RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

2020 Rutgers Governmental Accounting & Auditing Update Conference

12/03/2020

Miklos A. Vasarhelyi
Hussein Issa

Rutgers Business School

Outline

- Introduction
  - The CarLab (Miklos)
  - GASB Post-Implementation Review Project (Miklos)
- Back to the future: a vision
  - Objectives and Preliminaries (Miklos)
  - Architecture (Hussein)
  - Emerging technologies (Hussein)
  - Some immediate steps towards a digital strategy (Miklos)
- Conclusions (Miklos)
- APPENDIX: Some of our project

INTRODUCTION

THE CARLAB

All academic Accounting programs around the world are ranked annually by BYU. For many years now, the Accounting Information Systems (AIS) group at RBS has led the world in the application of information technology to the audit profession. We are very proud to announce that the just-released BYU rankings for 2019 confirm again the continued success of Rutgers Business School in both AIS and audit research:

Main Ranking for Accounting Information Systems (all methods) 2019

Top of Form

University	Last 6 Years	Last 12 Years	All Years
Rutgers, The State University of New Jersey	1	1	1

Main Ranking for Auditing (all methods) 2019

University	Last 6 Years	Last 12 Years	All Years
Rutgers, The State University of New Jersey	7	9	11

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School

CarLab Analytic Research in Public Sector

NYC Street Cleanliness and on-street Parking	IPSASB - XBRL	SICONFI
Brazilian Navy	Brazil Health System Acquisition – Rio de Janeiro Municipality	Securities and Exchange Commission of Brazil (CVM)
PCAOB - Webcast	NPO Form990 Database	Rutgers Internal Audit
Audit with Blockchain & Smart Contracts on the Government Sector	Open Government Financial Data	XBRL reporting for U.S. local governments

OUR EDUCATIONAL PROGRAMS AND DIGITAL LIBRARY

Rutgers Accounting Digital Library

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Rutgers Business School
Newark and New Brunswick

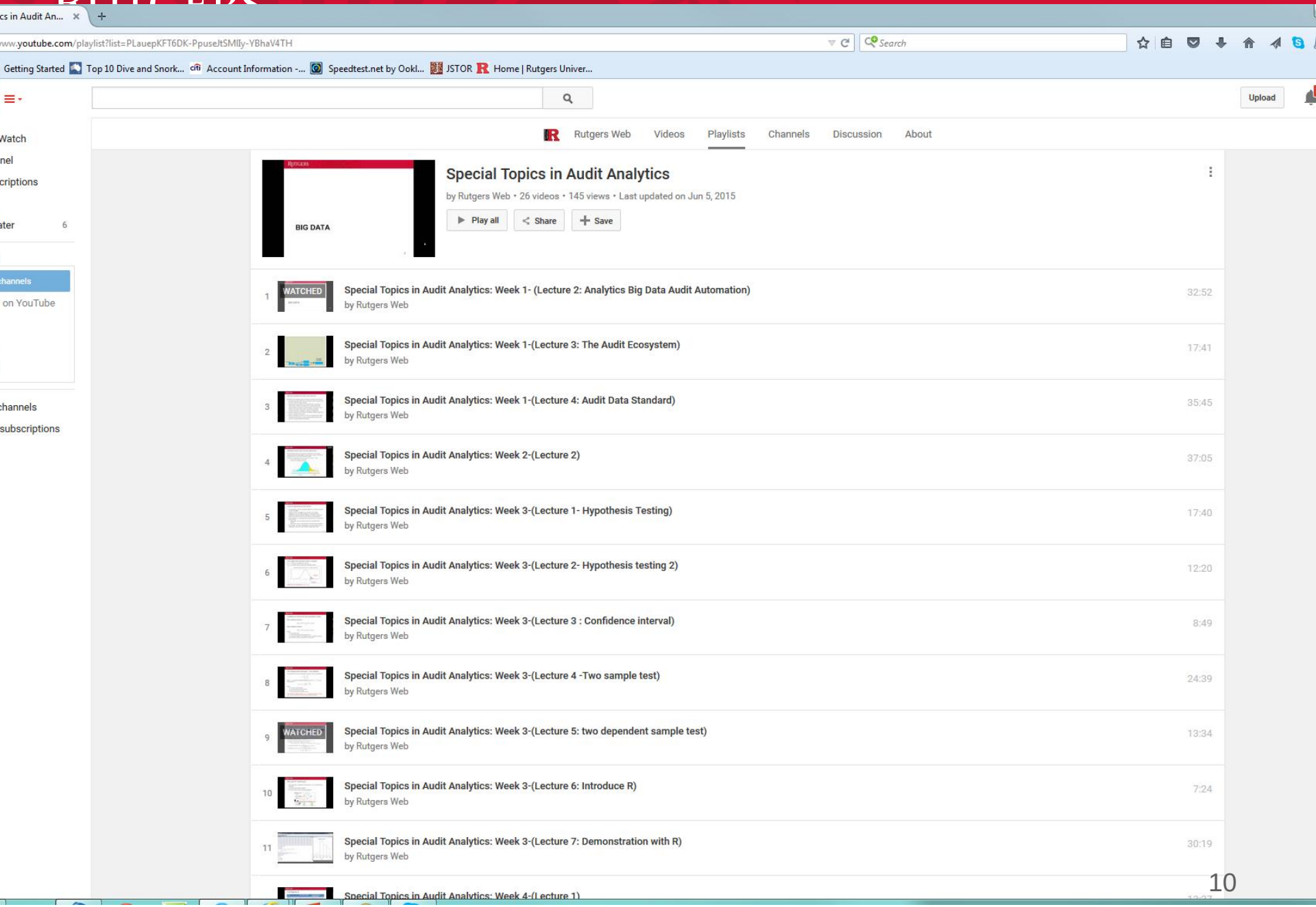
RUTGERS ACCOUNTING DIGITAL LIBRARY

Rutgers Accounting Web

Rutgers Accounting Web

Over 500 Online Classes for Students, Faculty and Public

- **Undergraduate**
  - ✓ Introduction to Financial / Managerial Accounting
  - ✓ Intermediate Accounting I & II
  - ✓ Advanced Accounting
  - ✓ Financial Accounting (Gold Series)
  - ✓ Auditing Principles
  - ✓ Management and Cost Accounting
  - ✓ Accounting Information Systems
  - ✓ Business Law I & II
  - ✓ Federal Taxation I
  - ✓ Accounting in the Digital Era
  - ✓ Decoding of Corporate Financial Communications
- **Graduate**
  - ✓ Accounting Principles and Practices
  - ✓ Information Technology
  - ✓ Government and Not-for-Profit Accounting
  - ✓ Advanced Auditing and Information Systems
  - ✓ Income Taxation
- **PhD**
  - Survey of Accounting Information Systems
  - Current Topics in Auditing
  - Machine Learning
- **Audit Analytics**
  - Introduction to Audit Analytics
  - Special Topics in Audit Analytics
  - Information Risk Management



cs in Audit An...

