



# Continuous Fraud Monitoring Systems

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# Continuous Monitoring

- Continuous monitoring is performing fraud analysis on transactions as they move through business systems
- It is difficult to do right, but it allows investigators to find fraud as it occurs rather than months later
- Monitoring is similar to regular controls
  - Controls ensure transactions happen according to certain rules; many times, they prevent things
  - Fraud monitoring searches for transactions that would normally conform to controls but might contain fraud
  - Because they are part of the process, controls must be taught to employees – they require training and conformance audits
  - Fraud monitoring allows investigators to find fraudsters working around the normal controls in the system

# Continuous Monitoring

- Continuous monitoring works very well in some areas:
  - Credit card fraud (very defined schemes repeated often)
  - Email spam (same process applied each time)
- Continuous monitoring can be difficult in businesses with less organized or less standardized transactions
  - Fraud schemes are varied and are implemented differently each time
  - Most businesses are in this category

# Fraud Investigations vs. Continuous Monitoring

	Traditional Fraud Investigation	Continuous Fraud Monitoring
Initiation	Anonymous tip, routine audit find, report from vendor or customer	Management decision to start fraud monitoring in routine transactions
Timing	Starts when problem is found	Monitors transactions during creation
Nature	Ad hoc; investigators analyze and move where needed	Takes much more planning; more rigid and difficult to change
Data	Investigators usually work on a snapshot of past data	Investigators embed the detection into routine business systems
Limitations	Investigators are free to take as much time as they want; analyses are not limited by many factors	Analyses must run very fast and usually must be entirely computerized routines

# Type 1 and 2 Errors

Continuous monitoring can be costly, can turn into witch hunts, and can be wasteful and embarrassing if done incorrectly

	Problems Exist	No Problems
Problem Found and Reported	✓	Significant Amounts of Wasted Money or Embarrassment
Problem Not Found or Not Reported	Worst Case Scenario! Missed Fraud - Problem Will Be Found Later	✓

# Continuous Monitoring

- Continuous monitoring is difficult for many reasons:
  - It works on real business systems, so investigators have to tread lightly
  - Perpetrators learn what is monitored and will adapt their methods accordingly
  - Some scheme analyses require human interaction and cannot be embedded into systems
  - It requires a high level of collaboration with the IT department

# Example Continuous Monitoring Systems

- United Nations Red Flags Application
- Amoco Oil (now British Petroleum) Fraud Detection Database
- North Carolina Picalo Data Mining System
- India Ministry of Health and Family Welfare



# Bid Rigging Example

Item	BidderAUnit	BidderATotal	BidderBUnit	BidderBTotal	BidderCUnit	BidderCTotal
1.1.10	1829.85	1829.65		2100.00		1895.00
1.1.20	1256.99	1256.99		1380.00		1301.88
1.1.30	3467.52	3467.52		3900.00		3591.36
1.1.40	4.21	421.00	4.65	465.00	4.36	436.00
1.1.50	1.91	229.20	2.10	252.00	1.98	237.00
1.1.60	13328.00	13328.00		15100.00		13804.00
1.1.70	3360.00					
1.2.10	32.48	162.40	35.60	178.00	33.62	168.20
1.2.20	13.22	661.00	14.50	725.00	13.69	684.50
1.2.30	13.89	694.00	15.25	762.50	14.38	719.00
1.2.40	9.97	229.10	10.95	328.50	10.32	309.60
1.3.10	124.43	373.29	136.65	409.95	128.88	386.64
1.3.20	139.63	279.26	153.35	306.70	144.62	289.24
1.3.30	34.12	102.36	37.45	112.35	35.34	106.02
1.3.40	124.43	622.15	136.65	683.25	128.88	644.40
1.3.50	26.82	536.40	29.45	589.00	27.78	655.60
1.3.60	20.80	416.00	22.85	457.00	21.54	430.80
1.3.70	39.66	793.20	43.55	871.00	41.08	821.60
1.3.80	51.48	1287.00	56.55	1413.75	53.32	1333.00
1.3.90	52.96	1324.00	58.10	1452.60	54.85	1371.25
1.3.100	52.96	847.36	58.10	929.60	54.85	877.60
1.3.110	277.28	11091.20	304.50	12180.00	287.19	11487.60
1.3.120	203.53		223.50		210.80	
1.3.130	45.99	2759.40	50.50	3030.00	47.63	2857.80
1.3.140	12.19	487.60	13.40	536.00	12.63	505.20
1.3.150	11.70	468.00	12.85	514.00	12.12	484.80
1.3.160	12.49	249.80	13.70	274.00	12.94	258.80
1.3.170	2.45	24.50	2.70	27.00	2.54	25.40
1.3.180	326.39	326.39		358.00		338.05
1.4.10	9541.68	9541.62	10480.00	10480.00	9882.46	9882.46



