

Introduction to “Integrity Filters”

Automated fraud detection systems for eProcurement

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What are “Integrity Filters”?



Integrity Filters are algorithms that can be embedded in eProcurement Systems to detect and prevent fraud or irregularities.

The Filters can run *ex-ante*, before bids are evaluated or payments are approved, or *ex-post*, against procurement data stored in historic databases.

Algorithms can include automated background checks of firms and individuals

The Benefits of Integrity Filters

Integrity Filters can analyze masses of data, virtually instantly, compared to the weeks that may be necessary for a manual review of the paper transactions



Integrity Filters exploit electronic procurement data to:

- Block non-compliant transactions
- Provide instant alerts of possible fraud
- Instantly review 100% of all transactions
- Permit real time remote monitoring by donors or oversight agencies
- Create detailed audit trails and digital evidence for investigators
- Identify evidence of previous or on-going misconduct in historic databases

Some common fraud and corruption schemes that can be detected by Integrity Filters

Collusive bidding

Bid rigging

Kickbacks

Conflicts of interest

False, inflated and duplicate invoices

Shell companies

Phantom vendors

Purchases for personal use or resale



Sample integrity filters to detect or prevent

Tendering Frauds

Color-coded Lists of Indicators

RED: Real-time BLOCKS or ALERTS of significant indicators, e.g., warning of a bid submitted by a debarred company or different bids from the same IP address

BROWN: Pre-programmed REPORTS for other common procurement fraud schemes, waste or abuse

ORANGE : Other less common reports to be listed in a HANDBOOK or ONLINE GUIDE for auditors, investigators or other users

BLUE: links to online public record, telephone and address information

Bid Rigging

Improper manipulation of the bidding or vendor selection process to favor certain suppliers and exclude others

Sample indicators include:

- **Procurement official's contact info = bidder's info**
- **Shorter notice to submit bids than the rules require**
- **Sole source awards > sole source limits**
- **Split purchases to avoid competitive bidding**
- **Multiple purchases just < procurement threshold**
- **Award to other than the low bidder**
- **Award to only one evaluated bidder**
- **Unusually high or low line item bids in winning bid + change order extending or dropping line item**
- **Low bid award followed by change order > price**
- **Winning bid price = cost estimate**
- **"SPQQD" analysis (Selection, Price, Quantity, Quality and Delivery Indicators); e.g.,**
 - **high #, % of awards to one bidder**
 - **bid prices significantly > norm**
 - **quantities significantly > norm**
- **High # of change orders vs. the norm**

Primary data sources:

- Bidder contact info
- Bid notice and due date
- Procurement rules, e.g. competitive bid thresholds
- Winning and losing bids

Other potential data sources:

- Line item bid prices
- Contract date and price
- Change orders and amounts
- Previous similar tender results
- Procurement plan info

Collusive Bidding

Secret agreements by bidders or suppliers to divide work and artificially inflate prices, often with the complicity of government officials

Sample indicators include:

- **Bids from the same IP address**
- **Bidders with same contact info**
- **Unusual bid patterns, e.g., bids an exact % apart**
- **Sequential bid securities**
- **High price bids; e.g. bids that exceed cost estimate by > 30%**
- **Bidders bid in same order in later rounds**
- **Losing bidder becomes subcontractor**
- **Pattern of rotation of winning bidders**
- **Same bidders always bid, win and lose**
- **Bid patterns differ from prior patterns**
- **Losing bidders can't be located in corp. directories or on the internet**

Primary data sources:

- Bidder's contact info, IP address
- Winning and losing bids
- Bid securities
- Cost estimates
- Subcontracts

Other data sources:

- Bids in prior similar tenders

Sample graphic reports of collusive bidding indicators

Blue and orange highlighted bids indicate potential collusion

Jobsite: East African Network Tollroad

Bidder	Bid	Ratios of Bid to		
		Estimate	Winner	Prev Bid
● Engineer Estimate	\$ 132.7M	-	-	-
● Barrytron	\$ 130.9M	-1.4%	-	-
⊗ Tessier-Ashpool	\$ 135.8M	2.4%	3.8%	-
⊗ Stay Puft Corporation	\$ 136.6M	2.9%	4.3%	0.5%
⊗ Barrytron	\$ 138.5M	4.4%	5.8%	1.4%
⊗ Galaxy Corp	\$ 140.8M	6.1%	7.5%	1.6%
⊗ 123 Warehousing	\$ 144.1M	8.6%	10.1%	2.4%
⊗ Spade and Archer	\$ 157.1M	18.3%	20.0%	9.0%

Jobsite: Rila motorway Development

Bidder	Bid	Ratios of Bid to		
		Estimate	Winner	Prev Bid
● Engineer Estimate	\$ 109.3M	-	-	-
● Carrys Candles	\$ 102.0M	-6.7%	-22.2%	-
● General Services Corporation	\$ 131.2M	20.0%	-	-
⊗ The Legitimate Businessmens Club	\$ 137.7M	26.0%	5.0%	5.0%
⊗ Flowers By Irene	\$ 140.3M	28.4%	7.0%	1.9%
⊗ Allied Biscuit	\$ 143.0M	30.8%	9.0%	1.9%
⊗ United Fried Chicken	\$ 145.6M	33.2%	11.0%	1.8%
⊗ Acme Corp	\$ 148.2M	35.6%	13.0%	1.8%

Jobsite: I-85/West Point Interchange Project (Troup County)