www.youtube.com/playlist?list=PLauepKFT6DK-PpuseJtSMIIy-YBhaV4TH

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BIG DATA

Special Topics in Audit Analytics

by Rutgers Web • 26 videos • 145 views • Last updated on Jun 5, 2015

Play all | Share | Save

1	WATCHED	Special Topics in Audit Analytics: Week 1- (Lecture 2: Analytics Big Data Audit Automation) by Rutgers Web	32:52
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3		Special Topics in Audit Analytics: Week 1-(Lecture 4: Audit Data Standard) by Rutgers Web	35:45
4		Special Topics in Audit Analytics: Week 2-(Lecture 2) by Rutgers Web	37:05
5		Special Topics in Audit Analytics: Week 3-(Lecture 1- Hypothesis Testing) by Rutgers Web	17:40
6		Special Topics in Audit Analytics: Week 3-(Lecture 2- Hypothesis testing 2) by Rutgers Web	12:20
7		Special Topics in Audit Analytics: Week 3-(Lecture 3 : Confidence interval) by Rutgers Web	8:49
8		Special Topics in Audit Analytics: Week 3-(Lecture 4 -Two sample test) by Rutgers Web	24:39
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10		Special Topics in Audit Analytics: Week 3-(Lecture 6: Introduce R) by Rutgers Web	7:24
11		Special Topics in Audit Analytics: Week 3-(Lecture 7: Demonstration with R) by Rutgers Web	30:19

Special Topics in Audit Analytics: Week 4-(Lecture 1)

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GASB Post-Implementation Review Project

Ben Yoon
Huaxia Li
Kevin Moffitt
Rutgers CarLab

July 2020

Project Objectives

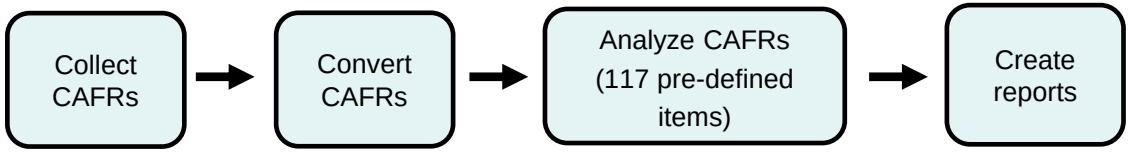
- This project will build a dynamic information system that
  1) automatically captures the CAFRs from different governmental entities,
  2) parses relevant items from the CAFRs, and
  3) converts them into a structured data

- The structured data be easily used by the GASB to perform the post-implementation review (PIR) of the new GASB pension standards.

  * In 2012, the GASB announced new pension standards (No. 67 and 68).

4 Steps of This Project

- This project consists of 4 steps.



- Rutgers has conducted initial pilot tests.
  - Step1: Collecting 36,676 CAFRs from 3 repositories
  - Step2: Converting PDF documents
  - Step3: Extracting 8 items from the CAFRs
  - Step4: Report with Excel format

Automatic CAFR Collection

- 36,676 CAFRs from multiple sources

  - GFOA (Government Finance Officers Association)

    : 16,161 CAFRs (4 years)

  - EMMA (Electronic Municipal Market Access)

    : 14,400 CAFRs (more than 10 years)

  - NJ Department of Education (Schools and School districts)

    : 6,115 CAFRs (9 years)

- Automatic CAFRs collection

  1) Analyzing webpage

  2) Web-crawling (Scrapy, open-source web-crawling framework written in Python)

Converting PDF

- Automatic CAFRs conversion
  - Utilizing open source program and commercial program
- Text format PDF or Password locked PDF
  - Apache Tika conversion tool
- Image-scanned PDF file
  - Commercial PDF conversion tool
  - Google's Tesseract-OCR Engine (Optical Character Recognition)
  - MS-WORD's OCR Engine

Extracting Information

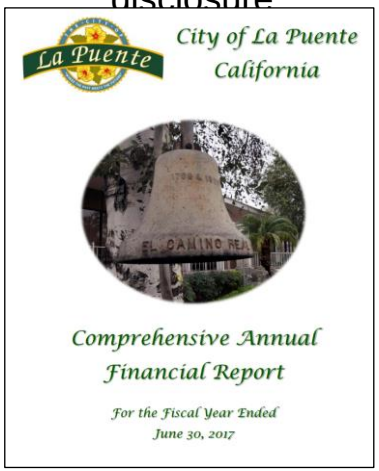
- Pension liability Percentage (detail examples)

Example of
Low Pension liability
percentage

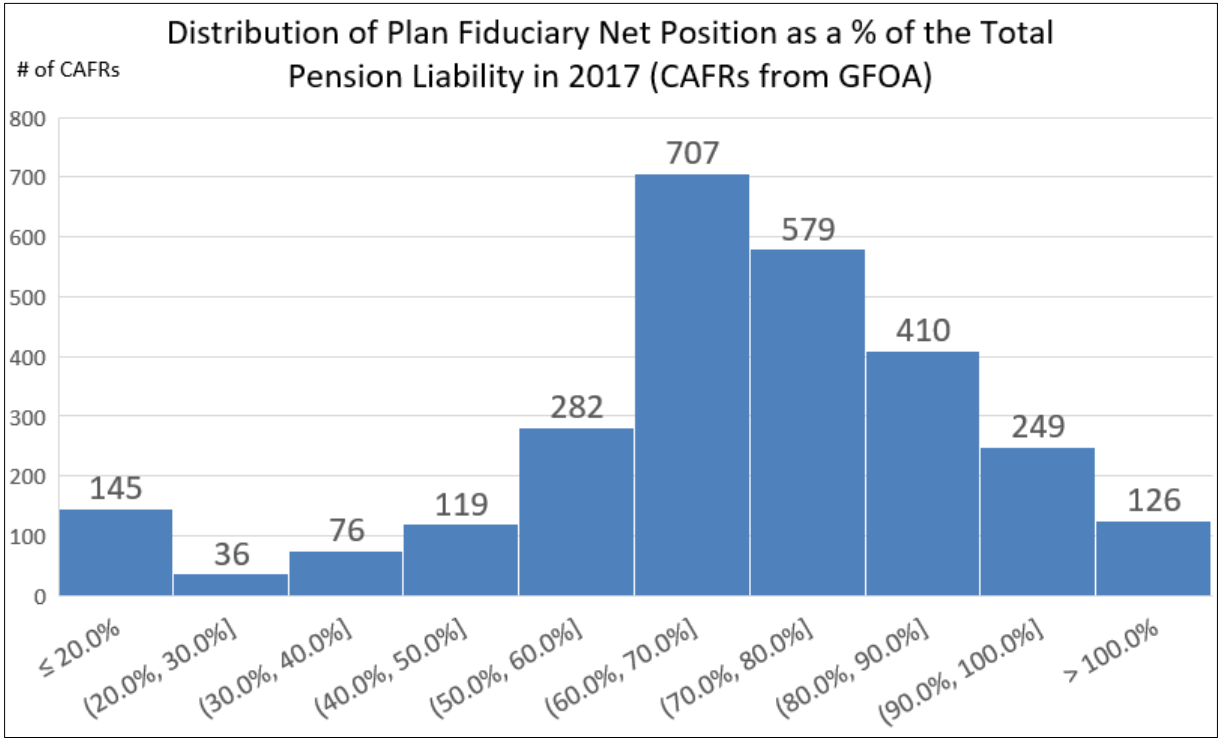
CITY OF MISHAWAKA
NOTES TO FINANCIAL STATEMENTS
December 31, 2017
(Continued)