# Example: Bidder Collusion

- Scheme: Two bidders are relatives and prepare their bids together
  - One bid is extremely high to make the lower bid more attractive
  - They may use the same address or same bid security bank
  - If they go to the same bid security bank, they might even have sequential instrument numbers
- Indicators:
  - Fuzzy match addresses
  - Fuzzy match bid security bank name
  - Check sequence of security instrument numbers

# Indicator 1: Fuzzy Match Bidder Addresses

Bidder 1 Address	Bidder 2 Address	Match Score
77 Lodhi Estate	76 Lodhi Estate	85 %
77 Lodhi Estate	77 Lodhi Colony	53 %
77 Lodhi Estate	76 Lodhi Gardens	35 %
77 Lodhi Estate	77 Friends Colony	6 %
77 Lodhi Estate	37 Golf Links Colony	0 %

Anything above about 25% is raised as an indicator

## Indicator 2: Fuzzy Match Bid Security Bank Names

Bidder 1 Security Bank Name	Bidder 2 Security Bank Name	Match Score
State Bank of India	State Bank of Indi (note misspelling)	92 %
Union Bank of India	Indian Bank	25 %
UTI	UTI Bank	100 %
South Indian Bank	IDBI Bank	0 %
IDBI	IDBI Bank	100 %

Requires a high match (85%) for indicator  
Remove "Bank" from the name before matching

## Indicator 3: Check Sequence of Bid Security Instrument Numbers

Bidder 1 Instrument Number	Bidder 2 Instrument Number	Sequential?
1505111	1505112	Yes
532144	9630255	No
8887254	671515238	No
90000001	90000000	Yes

# Detailed Example: Health Care Procurement in India



# Background

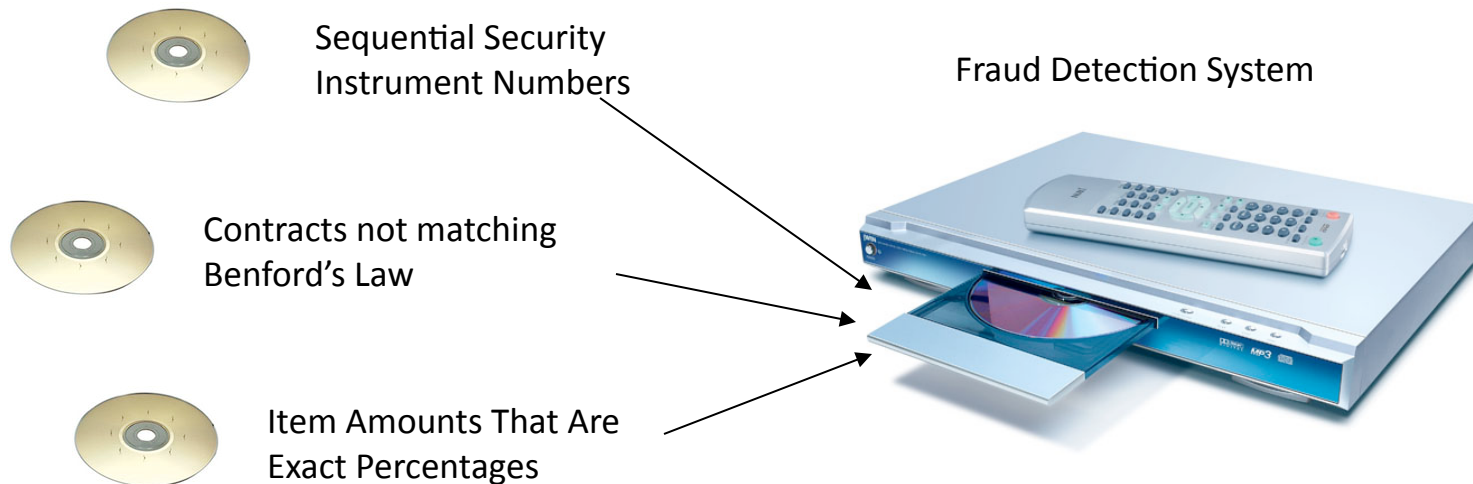
- India's Ministry of Health and Family Welfare (MoHFW) had several large frauds in World Bank-sponsored projects
- As part of an agreement with the World Bank, India agreed to implement a continuous monitoring system
- Initial implementation was difficult because many states used manual record systems
  - A new nationwide information system finally solved this problem

