

FIT3003 – Business Intelligence and Data Warehousing

Week 9 – Business Intelligence

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Agenda

- Business Intelligence Systems
- User Interface and Dashboard
- Navigation Methods
- Trends in BI Systems

Business Intelligence Systems

Business Intelligence Systems

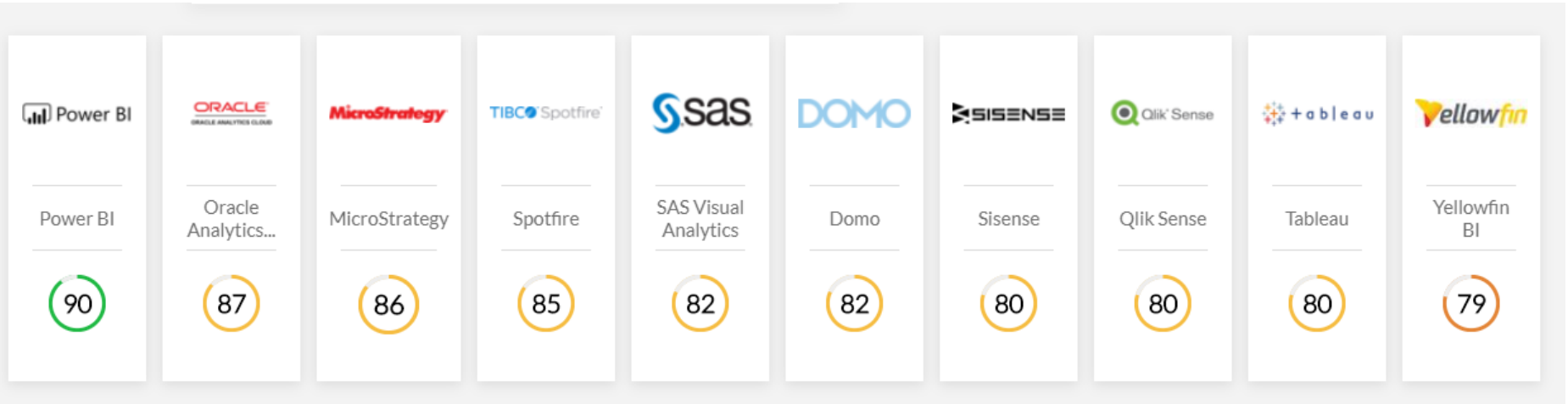
- What are business intelligence (BI) systems?
 - “An *integrated set of tools, technologies and programmed products that are used to collect, integrate, analyse and make data available.*” (Reinschmidt and Francoise, 2000)
- Use of technology for **decision support** not new:



- Functionally, EIS and BI very similar.
 - Current trend towards the use of the term ‘Business Analytics’

BI Systems in the Market

Top 10 Business Intelligence Tools Leaders by Analyst Rating (of 269 products)



