Agenda

- **Analytics and Data in Governmental Accounting and Auditing – CarLab research**
  - Dr. Miklos A. Vasarhelyi - KPMG Distinguished Professor of AIS, Rutgers, the State University of New Jersey Director of CarLab
- **Big Data Based Government Economic Measurement (GEM)**
  - Arion Cheong – PhD student in Accounting Information System, Rutgers Business School
- **Examining the Usability of the Comprehensive Annual Financial Report's MD&A using Textual Analytics**
  - Xinxin Wang– PhD student in Accounting Information System, Rutgers Business School
- **GASB Post-Implementation Review (PIR) Project**
  - Xinxin Wang– PhD student in Accounting Information System, Rutgers Business School

Analytics and Data in Governmental Accounting and Auditing – CarLab research

Miklos A. Vasarhelyi

KPMG Distinguished Professor of AIS,

Rutgers, the State University of New Jersey

Director of CarLab

November 29, 2018

RUTGERS

RUTGERS BUSINESS SCHOOL

THE CARLAB (CONTINUOUS AUDIT AND REPORTING LABORATORY)

AI: Deep Learning	Continuity Equations at HCA	Envisaging the Future of Audit and Big Data	Litigation Prediction	Process Mining at Gamma Bank
Cybersecurity and the Darkweb	Continuous Audit at the Brazilian Navy	Exceptional Exceptions	Logit Regression for Control Risk Assessment	Ratios for Fraud and Anomaly Detection
Audit Data Analytics and EDA	Continuous Process Mining At Hering	Exogenous Variables Audit	MADS: Full Population Testing	Robotic Process Automation (RPA)
Blockchain and Smart Contracts	Continuity Equations	Expert System for P-Card	Monitoring Unibanco's Branches	Rule-Based Selection for Transitory Accounts
Brazilian Stock Exchange	Cybercurrency Valuation	Fraud Risk Assessment Using EDA	Multidimensional Clustering For Fraud Detection	Text Mining
Detecting Duplicate Records	Cybersecurity Risk Factors	GEM	New York City Cleanliness Tweets	The Visual Audit
Clustering	Decoding Cybersecurity Risk Disclosure	Insurance Analytics	PIOB: What Is Public Interest?	XBRL
Cognitive Intelligent Decision Support Tool	Intelligent Process Automation (IPA)	Cryptocurrency	Predictive Analytics with Weather Data	Continuous Audit

CarLab Analytic Research in Public Sector

NYC Street Cleanliness and on-street Parking	IPSASB - XBRL	GEM
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

http://raw.rutgers.edu/CAR%20Lab%20Directory/Sign-in.html Research Dashboard, Password Access
Email: jasmeensingh72@gmail.com

BRIGHAM YOUNG UNIVERSITY			
The Ranking of Rutgers in the Accounting Areas 2017			
Areas	Ranking 2011-2017	Ranking 2005-2017	Ranking 1990-2017
AIS	**#1** out of 150	#1	#1
Audit	#9 out of 355	#6 out of 370	#14
Financial	#61 out of 397	#76 out of 406	#78
Managerial	#116 out of 300	#85	#74
Tax	#69 out of 129	#57	#71
Other	#21	#40	#23

Jimmy Chin
Skiing down the
Everest

Big Data Based
Government Economic Measurement
(GEM)

Miklos A. Vasarhelyi

Arion Cheong

Xinxin Wang

The Data Era

Data
(Exogenous and Endogenous)
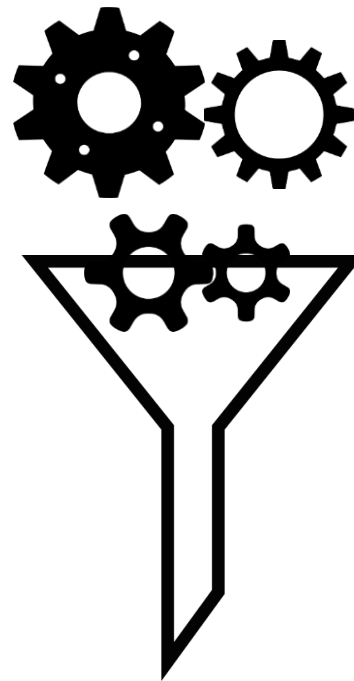
**Applying Taxonomy
& Data Integration**