# Background

- We used the six-step (proactive) method for finding fraud
  - Started with a discovery mission to India
  - Brainstormed the potential schemes in the procurement system
  - Detailed the indicators of those schemes
  - Determined how to discover those indicators in the systems
- The Detectlet architecture was selected as the implementation platform

# Detectlets

- Since fraudsters constantly change and update their schemes, the system needs to quickly adapt and improve
- The fraud knowledge is encoded in detectlets: small, self-contained plugins





# Detectlets

- A detectlet encodes:
  - Background information on a scheme
  - Detail on a specific indicator of the scheme
  - Wizard interface to walk the user through input selection
  - Algorithm coded in standard format
  - “How to interpret results” follow-up

# Detectlet Example: Digital Analysis

The screenshot shows the Picalo software interface. The 'Tools' menu is open, and the 'Detectlets' sub-menu is selected. The 'Phantom Vendors' option is highlighted. Below the menu, a data table is visible with the following content:

	Invoice_Num	Date	Purchaser	
1	2.0	2004-01-01	Vijay	OJQ
2	27.0	2004-01-01	Vijay	GYP
3	32.0	2004-01-01	Adam	JCY
4	65.0	2004-01-01	Adam	PAY

**Detectlet Wizard: Find Groups Of Fabricated Numbers**

Welcome to the Detectlet Wizard! This Detectlet is described as follows:

This wizard allows you to find groups of invoice prices, pay rates, or other numbers that do not match Benford's law of probabilities. In the early 1900's, Frank Benford discovered that "natural" numbers generally follow a predictable pattern. Natural numbers (not random numbers!) are numbers that occur in nature, such as stock prices, invoice prices, pay rates, or election results.

As long as there are not unnatural limits on a set of numbers (such as a maximum pay rate), Benford's distribution gives a sense of whether numbers are natural. Human generated numbers do not follow the distribution.

If someone is fabricating invoices, bids, or other documents, the amounts they generate will not follow Benford's distribution, assuming the perpetrator doesn't know about the law. Comparing the difference between

Show Example Input Data

Click "Next" to begin.

< Back Next > Cancel

**Detectlet Wizard: Find Groups Of Fabricated Numbers**

First, select a table to analyze for Benford's distribution.

charges

Next, select a column to analyze for Benford's distribution. The column should contain naturally-occurring numbers, such as invoice amounts, stock prices, spending amounts, etc. (Numbers like unique ids, employee badge numbers, or social security numbers do not match Benford's distribution.)

Invoice\_Num  
Date  
Purchaser  
Vendor\_Code  
Amount

< Back Next > Cancel

# Mining for Fraud and Corruption

- While borrowers and World Bank officials can only review a small sampling of contracts, computers can analyze the full population
- Many procurement frauds are predictable and can be found using computer algorithms
- While the initial indicator set starts small, the plugin architecture allows the system to build and mature over time
  - Indicators will become more and more refined to Indian health system over time

The slide features a blue gradient background. At the top, there is a horizontal band with a grid pattern. Below this, the main area is a solid dark blue color. The text "System Screen Designs" is centered in white. At the bottom, there is another horizontal band with a grid pattern, similar to the top one.