	1925 Police Officers' Pension
Actuarial net pension liability	$ 18,095,597
Plan fiduciary net position	(763,592)
Net pension liability	$ 17,332,005
Plan fiduciary net position as a percentage of total pension liability	4.22%

Example of
No pension liability percentage
disclosure



Extracting Information



Extracting Information

- Example of the report

	A	B	C	D	E	F	G	H	I
1	File Name	Auditor's report			Pension Investment Policy			Liability Ratio	Discount rate
2		Audit Opinion	Report Date	GASB 67	Procedures & Policies for Estab. & Amending (Y/N)	Asset Allocation Policies (Y/N)	Significant Changes in Investment Policies (Y/N)		
3	GFOA_2017_Data/AL/Municipality/GulfShoresAL.pdf	Unqualified Opinion	4/19/2018	Yes	Yes	Yes	Not Mention	71.4%	8.0%
4	GFOA_2017_Data/AL/Municipality/DecaturAL.pdf	Unqualified Opinion	5/31/2018	No	Yes	Yes	Not Mention	67.9%	7.8%
5	GFOA_2017_Data/AL/Municipality/TuscaloosaAL.pdf	Unqualified Opinion	6/7/2018	No	Yes	Yes	Not Mention	74.3%	3.8%
6	GFOA_2017_Data/AL/Municipality/PrattvilleAL.pdf	Unqualified Opinion	3/23/2018	No	Yes	Yes	Not Mention	71.0%	7.8%
7	GFOA_2017_Data/AL/Municipality/HuntsvilleAL.pdf	Unqualified Opinion	NA	No	Yes	Yes	Not Mention	63.7%	7.8%
8	GFOA_2017_Data/AL/Municipality/HooverAL.pdf	Unqualified Opinion	3/28/2018	No	Yes	No	Not Mention	74.5%	7.8%
9	GFOA_2017_Data/AR/Enterprise Fund(s)/ArkansasWaterandSewerCommissionAR.pdf	Unqualified Opinion	1/12/2018	No	Yes	No	Not Mention	NA	NA
10	GFOA_2017_Data/AR/Enterprise Fund(s)/ArkansasLotteryCommission.pdf	Unqualified Opinion	11/28/2017	No	Yes	Yes	Not Mention	75.5%	7.5%
11	GFOA_2017_Data/AZ/Municipality/SedonaAZ.pdf	Unqualified Opinion	12/15/2017	No	Yes	Yes	Not Mention	67.1%	8.0%

Some immediate steps

- Require directly processable format (CSV, text, not PDF)
- Create a common store a la open data (e.g. EDGAR)
- Use our robot / methodology to make the data store more compliant
- Publish some PIR results with exception reporting

Back to the future: a vision of leapfrogging

- Objectives & Preliminaries
- Architecture
- Emerging technologies
- Progressing
  - Immediate steps
  - Intermediary
  - The Big vision

OBJECTIVES & PRELIMINARIES

What could government reporting really do?

- Assessing accountability
- Serve as a basis for financing of government entities
- Report / measure service reductions
- Provide a basis for armchair audits
  - The public see government finances (operations???)
- Rank and compare states / municipalities
- Compliance with laws and regulations
- Further understand the implementation of budgets
- Predict events (bankruptcy, shortfalls, social pathologies)
- Further understand the investments in infrastructure and the status of infrastructure
- Replace a myriad of existing reports (a la SBR in Holland)

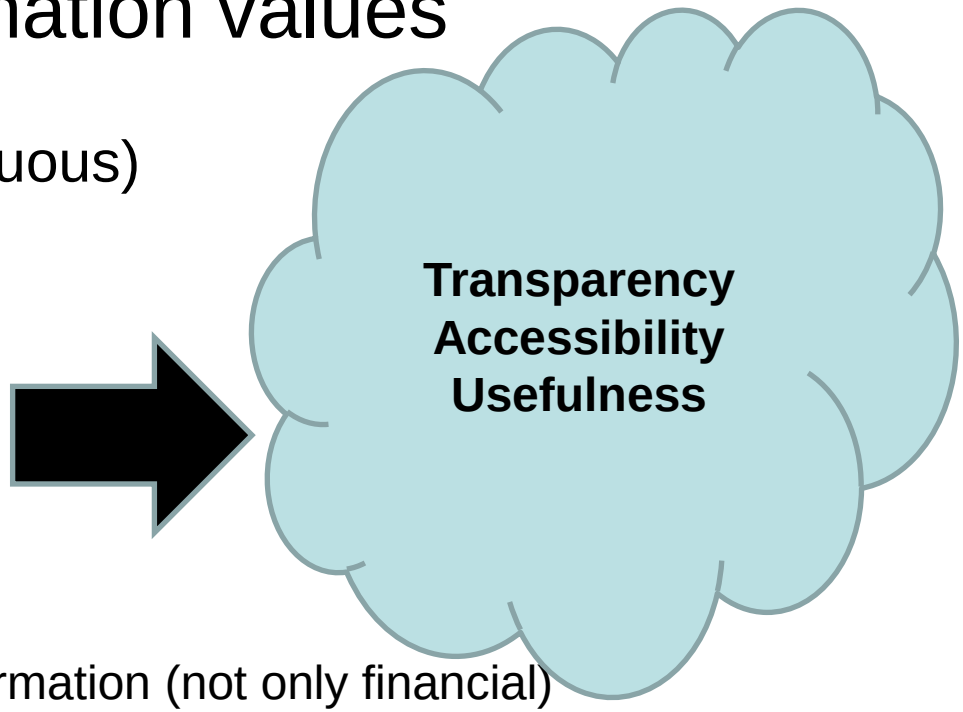
Preliminaries

- In the sixties corporate financial information reports explained about 60% of the valuation today about 5% (see the End of Accounting by Lev and Gu)
- Auditors today still use judgmental samples of 50 to evaluate populations of millions of transactions
- Analysts/ loan officers of municipal titles use nearly manual methods to evaluate municipal titles in the lack of comprehensive comparative databases
- 85% of S&P 500 firms publish non-GAAP info and 35% have some form of assurance. Typically SASB and Integrated reporting information

- Lev, B., & Gu, F. (2016). *The end of accounting and the path forward for investors and managers*. John Wiley & Sons.

3 core information values

- Timely (continuous)
- Standardized
- Informational
  - Current
  - Past
  - Future



