DATA WAREHOUSES (DWH/DW) - INTRO

1. **Introduction to the DWH discipline**
2. **Brief history** (Inmon &Linstedt,2015) **and Data Architecture** (Kimball&Ross,2016)
3. **Dimensional Modeling Fundamentals** (Kimball&Ross,2016)
4. **Technical Architecture Considerations** (Kimball&Ross,2016)
5. **Extract Transform Load and Data Quality** (Kimball&Ross,2016)
6. **DWH Lifecycle** (Kimball&Ross,2013)
7. **Trends in the evolution of DWH:**

   Extended RDBMS Architecture (Kimball&Ross,2013)**.**

   Pushing into the Future (Reeves,2009)**.**

   DWH 1.0 vs. 2.0 (Krishnan,2013)

Assessment

Type of activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Share of final grade
Developing support components for a DWH application prototype	Real-world application, complexity, validity and originality	Six face-to-face lab presentations of the homework about: the design of DWHcubes & DM models implemented, the support MDX & DMX queries and the code execution behind .NET forms in weeks No.: 3, 5, 7, 9, 11 and 13.	40% (6 * 6.66%)
Theoretical presentations during lecture hours (see those 14 themes on domains at section 8.1, pp.2)	Format, consistent pro-or-cons arguments, originality of comments and conclusions	Theoretical presentation and responses to questions	20%
Theoretical exam	Knowledge about DWH theory, real-world scenarios and personal implementations	Final theoretical test with at least three open questions	40%

10.6 Minimum performance standard

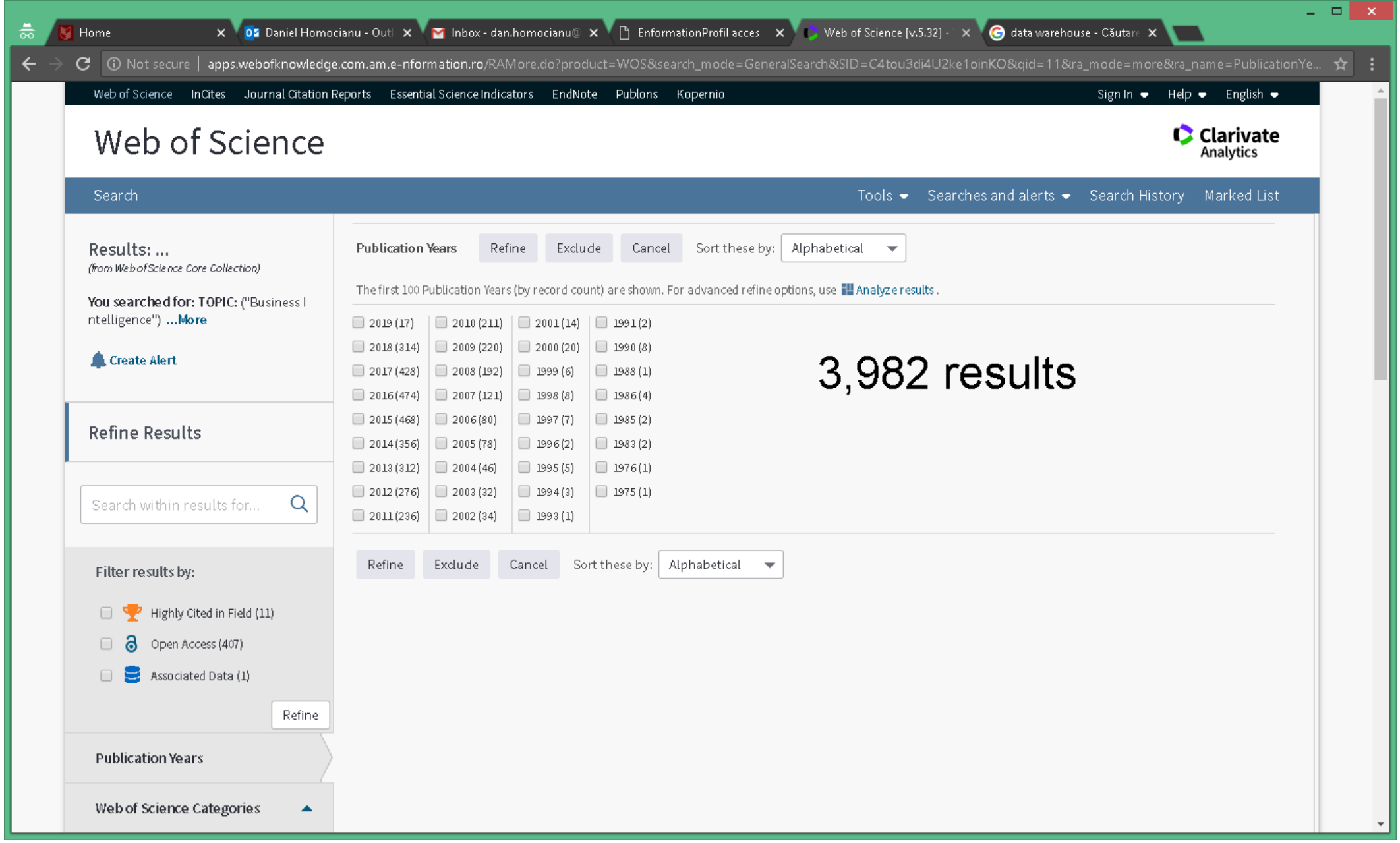
- Design and implement a DWH cube, a DM model, two interfaces to programmatically connect to and query them by using MDX and DMX queries, alternative examples (user mode) with Microsoft Excel add-ins;
- Each master student must create, present and answer questions for a part of those at least 10 specific presentations (14 themes on domains - section 8.1, pp.2) during lecture hours;
- The average grade for all those six face-to-face lab presentations (section 8.2, pp.3) of the homework is grater than or equal to 5;
- The grade for the final theoretical test must be greater than or equal to 5.

Planning those at least 10 presentations (course hours, 20% in final grades) of master students (teams) about:
(1.) retail sales, (2.) inventory, (3.) procurement, (4.) order management, (5.) accounting, (6.) CRM, (7.) HRM,
(8.) financial services, (9.) telecommunications,
(10.) transportation, (11.) education, (12.) healthcare,
(13.) e-commerce, (14.) insurance
details: **Kimball&Ross,2013**.
by **e-mail**: dan.homocianu@gmail.com
(**subject**: *DWH course pres. theme TITLE.. on DATE..*
content: *team: MEMBER1, MEMBER2, MEMBER3*)
Each master student (team member) must present a part of his team's support presentation for at least 5-10 minutes
and answer questions.

Semestrul al II-lea

- **15 februarie – 30 mai** – 14 săptămâni – Activitate didactică
- **3 mai – 9 mai** – 1 săptămână liberă în perioada sărbătorilor de Paște
- **31 mai – 13 iunie** – 2 săptămâni – Evaluare (sesiune)
- **14 iunie – 4 iulie** – 3 săptămâni practică de specialitate și evaluare. În această perioadă, fiecare facultate organizează o săptămână de evaluare (reexaminări în vederea promovării sau măririi notei).
- **5 iulie – 30 septembrie** – Vacanța de vară

În perioada 1-10 septembrie, fiecare facultate organizează o sesiune de evaluare (reexaminări în vederea promovării sau maririi notei).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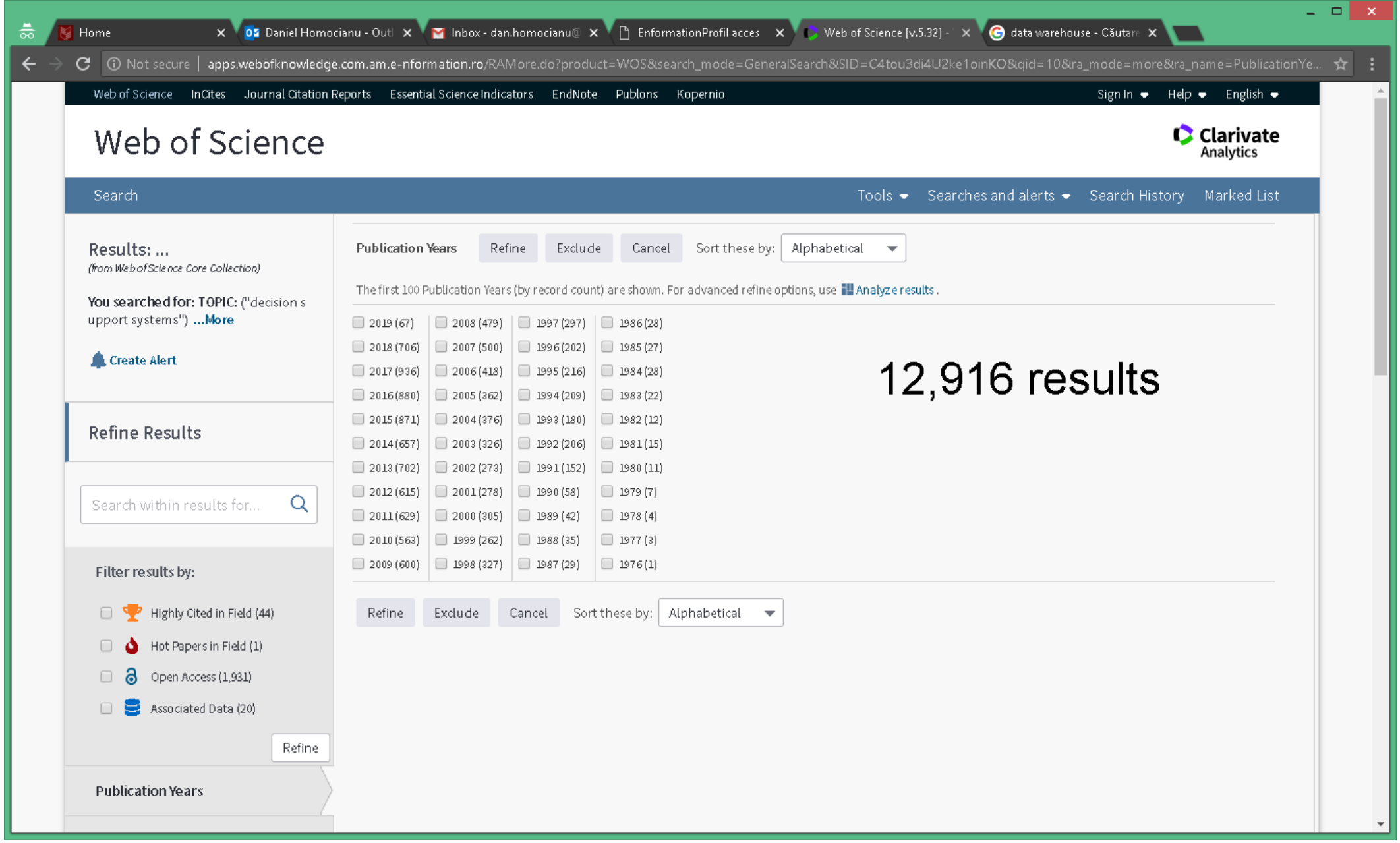
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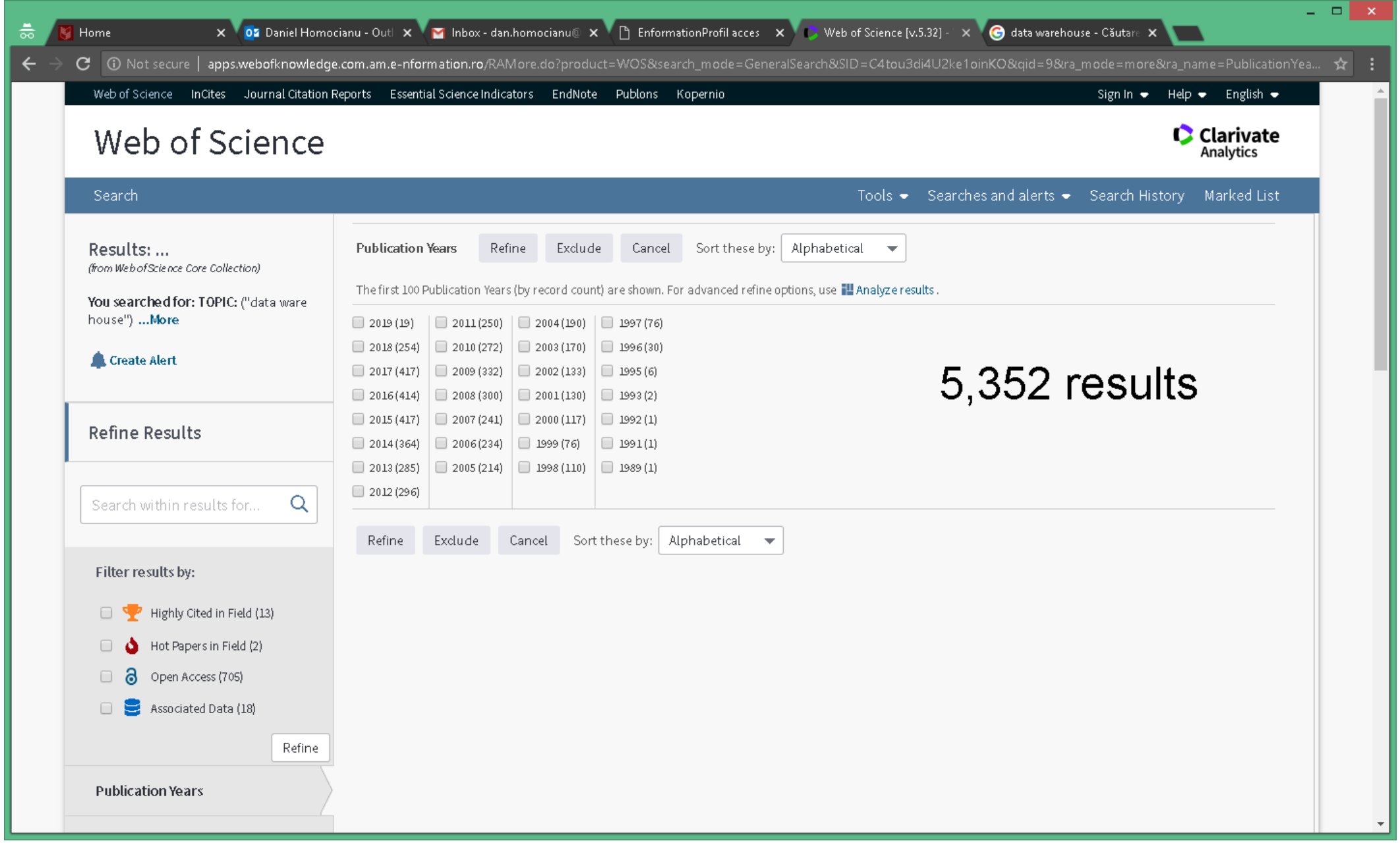
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Reporting as Democratization

In turn, democratizing your data does not render a reporting program obsolete—it enhances it. Consider a system architected as in Figure 16-2.

