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Exposing Offshore Secrets

Network & Social Media Analytics in the Panama Papers

Introduction: Panama Papers Scandal

- In 2016, a leak of 11.5 million documents from Panamanian law firm Mossack Fonseca exposed how wealthy individuals, corporations, and politicians used offshore companies to hide assets and evade taxes.
- The leak revealed over 214,000 shell companies operating across multiple jurisdictions.

What are Offshore Files?

- Offshore files refer to financial records that document hidden wealth, tax evasion, and financial secrecy through offshore bank accounts and shell companies.

Dataset Overview:
Role of ICJS (International Consortium of Investigative Journalists)

Dataset Overview

- A massive dataset exposing offshore financial connections.
- Contains entities, intermediaries, addresses, officers, and relationships.
- Structured as a network graph to analyze hidden links.
- Used to uncover tax evasion, money laundering, and financial secrecy.

Offshore Addresses & Entities

- 402,246 Addresses linked to offshore financial activities.
- 814,344 Entities, including shell companies and trusts.
- British Virgin Islands, Malta, Hong Kong, and Switzerland dominate offshore registrations.
- Many companies are registered in tax havens to obscure ownership.

Role of Intermediaries & Officers

- 26,768 Intermediaries facilitate offshore transactions.
- 771,315 Officers act as directors, shareholders, or corporate representatives.
- A small number of intermediaries control vast networks of companies.
- Key financial firms and law offices help maintain secrecy.

## Relationships & Network Structure

- 3,339,267 Relationships link entities, officers, and intermediaries.
- Connections include ownership, intermediary roles, and registered addresses.
- Network analysis helps detect hidden financial patterns.
- Highly connected entities indicate strategic financial operations.

Exploring the Data

- The dataset was preprocessed as a directed graph, mapping financial relationships.

- Entities, intermediaries, and addresses were represented as nodes while ownership, intermediary roles, and financial links were captured as edges.

- Network analysis helped reveal hidden connections, financial hubs, and key facilitators in offshore structures.
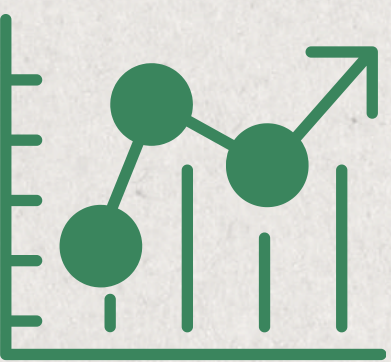
Nodes

- Address – Offshore company locations or financial activity hubs.
- Entities – Shell companies, trusts, and foundations for asset management.
- Intermediaries – Lawyers, accountants, and financial firms enabling offshore structures.
- Officers – Directors, shareholders, or key individuals managing offshore entities.

Edges

- Intermediary of – Links intermediaries to the entities they facilitate.
- Registered Address – Ties companies to specific locations, often revealing shared hubs.
- Shareholder of – Identifies direct ownership between individuals and companies.
- Records & Registers of – Official documents linking people to offshore financial activities.

Quantify

- 402,246 Addresses (offshore locations).
- 814,344 Entities (shell companies & financial structures).
- 26,768 Intermediaries (law firms & financial facilitators).
- 771,315 Officers (directors, shareholders, and key actors).
- 3,339,267 Relationships (ownership, intermediary roles, and registration details).