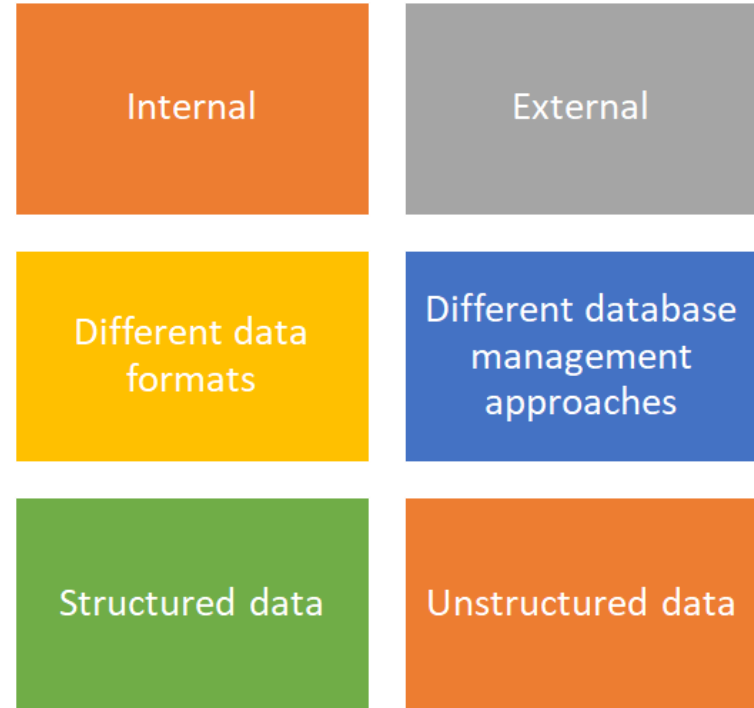
Source: selecthub.com

Business Intelligence Systems

- Common features
 - Deals with **huge amount of data**, from **different sources**
 - Include **dashboards** that provide overview and monitoring of performance
 - Supports **navigation** from one report to the another for further investigation
 - **Visualise** data in both textual and graphical

Data and Business Intelligence

- BI systems have to:
 - a. Acquire data
 - b. Process it
 - c. Present it
- Where does the data come from?
- Solution: data warehouse



Why learn about BI/DW?

- Three key aspects of BI/DW systems make them different to other information systems:
 - a. The task supported
 - b. The users
 - c. The development process required

The Task - Decision Making

- Subject to
 - cognitive overload
 - systemic biases
 - personal preference
- The same decision task leads to different outcomes for different people!
 - Inherently ambiguous, especially for strategic decisions
 - No single 'right' answer
 - Possibly no single 'right' way to make a decision

The User

- Organisational decision makers:
 - Knowledge workers
 - Managers
 - Executives
 - Directors
- Impossible to specify what these people do from moment to moment
 - Compare with a sales clerk: very specific actions, repetitive task
 - Managers: many different actions, sometimes unique one-off tasks
- Organisationally powerful

The Development Process

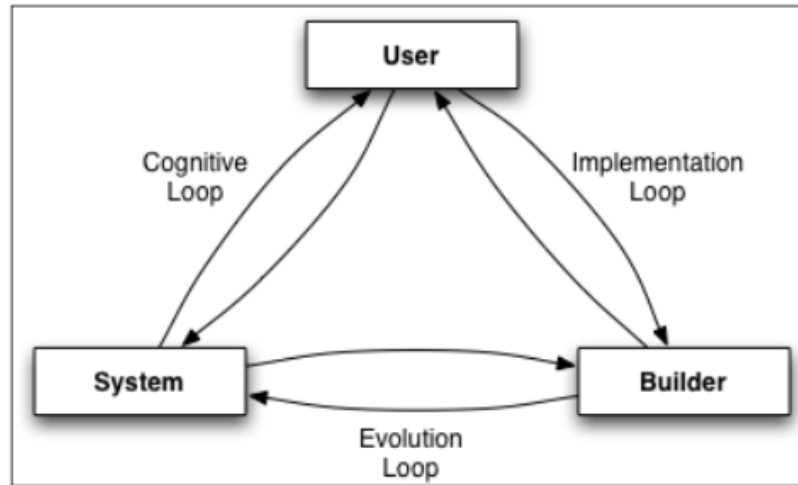
- The purpose of the system is to help users understand the decision problem so they can make a better decision
- The information needed to make a good decision depends on the decision problem.

Catch 22!

- You don't know what information you'll need until you start using the system
- You can't use the system until it's designed
- It can't be designed until the designer has gathered the information requirements

The Development Process (cont.)

Framework that supports any system that supports decision making:



Peter Keen, 1980

User Interface and Dashboard

User Interface in BI Systems

- The user interface must be easy to learn and easy to remember
 - Managers will not attend long training sessions
 - Some managers only use the system infrequently
- Interface must not get in the way
 - Allow analysis “at the speed of thought”
 - “Transparent interaction”
- Information presented must be easy to understand
- It must be clear where information comes from