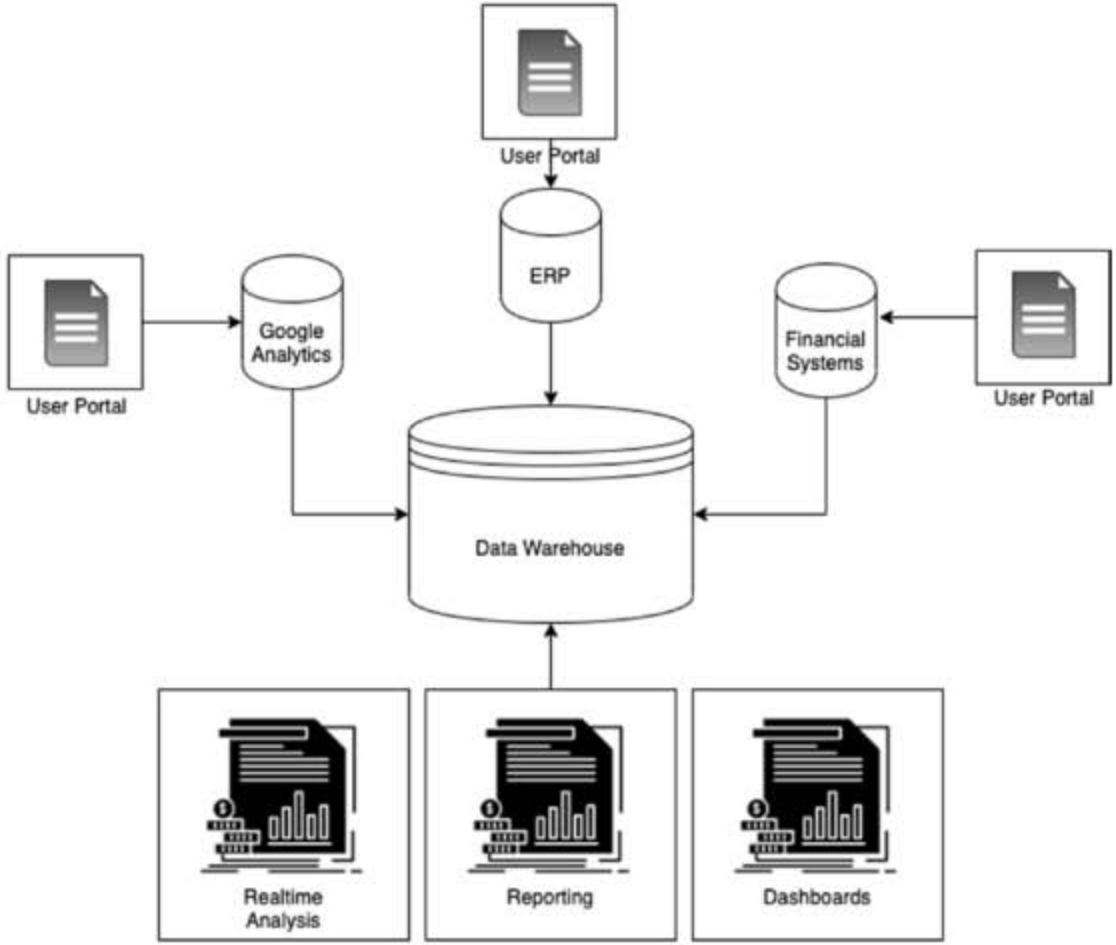
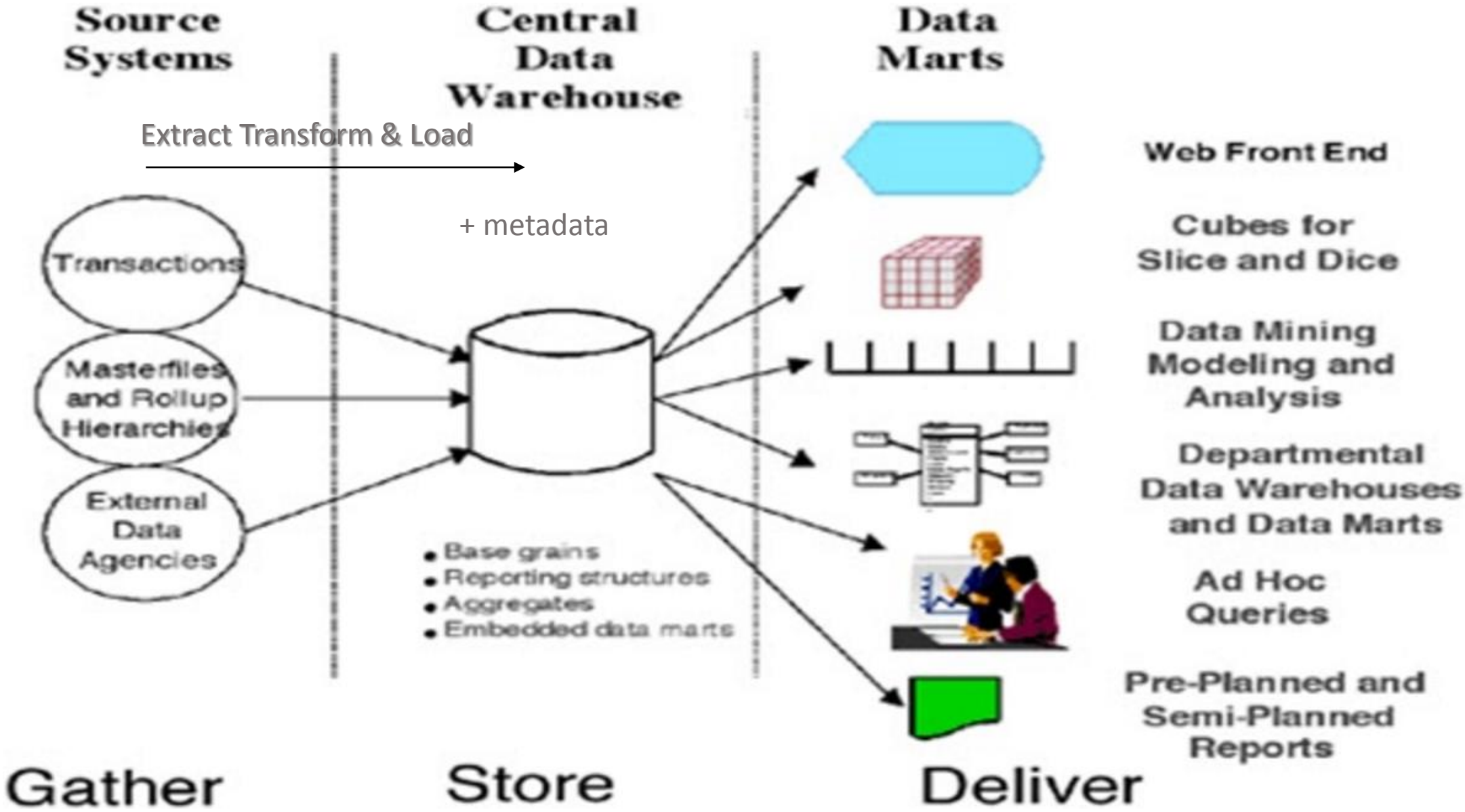
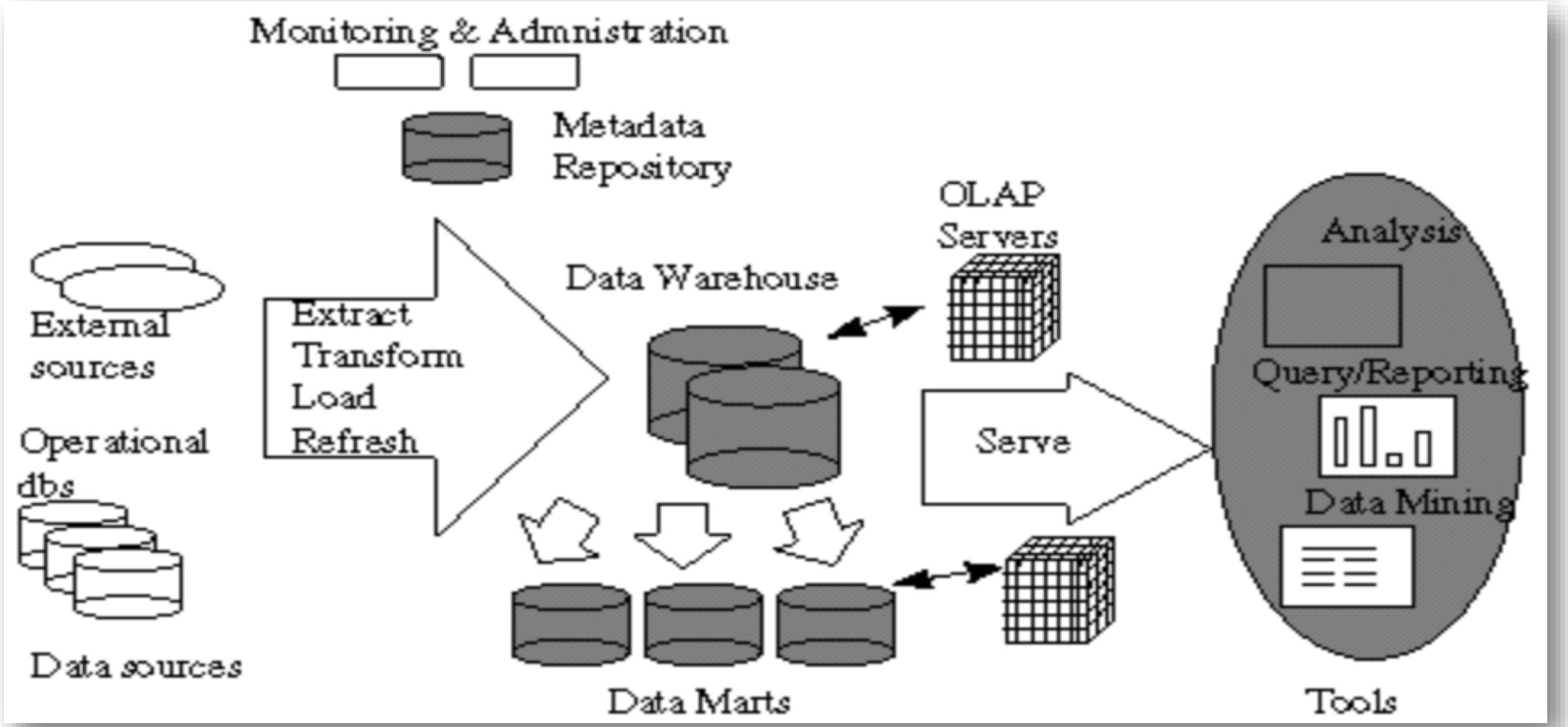