Exploring offshore locations

Network Analysis

Uncovering Hidden Links Using Social Network Analysis
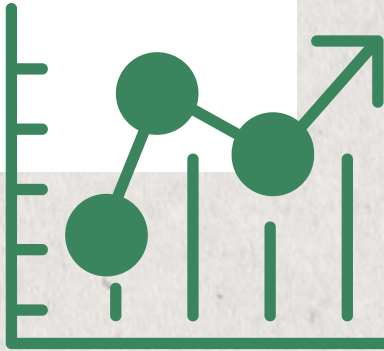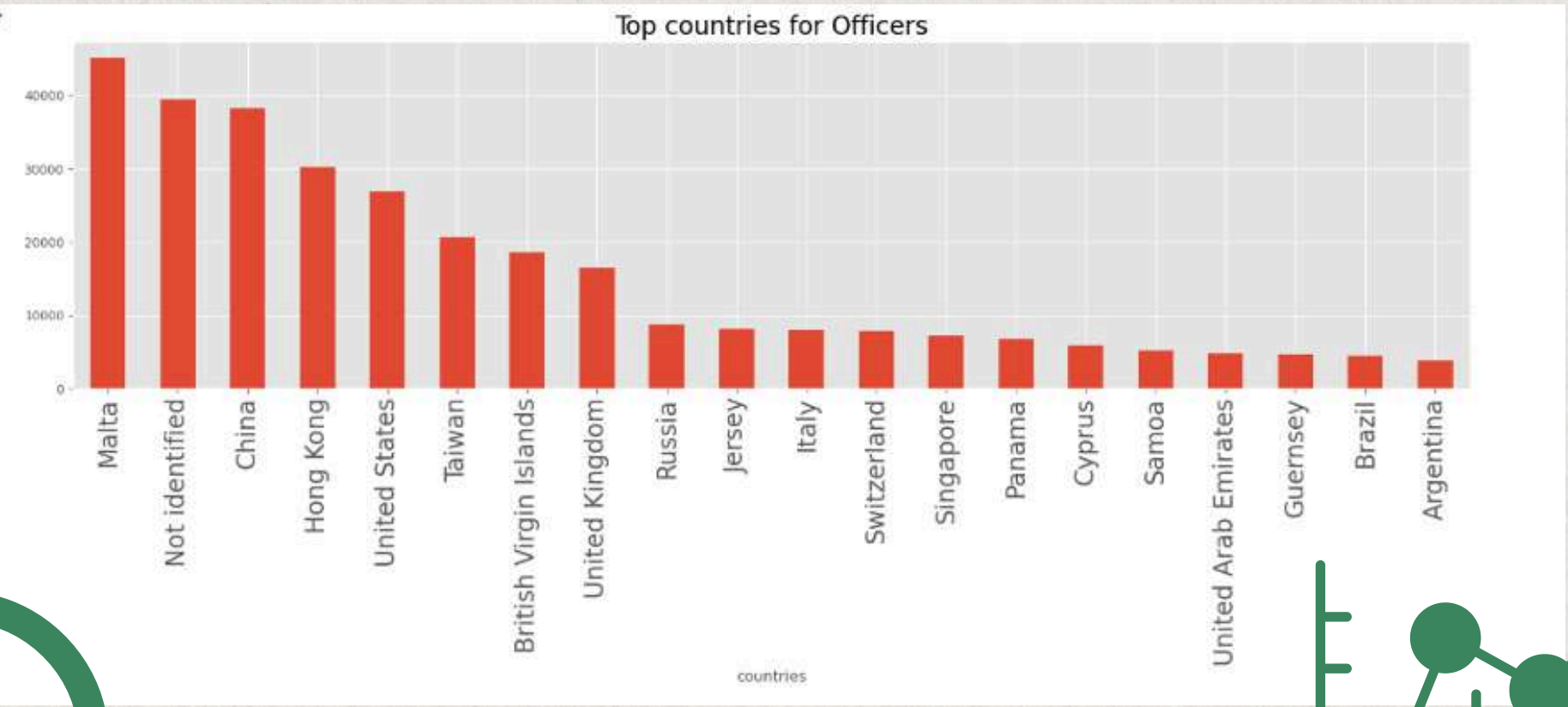