# System Screen Designs

# View All Contracts Screen

Contract Entry System

Today is: 12 December, 2006  
News:

You are logged in as State of Rajasthan – Logout  
Manage my account

## View All Contracts

### Filters:

Contract Range:  to

Contracts With:

Region:

### Contracts:

Contract	Borrower	Number of Red Flags	Lost Bids	Brand Names	Last Bidder Winner	(additional indicators for a wide table...)
145623	Tamil Nadu	8	5%	20%	100%	
213422	Andhra Pradesh	2	10%	23%	0%	

This is called a  
“Matasos Matrix”

The base data element of analysis in this system is a contract, but it could have been an employee, a bidder, etc.

# View Contract Detail Screen

**Contract Entry System**

Today is: 12 December, 2006  
News:

You are logged in as State of Rajasthan – Logout  
[Manage my account](#)

## View Contract Detail

### Contract Information:

Contract Number: 14253  
Contract Name: Medicine Kit #23  
Borrower: Tamil Nadu

[View Contract Details](#)

### Indicators:

Indicator	Result	Description
Lost Bids	5%	This indicator looks for lost bids during the tender process. Bids should be recorded and kept throughout the process, and a lost bid may indicate more detailed problems.
Brand Names	20%	This indicator looks for brand names used in the bid requirements. Brand names can unfairly exclude many bidders and favor the bidders who make the brand names.
Last Bidder Winner	100%	This indicator finds bids where the last bidder is the winner. A bidder being the last winner on a single contract is not necessarily a problem, but a pattern of this behavior may indicate that the bidder is being given advance information about other bids.

This screen displays when a specific contract is selected.

It shows the detail for each indicator hit.

# View Contract Indicators Screen

**Contract Entry System**

Today is: 12 December, 2006  
News:

You are logged in as State of Rajasthan – Logout  
[Manage my account](#)

## View Contract Indicator Detail

### Contract Information:

Contract Number: 14253  
Contract Name: Medicine Kit #23  
Borrower: Tamil Nadu

[View Contract Details](#)

### Indicator: Same Security Bank

This indicator finds contracts with two bids using the same security deposit bank. It is rare that two bidders would use the same bank because of the many available banks that provide this service.

**Result: 100%**

Bid 10522: Swerkit Corporation  
Bank Name: IDBI Bank  
Bank Address: 552 Lodhi Estate

Bid 10535: Prakash Medical  
Bank Name: IDBI Bank  
Bank Address: 552 Lodhi Estate

This screen shows the detail behind an individual hit on a contract.

It allows the investigator to drill down into the detail behind it.

# Maintain Indicators Screen

Contract Entry System

Today is: 12 December, 2006  
News:

You are logged in as State of Rajasthan – Logout  
Manage my account

## Maintain Indicators

### Indicators:

Indicator	Description	Script	Red	Yellow	Updated	Actions
Lost Bids	This indicator looks for lost bids during the tender process. Bids should be recorded and kept throughout the process, and a lost bid may indicate more detailed problems.	LostBids.py	50%	10%	6 Mar 2006	<a href="#">Edit</a>   <a href="#">Delete</a>
Brand Names	This indicator looks for brand names used in the bid requirements. Brand names can unfairly exclude many bidders and favor the bidders who make the brand names.	Brand Names.py	60%	25%	16 Jun 2006	<a href="#">Edit</a>   <a href="#">Delete</a>
Last Bidder Winner	This indicator finds bids where the last bidder is the winner. A bidder being the last winner on a single contract is not necessarily a problem, but a pattern of this behavior may indicate that the bidder is being given advance information about other bids.	Last Bidder Winner.py	30%	7%	23 Dec 2005	<a href="#">Edit</a>   <a href="#">Delete</a>

[Add New Indicator](#)

This screen allows new detectlets to be added and poorly-performing detectlets to be improved or removed.





# List of Potential Indicators

# Procurement Fraud Indicators

- Bids are “lost”: Bid data is entered at first but then goes incomplete.
- Purchaser uses brand name in request for bids
- Rotation of winning bidders by job, type of work or geographical area
- The failure to adequately publicize requests for bids, e.g., using only local publications, or failing to publicize the request for bids
- Similarity between specifications and winning contractor’s product or services
- Specifications are significantly narrower or broader than similar previous requests for bids
- Unreasonably narrow contract specifications
- Unusual bid patterns. Bids have round numbers
- Unusual bid patterns. Bids come in on the same day
- Unusual bid patterns. Same bidder is always last
- Unusual bid patterns. Bids use the same bank for security deposit
- Unusual bid patterns. Security deposit has a sequential check number
- All bidders but one are disqualified for being technically nonresponsive
- Allowing an unreasonably short time limit to bid
- High number of competitive or sole source awards to one supplier
- Only one or a few bidders respond to request for bids
- Subsequent change orders reducing requirements for low bid line item
- Unusual bid patterns. Bids are too consistent in what items were responded to
- Unusual bid patterns. Bids are too inconsistent in what items were responded to