**Piggybacked
App Analytics**

Traditional Economic Measurement

Traditional Government Economic Measurement

e.g. GDP, Survey on Social Pathologies, Healthcare, Education

- **They are Annual in nature and often delayed**

- **They do not respond do changes in the environment**

- **They often do not even follow GASB standards**

Surveillance Capitalism

"*Surveillance capitalism, unilaterally claims human experience as free raw material for translation into behavioral data. Although some of these data are applied to service improvement, the rest are declared as a proprietary behavioral surplus, fed into advanced manufacturing processes known as 'machine intelligence', and fabricated into prediction products that anticipate what you will do now, soon, and later.*"

- Shoshana Zuboff
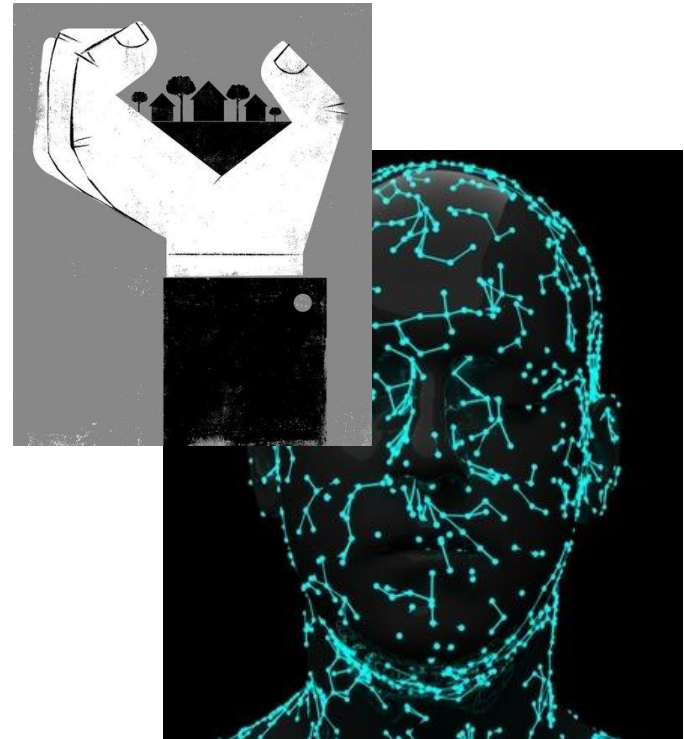
Surveillance Capitalism   **State Control**

Exogenous Data

Social Media
Internet of Things
Click Data
Location Data
Search Data
Internet Sales Data
Weather Data
Economics Data
And More...

- Easy Access
- Greater tamper resistance
- ED relationship will be stochastic
- ED may create new procedures
- ED may complement current procedures
- New form of confirmation

Exogenous Data

Police Report
Insurance
Government Agency
Online Retailers
Supermarkets
Drug Usage
Transportation
Stock Market
Telephone Usage
Energy Usage
And More...
Darkweb