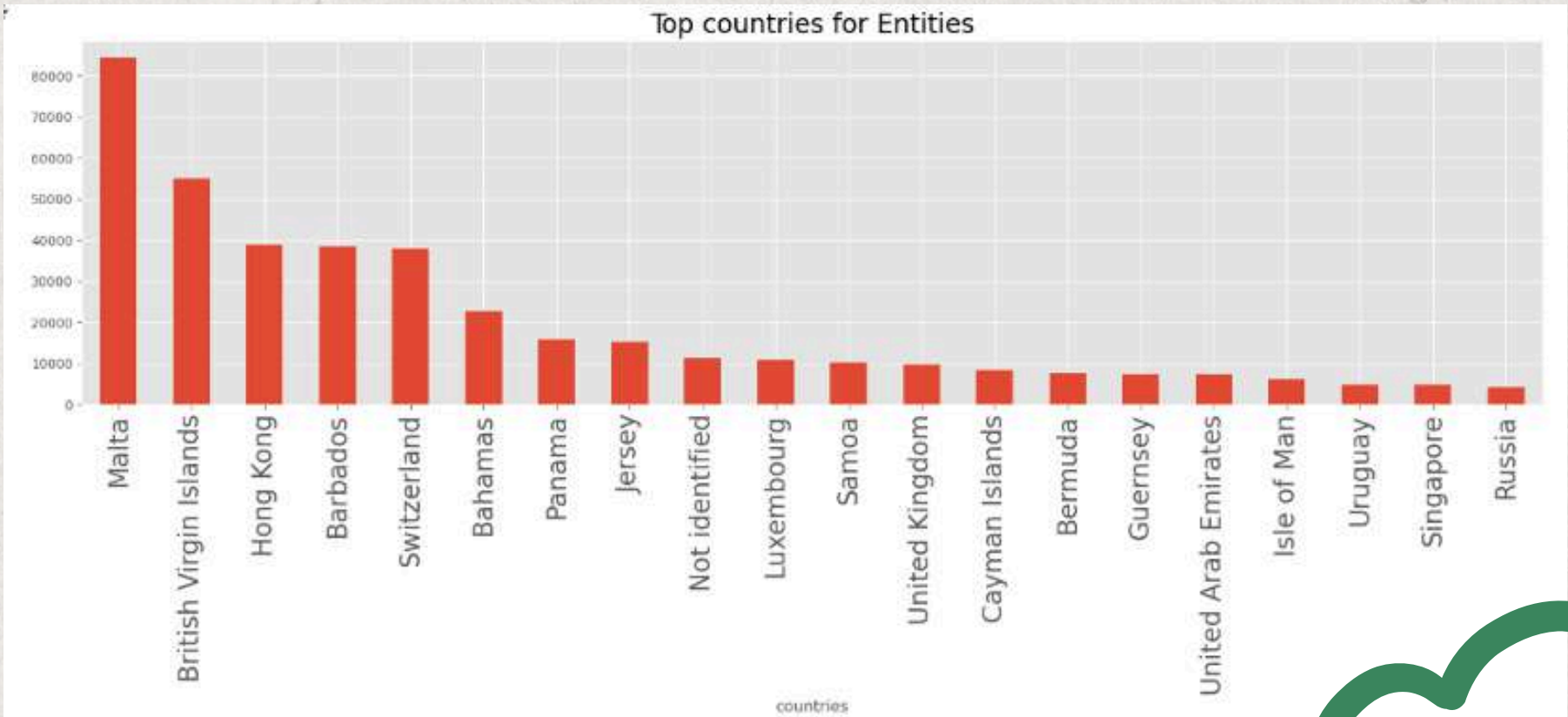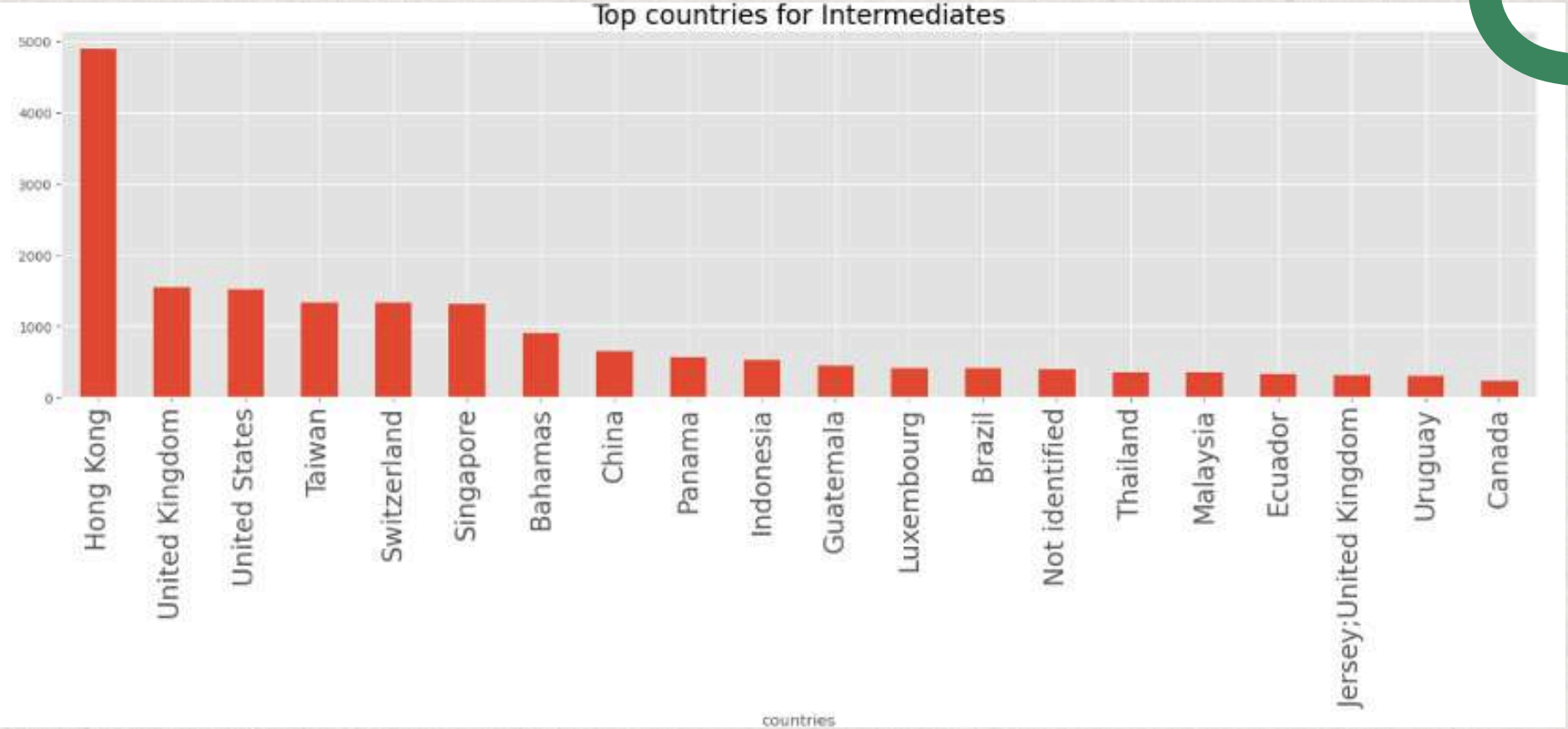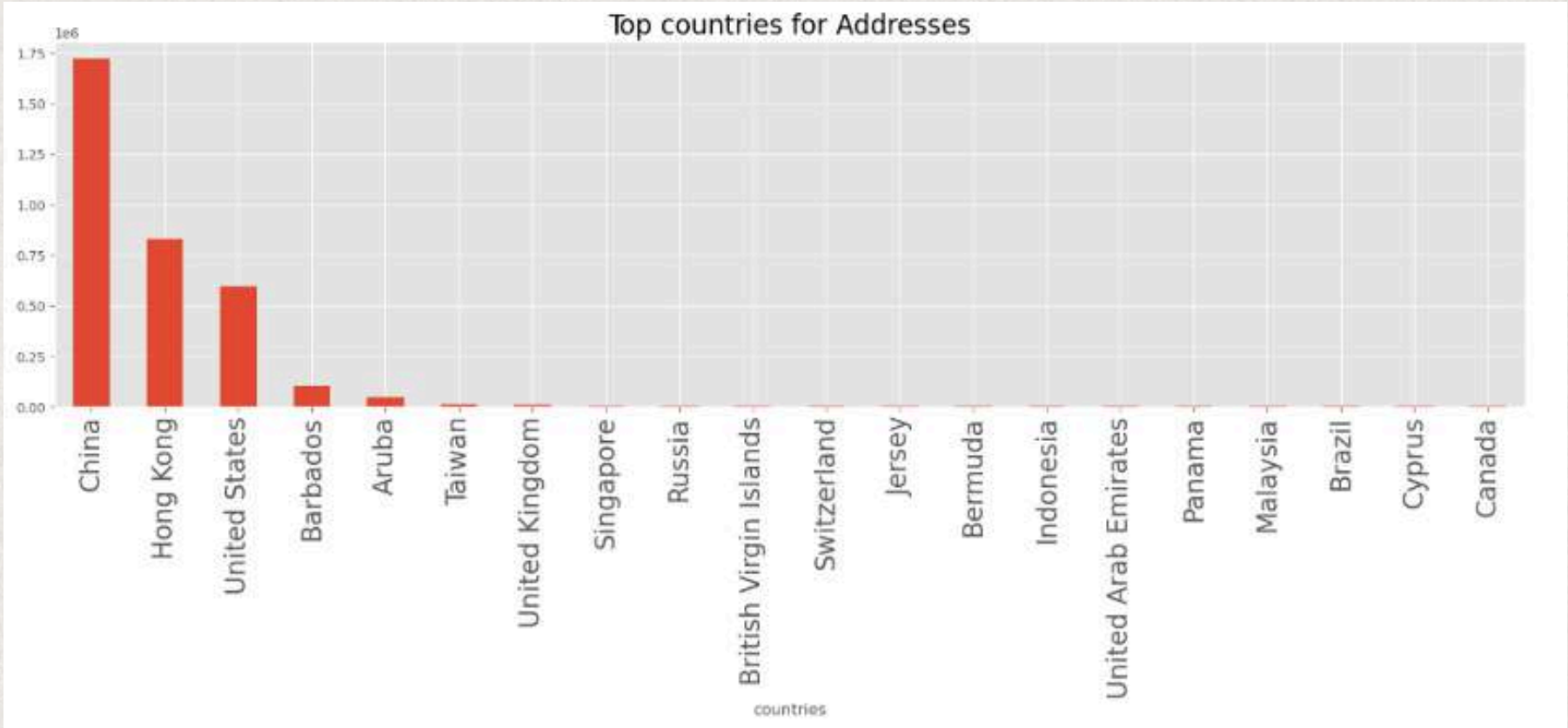
01.
Network Centrality: Detecting Key Intermediaries