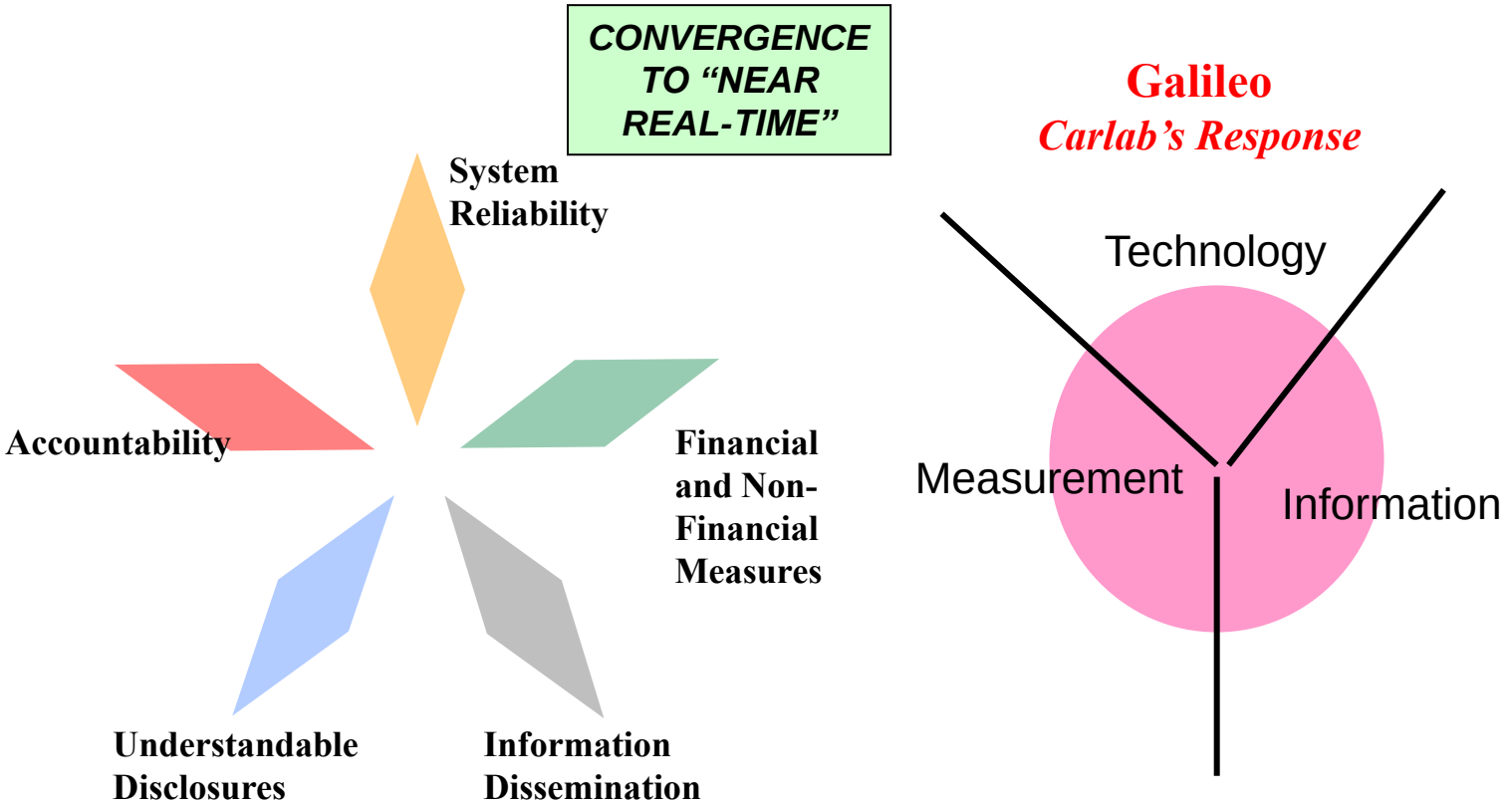
  - Scope of information (not only financial)
  - Rapid response
  - Qualitative and quantitative
  - Interactive for the government

ARCHITECTURE

Stakeholders

- Citizens
- Analysts
- Bond Investors
- Creditors
- Legislative and oversight bodies
- Policy makers
- Auditors
- Journalists
- Lobbyists
- Preparers
- etc

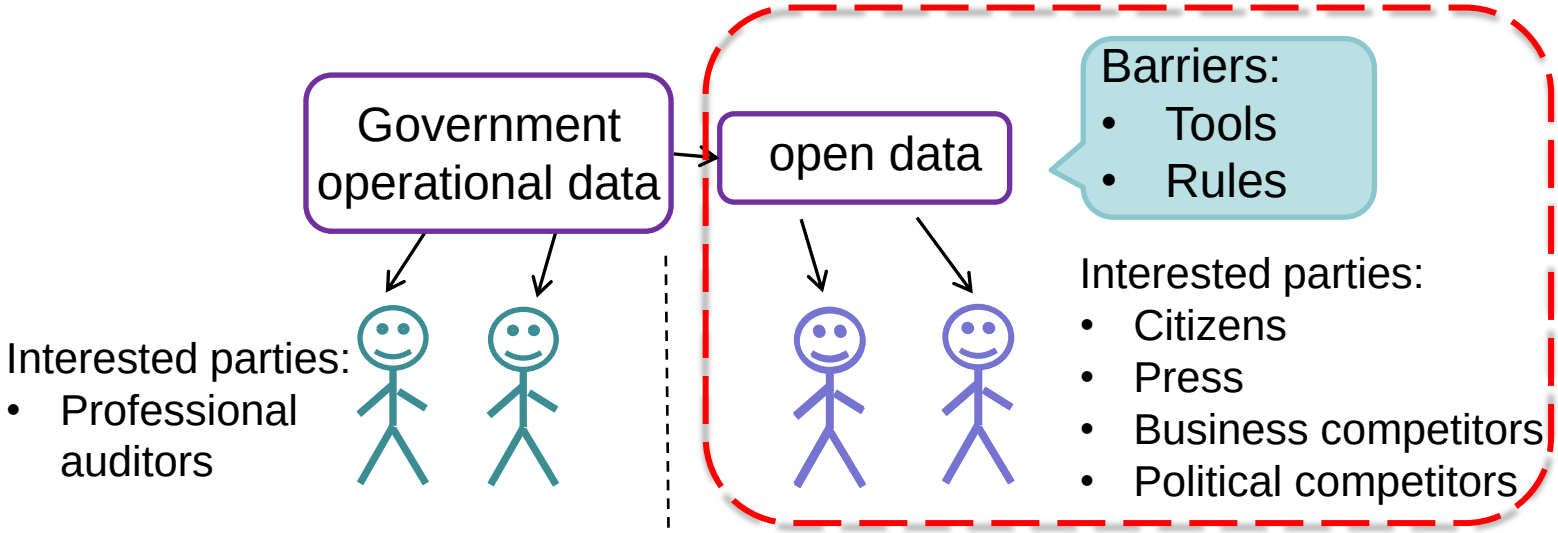
ELEMENTS OF ENHANCED GOVERNMENT REPORTING