Bidder	Bid	Ratios of Bid to		
		Estimate	Winner	Prev Bid
● Engineer Estimate	\$ 122.6M	-	-	-
● LexCorp	\$ 137.8M	12.4%	-	-
⊗ Krustyco	\$ 141.3M	15.3%	2.6%	-
⊗ General Services Corporation	\$ 151.5M	23.6%	10.0%	7.2%
⊗ Sixty Second Avenue	\$ 166.7M	36.0%	21.0%	10.0%
⊗ Smith and Co.	\$ 183.3M	49.6%	33.1%	10.0%
⊗ LuthorCorp	\$ 201.7M	64.6%	46.4%	10.0%

Sample integrity filters to detect or prevent

Purchasing Frauds

Phantom Vendors

Sample indicators include:

- **Vendor not listed in corporate registries, directories or on the internet**
- **Vendor located at non-business address**
- **Employee/Vendor match**
- **Vendor not in Approved Vendor List**
- **“Fuzzy match” vendors with different bank accounts**
- **High # or % of sequential invoice numbers**
- **Broken sequence invoice numbers**
- **Split purchases**
- **Small initial purchase**
- **Benford’s Law violations**
- **Vendor provides hard to verify goods, works or services (per product code)**
- **Incomplete PO, invoice or receiving info**

Primary data sources:

- Approved and paid vendor lists
- HR and vendor master files
- PO, invoice, receiving, payment info

Other potential data sources:

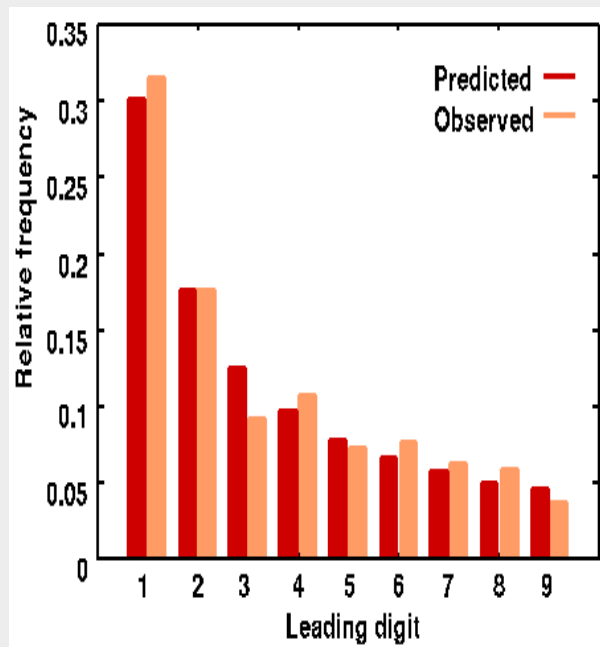
- Procurement rules, thresholds
- Benford’s Law distributions
- Vendor and product code lists

Benford's Law

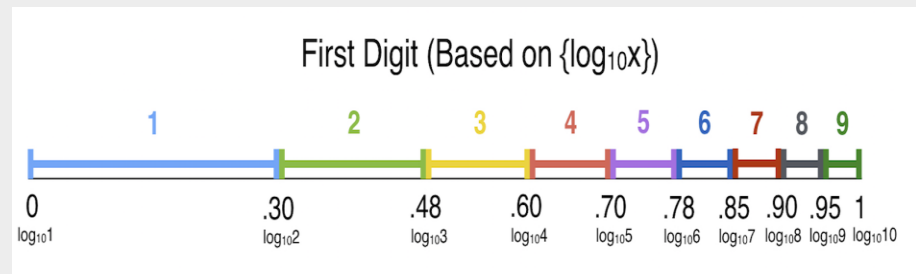
“Law of the first digit” used in fraud detection

In naturally generated numbers, the number 1 is the first digit 30.4 % of the time, with other numbers appearing as the first digit in descending order (as in the graph below left)

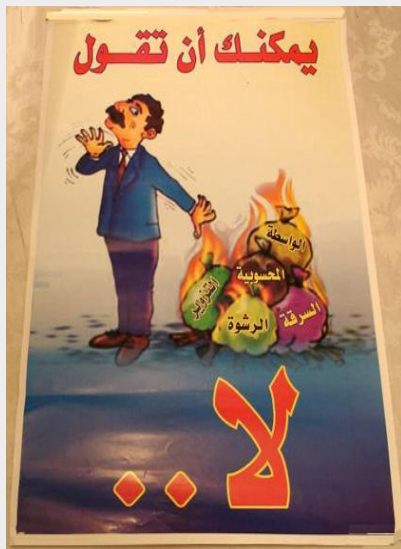
Prices in invoices, quantities in reports, etc. that do not follow this pattern can indicate fabricated numbers and fraud



$$P_D = \frac{\int_D^{D+1} P(x) dx}{\int_1^{10} P(x) dx} = \log_{10} \left(1 + \frac{1}{D} \right)$$



Integrity Filters



Methods to Limit “False Positives”

The primary risk in electronic fraud detection

Identify unambiguous indicators

e.g., PO info does not match invoice; duplicate invoices;
different bids from the same IP address

Identify and prioritize other strong indicators

e.g., bids from different bidders that are an exact % apart;
sequential bid securities

Identify patterns and repeat transactions

e.g., high number of % or split purchases by the same
procurement official from the same supplier

Identify transactions with multiple indicators

e.g., high number of red flags associated
with a single purchase or procurement official

Link indicators to reports of fraud

Look for indicators to confirm or rebut a
whistleblower complaint or audit concern

That's it...Questions?