Figure 16-2. *Architectural diagram of systems*

DWH – overview



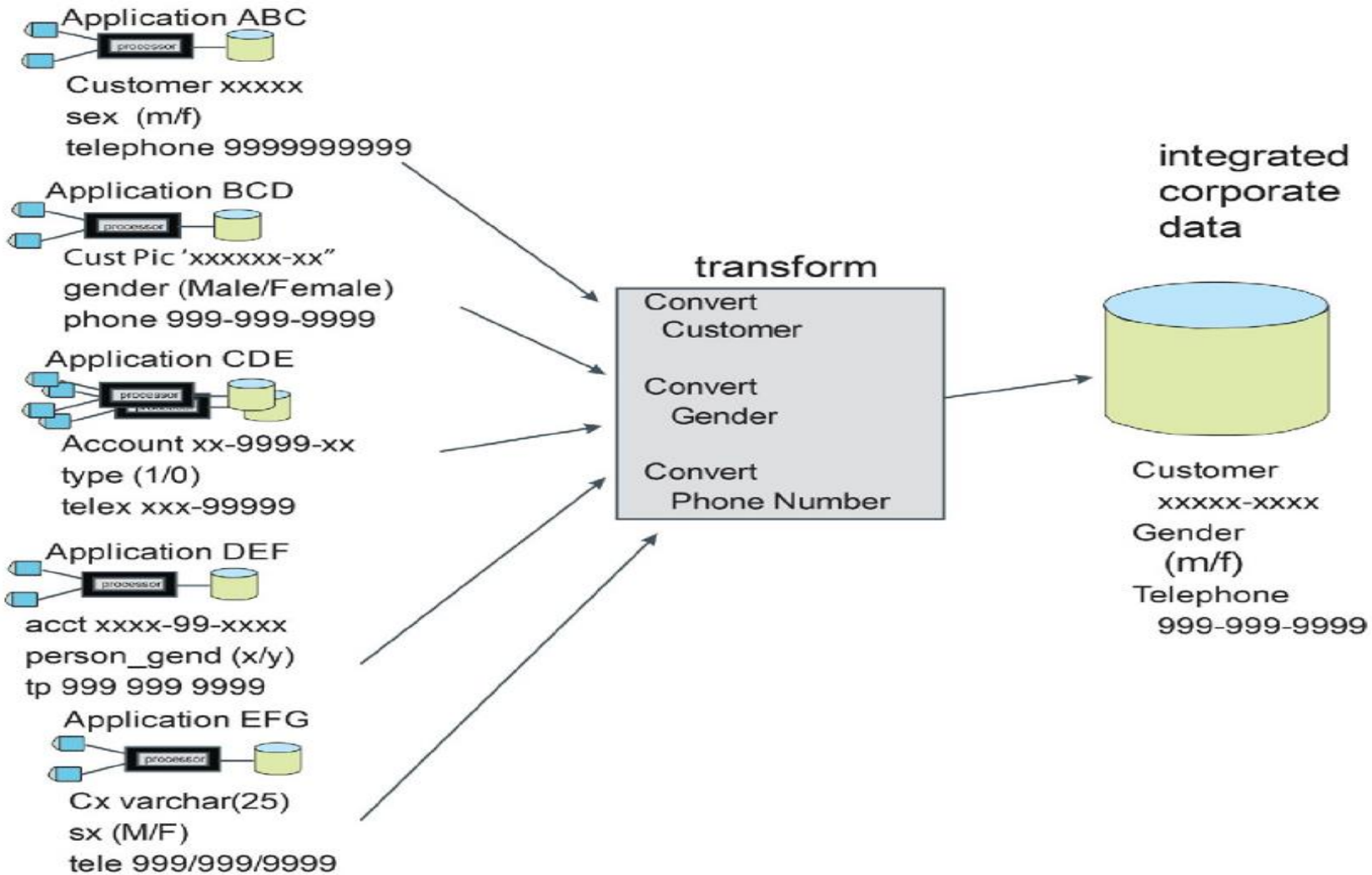
DWH – overview



http://redbook.cs.berkeley.edu/redbook3/lec28.html

Extract Transform & Load (ETL)

Inmon &Linstedt,2015



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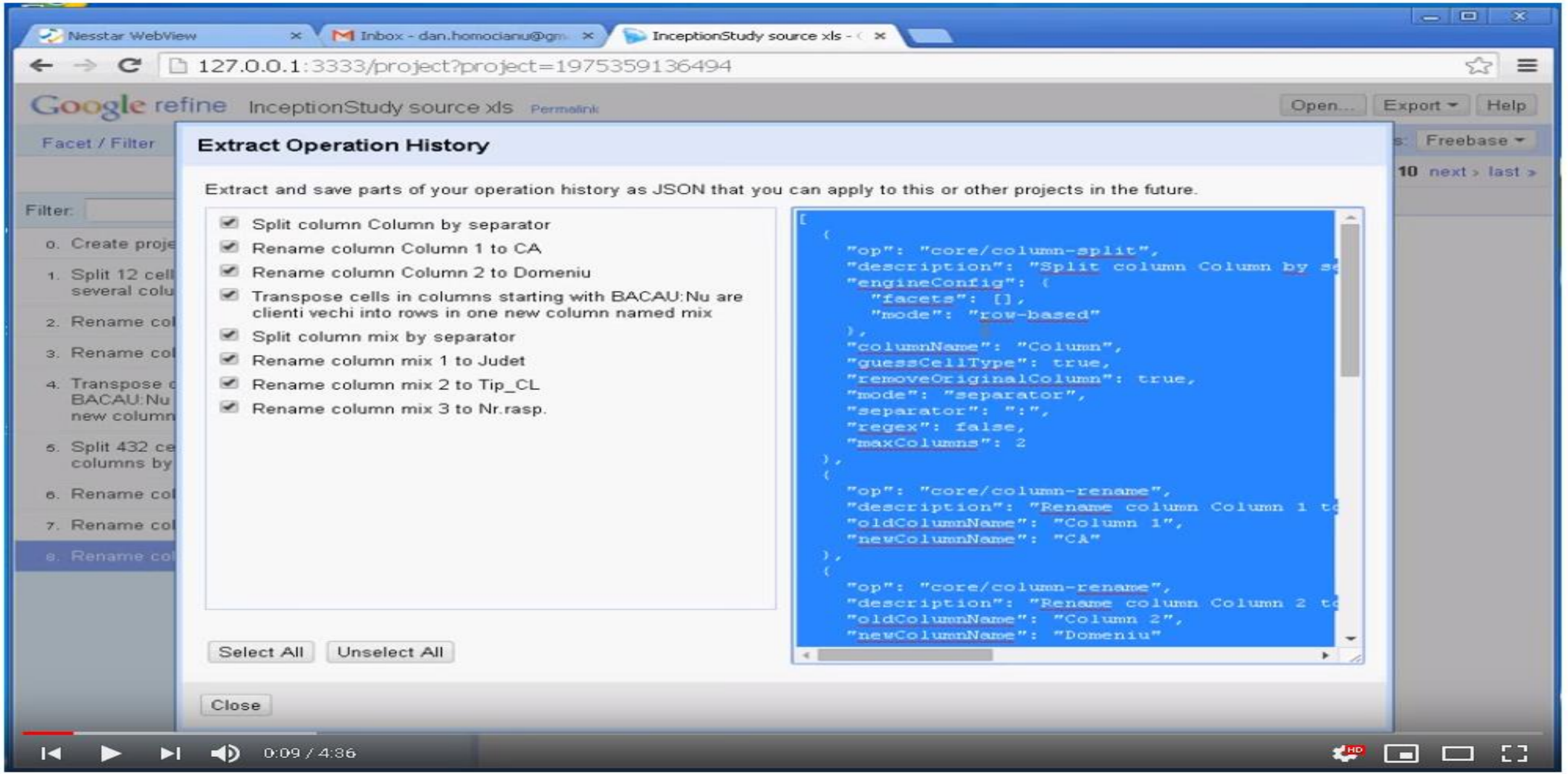


Uses With ETL

tfmorris edited this page on Jan 9, 2013 · 2 revisions

Is OpenRefine an ETL tool ? or can it be used in batch operations or job control ?

OpenRefine is a discovery and cleanup tool mostly, as it stands now at release 2.5. It also has the benefit of aligning, reconciling, and exporting data, to Freebase or somewhere else. Some folks in the community have expressed the idea or need for batching transform operations or evolving OpenRefine into an automated pipeline process.

One feature of OpenRefine that folks find intriguing is it's ability to display inconsistencies in your data and clean it up easily.

Usage with Enterprise data or large databases,

- For instance, you might leverage OpenRefine to analyze and find faults in the output of some of your stored procedures within an existing database and then fix them outright.
- Or, you might make slight job changes inside your program or ETL tool after you discover (using OpenRefine) that your output isn't always correct, and the job needs to be modified.

Also, if your interest is transforming large amounts of data, you might also want to look at existing database ETL tools (Extract, Transform, Load) which some we have listed here: Related Software

(Currently, using OpenRefine with extremely large amounts of data and millions of rows does require plenty of RAM and Java 64 bit, so you might find a hard time absorbing and utilizing, for example, a 1 billion row Enterprise database table.)

We're interested in your ideas and comments ! and patches are always welcome !

Documentation for Developers

- Wiki for Developers
- Developer Discussion List

Documentation for User

Official Documentation

- FAQ
- Official Documentation Wiki

Support and Questions

- OpenRefine Support Mailing List
- StackOverflow Tag
- File a Bug or Feature Request

Online Courses

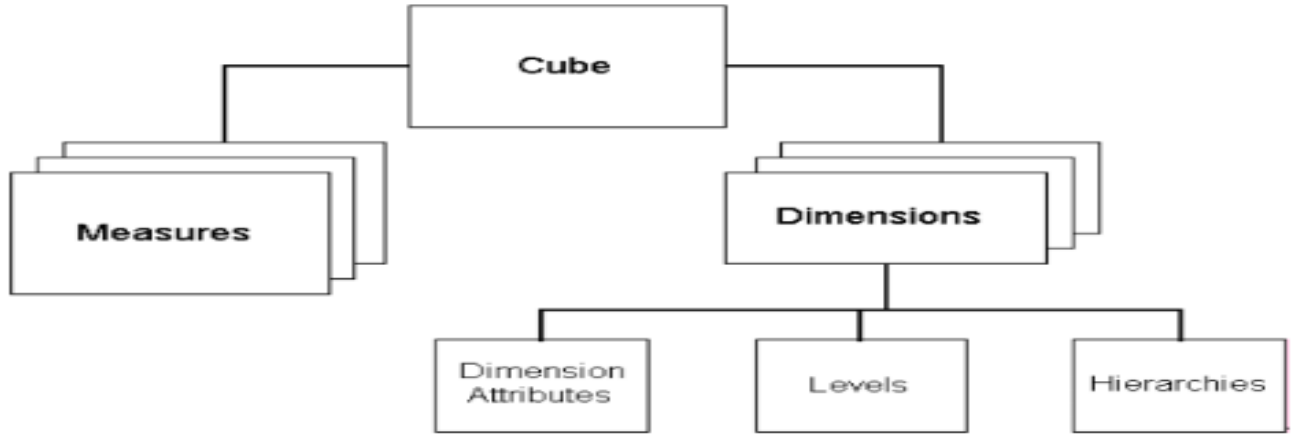
- Cognitive Class: OpenRefine 101 (with video)
- DataCarpentry: OpenRefine for Social Science Data
- DataCarpentry: OpenRefine for Ecology
- The Programming Historian: Cleaning Data with OpenRefine (en) and (es)
- The Programming Historian: Fetching and Parsing Data from the Web with OpenRefine
- Nettoyer et préparer des données avec OpenRefine : atelier pour les journées du consortium MASA - 14/11/2018 (fr)
- Curated Tutorial List

Using OpenRefine - The Book

Using OpenRefine by Ruben Verborgh, Max De Wilde offers anyone a great introduction to OpenRefine. Organized by recipes with hands on examples, the book covers the following topics:

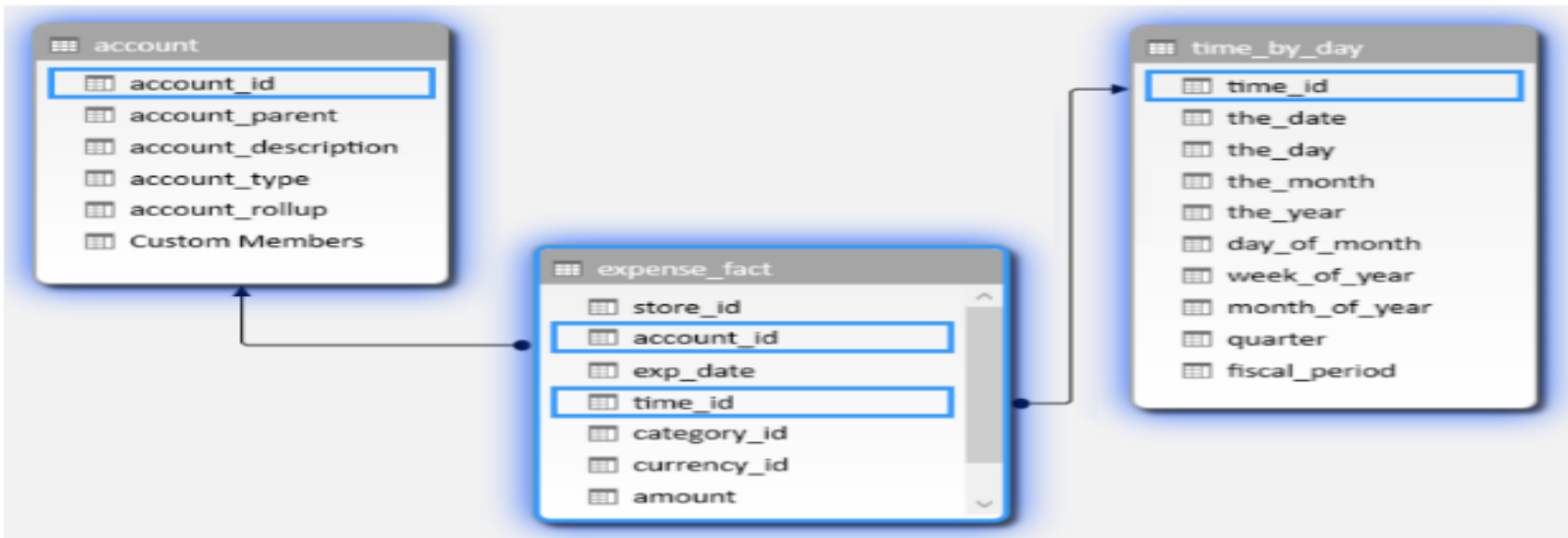
1. Import data in various formats

Figure 1. The diagram of the multidimensional model



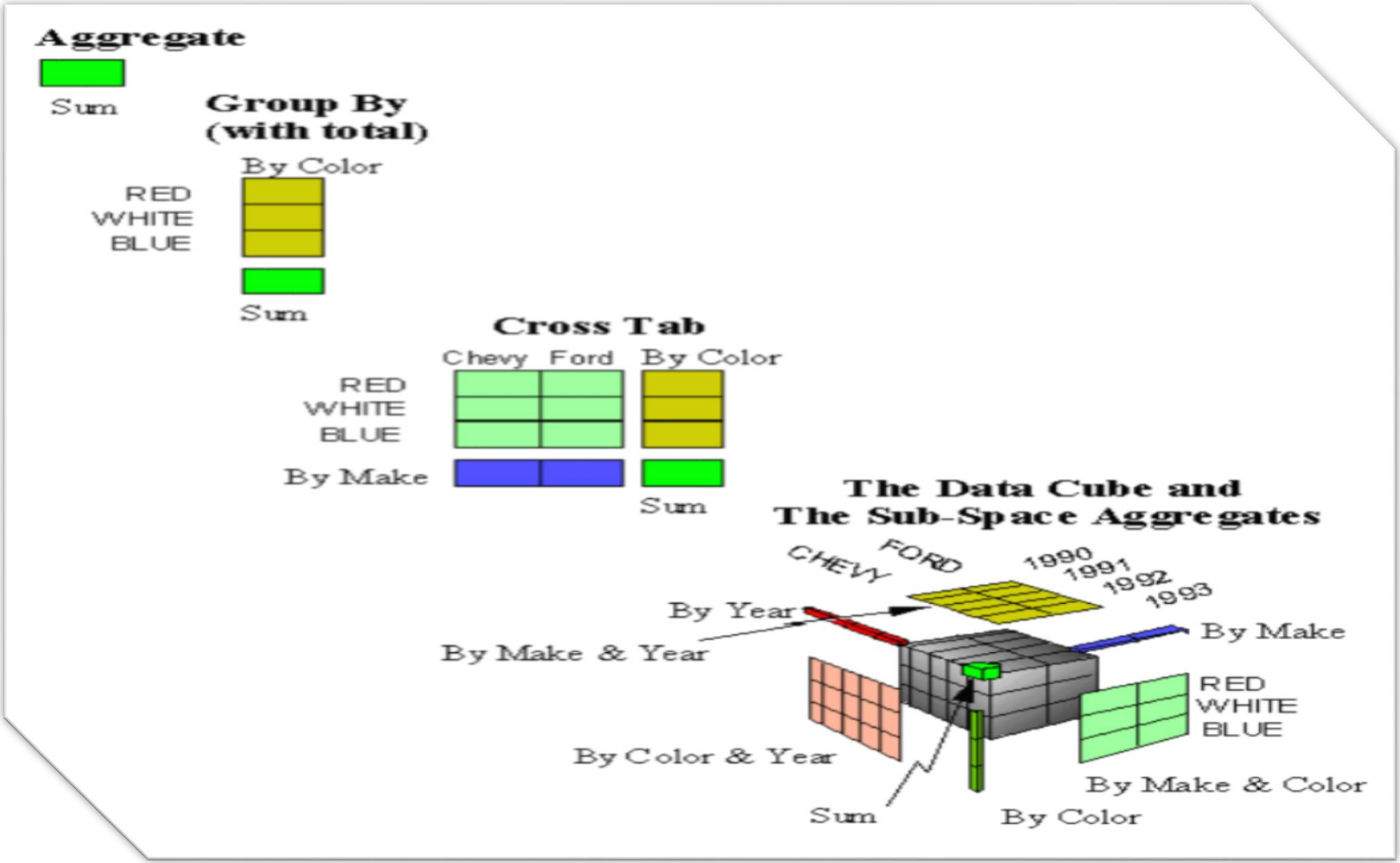
Source: http://web.stanford.edu/dept/itss/docs/oracle/10g/olap.101/b10333/multimodel.htm

Figure 2. Example of the simplest scheme (star) of relational implementation of the multi-dimensional model with three tables containing attributes about account, expenses (expense_fact) and time (time_by_day)



Source: The video tutorial developed by the author: https://www.youtube.com/watch?v=zR37OZ18mPY

THE DATA CUBE



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Data Marts

- *Data mart* has been replaced with *business process dimensional model*, *business process subject area*, or just *subject area*, depending on the context. (Kimball&Ross,2016)

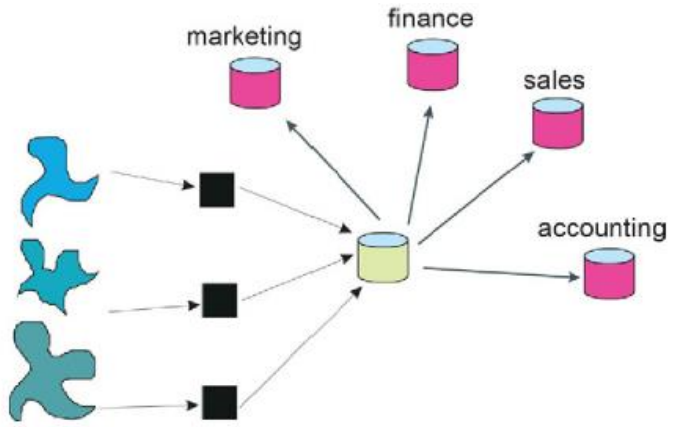
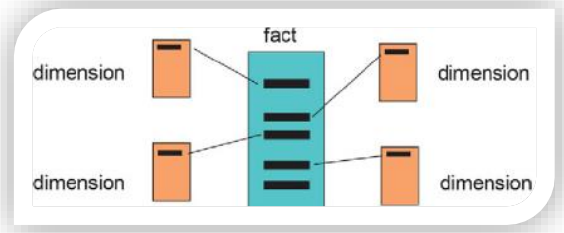


Figure 3.4.3

Figure 3.4.3 shows that each different organization has its own perspective of data. All data begins with the granular data found in the data warehouse. But the different interpretation of data is created for each different department from that granular data. Note that while each department has its own interpretation of data, *all* data is still reconcilable to the common data warehouse. Also note that if it is desired to build a new data mart, the data in the data warehouse is available for the immediate construction of a new perspective of data.

The database design for the data mart that is optimal is the dimensional model. Figure 3.4.4 shows that there is a different and unique dimensional model for each data mart.

(Inmon &Linstedt,2015)



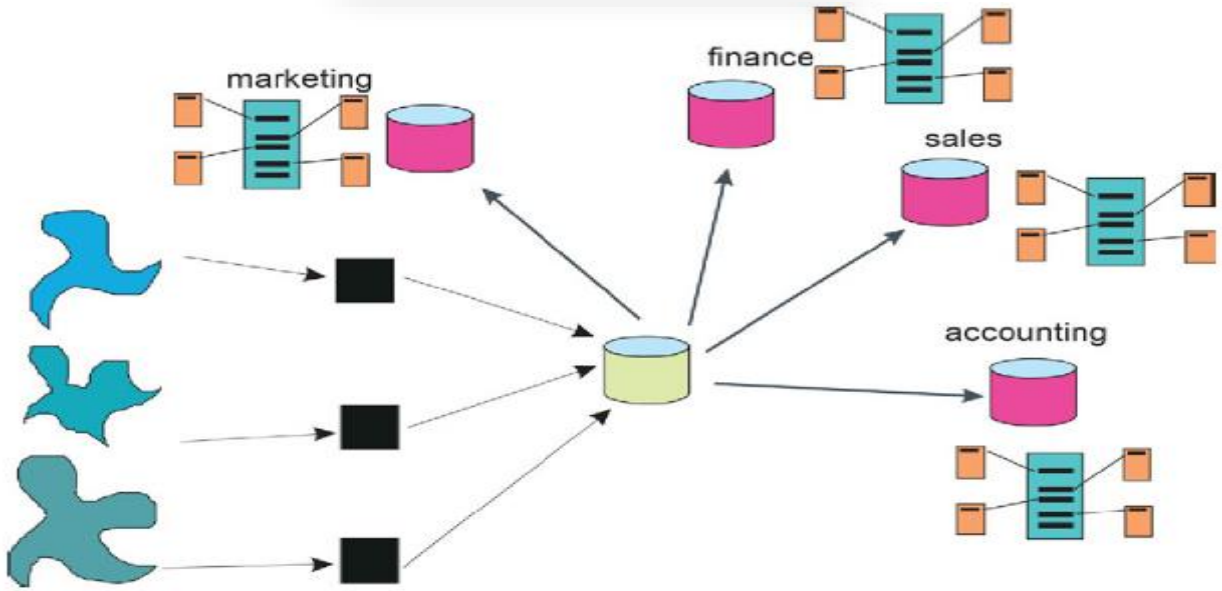


Figure 3.4.4

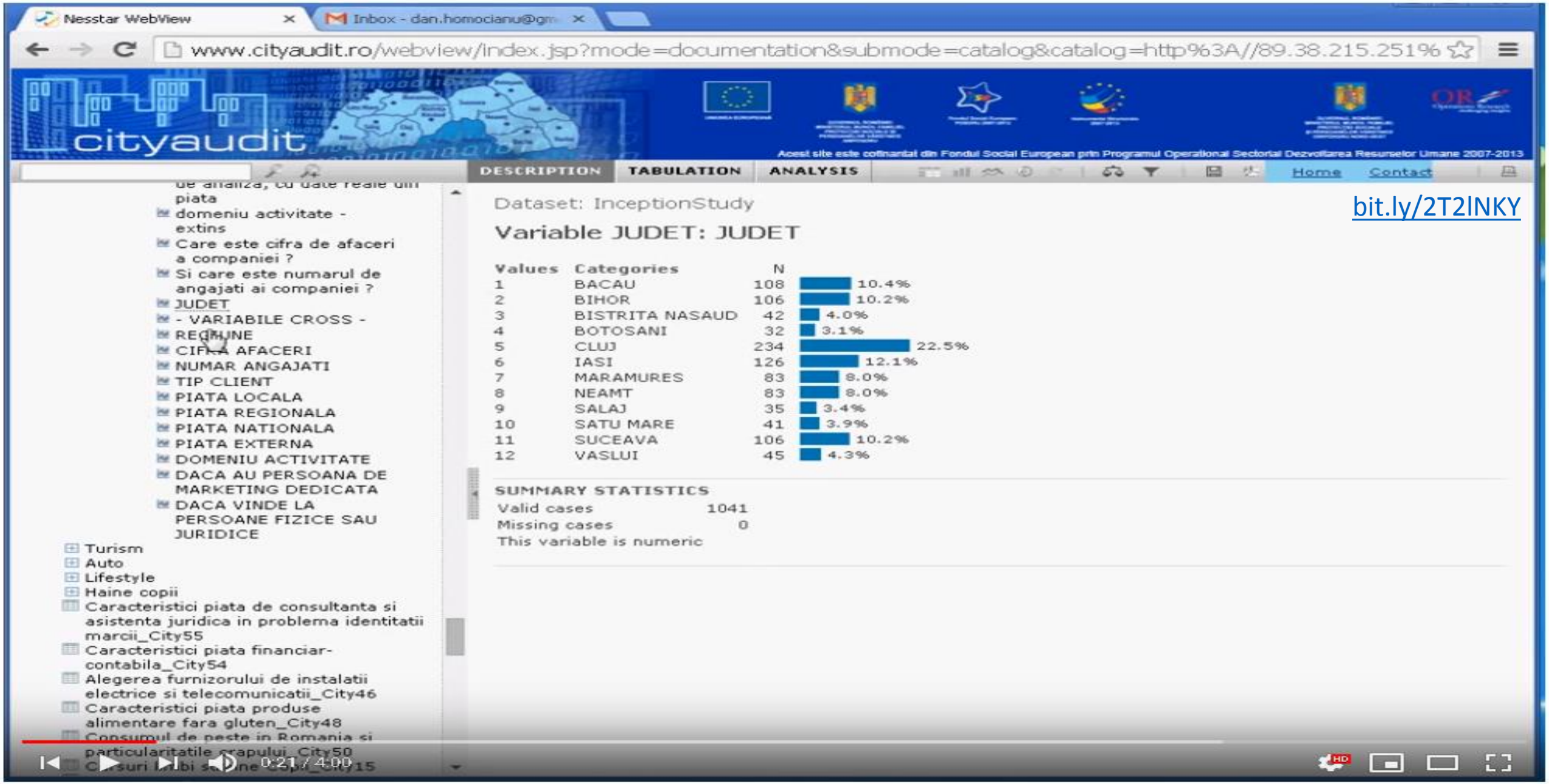
Business Processes & Common Dimensions

(Kimball Group)