Data Tree

Proposed GEM Framework
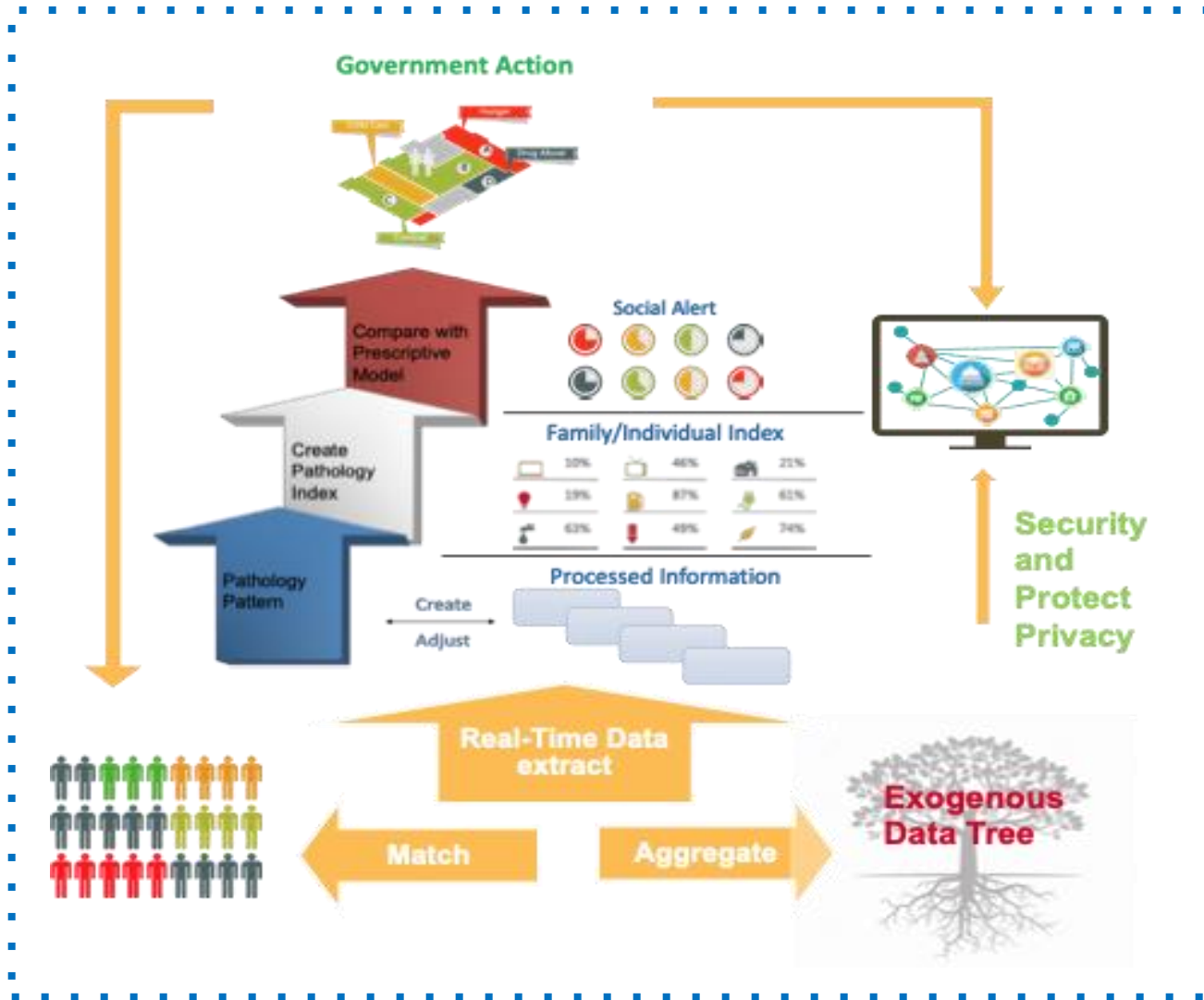
SNAP Case Study

SNAP Case Study

Current *SNAP Process*

Proposed *SNAP Process*
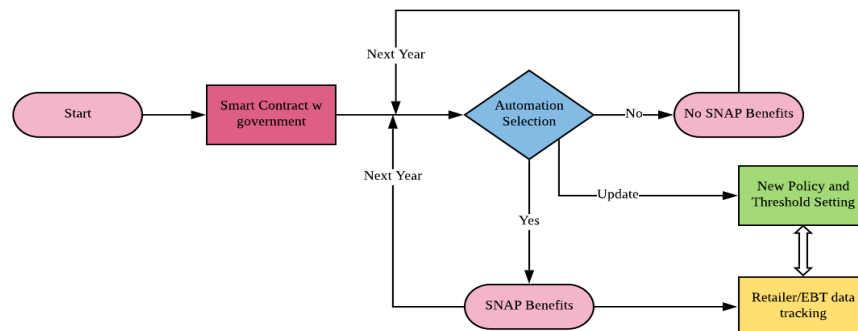
Privacy-Preserving Blockchain DB
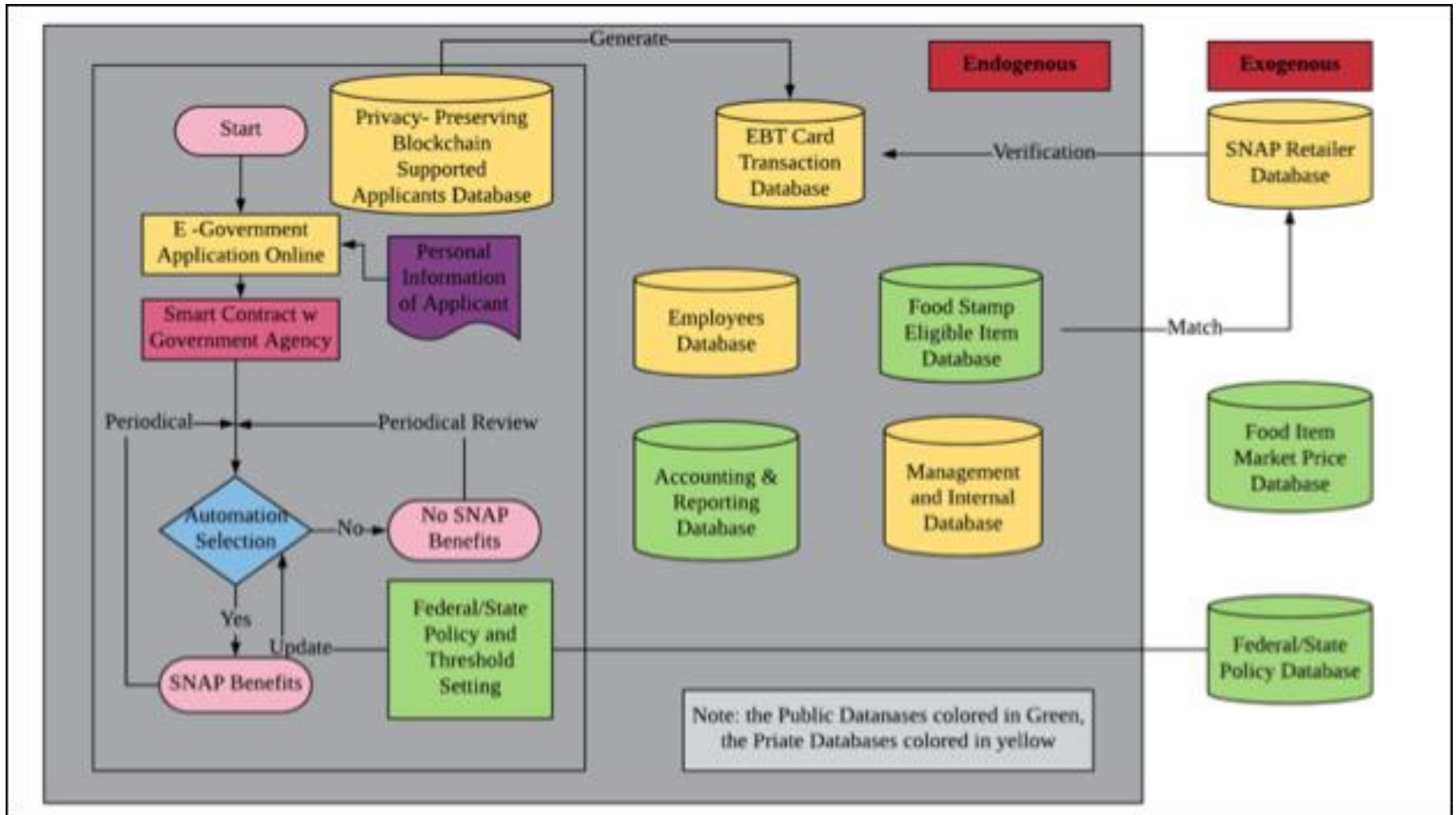
Examining the Usability of the Comprehensive Annual Financial Report's MD&A using Textual Analytics

Xinxin Wang

Rutgers, the State University of New Jersey

Mauricio Codesso

Federal University of Santa Catarina

Hussein Issa

Rutgers, the State University of New Jersey

Motivation and Objectives

