godlike rulers of these new worlds, invented and/or used non-government-based cryptocurrency (e.g. Monero and its family such as MoneroC, Monero Gold, MoneroV, Monero Classic) for their own gain without government’s control.

Next, these non-state actors do their own affairs and transactions by using Inagaki’s strategy of weeds. First of all, they understand and evaluate their own weaknesses in lack of legitimate power, called sovereignty, and necessary resources and state mechanisms such as army and territory in the actual world. However, despite their weaknesses, they select a new territory for making profits by using the virtual world (e.g. online communities, e-commerce, and metaverse) in order to earn easy money with tax evasion and other lawless actions from all types of businesses-both legal and illegal. Their affairs and transactions are government-free. Second, simplification is built by these non-state actors via lots of tools (e.g. TOR, I2P, Freenet, and non-government-based cryptocurrencies with their forking). Third, they avoid fighting with the state and its mechanisms (e.g. civil service systems, laws, tax, privatization, government-based cryptocurrency/CBDC, and legalization) by employing both actual and virtual tools, including IT, underground websites (both deep webs and dark webs), blockchain, non-government-based cryptocurrencies (e.g. Bitcoin, Ripple, Ethereum, and Ethereum Classic), and metaverse. These actions are conducted in order to make money without the government’s control. Fourth, they set up their good places to do business without laws and governments by narrowing their limited areas via two choices, including underground websites and metaverse. Last, they create their own value-creating diversification via lots of lawless businesses. In addition, they also apply starfish organization into their business. For example, BitTorrent, non-government-based cryptocurrency, and metaverse are used as their decentralized mechanisms for government-free affairs and transactions.

Last, according to the first two above-mentioned issues, a state cannot stand for the catastrophic loss of its absolute power in the *kakostoscryptocracy*. Unfortunately, it has limited resources

such as officers, budget, and partners. In order to maintain the state's power and existence, there are two solutions for the emergence of kakistoscryptocracy, including tech ambassador as a diplomacy mechanism and corsair as a piracy-based mechanism. The first one is for building good relationships and negotiating with legal non-state actors in both actual and virtual worlds, such as people, firms, and net states, and giving policy advice to other government agencies, both internal and international levels, such as the use of policy tools like new marketable goods in crypto assets. Next, the latter one is for building good relationships and hiring dark IT professionals (e.g. cyber criminals and dark hackers) in order to decrease the amount of illegal non-state actors and limit their affairs and transactions in some restricted areas via policy tools like legalization and taxation (Durand & Vergne, 2012).

## Conclusion

Studying the state-of-the-art in kakistoscryptocracy and looking for potential solutions to this phenomenon were the two main goals of this work. In the study, documentary research was used. The findings showed that the kakistoscryptocracy was divided into sections that were state-based, stateless, and net states-based for both real worlds and virtual ones. Using Inagaki's "weeds" technique, non-state actors arbitrarily carried out all transactions and affairs both within and outside of the state. Finally, two fundamental solutions for the kakistoscryptocracy were provided by tech ambassador and corsair.

## References

Accenture. (2022). *Technology Vision 2022: Meet Me in the Metaverse*. Retrieved from [www.accenture.com/\\_acnmedia/Thought-Leadership-Assets/PDF-5/Accenture-Meet-Me-in-the-Metaverse-Full-Report.pdf](http://www.accenture.com/_acnmedia/Thought-Leadership-Assets/PDF-5/Accenture-Meet-Me-in-the-Metaverse-Full-Report.pdf).

Blake, F. (2022). *METAVERSE INVESTING: A step-by-step guide to digital assets in the Metaverse, crypto gaming and the future of the blockchain technology applied to the Metaverse investing*. n.p.: Independently Published.

Brafman, O., & Beckstrom, R. (2006). *The Starfish and the Spider: The Unstoppable Power of Leaderless Organizations*. London: Portfolio.

Cabrera, M. (2018). *Denmark creates world's first Tech Embassy to understand global tech giants impact on society*. Retrieved from [www.cio.com/article/228651/denmark-creates-worlds-first-tech-embassy-to-understand-global-tech-giants-impact-on-society.html](http://www.cio.com/article/228651/denmark-creates-worlds-first-tech-embassy-to-understand-global-tech-giants-impact-on-society.html).