# Procurement Fraud Indicators

- Unusual bid patterns. Bid prices are identical or similar to prior or other bid
- Unusual bid patterns. One bid is far too low compared to the rest
- Unusual bid patterns. Bid amounts are too high.
- Winning bid too high compared to cost estimates
- Bid line item amounts that do not match Benford's law
- Bid total amounts that do not match Benford's law
- Verify line items with bid total amount
- Winning bid too high compared to similar jobs
- Bids with identical line item amounts between two competing bids
- Bid line items that are exact percentages of one another (from two competing bids)
- Apparent connections between bidders: common addresses, personnel, phone numbers, etc.
- Unusual bid patterns. Bids are incomplete
- Apparent high prices compared to similar contracts
- Sole source award above or just below competitive bidding limits
- Split purchases to avoid competitive bidding limits
- Previously competitive procurements become non-competitive
- Bid amounts for items on one contract are significantly higher than the same item on other contracts
- Estimates for items on one contract are significantly higher than the same item on other contracts
- Winning bid too high compared to published price lists
- Winning bid too high compared to industry averages

# Procurement Fraud Indicators

- The contractor submits the same or similar documentation to support billings on different contracts
- Contractor refuses, delays or is unable to provide supporting documentation for costs
- Contractor provides inadequate or out-of-date documentation for cost proposals
- Contractor fails to record rebates, discounts, etc.
- Weak or un-enforced controls in the receipt of goods and payment of invoices
- Inadequate, copied or apparently altered supporting documents
- Invoiced goods or services cannot be located in inventory or accounted for
- No receiving report for invoiced goods or services
- Questionable purchase order for invoiced goods or services
- Discrepancies between invoice and supporting documents.
- Discrepancies between reported facts and test and inspection results
- Refusal or inability to provide supporting documentation
- Inadequate or apparently altered supporting documentation
- No oversight or weak controls on disbursements and reimbursements
- Lack of supporting documentation; altered or copied documentation
- Endorsement on check differs from payee; unusual or second endorsement
- Use of imprest accounts for unauthorized purposes
- Use of imprest accounts for “loans”
- Poor controls on bidding procedures, e.g., failure to enforce deadlines
- Poor controls on bidding procedures, e.g., non-public opening of bids

# Procurement Fraud Indicators

- Multiple awards for similar work are given to the same contractor
- Similar work orders are issued to the same contractor under more than one contract
- Multiple invoices: In the same amount to related vendors
- Multiple invoices: In the similar amount to the same vendors
- Multiple invoices: In the similar amount to related vendors
- Multiple invoices: For the similar goods or services
- Disbursement of same or similar amounts to same person from both imprest fund accounts and accounts payable
- Bid due date extended unnecessarily
- Apparent high prices compared to price lists
- Apparent high prices compared to industry averages
- Unusual variances between estimated costs and actual costs
- Unusual variances between reported costs and actual costs
- High rate of rejections
- High rate of returns
- High rate of failures
- Complaints from users
- Use of imprest accounts for amounts in excess of those permitted
- Winning bid just under the next lowest bid
- No purchase order for invoiced goods or services
- Invoice prices exceed or do not match: Contract terms

# Procurement Fraud indicators

- Invoice amounts exceed or do not match: Purchase order
- Invoice amounts exceed or do not match: Receiving records
- Invoice amounts exceed or do not match: Inventory or usage records
- Invoice item descriptions exceed or do not match: Contract terms
- Invoice item descriptions exceed or do not match: Purchase order
- Invoice item descriptions exceed or do not match: Receiving records
- Invoice item descriptions exceed or do not match: Inventory or usage records
- Invoice terms exceed or do not match: Contract terms
- Invoice terms exceed or do not match: Purchase order
- Invoice terms exceed or do not match: Receiving records
- Invoice terms exceed or do not match: Inventory or usage records
- Multiple invoices: In the same amount to the same vendors
- Multiple invoices: On the same invoice
- Multiple invoices: On the same purchase order
- Multiple invoices: For the same goods or services
- Multiple invoices with the same: Description of goods or services
- Multiple invoices with the same: Amount
- Multiple invoices with the same: Invoice number
- Multiple invoices with the same: Purchase order number
- Total payments to vendor exceed total purchase order