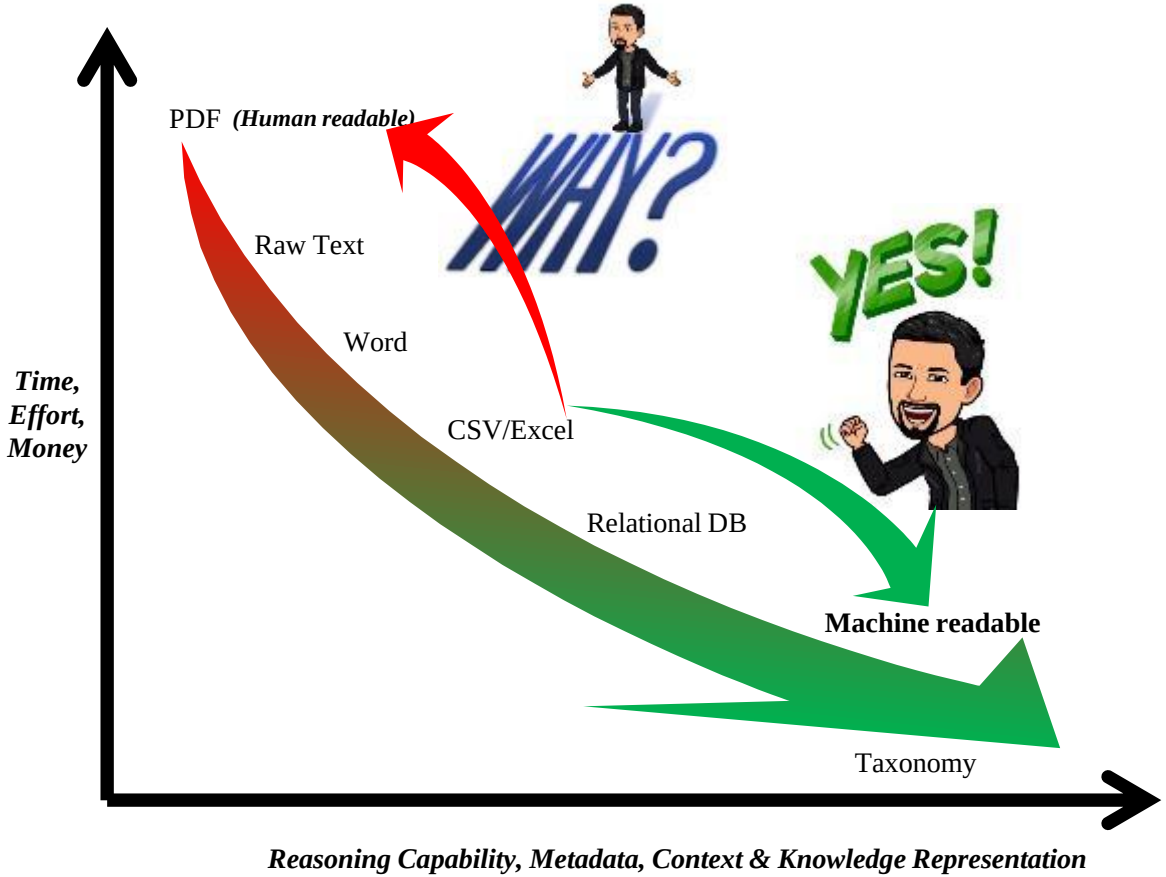
Government Open Data and Armchair Auditors

- Countries are undertaking initiatives to open third-party access to data regarding financial and operational information of governments (O'Leary 2015; Schneider et al. 2015)

- Following the open data movement, "armchair auditors" are playing an increasingly important role in crowdsourced monitoring of government expenditures
  - Armchair auditor: anyone who has interest in government spending



Data formats



Machine readable format for State and Local U.S. Governm… Financial Reports

This PDF must be manually extracted!

Original PDF

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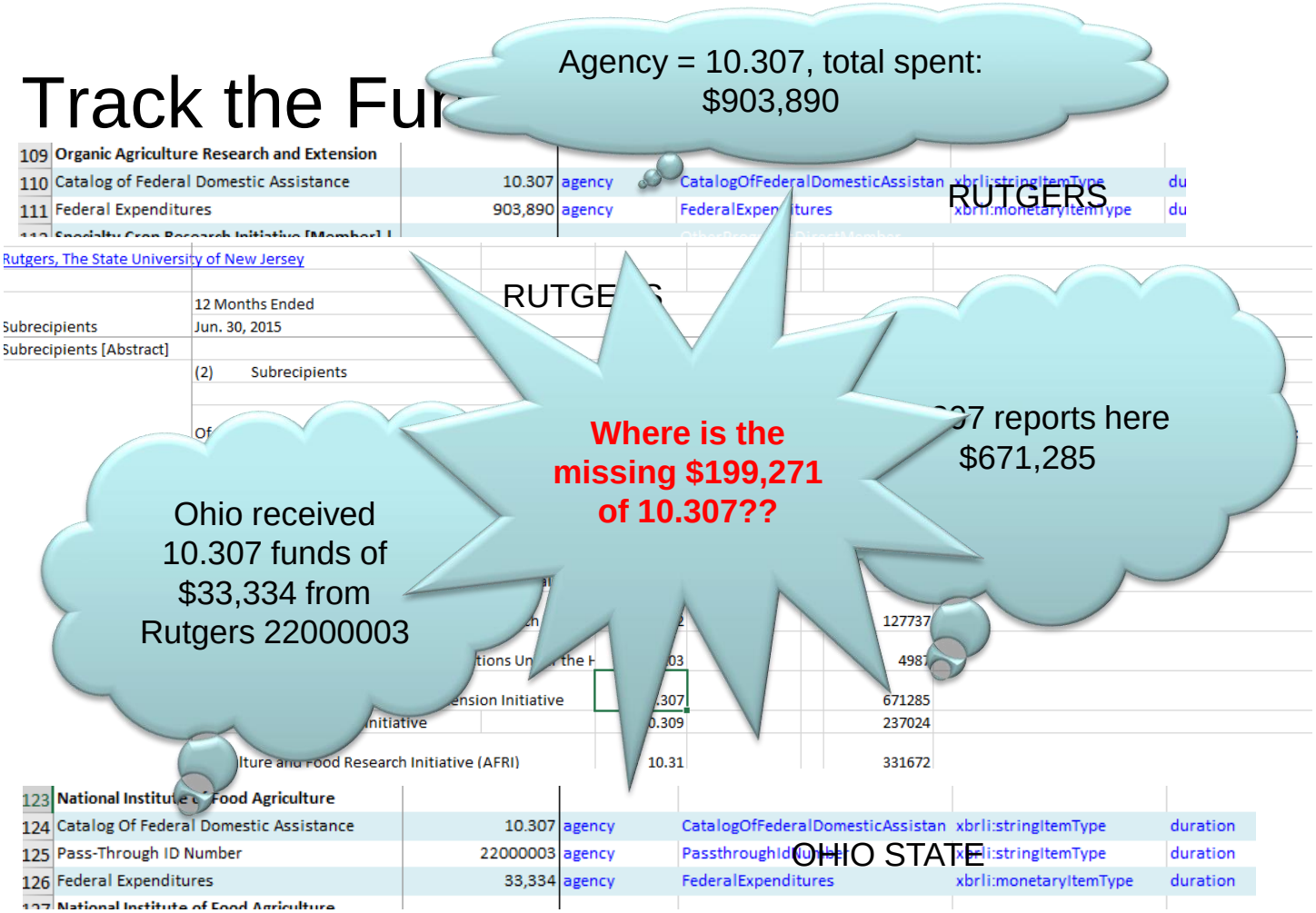
Schedule of Expenditures of Federal Awards

Year Ended June 30, 2015

Federal Grantor/Pass Through Grantor/Program or Cluster Title	Federal CFDA Number or Other ID Numbers	ARRA	Federal Expenditures
Research and Development Cluster, continued:			
Pass Through, continued:			
Corporation for National and Community Service:			
State of New Jersey – Department of State			
AmeriCorps	94.006	$	48
The College of New Jersey			
AmeriCorps	94.006		27,977
Subtotal Corporation for National and Community Service			28,025
U.S. Department of Agriculture:			
Auburn University			
Agriculture and Food Research Initiative (AFRI)	10.310		129,455
Brigham Young University			
Various	10.RD		16,431
Colorado State University			
Integrated Programs	10.303		294
Connecticut Agricultural Experiment Station			
Grants for Agricultural Research, Special Research Grants	10.200		4,633
Cornell University			
Grants for Agricultural Research, Special Research Grants	10.200		64,964