BUSINESS PROCESSES	COMMON DIMENSIONS: Date	Product	Warehouse	Store	Promotion	Customer	Employee
Issue Purchase Orders	X	X	X				
Receive Warehouse Deliveries	X	X	X				X
Warehouse Inventory	X	X	X				
Receive Store Deliveries	X	X	X	X			X
Store Inventory	X	X		X			
Retail Sales	X	X		X	X	X	X
Retail Sales Forecast	X	X		X			
Retail Promotion Tracking	X	X		X	X		
Customer Returns	X	X		X	X	X	X
Returns to Vendor	X	X		X			X
Frequent Shopper Sign-Ups	X			X		X	X

Business Process / Event	Time	Customer	Service	Rate Category	Local Svc Provider	Calling Party	Called Party	Long Dist Provider	Internal Organization	Employee	Location	Equipment Type	Supplier	Item Shipped	Account Status
Customer Billing	X	X	X	X	X			X			X				X
Service Orders	X	X	X		X			X	X	X	X	X			X
Trouble Reports	X	X	X		X	X		X	X	X	X	X	X	X	X
Yellow Page Ads	X	X		X		X			X	X	X				X
Customer Inquiries	X	X	X	X	X	X		X	X	X	X				X
Promotions & Communication	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Billing Call Detail	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Network Call Detail	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Customer Inventory	X	X	X	X	X			X	X		X	X	X	X	X
Network Inventory	X		X						X	X	X	X	X	X	
Real Estate	X								X	X	X	X			
Labor & Payroll	X								X	X	X				
Computer Charges	X	X	X		X			X	X	X	X	X	X	X	
Purchase Orders	X								X	X	X	X	X	X	
Supplier Deliveries	X								X	X	X	X	X	X	

Web-based OLAP & Questionnaire variables



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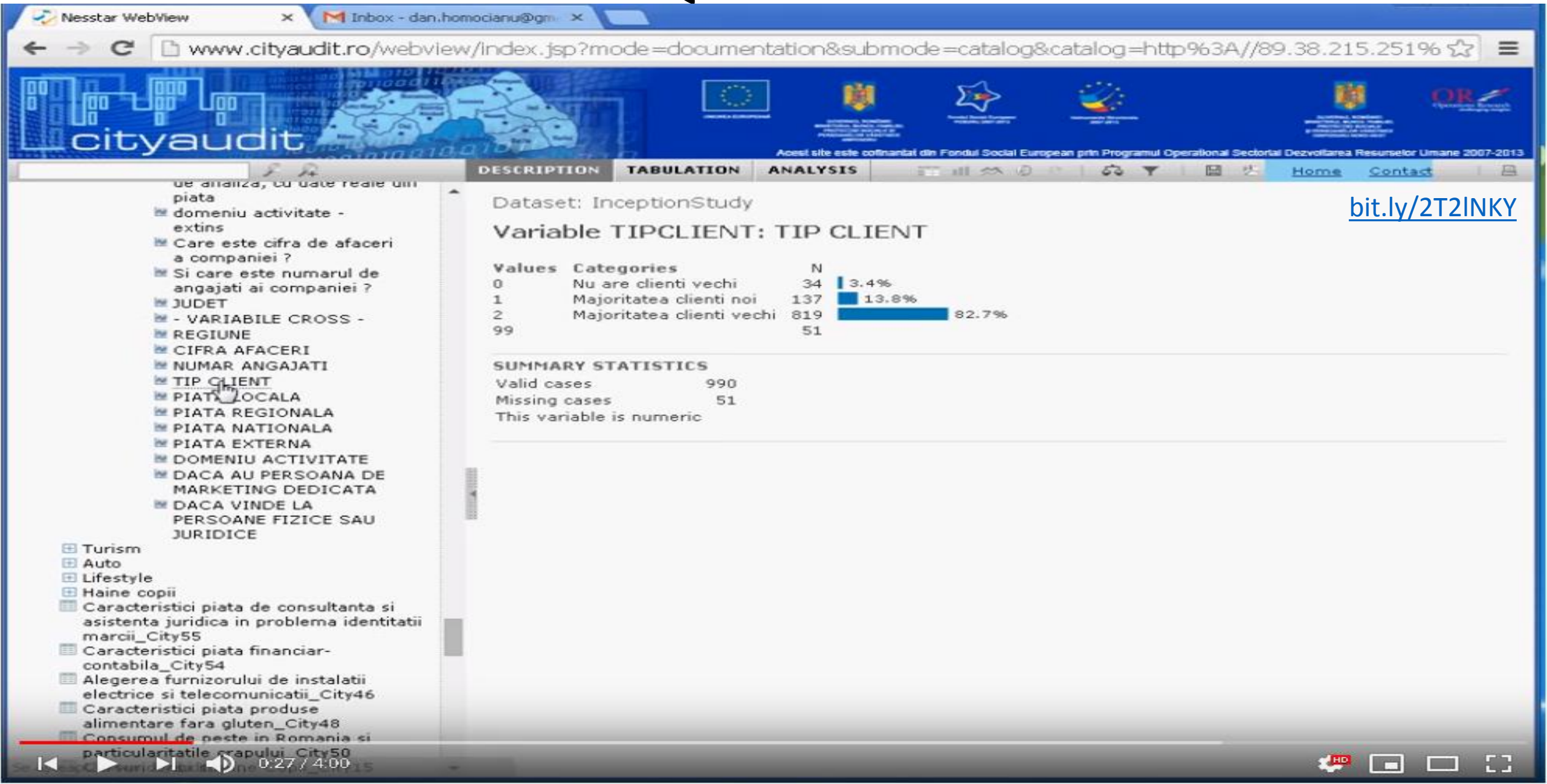
Web-based OLAP & Questionnaire variables



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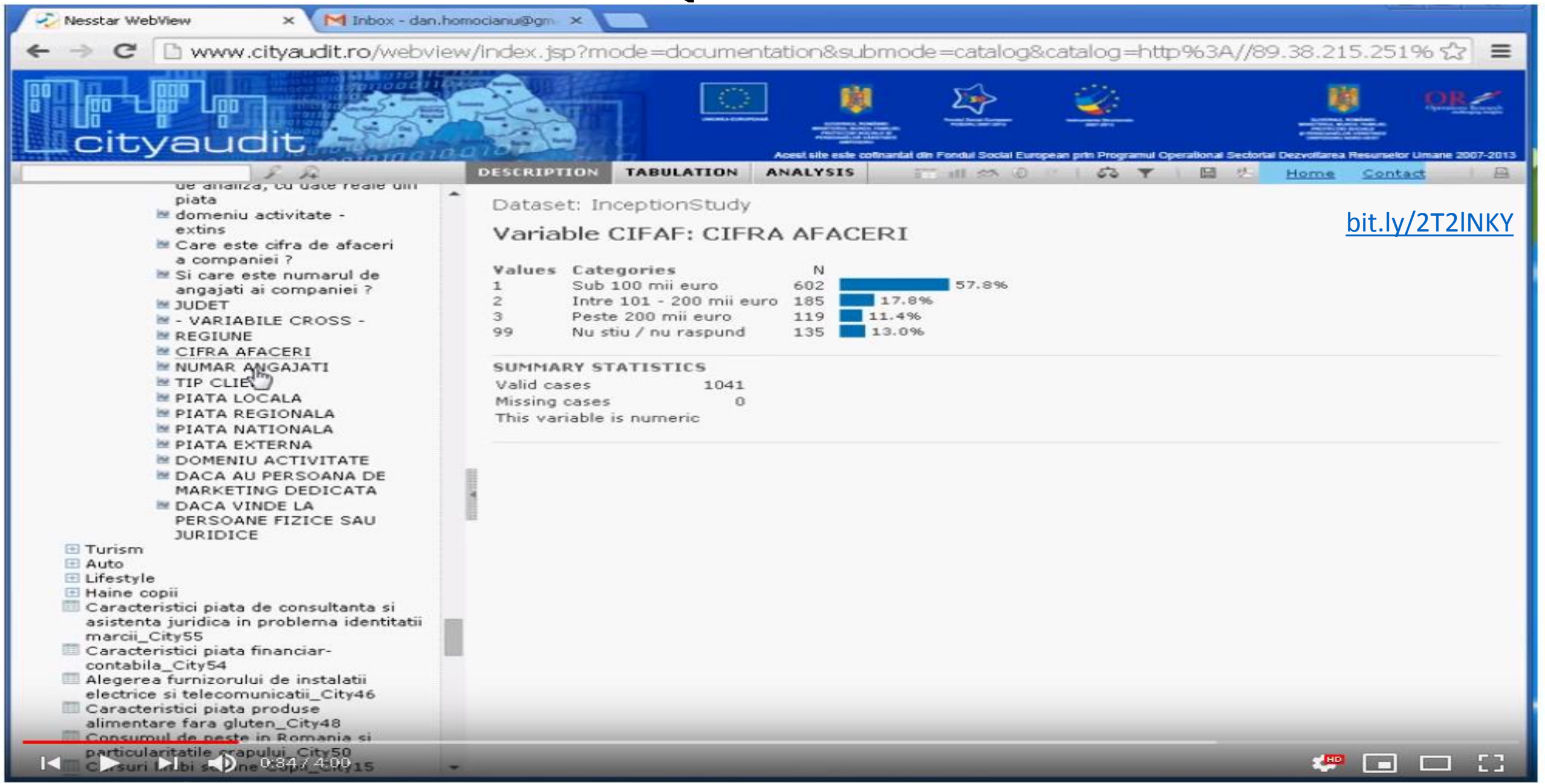