- GASB statement No. 34 required:

  *"Financial managers will be asked to share their insights in a required management's **discussion and analysis** (referred to as MD&A) by giving readers an objective and easily readable analysis of the government's financial performance for the year"* *(GASB,1999)*

- Extent academic studies focus on textual analysis of corporate Management's Discussion and Analysis (MD&A) section but very less attention on CAFR's MD&A.

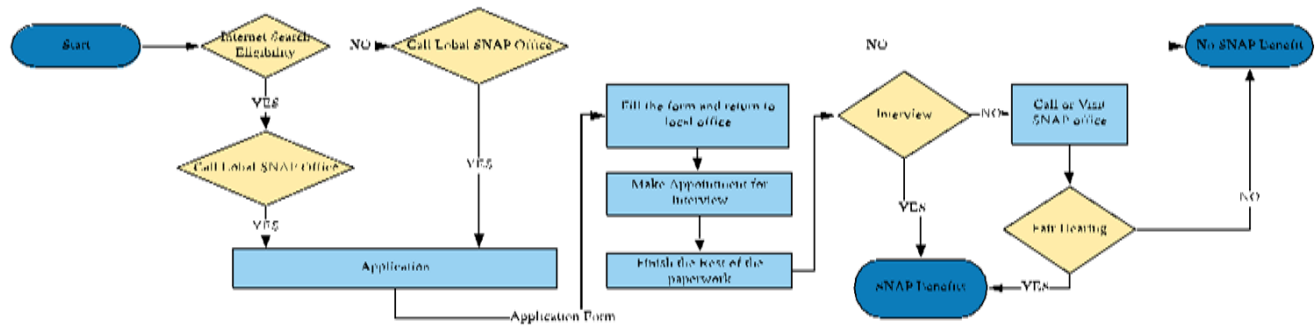- CAFRs in PDF increased the difficulty of this research.