Identified high-degree nodes (intermediaries) that control vast portions of the offshore financial web, acting as crucial enablers.

02.
Subgraph Analysis: Identifying Hidden Financial Clusters

Revealed clusters of offshore companies, showing how some operate independently while others are tightly linked through shared intermediaries.

03.
Shortest Path Analysis: Tracing Financial Flows

Mapped indirect ownership trails through multiple intermediaries, uncovering hidden financial flows between entities.

04.
PageRank Algorithm: Ranking Most Influential Players

Determined which intermediaries and entities hold the most power in the offshore network based on their global influence.
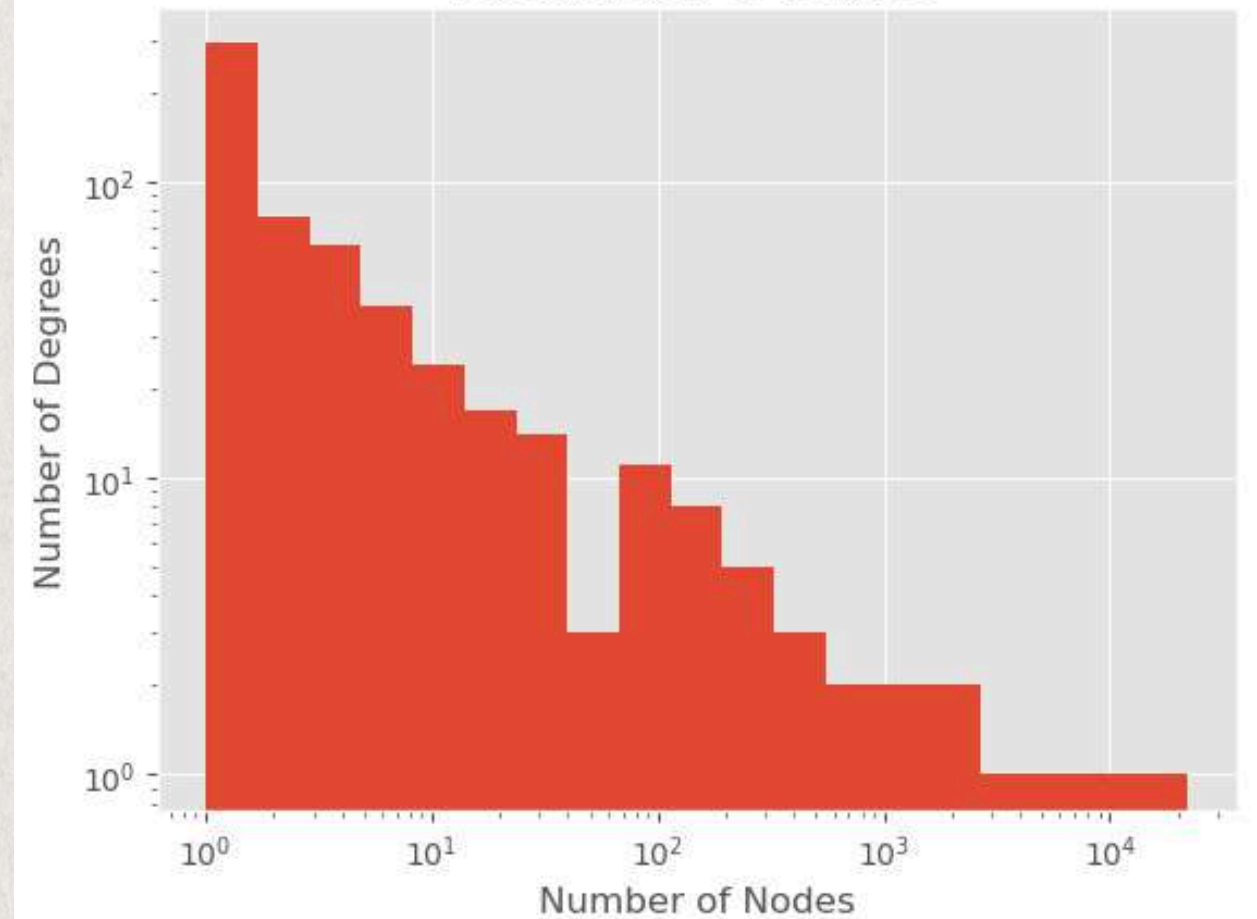
Network Centrality
Detecting Key Intermediaries

- A high mean and low median suggest a skewed distribution with a few highly connected hubs (outliers) while most nodes have low connectivity — a characteristic of scale-free networks.

- The highest-degree node is an address linked to the intermediary Portcullis TrustNet, serving as the registered address for over 37,000 entities — highlighting its role as a major offshore hub


```
node_degree.sort_values("degree", ascending=False)[0:25]
```

|	node_type	degree	name
236724	address	37338	Portcullis TrustNet Chambers P.O. Box 3444 Roa...
54662	officers	36256	portcullis trustnet (bvi) limited
23000136	intermediates	14902	mossack fonseca & co. (bahamas) limited
23000147	intermediates	9719	ubs trustees (bahamas) ltd.
23000330	intermediates	8302	credit suisse trust limited
23000156	intermediates	8287	trident corporate services (bah) ltd
23000133	intermediates	8150	mmg bahamas ltd.
11001746	intermediates	7016	orion house services (hk) limited
298333	intermediates	5700	unitrust corporate services ltd.
288469	address	5699	Unitrust Corporate Services Ltd. John Humphrie...
23000213	intermediates	5319	k.m.c. corporate services ltd.
23000046	intermediates	5015	** disabled suisse security bank & trust
23000280	intermediates	4996	private trust corporation limited
11011863	intermediates	4364	mossack fonseca & co.
96909	officers	4260	portcullis trustnet (samoa) limited
11012037	intermediates	4117	prime corporate solutions sarl
11001708	intermediates	4094	offshore business consultant (int'l) limited
298293	intermediates	3897	sealight incorporations limited
285729	address	3896	Sealight Incorporations Limited Room 1201, Con...
12160432	officers	3890	mossfon subscribers ltd.
11008027	intermediates	3888	mossack fonseca & co. (singapore) pte ltd.
23000198	intermediates	3602	lennox corporate services limited
23000381	intermediates	3422	elco corporate services limited
294268	intermediates	3339	offshore business consultant (hk) ltd.
23000400	intermediates	3305	aleman, cordero, galindo & lee (bahamas)

Distribution of Degree

node_type	count	mean_degree	median_degree
address	142013	2.142797	1.0
entities	448380	2.460750	2.0
intermediates	12696	35.301985	3.0
officers	339083	2.571884	2.0