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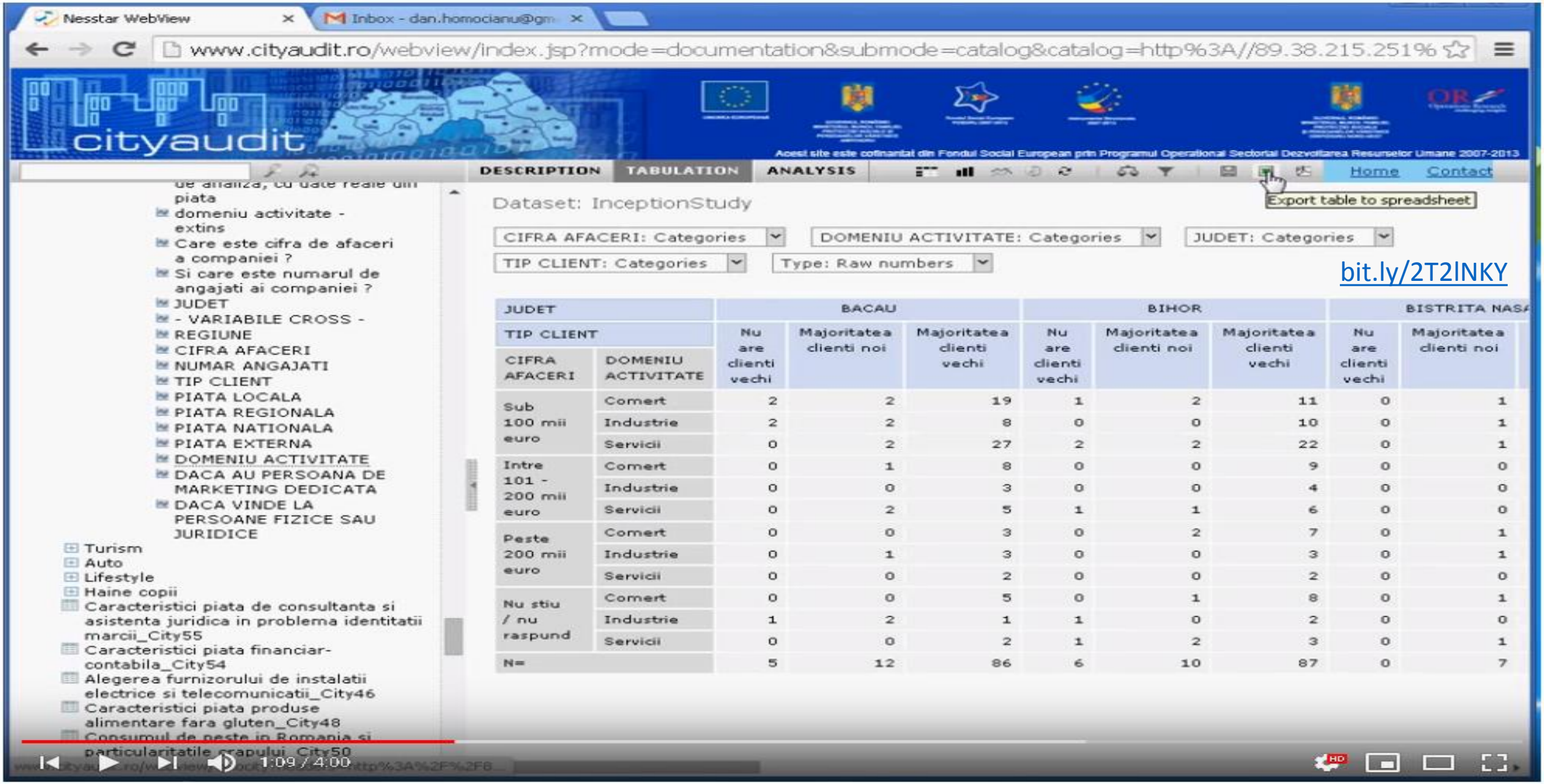
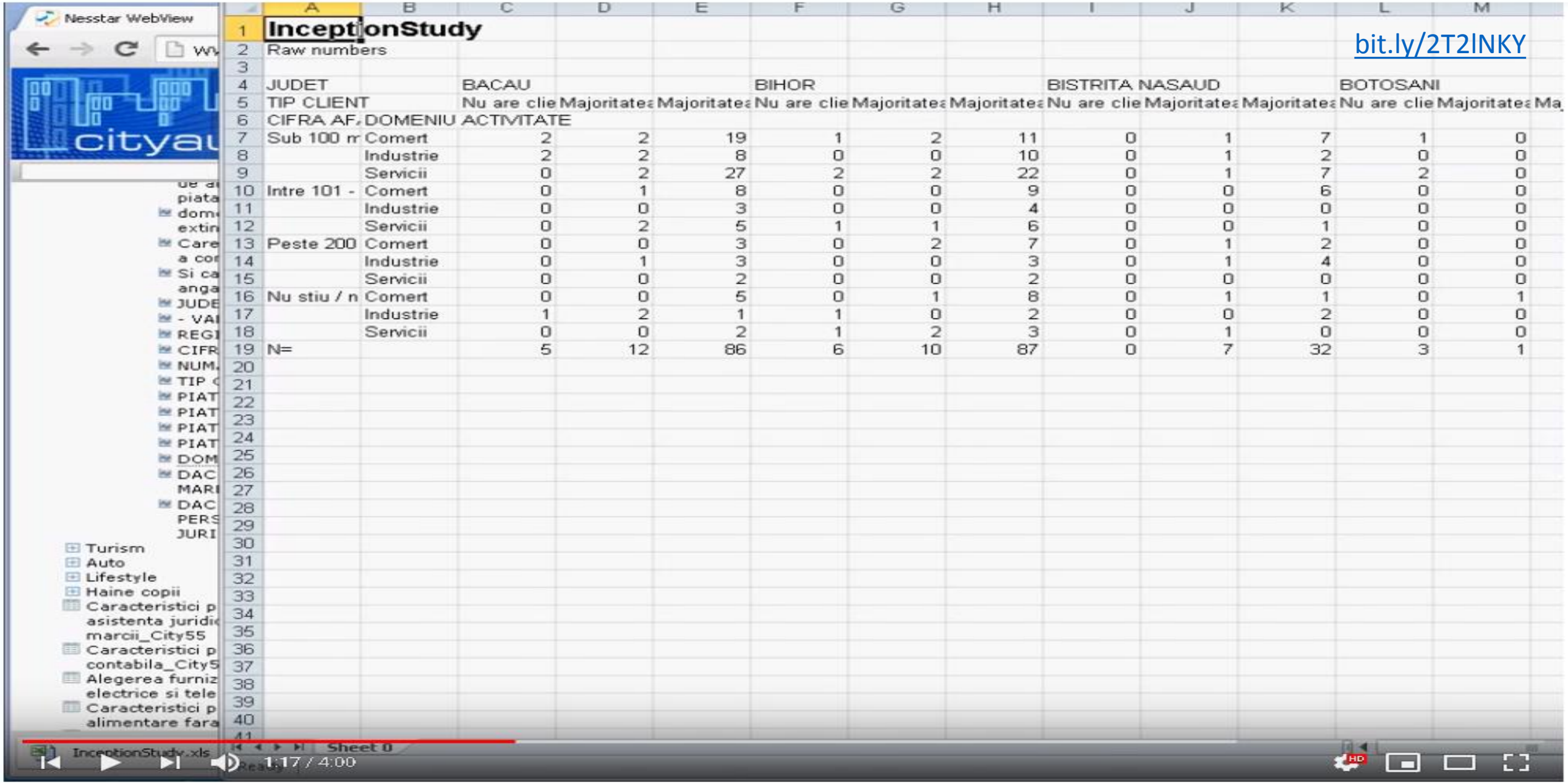


Web-based OLAP & Questionnaire variables



InceptionStudy

Raw numbers

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	Industrie	2	2	8	0	0	10	0	1	2	0	0	
	Servicii	0	2	27	2	2	22	0	1	7	2	0	
Intre 101 -	Comert	0	1	8	0	0	9	0	0	6	0	0	
	Industrie	0	0	3	0	0	4	0	0	0	0	0	
	Servicii	0	2	5	1	1	6	0	0	1	0	0	
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	Industrie	0	1	3	0	0	3	0	1	4	0	0	
	Servicii	0	0	2	0	0	2	0	0	0	0	0	
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	Industrie	1	2	1	1	0	2	0	0	2	0	0	
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	Kimball	Inmon
Need	Immediate	Longer time scale
Drive	Business areas	Enterprise
Budget	Smaller budget	Larger budget
Requirements	Volatile	More stable and growing
Customer	User base	Corporate
Sources	Stable	Changeable
Startup cost	Lower	Higher
Projects	Same cost as start up	Cheaper than start up

Common Goals

- Inmon – stresses on iterative approach
- Kimball – stresses on integration for consistency

Approaches

- Bill Inmon

- Building large centralized enterprise-wide DW (top-down)

- Ralph Kimball

-Integrating data marts for consistency through an information bus (bottom-up)

Structure

- Bill Inmon

-Relational model(3NF)

- Ralph Kimball

-Multidimensional(star schema & snowflakes)

Some benefits of DWH

Inmon &Linstedt,2015

Some of the many benefits of having a data warehouse include:

- Data is immediately available to the analyst. The data exists in a data warehouse and awaits analysis. There is no integration work required in order to begin analysis.
- Data is integrated consistently for all analysts. One analyst does not integrate data one way and another analyst does not integrate data another way.
- Data reconciliation is a real possibility. If there is a discrepancy in the results achieved by any two analysts, it is a simple matter to do a reconciliation.
- If an entirely new analysis needs to be built, there is a foundation of data on which to build.
- If it becomes necessary to do compliance or an audit, there is a believable foundation that stands ready for analysis.

Some benefits of DWH: support for OLAP & dashboards (with KPIs)

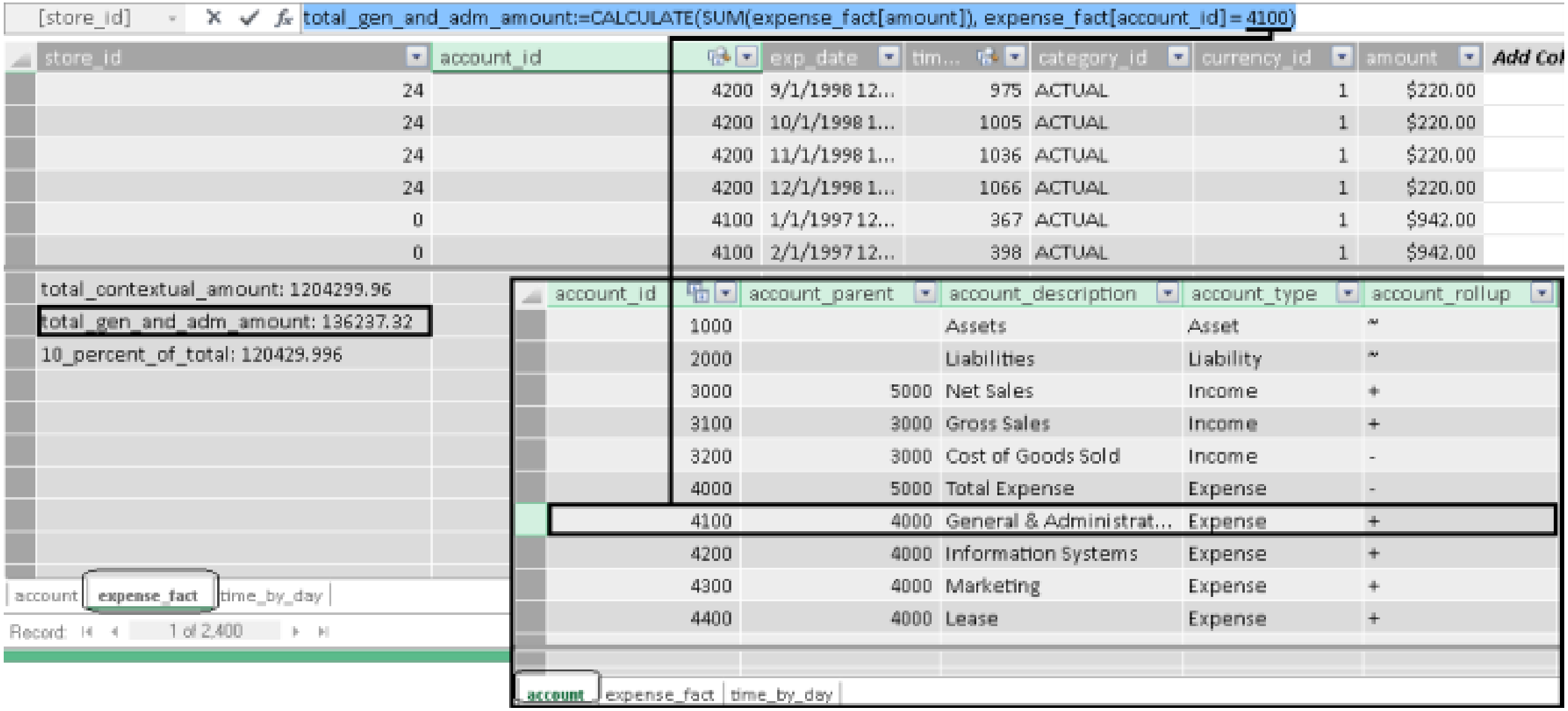


Figure 6. Example of using DAX Calculate function together with Sum & a condition similarly to SumIf / DSum in the traditional Excel and Select Sum(field_name) From table_name Where condition_or_conditions in SQL

Some benefits of DWH: support for OLAP & dashboards (with KPIs)