# Procurement Fraud Indicators

- Vendors not listed in business directories.
- Vendors not listed in telephone directories.
- Vendor address is mail drop
- Poor controls and inadequate bidding procedures
- Bidder close to procurement personnel or participated in drafting contract specifications
- A qualified bidder disqualified for questionable reasons
- Persistent high prices over time
- Particular line item bids do not appear to have been performed or purchased as specified in the contract
- Losing bidders hired as subcontractors
- Acceptance of late bids
- Winning bid voided for “errors” in contract specifications and the job is re-bid
- No justification or documentation for non-competitive awards
- Awards made below the competitive bid limits that are followed by change orders that exceed such limits
- Bidder has been black listed but is allowed to bid
- Unusual or generic packaging
- Product identification numbers differ from published or catalogue numbers or numbering system
- Discrepancy between product's description or normal appearance and actual appearance (e.g., “new” product appears to be used)
- Discrepancies between test and inspection results and contract claims and specifications

# Procurement Fraud Indicators

- Failed tests or inspections
- Low quality, poor performance and high volume of complaints
- Early failure or high repair rates
- Above average number of test or operation failures, early replacements, or high maintenance and repair costs.
- Weak controls and lax procedures regarding review of need for change orders
- Unexplained change orders for a specific contractor approved by same employee
- Vague contract specifications followed by change orders
- Incomplete or “preliminary” specifications subject to change based on later engineering studies, etc.
- Purchased items “returned” to vendor without vendor credit or refund
- Unusual or unexplained high volume purchases of products or services from a particular supplier
- Inadequate or rushed needs analysis and justification
- Unusual change orders for a specific contractor approved by same employee
- Unusual purchases of “consumer items” or items suitable for personal use or resale
- Numerous change orders for a specific contractor approved by same employee
- High volume purchases of “consumer items” or items suitable for personal use or resale
- Two or more similar procurements from the same supplier in amounts just under competitive bidding or upper level review limits
- Replacement or repairs after unreasonably short time period
- Business purchases from vendors that sell consumer products
- Purchased items to be drop shipped or delivered to another location



# Procurement Fraud Indicators

- Suspect employee conducts an outside business
- Surplus sales followed by reorders
- Pattern of low bid award followed by change orders that increase the price of the contract
- Pattern of low bid award followed by change orders that increase the scope of the contract
- Pattern of low bid award followed by change orders that extend the contract period
- Contracts under the competitive bid limit followed by change orders that increase amounts of the contract
- Unjustified separation of purchases, e.g. separate contracts for labor and materials, each of which is below competitive bidding limits, but when combined is over such limits
- Sequential purchase orders or invoices under upper level review or competitive bidding limits
- Adopting unreasonable “pre-qualification” procedures
- Evaluation committee composition - bribery, you give me/I give you,
- Number of bidding documents issued vs. number of bidders (if a big difference, something must be going on)
- Number of clarification requests
- Delays in award after evaluation committee
- Collusion during the implementation
- Intentional simple arithmetic errors to make the final amount higher
- Invoiced goods or services cannot be located or verified.
- Acceptance of late bids
- The contractor submits several billings for the same or similar expenses or work under different jobs or contracts
- Total payments to vendor exceed total contract amounts

# Procurement Fraud Indicators

- Invoice prices exceed or do not match: Purchase order
- Invoice prices exceed or do not match: Receiving records
- Invoice prices exceed or do not match: Inventory or usage records
- Invoice amounts exceed or do not match: Contract term
- Late bidder is the low bidder
- Weak controls: same employee can order, receive and approve payment for goods or services
- Paid vendors not on the approved vendor list
- Winning bid was not the lowest bid
- Particular line item bids appear to be unreasonably low compared with past bids of the product
- A significant number of qualified bidders fail to bid