Chuanwei, Z., Yixin, C., Chen, C., & Puyu, W. (2022). *The Economics of Metaverse*. Retrieved from [https://group.hashkey.com/viewerjs-0.5.8/documents/en/blockchain\\_research/Blockchain-Research-No.204-The-Economics-of-Metaverse-1.pdf](https://group.hashkey.com/viewerjs-0.5.8/documents/en/blockchain_research/Blockchain-Research-No.204-The-Economics-of-Metaverse-1.pdf).

*Convention on Rights and Duties of States*, opened for signature 26 December 1933, (1933) 49 Stat. 3097 (entered into force 23 December 1936).

Davis, W. (2021). *Metaverse Explained for Beginners: A Complete Guide to Investing in Cryptocurrency, NFT, Blockchain, Digital Assets, Web 3 & Future Technologies*. n.p.: Independently Published.

Doolani, S., Wessels, C., Kanal, V., Sevastopoulos, C., Jaiswal, A., Nambiappan, H., & Makedon, F. (2020). A Review of Extended Reality (XR) Technologies for Manufacturing Training. *Technologies*, 8(4), 77.

Durand, R., & Vergne, J. (2012). *The Pirate Organization: Lessons from the Fringes of Capitalism*. Massachusetts: Harvard Business Review.

Ejike, P. (2022). *WEB 3.0: What Is Web3? Potential of Web 3.0 (Token Economy, Smart Contracts, DApps, NFTs, Blockchains, GameFi, DeFi, Decentralized Web, Binance, Metaverse Projects, Web3.0 Metaverse Crypto guide, Axie)*. n.p.: Independently Published.

Global Multimedia Protocols Group. (n.d.). *Global Multimedia Protocols Group*. Retrieved from [www.gmpg.org/](http://www.gmpg.org/).

Gohwong, S. (2018). The State of the Art of Cryptocurrencies. *Asian Administration and Management Review*, 1(2), 1-16.

Gohwong, S. (2020). Public Administration Paradigm Revisited. *Asian Political Science Review*, 4(1), 1-6.

Inagaki, H. (2020). *The strategy of “weeds”: How to survive the unpredictable times*. Tokyo: Nippon Jitsugyo Publishing Co., Ltd.

Klynge, C., Ekman, M., & Waedegaard, N. (2020). Diplomacy in the Digital Age: Lessons from Denmark’s TechPlomacy Initiative. *The Hague Journal of Diplomacy*, 15(1-2), 185-195.

Loguidice, B. (2019). *Fortnite for dummies*. New Jersey: John Wiley & Sons.

Marr, B. (2021). *Extended Reality in Practice: 100+ amazing ways virtual, augmented and mixed reality are changing Business and Society*. West Sussex: John Wiley & Sons.

Meta. (2021). *Introducing Meta: A Social Technology Company*. Retrieved from <https://about.fb.com/news/2021/10/facebook-company-is-now-meta/>.

Mojang AB & The Official Minecraft Team. (2022). *Minecraft: Guide to Survival (Updated)*. New Jersey: Random House Worlds.

Office of Denmark’s Tech Ambassador. (2021). *White paper June 2021: Towards a better social contract with big tech*. Retrieved from <https://techamb.um.dk/impact/white-paper>.

Peters, L. (2022). *Metaverse Investing 2022: All the Secrets Behind Metaverse Land, NFTs, DeFi Opportunities and How to Make Passive Income with them*. n.p.: Independently Published.

Russel, J. (2021). *Metaverse for Beginners: A Complete Guide on How to Invest in the Metaverse*. n.p.: Independently Published.

Sabet, A. (2010). Wickedness, Governance and Collective Sanctions: Can Corruption be Tamed?. In A. Salminen. (ed.). *Ethical Governance: A Citizen Perspective* (pp. 91-112). Vaasa: University of Vaasa.

Sonvilla-Weiss, S. (2008). *(IN)VISIBLE: Learning to Act in the Metaverse*. Wien: Springer.

Stephenson, N. (1992). *Snow Crash*. New York: Bantam Book.

Tromp, J., Le, D., & Le, C. (2020). *Emerging Extended Reality Technologies for Industry 4.0: Early Experiences with Conception, Design, Implementation, Evaluation and Deployment*. New Jersey: John Wiley & Sons.

Von Bertalanffy, L. (1969). *General System Theory: Foundations, Development, Applications*. New York: George Braziller.

Weimer, D., & Vining, A. (2011). *Policy Analysis: Policy Analysis: Concepts and Practice*. New Jersey: Longman.

Wichowski, A. (2020). *The Information Trade: How big tech conquers countries, challenges our rights, and transforms our world*. New York: HarperOne.

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