Track the Fu


Agency = 10.307, total spent: $903,890
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Where is the missing $199,271 of 10.307??
Ohio received 10.307 funds of $33,334 from Rutgers 22000003
07 reports here $671,285
OHIO STATE
109 Organic Agriculture Research and Extension
110 Catalog of Federal Domestic Assistance 10.307 agency CatalogOfFederalDomesticAssistan xbrli:stringItemType du
111 Federal Expenditures 903,890 agency FederalExpen itures xbrli:monetaryItemType du
Rutgers, The State University of New Jersey
12 Months Ended
Jun. 30, 2015
Subrecipients
Subrecipients [Abstract]
(2) Subrecipients
127737
4987
671285
237024
331672
10.31
123 National Institute of Food Agriculture
124 Catalog Of Federal Domestic Assistance 10.307 agency CatalogOfFederalDomesticAssistan xbrli:stringItemType duration
125 Pass-Through ID Number 22000003 agency PassthroughIdNumber xbrli:stringItemType duration
126 Federal Expenditures 33,334 agency FederalExpenditures xbrli:monetaryItemType duration

EMERGING TECHNOLOGIES

The Emerging Technological Landscape

- Artificial Intelligence
- Drones
- RPA/IPA
- Blockchain
- Text mining
- Process mining
- Image and video recognition
- And many more

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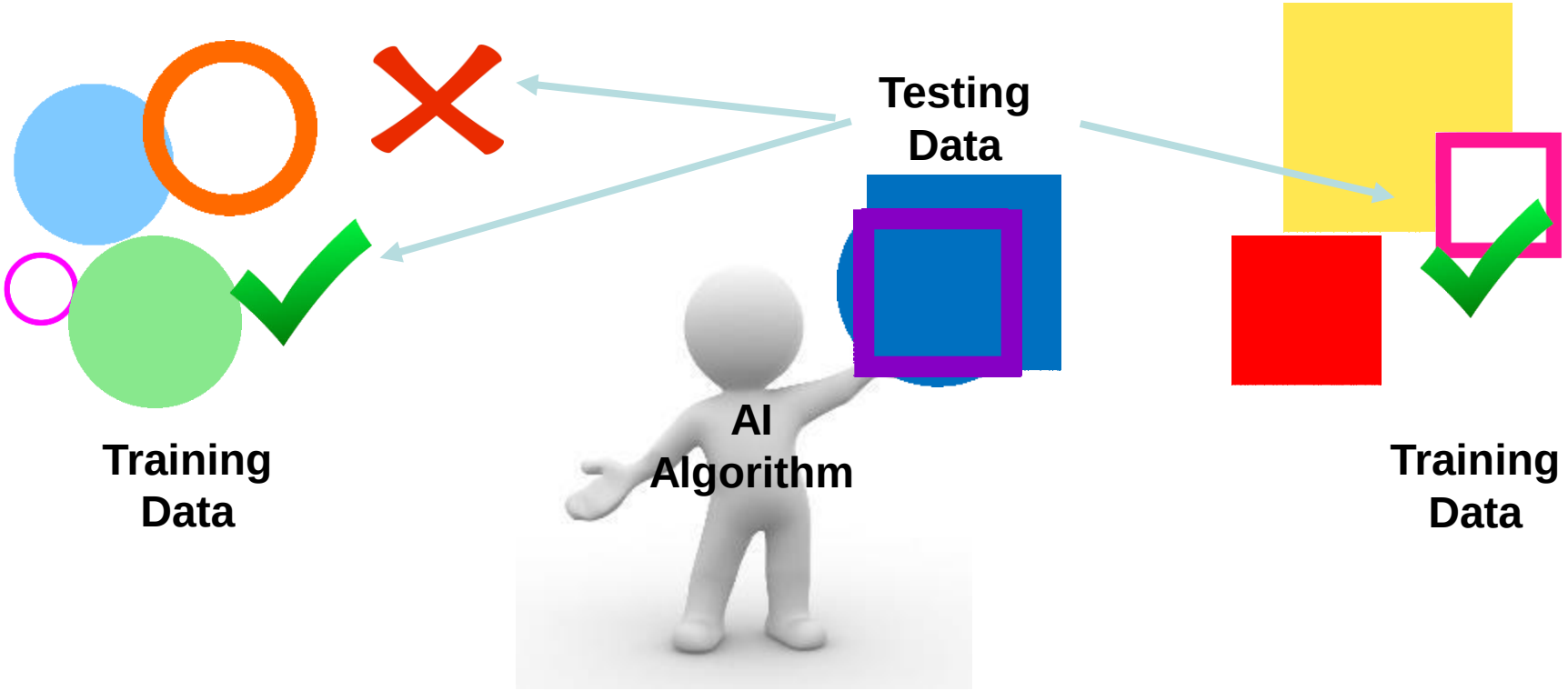
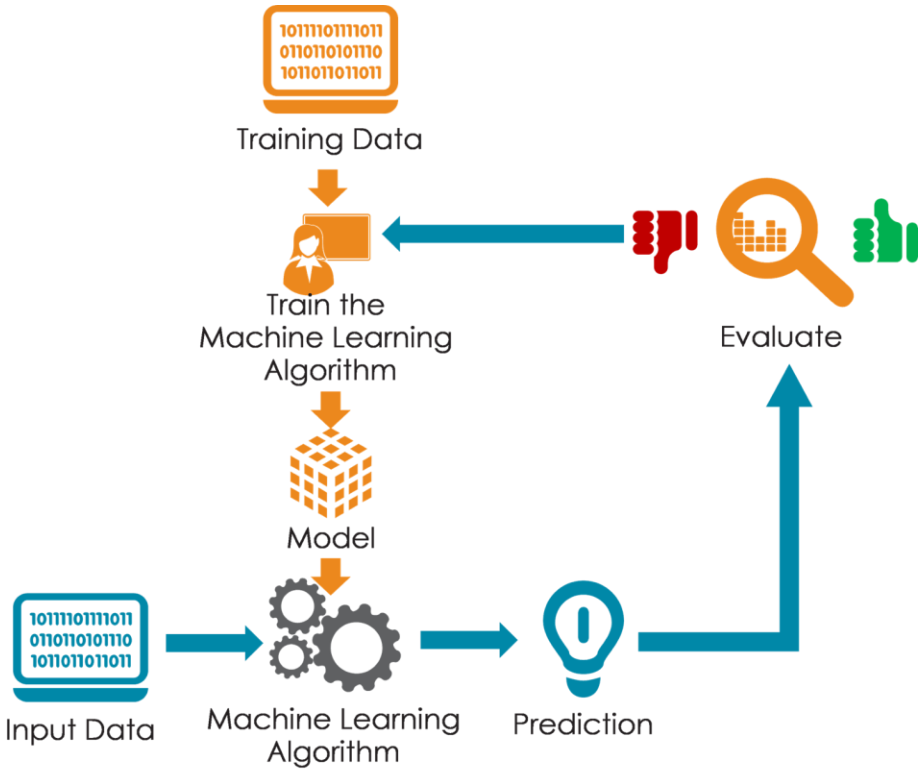
ARTIFICIAL INTELLIGENCE

How does AI work?