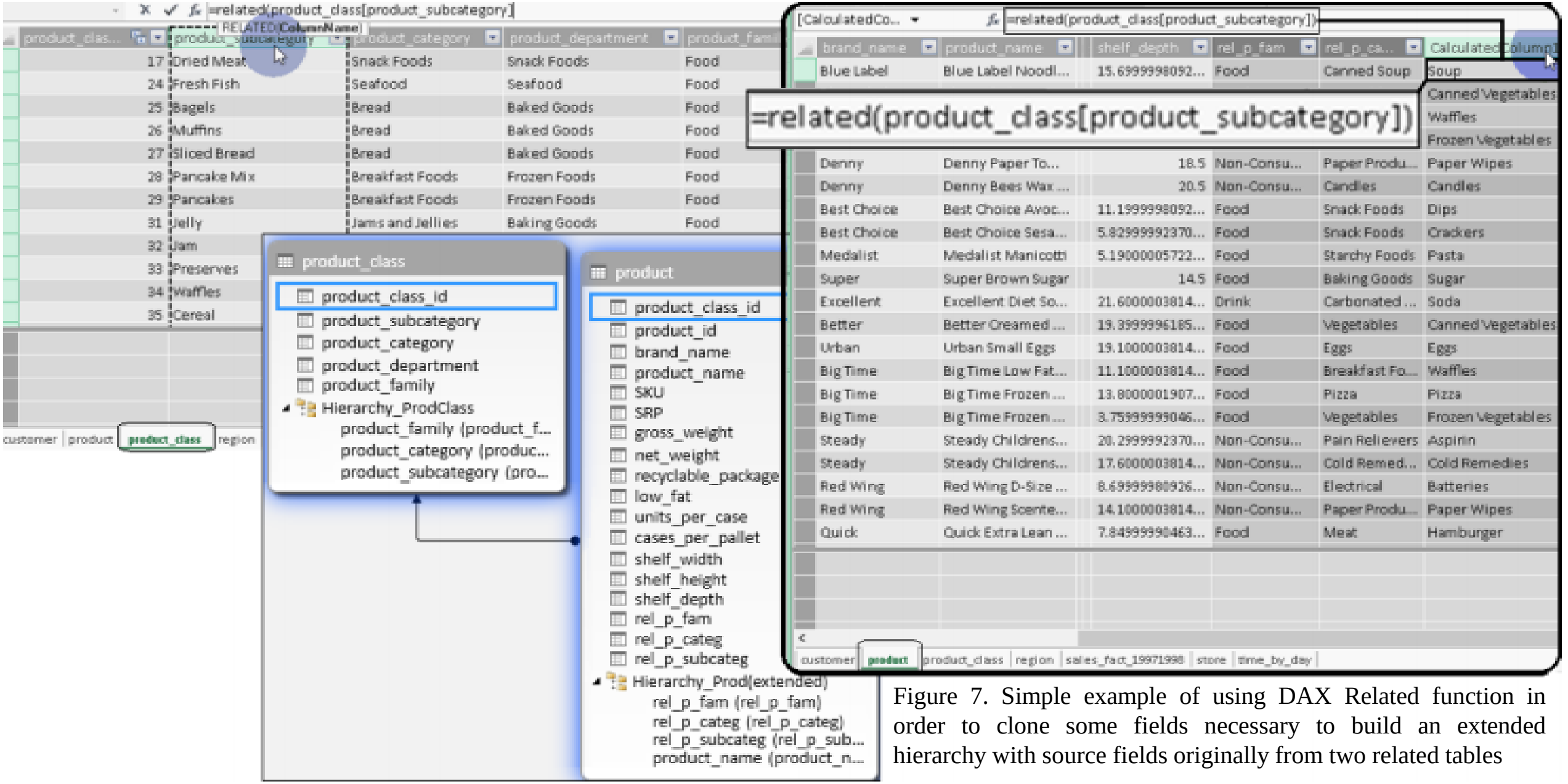
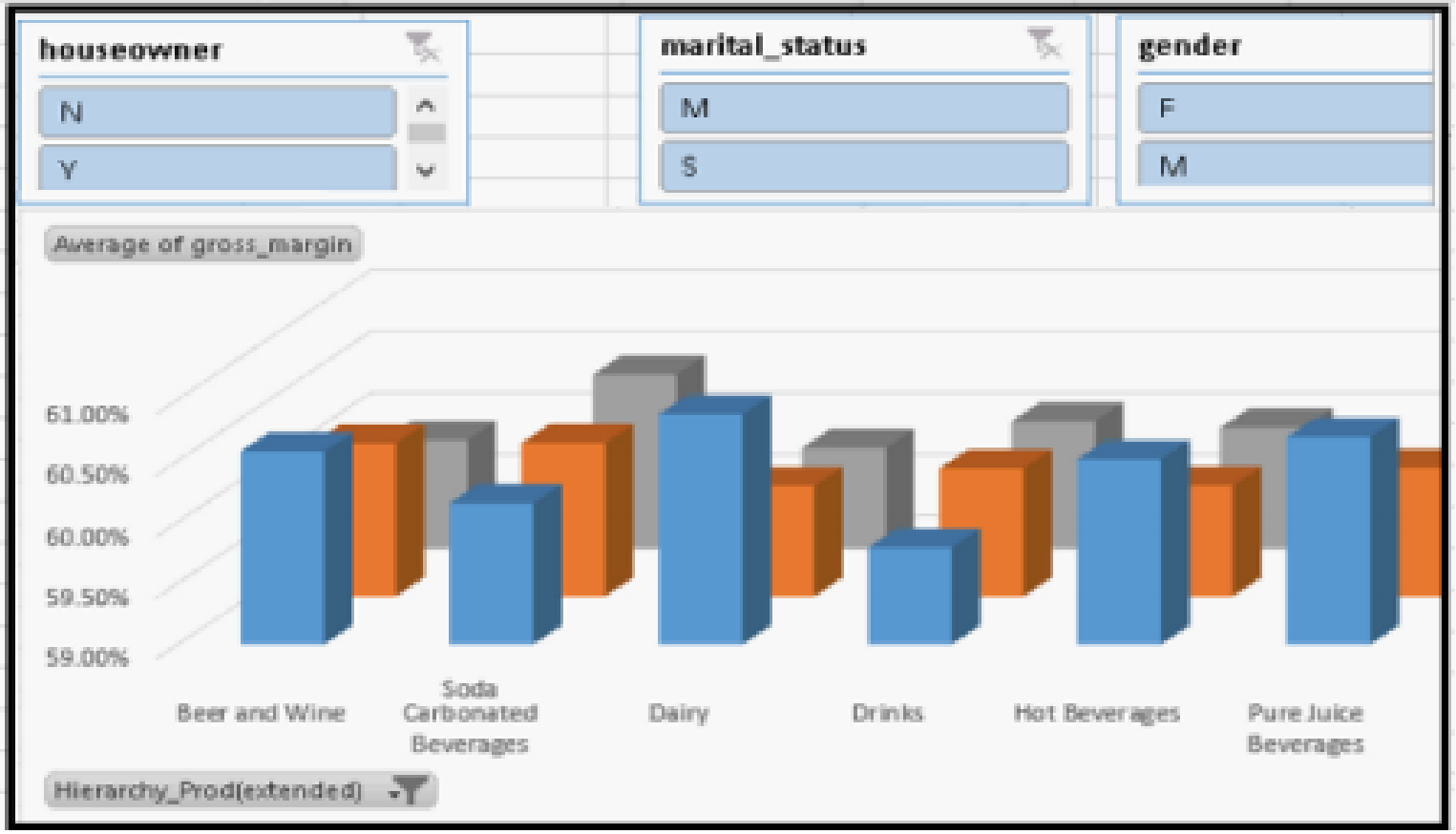


Figure 7. Simple example of using DAX Related function in order to clone some fields necessary to build an extended hierarchy with source fields originally from two related tables

Some benefits of DWH: support for OLAP & dashboards (with KPIs)

Average of gross_margin		sales_region		
rel_p_categ	rel_p_subcateg	Central West	North West	South West
Beer and Wine		60.58%	60.25%	59.89%
Carbonated Beverages	Soda	60.16%	60.26%	60.42%
Carbonated Beverages Total		60.16%	60.26%	60.42%
Dairy		60.88%	59.90%	59.82%
Drinks		59.79%	60.05%	60.04%
Hot Beverages		60.51%	59.91%	59.99%
Pure Juice Beverages		60.70%	60.05%	59.63%



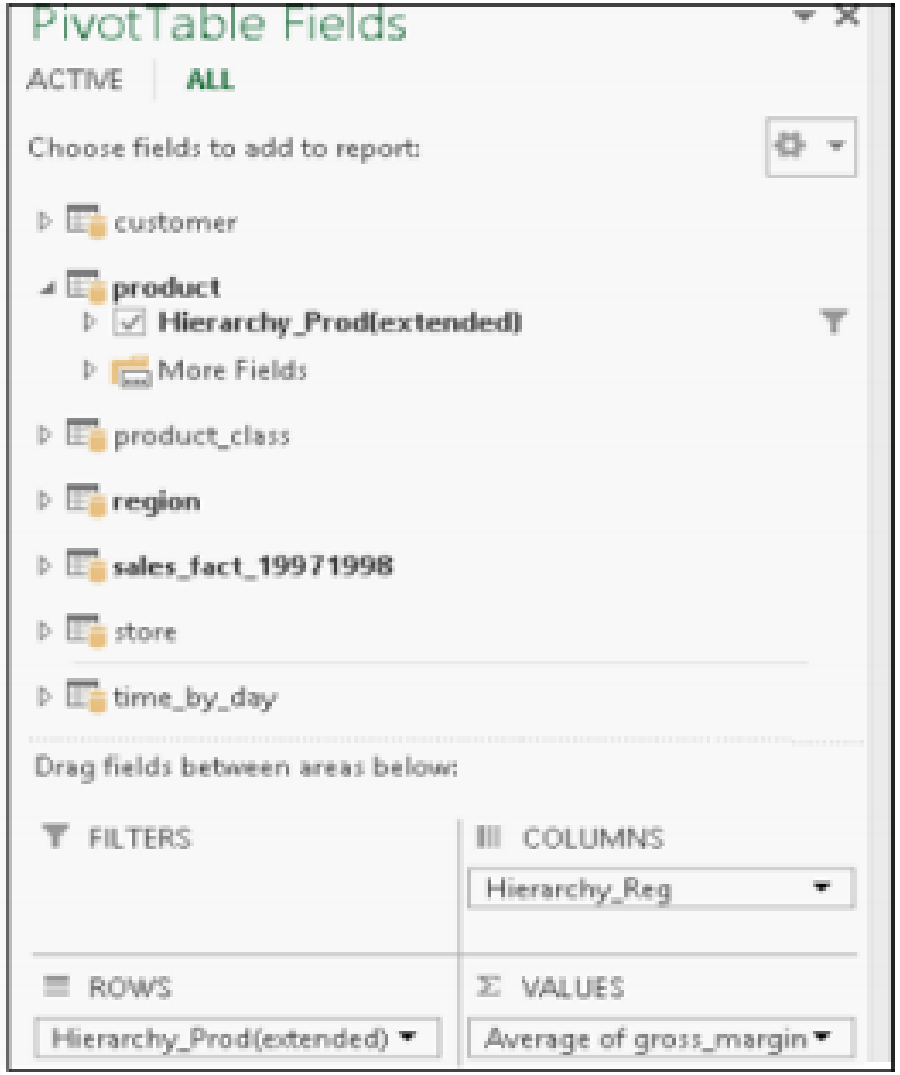
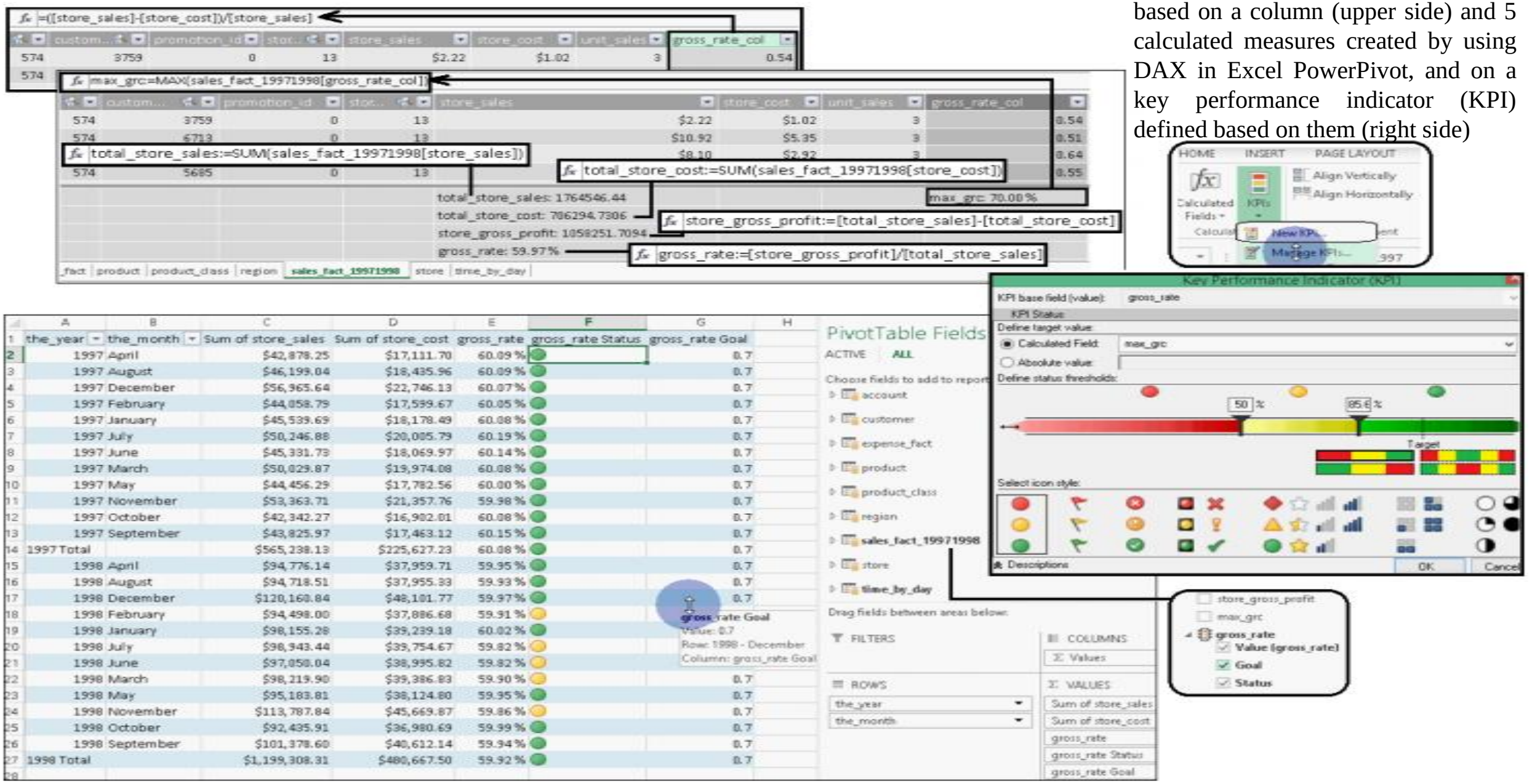