- This study proposes to apply textual analysis to examine the MD&A sections in municipal CAFRs, as an approach of increasing government financial transparency and accountability.

- This paper examining the **Usability** of CAFR's MD&A in three dimensions include the **timeliness, readability and usefulness.**

Data Preprocessing Steps

- Step 1 - Municipalities List with Population
- Step 2 - Google Search - Municipality Name, NY Comprehensive Financial Report collect the URLs
- Step 3 - Python - collection of the CAFRs
- Step 4 - Python - Transfer the PDF to machine readable format
- Step 5 - Extract the MD&A section of CAFRs

Preliminary Result - Timeliness

Table 4 The Issue Period of Municipalities for Fiscal Year 2016

City	Year	Audit Report Date	Fiscal Year	Issue Period
Aurora	2016	5/22/17	12/31/16	142
Buffalo	2016	11/1/16	6/30/16	124
Carmel	2016	6/9/17	12/31/16	160
Cortlandt	2016	6/19/17	12/31/16	170
Eastchester	2016	3/1/17	12/31/16	60
Easthampton	2016	6/7/17	12/31/16	158
Greenburgh	2016	8/9/17	12/31/16	221
Huntington	2016	5/30/17	12/31/16	150
NewRochelle	2016	6/5/17	12/31/16	156
NewYork	2016	10/31/16	6/30/16	123
Hornell	2016	8/8/16	3/31/16	130
NorthCastle	2016	4/11/17	12/31/16	101
OrangeTown	2016	6/21/17	12/31/16	172
Rochester	2016	12/13/16	6/30/16	166
RockvilleCentre	2016	12/5/16	5/31/16	188
SoutHampton	2016	4/20/17	12/31/16	110
Whiteplains	2016	11/23/16	6/30/16	146
Yonkers	2016	1/4/17	6/30/16	188

Previous study shows that the determinants of local government reporting lag, including both audit report lag (ARL) and regulatory reporting lag (RRL) (Sohl, Waymire, & Webb, Spring 2018).

23

Preliminary Result - Readability

Flesch Reading Ease

City	Year	
	2015	2016
Aurora	17.04	7.80
Buffalo	21.50	23.57
Carmel		18.36
Cheektowaga	20.18	
Cortlandt		21.40
Eastchester	24.14	19.27
Easthampton		20.93
Greenburgh		18.25
Huntington	20.49	14.80
NewRochelle		22.11
Nornell	25.26	6.68
NorthCastle	27.12	23.67
OrangeTown		32.80
Rochester		25.60
RockvilleCentre		20.93
Rye	20.22	
SoutHampton		22.25
Whiteplains	9.15	2.52
Yonkers	18.15	17.85

Fog Index

City	Year	
	2015	2016
Aurora	20.920	23.910
Buffalo	18.720	20.870
Carmel		20.090
Cheektowaga	19.390	
Cortlandt		18.860
Eastchester	17.910	19.690
Easthampton		22.360
Greenburgh		20.180
Huntington	20.060	22.100
NewRochelle		18.720
Nornell	17.410	24.500
NorthCastle	19.730	21.130
OrangeTown		17.540
Rochester		20.120
RockvilleCentre		22.360
Rye	22.550	
SoutHampton		21.480
Whiteplains	26.900	26.230
Yonkers	20.140	20.190

Preliminary Result - Usefulness

City	Cosine Similarity
Aurora	96.04%
Buffalo	98.91%
Eastchester	98.65%
Huntington	96.67%
Nornell	75.02%
North Castle	99.26%
Whiteplains	99.48%
Yonkers	98.13%

Future Research

- Expand the Sample size
- 50 cities
- at least three years

- XBRL in CAFRs reporting - Florida

GASB Post-Implementation Review (PIR) Project

Huaxia Li, Kathy Wei, Ben Yoon, Irfan Bora,
Kevin Moffitt, and Miklos A. Vasarhelyi

Rutgers, the State University of New Jersey

Project Overview

- This project aims at capturing information from the CAFRs.