Machine Learning



https://www.linkedin.com/pulse/building-machine-learning-infrastructure-pat-alvarado/

Examples of What Machine Learning can do

INPUT A	RESPONSE B	APPLICATION
Picture	Are there human faces? (0 or 1)	Photo tagging
Loan Application	Will they repay the loan? (0 or 1)	Loan approvals
Ad plus user information	Will user click on ad? (0 or 1)	Targeted online ads
Audio clip	Transcript of audio clip	Speech recognition
English Sentence	French Sentence	Language translation
Sensor from plane engine, etc	Is it about to fail?	Preventive maintenance
Car camera and other sensors	Position of other cars	Self-driving cars

Source: Andrew Ng

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DRONES

Drones

E&Y University Drones for Inventory Case Studies! Bryan's Amazing Animals

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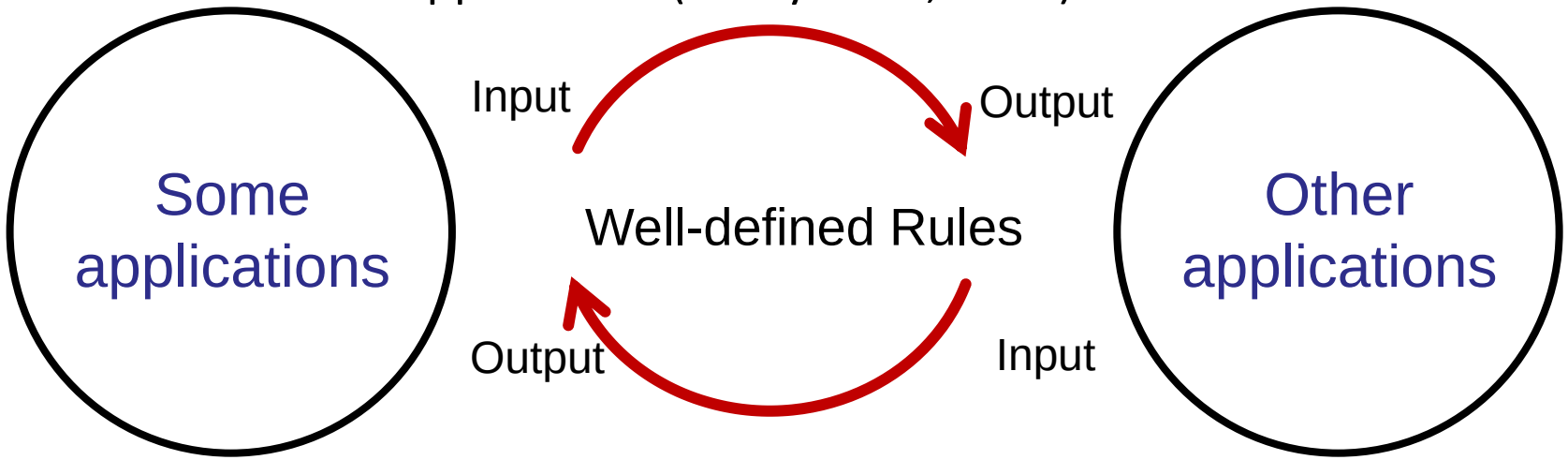
ROBOTIC PROCESS AUTOMATION

Robotic Process Automation

- RPA is a software that can automate repetitive and rule-based tasks.
- RPA robots are capable of mimicking many–if not all–human user actions.
- They log into applications, move files and folders, copy and paste data, fill in forms, extract structured and semi-structured data from documents, scrape browsers, and more.

Robotic Process Automation

- RPA is ideal for “swivel chair” processes in which the inputs from some applications are processed using rules and the outputs are then entered in other applications (Lacity et al., 2015).



Interoperability

Tasks that RPA deals with

- Definable
- Standardized
- Rule-Based
- Repetitive
- Machine-readable inputs

RPA simple functions

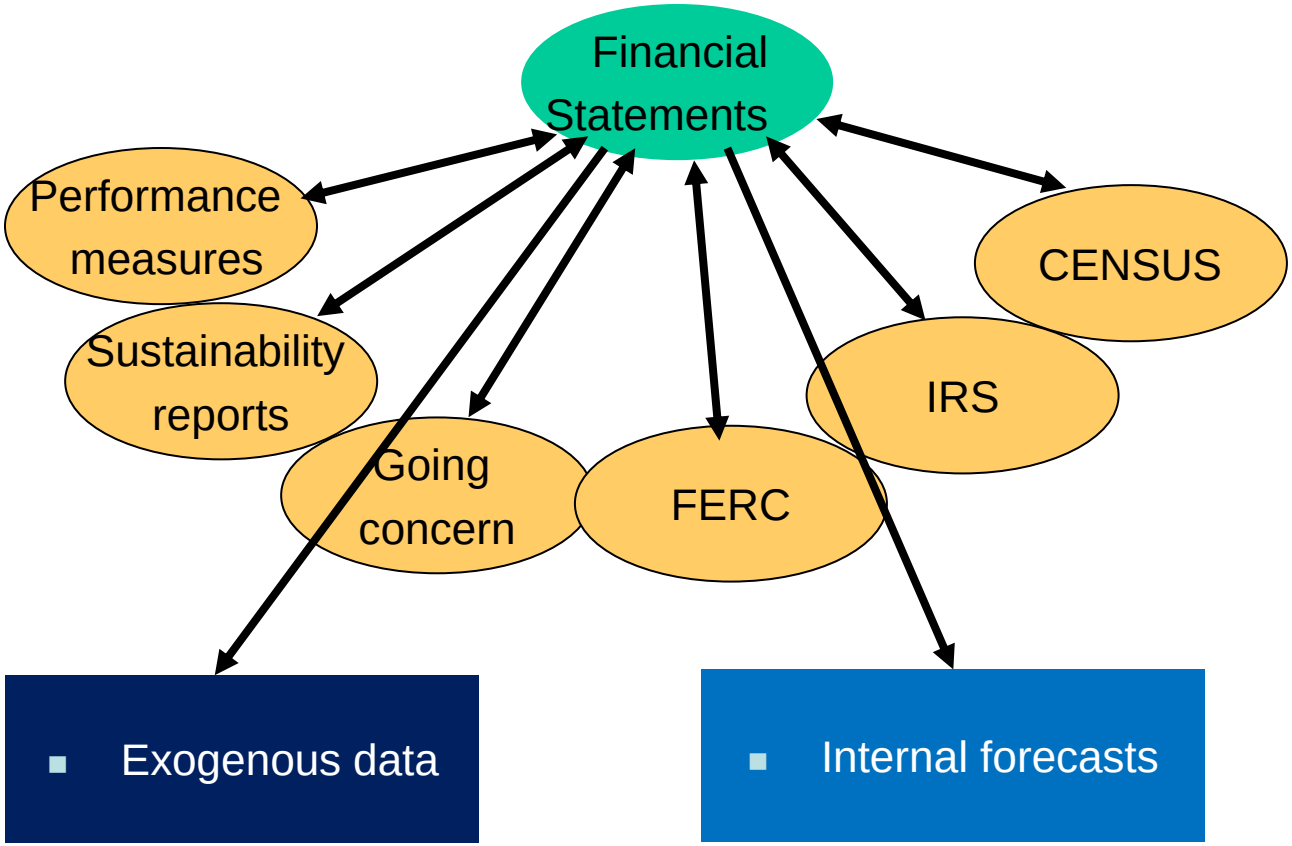
- Open, read, and create emails
- Log in to enterprise apps
- Move files and folders
- Copy and paste
- Fill in forms
- Read and write to databases
- Follow decision rules
- Collect statistics
- Extract data from documents
- Make calculations
- Obtain human input via emails and workflow
- Pull data from the internet
- Keystrokes