Figure 8. Simple example of dashboard exploiting the concept of dimensional hierarchy

Some benefits of DWH: support for OLAP & dashboards (with KPIs)

Figure 9. Dynamic dashboard built based on a column (upper side) and 5 calculated measures created by using DAX in Excel PowerPivot, and on a key performance indicator (KPI) defined based on them (right side)



the_year	the_month	Sum of store_sales	Sum of store_cost	gross_rate	gross_rate Status	gross_rate Goal
1997	April	$42,878.25	$17,111.70	60.09 %		0.7
1997	August	$46,199.04	$18,435.96	60.09 %		0.7
1997	December	$56,965.64	$22,746.13	60.07 %		0.7
1997	February	$44,058.79	$17,599.67	60.05 %		0.7
1997	January	$45,539.69	$18,178.49	60.08 %		0.7
1997	July	$50,246.88	$20,065.79	60.19 %		0.7
1997	June	$45,331.73	$18,069.97	60.14 %		0.7
1997	March	$50,029.87	$19,974.08	60.08 %		0.7
1997	May	$44,456.29	$17,782.56	60.00 %		0.7
1997	November	$53,363.71	$21,357.76	59.98 %		0.7
1997	October	$42,342.27	$16,902.01	60.08 %		0.7
1997	September	$43,825.97	$17,463.12	60.15 %		0.7
1997 Total		$565,238.13	$225,627.23	60.08 %		0.7
1998	April	$94,776.14	$37,959.71	59.95 %		0.7
1998	August	$94,718.51	$37,955.33	59.93 %		0.7
1998	December	$120,160.84	$48,101.77	59.97 %		0.7
1998	February	$94,498.00	$37,886.68	59.91 %		
1998	January	$98,155.28	$39,239.18	60.02 %		0.7
1998	July	$98,943.44	$39,754.67	59.82 %		
1998	June	$97,050.04	$38,995.82	59.82 %		
1998	March	$98,219.90	$39,386.83	59.90 %		0.7
1998	May	$95,183.81	$38,124.80	59.95 %		0.7
1998	November	$113,787.84	$45,669.87	59.86 %		0.7
1998	October	$92,435.91	$36,980.69	59.99 %		0.7
1998	September	$101,378.60	$40,612.14	59.94 %		0.7
1998 Total		$1,199,308.31	$480,667.50	59.92 %		0.7

Some benefits of DWH: availability for Data Mining and support for modeling

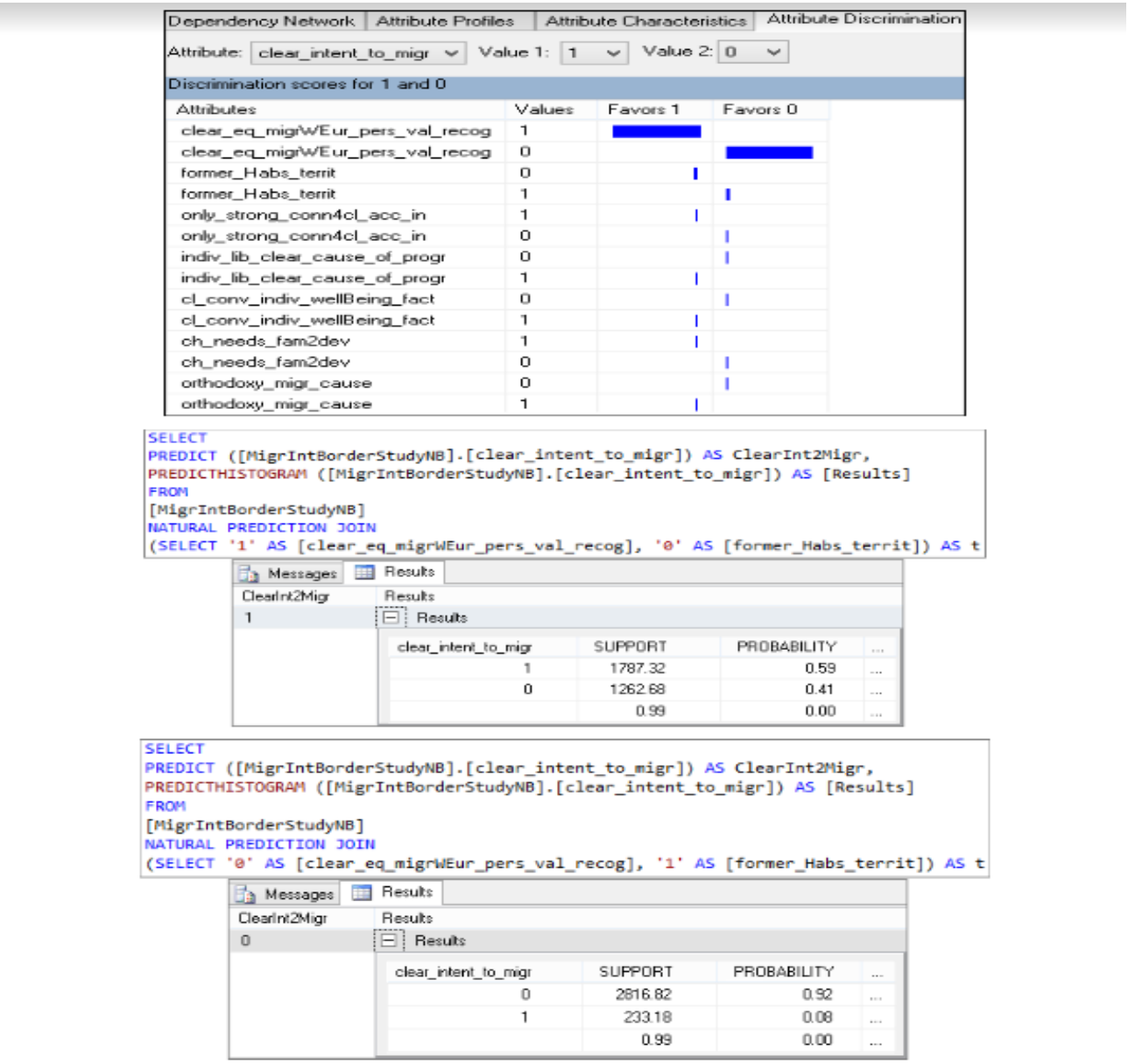
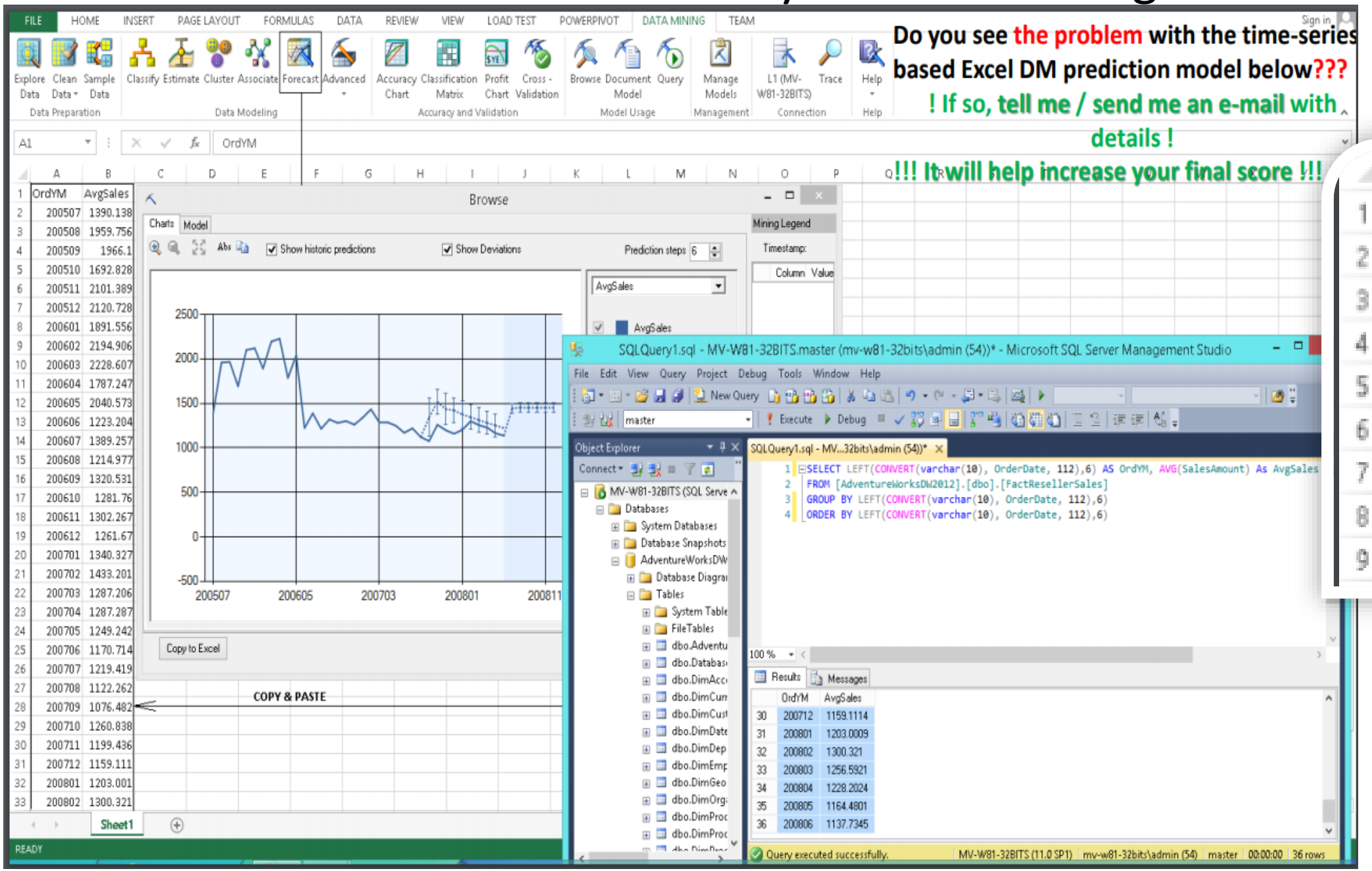


Figure 2. Using a classification technique (Naive Bayes algorithm) in Microsoft Excel Data Mining and exploring the model's most powerful influences using SQL Server Analysis Services

Variables	(a)	(b)	(c)	(d)
clear_eq_migrWEur_pers_val_recog	**2.343*** **	**2.337*** **	**2.286*** **	**2.275*** **
	(0.105)	(0.106)	(0.107)	(0.108)
former_Habs_territ	**-0.516*** **	**-0.526*** **	**-0.572*** **	**-0.579*** **
	(0.104)	(0.106)	(0.107)	(0.108)
interpers_trust_lvl_under_or_eq3			**0.447** **	**0.447** **
			(0.184)	(0.186)
orthodoxy_migr_cause			**0.591*** **	**0.548*** **
			(0.161)	(0.163)
accept_or_doubts_notpaying_pub_t			**0.251***	**0.269***
			(0.142)	(0.143)
only_strong_conn4cl_acc_in			**0.241** **	**0.245** **
			(0.111)	(0.111)
indiv_lib_clear_cause_of_progr			**0.494*** **	**0.494*** **
			(0.128)	(0.128)
cl_conv_st_cr_wellBeing			**0.238** **	**0.252** **
			(0.110)	(0.111)
cl_conv_st_inv_moreEc			**-0.411*** **	**-0.357*** **
			(0.121)	(0.122)
min_dist2fHt_over_or_eq75		**0.312*** **		**0.307*** **
		(0.105)		(0.107)
inh_val_resp4tradit		**-0.318*** **		**-0.285** **
		(0.110)		(0.112)
m_edu_over_or_eq12		**0.233** **		**0.199***
		(0.112)		(0.113)
both_p_gone_abroad		**0.258***		**0.265***
		(0.150)		(0.152)
CONSTANT	**-1.987*** **	**-2.212*** **	**-2.724*** **	**-2.981*** **
	(0.084)	(0.130)	(0.233)	(0.259)
Observations	3051	3051	3051	3051
LR chi2(df)	563.43	588.59	620.46	641.62
df	2	6	9	13
Prob > chi2	0.0000	0.0000	0.0000	0.0000
Pseudo R square	0.1893	0.1977	0.2085	0.2156
AUC(ROC)	0.7707	0.7897	0.8002	0.808

Table 2. Raw coefficients for logit regressions (Stata 13) considering the entire dataset

Some benefits of DWH: availability for Data Mining



	A	B
1	OrdYM	AvgSales
2	200507	1390.138
3	200508	1959.756
4	200509	1966.1
5	200510	1692.828
6	200511	2101.389
7	200512	2120.728
8	200601	1891.556
9	200602	2194.906

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