Network Centrality
Detecting Key Intermediaries

- The visualization shows "First Directors Inc." as a central hub, connecting multiple offshore entities and officers, highlighting its key role in financial networks.
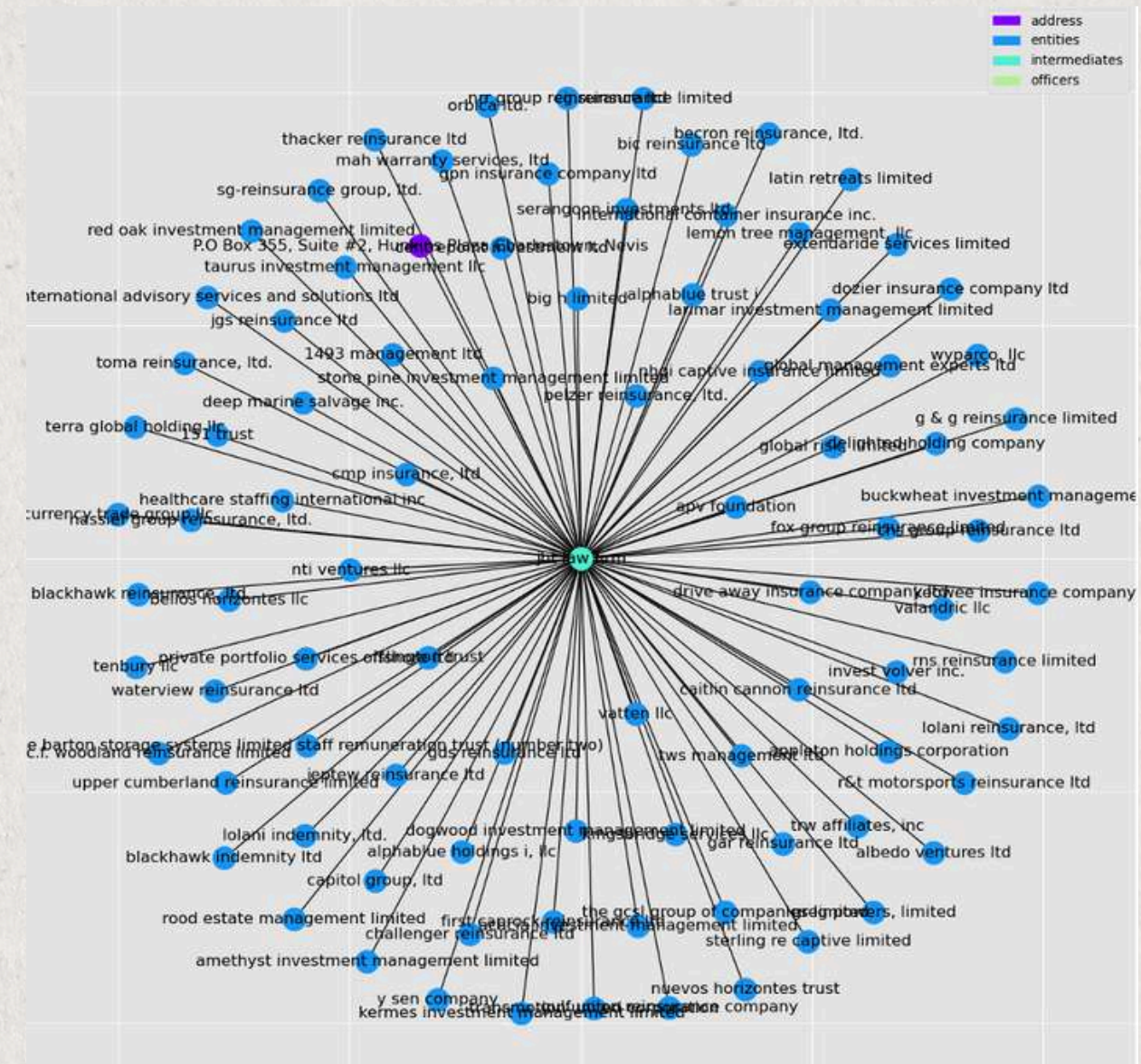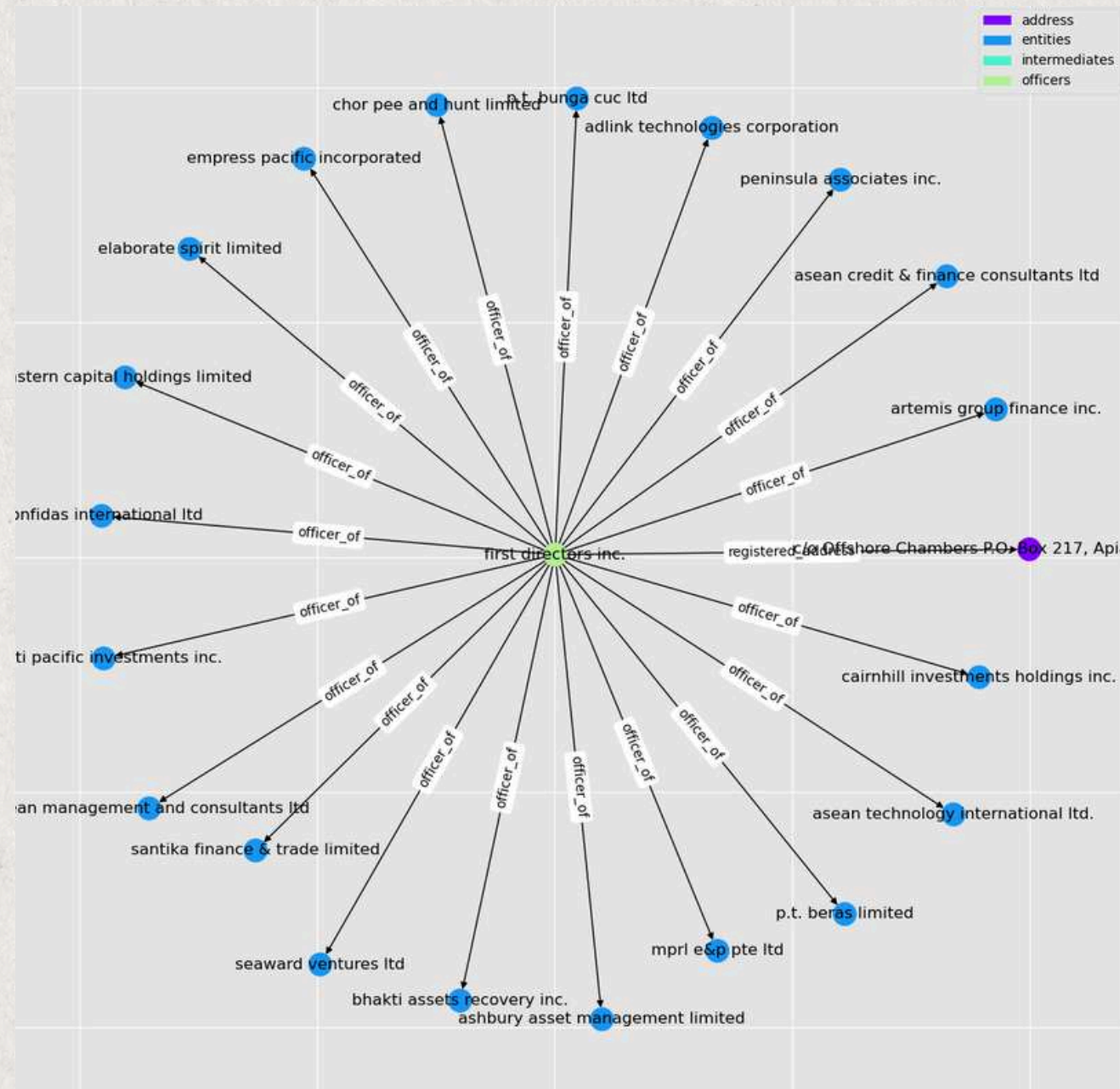
- The other visualization helps us to understand how a single intermediary is connected to a number of entities which highlights the key intermediaries of the scam.