    - This project will help the GASB for the post-implementation review (PIR) of the new standards.
    - We use the GASB's new pension standards (No. 67 and No. 68).

- This project consists of 4 steps.

    1) Robotic downloading CAFRs from the Internet
    2) PDF conversion
    3) Automatic extraction of the relevant information (117 items)
    4) Creation of a report with spreadsheet

Step 1 – Robotic downloading CAFRs from the Internet

- Downloading from EMMA (Electronic Municipal Market Access)

	2013	2014	2015	2016	2017	2018	Others	Total
City	3,235	6,908	7,437	7,434	7,520	4,593	45,661	82,788
County	1,808	3,616	4,064	3,779	3,638	2,218	24,767	43,890
State	673	1,561	1,711	1,598	1,644	1,199	11,246	19,632
Total	5,716	12,085	13,212	12,811	12,802	8,010	81,674	146,310

- Downloading from GFOA (Government Finance Officers Association)

	2014	2015	2016	2017	Total
College or University	68	77	84	78	307
Council of Governments	12	16	18	17	63
County	502	545	545	492	2,084
Enterprise Fund(s)	408	473	496	457	1,834
Investment Pool	8	9	9	9	35
Municipality	1,926	2,006	2,051	1,924	7,907
Public Employee Benefit System	139	165	171	157	632
School District	495	544	547	515	2,101
Special District	228	264	278	267	1,037
State-level Institution	40	43	43	35	161
Total	3,826	4,142	4,242	3,951	16,161

Step 2 & 3 – Extracting information from CAFRs

- Example #1 - Investment policy (GASB No. 67)

Notes to Financial Statements

30. The following should be disclosed in notes to financial statements, as applicable:

    b. Pension plan investments:
      (1) Investment policies, including:
        (a) Procedures and authority for establishing and amending investment policy decisions
        (b) Policies pertaining to asset allocation
        (c) Description of significant investment policy changes during the reporting period.

Investments

Investment Policies

Funds of the System are invested pursuant to the Los Angeles City Charter and the System's investment policy established by the Board as required by Article XI Section 1106(d) of the City Charter. The System has a long-term investment horizon, and utilizes an asset allocation that encompasses a strategic, long run perspective of capital markets. The System's investment portfolio is composed of domestic and international equities, domestic and international bonds, bank loans, derivative instruments, private real estate, private equity, and short-term investments. During the reporting period, there were no significant investment policy changes.

As of June 30, 2014, the Board's adopted asset allocation policy was as follows:

Asset Class	Target Allocation
Domestic and International Equities	53.0%
Domestic and International Bonds	19.0
Private Equity	12.0
Private Real Estate	5.0
Public Real Assets	5.0
Short-term Investments	1.0
Credit Opportunities	5.0
Total	100.0%

Step 2 & 3 – Extracting information from CAFRs

• Example #1 - Investment policy (GASB No. 67)

☐ Some entities started including the investment policy in CAFRs after 2014.

	filename	Procedures & Policies for Estab. & Amending (Y/N)	Asset Allocation Policies (Y/N)	Significant Changes in Investment Policies (Y/N)
0	LosAngelesCityEmployeesRetirementSystemCA2012.pdf	Yes	No	Not Mentioned
1	LosAngelesCityEmployeesRetirementSystemCA2013.pdf	Yes	No	Not Mentioned
2	LosAngelesCityEmployeesRetirementSystemCA2014.pdf	Yes	Yes	No
3	LosAngelesCityEmployeesRetirementSystemCA2015.pdf	Yes	Yes	No
4	LosAngelesCityEmployeesRetirementSystemCA2016.pdf	Yes	Yes	No
5	LosAngelesCityEmployeesRetirementSystemCA2017.pdf	Yes	Yes	No
6	SanDiegoCountyEmployeesRetirementAssociationCA2012.pdf	Yes	No	Not Mentioned
7	SanDiegoCountyEmployeesRetirementAssociationCA2013.pdf	Yes	No	Not Mentioned
8	SanDiegoCountyEmployeesRetirementAssociationCA2014.pdf	Yes	No	Not Mentioned
9	SanDiegoCountyEmployeesRetirementAssociationCA2015.pdf	Yes	No	Not Mentioned
10	SanDiegoCountyEmployeesRetirementAssociationCA2016.pdf	Yes	No	Not Mentioned
11	SanDiegoCountyEmployeesRetirementAssociationCA2017.pdf	Yes	No	Not Mentioned