Audit with RPA-Tax software case study

- Open a Parameters files (excel)
- Start the tax software
- Use user credentials (from the parameters file) to log in
- Message popup asking for user input (Captcha)
- Navigate to the client's records (based on the parameters file)
- Open the client's records
- Initiate Import process
  - Navigate to the needed file (based on the parameters file)
  - Import the file (multiple steps)
- Run Analyses (e.g. depreciation)
- Initiate Export process
  - Navigate to the needed folder (based on the parameters file)
  - Export the file (multiple steps) in Excel format
  - Rename the file (unique, with date and client name)
  - Save in the Export folder
- Open the exported file in Excel
  - Run a Macro in Excel (data manipulation, pivot, sheet creation, etc)
  - Save the final file

PROGRESSING – BABY STEPS

Many non-financial reporting disclosures



Plentiful of external (exogenous) data

- XBRL enabled real-time comparative benchmarks
- Links to vendors and suppliers (enrich the value chain information)
- Required disclosure of related parties like dependent SPEs if not consolidated
  - (a requirement of disclosure even for **private companies** that are SPElike and non-consolidated…)
  - --research needed to understand all types of related entities that are of this type and are not consolidated
- Information on the markets of the product lines

Types of Measures in Use

- Typical Measures:
  - Quality of Output
  - Customer Satisfaction/Retention
  - Employee Turnover
  - Employee Training
  - R&D Productivity
  - Environmental Competitiveness, and
  - Company-specific measures.

Source: New Corporate Performance Measures

Immediate Steps

- GET RID OF PDFs (recommend processable files)
- Create Database of CAFRs (use AI / text mining to make them credibly compatible) - EDBCAFRS
- Enrich this with exogenous variables
- Create comparative Dashboard
- Hyperlink to relevant sources of information in particular dynamic exogenous variables

Longer term steps

- Create and require reporting on a set of standardized reports in XBRL-GL
- Move towards more frequent reports and explanatory transition matrices (a la Siconfi)
- Create standardized connectivity to ERP's and software of major vendors to allow the existence of an "**government accounting data standard.**"
- Link government disclosures to open data standards and available data
- Run machine learning based diagnostics for prediction or critical issues
- Create an automatic methodology of continuous assurance as an overlay

Conclusions

- A few simple steps could substantially help creating a baseline for digital strategy
- The key issue for effective government reporting is not at this stage accounting standards but the needs of digital enablement to satisfy a wider range of stakeholder
- While business and human behavior has become very digital reporting has remained in the paper pushing model
- Is essential to create a government measurement and disclosure model that is more frequent, timely, standardized, encompass a much wider set of variables and provides the basis for “armchair audits” with open data
- The important issue is data accessibility (machine readable) rather than the format itself (XML, XBRL, etc) because technology changes

SOME OF OUR PROJECTS

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IFAC / PIOB project

Kevin Moffitt
Ben Yoon
Hiaxia Li

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Big data and algorithmic trading against periodic and tangible asset reporting: the need for U-XBRL

Dr. Miklos A. Vasarhelyi

KPMG Distinguished Professor Rutgers Business School - Newark & New Brunswick

Director, Rutgers Accounting Research Center & Continuous Auditing & Reporting Lab

Duo (Selina) Pei

PhD Student Rutgers Business School - Newark & New Brunswick

APPLICATIONS OF DATA ANALYTICS: VISUALIZATION AND CLUSTER ANALYSIS OF GOVERNMENTAL DATA – TWO CASE STUDIES

ESSAY 2: COOPERATION WITH THE VOLCKER ALLIANCE

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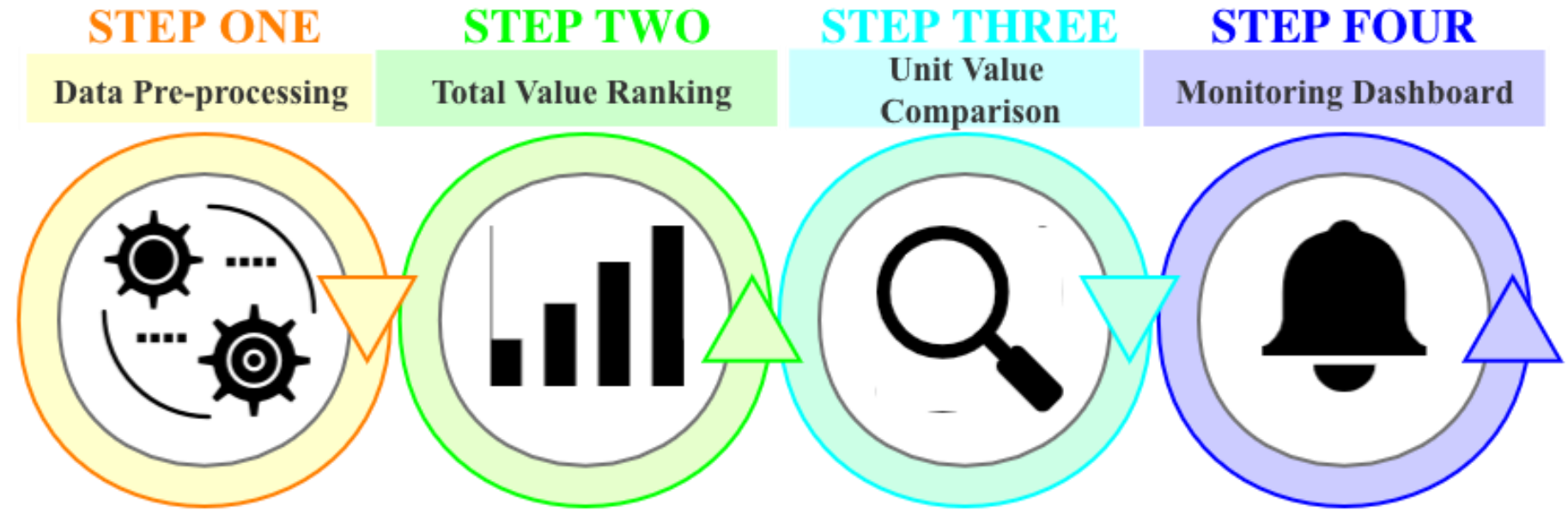
Continuous Monitoring and Audit Methodology for Medication Procurement

Wenru Wang – Rutgers University
Miklos A. Vasarhelyi – Rutgers University

Overview

- Prefeitura de Rio de Janeiro. 30,000+ Medication procurement data, 2017 – 2019.
- Continuous monitoring and audit system for exception and anomaly detections.



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New York City Street Cleanliness: Apply Text Mining Techniques to Social Media Information

Huijue Kelly Duan[1]

Mauricio Codesso[2]

Zamil Alzamil[3]

[1]Rutgers, the State University of New Jersey
[2]Northeastern University
[3]*Majmaah University*

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Continuous Intelligent Pandemic Monitoring (CIPM)

Huijue Kelly Duan
Hanxin Hu
Miklos Vasarhelyi

Accounting Information System
Rutgers, the State University of New Jersey