Subgraph Analysis
## Identifying Hidden Financial Clusters

- We tried finding subgraphs within our network based on the largest number of nodes with a subgraph of 942172 nodes as the biggest subgraph

- We used is_directed_acyclic_graph function to find cyclicity in our network and this uncovered that the subgraphs are connected through intermediaries and addresses which clearly gives out that something is fishy.


```
[ ]  if nx.is_directed_acyclic_graph(G):
         lp = nx.dag_longest_path(G)
         print("The longest path is {} nodes long.".format(len(lp)))
         plot_graph(G.subgraph(lp), label_edges=True)
     else:
         print("Graph contains cycles and is not a DAG.")
```

```
[ ]  # Sort subgraphs by the number of nodes (largest first)
     subgraphs = sorted(subgraphs, key=lambda x: x.number_of_nodes(), reverse=True)

     # Print number of nodes in the top 50 largest subgraphs
     print([s.number_of_nodes() for s in subgraphs[:200]])

⇄   [942172, 284329, 161754, 161499, 91168, 72375, 35360, 16632, 7566, 4640, 2637, 2605, 2373, 2009, 1669, 1639, 1599, 1481, 1318, 1295, 1232, 1226, 1156, 1135, 1094,
```
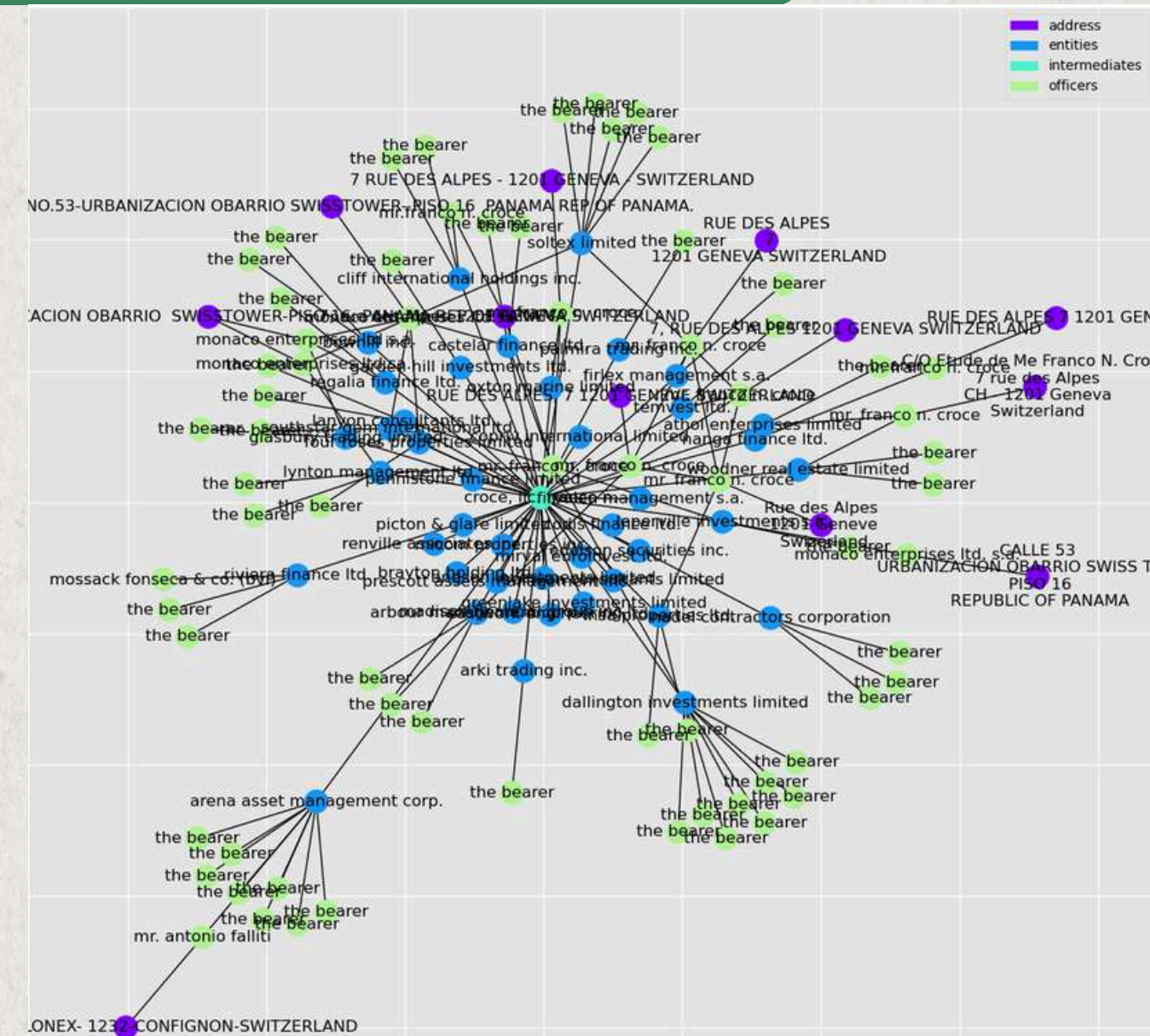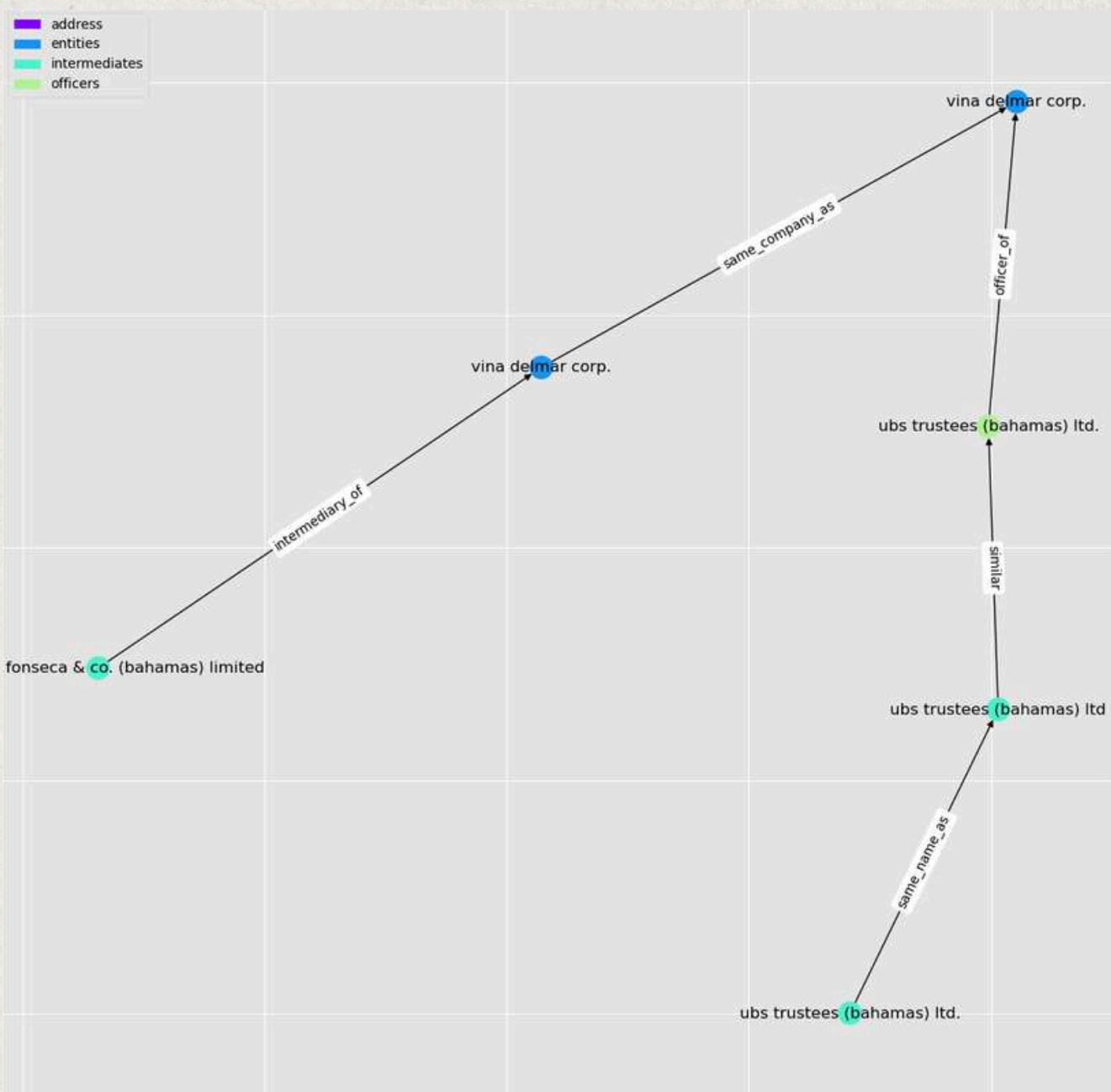
Shortest Path Analysis
Tracing Financial Flows