RUTGERS

Step 2 & 3 − Extracting information from CAFRs

- Example #2 − Pension liability (GASB No. 67)

31. In addition to the information required by paragraph 30, the information identified in subparagraphs (a)−(c), below, should be disclosed in notes to financial statements.

   a. The components of the liability of the employers and nonemployer contributing entities to plan members for benefits provided through the pension plan (net pension liability), calculated in conformity with the requirements of paragraphs 35−46:

   (1) The total pension liability
   (2) The pension plan's fiduciary net position
   (3) The net pension liability
   (4) The pension plan's fiduciary net position as a percentage of the total pension liability

Schedule of Net Pension Liability

	June 30, 2014	June 30, 2013
Total Pension Liability	$ 16,248,853	$ 14,881,663
Plan Fiduciary Net Position	(11,791,079)	(10,154,486)
Plan's Net Pension Liability	$ 4,457,774	$ 4,727,177
Plan Fiduciary Net Position as a Percentage of the Total Pension Liability	72.6%	68.2%

Step 2 & 3 – Extracting information from CAFRs

• Example #2 - Pension liability (GASB No. 67)

    - The net pension liability has been disclosed since 2014.

    - The liability ratio keeps fluctuating over the years.

	filename	Total Pension Liability (Y/N)	Plan Fiduciary Net Position (Y/N)	Net Pension Liability (Y/N)	PFNP ÷ TPL(Y/N)	Total Pension Liability	Plan Fiduciary Net Position	Net Pension Liability	PFNP ÷ TPL
0	C:\6CAFRs\LosAngelesCityEmployeesRetirementSystemCA2012	No	No	No	No	N/A	N/A	N/A	N/A
1	C:\6CAFRs\LosAngelesCityEmployeesRetirementSystemCA2013	No	No	No	No	N/A	N/A	N/A	N/A
2	C:\6CAFRs\LosAngelesCityEmployeesRetirementSystemCA2014	YES	YES	YES	YES	16248853	11791079	4457774	72.6%
3	C:\6CAFRs\LosAngelesCityEmployeesRetirementSystemCA2015	YES	YES	YES	YES	16909996	11920570	4989426	70.5%
4	C:\6CAFRs\LosAngelesCityEmployeesRetirementSystemCA2016	YES	YES	YES	YES	17424996	11809329	5615667	67.8%
5	C:\6CAFRs\LosAngelesCityEmployeesRetirementSystemCA2017	YES	YES	YES	YES	18458188	13180516	5277672	71.4%
6	C:\6CAFRs\SanDiegoCountyEmployeesRetirementAssociationCA2012	No	No	No	No	N/A	N/A	N/A	N/A
7	C:\6CAFRs\SanDiegoCountyEmployeesRetirementAssociationCA2013	No	No	No	No	N/A	N/A	N/A	N/A
8	C:\6CAFRs\SanDiegoCountyEmployeesRetirementAssociationCA2014	YES	YES	YES	YES	12318409.0	10180694.9	2137714.1	82.65%
9	C:\6CAFRs\SanDiegoCountyEmployeesRetirementAssociationCA2015	YES	YES	YES	YES	13137.9	10330.3	2807.6	78.63%
10	C:\6CAFRs\SanDiegoCountyEmployeesRetirementAssociationCA2016	YES	YES	YES	YES	14559258	10261268	4297990	70.48%
11	C:\6CAFRs\SanDiegoCountyEmployeesRetirementAssociationCA2017	YES	YES	YES	YES	15084062	11397064	3686997	75.56%

Future Plan for GASB project

- Expanding more items

  - There are total 117 items which the GASB wants to monitor (regarding GASB rule No. 67 and No. 68).

- Expanding more various CAFR repositories

  - Downloading CAFRs from the Internet other than EMMA and GFOA

RUTGERS

Rutgers Business School
Newark and New Brunswick

RUTGERS ACCOUNTING DIGITAL LIBRARY

Rutgers Accounting Web

Rutgers Accounting Web

Over 3000 Online Videos for Students, Faculty and the 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

RUTGERS

THANK YOU