Key Takeaways from This Shortest Path Analysis:

- **Intermediaries** play a central role in connecting multiple corporate entities, making them crucial in offshore financial networks.
- **Corporate officers and trust services firms act as gateways** that bridge offshore structures, ensuring that ownership remains opaque.
- Longer paths may indicate efforts to obscure direct relationships, using multiple layers of intermediaries to create financial distance between entities.
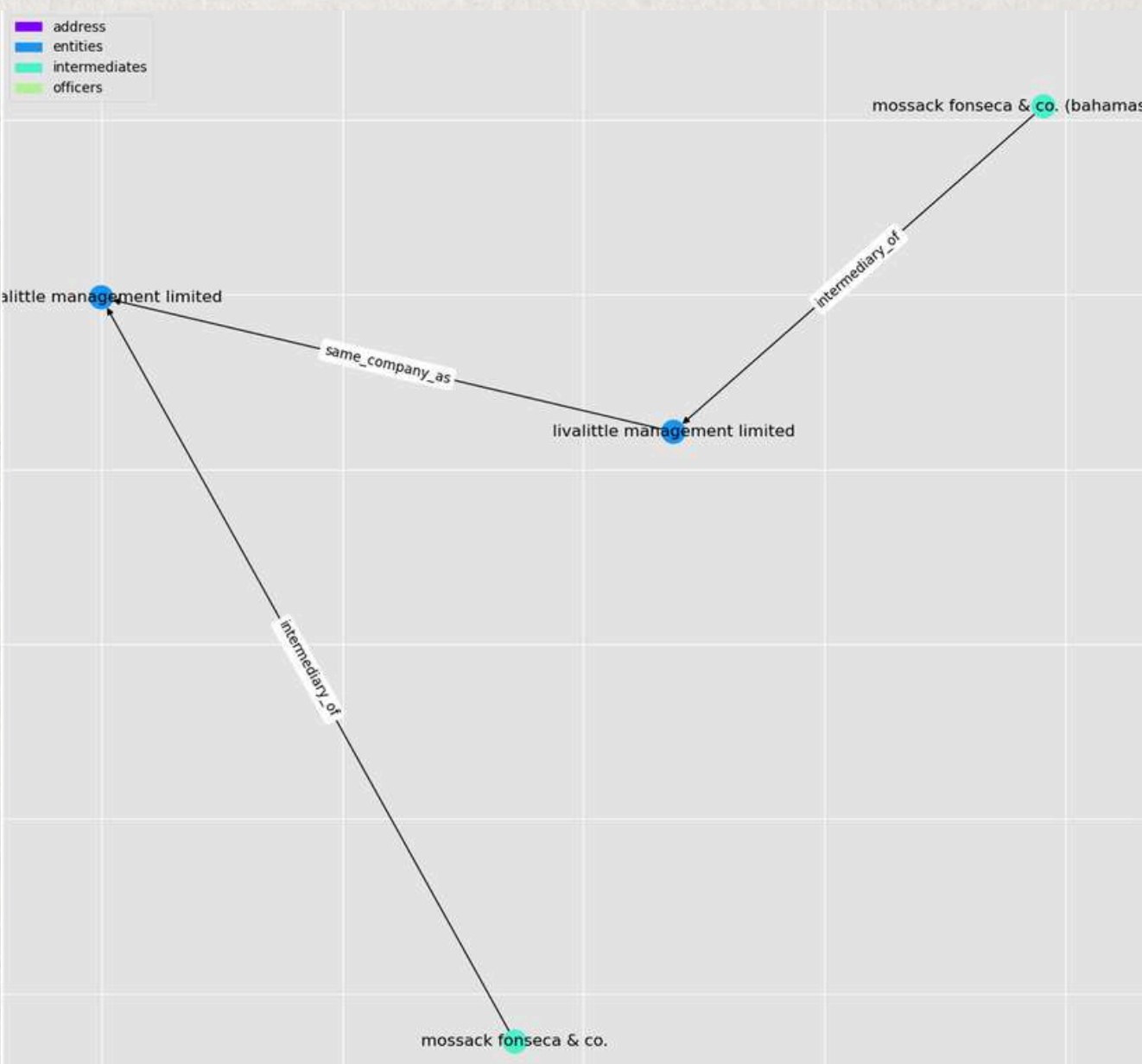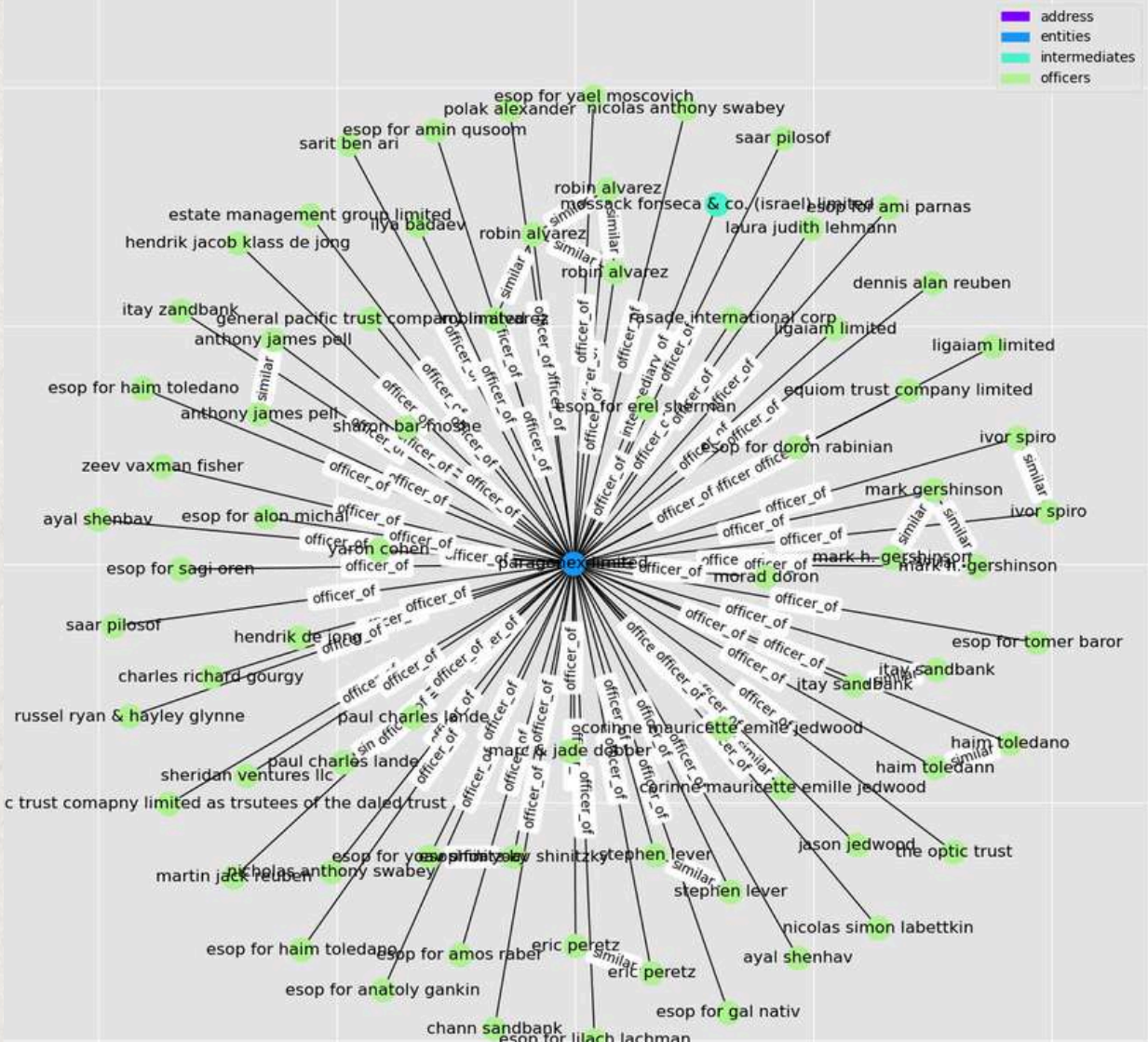
PageRank Algorithm
Ranking Most Influential Players

- Identifies Key Intermediaries – PageRank ranks highly influential nodes, helping detect powerful facilitators like law firms and financial service providers that control offshore networks.

- Reveals Hidden Hubs – Unlike simple degree centrality, PageRank highlights nodes linked to other influential entities, exposing critical offshore structures used for financial secrecy.


```
node_degree.sort_values("page_rank", ascending=False)[0:15]
```

	node_type	degree	name	page_rank
23000147	intermediates	9719	ubs trustees (bahamas) ltd.	0.008680
23000133	intermediates	8150	mmg bahamas ltd.	0.007152
236724	address	37338	Portcullis TrustNet Chambers P.O. Box 3444 Roa...	0.007095
54662	officers	36256	portcullis trustnet (bvi) limited	0.006703
23000136	intermediates	14902	mossack fonseca & co. (bahamas) limited	0.006702
23000156	intermediates	8287	trident corporate services (bah) ltd	0.006250
23000213	intermediates	5319	k.m.c. corporate services ltd.	0.004782
23000330	intermediates	8302	credit suisse trust limited	0.004667
23000046	intermediates	5015	** disabled suisse security bank & trust	0.004522
23000280	intermediates	4996	private trust corporation limited	0.004439
23000381	intermediates	3422	elco corporate services limited	0.003033
11011863	intermediates	4364	mossack fonseca & co.	0.003027
23000400	intermediates	3305	aleman, cordero, galindo & lee (bahamas)	0.002952
11012037	intermediates	4117	prime corporate solutions sarl	0.002950
23000362	intermediates	3265	cititrust (bahamas) limited	0.002933

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Thank you very much!