Dashboards

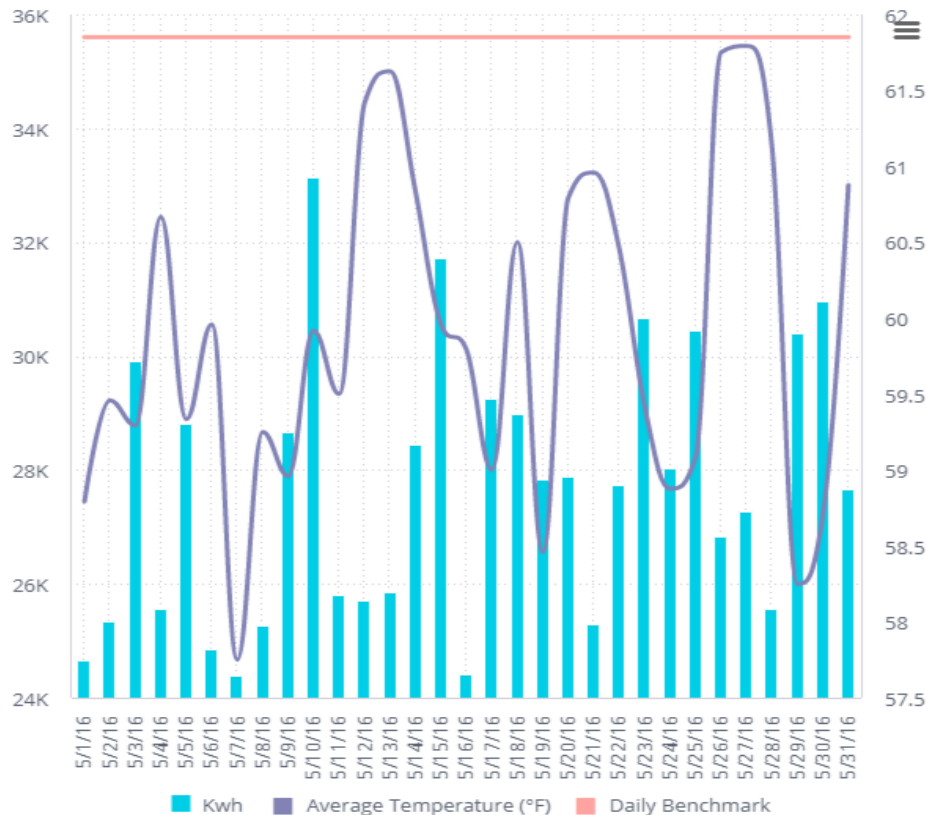
- “*Visual display of the most important information needed to achieve one or more objectives which **fits entirely on a single computer screen** so it can be monitored at a glance.*” (Few, 2013 p34)
- Small, concise, clear, intuitive and often interactive display.
- Customised for a specific person, group or function
- Focus on monitoring and measuring
- Consists of a combination of charts and tables

Report

- A document that presents information in an organised format for a **specific audience and specific purpose**
- Information is usually organised in a **combination of graphic, tabular** and / or **narrative** formats.
- Reports can be **static** or **interactive** (e.g. user can enter parameters, sort columns, filter content)

Report - Examples on Electricity Consumption

Electricity Consumption



Days in Date	Kwh	Average Temperature (°F)	Daily Benchmark
05/1/2016	24657.708	58.79166667	35600
05/2/2016	25332.25	59.45833333	35600
05/3/2016	29905.583	59.29166667	35600
05/4/2016	25558.875	60.66666667	35600
05/5/2016	28812.958	59.33333333	35600
05/6/2016	24851.583	59.95833333	35600
05/7/2016	24391.25	57.75	35600
05/8/2016	25271.375	59.25	35600
05/9/2016	28669.917	58.95833333	35600
05/10/2016	33140	59.91666667	35600
05/11/2016	25810.625	59.5	35600
05/12/2016	25704.75	61.41666667	35600
5/13/16	25868.5	61.625	35600
5/14/16	28450.583	60.83333333	35600
5/15/16	31713.958	59.95833333	35600
5/16/16	24424.5	59.79166667	35600

Credit: sisense.com

Report - Examples on Electricity Consumption

Site Selector



MAY 2016

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Credit: sisense.com

Tables vs Graphs

- Tables are the most appropriate method to:
 - Display information when the user has the need to look up individual values.
 - Display simple relationship between numeric values and categorical values.
- Graphs are the most appropriate method when:
 - The message is contained in the shape of the values
 - The objective is used to reveal relationships among multiple values.

Types of Dashboards

Strategic

- Used by managers to monitor business health and progress towards meeting strategic objectives
- High-level measures of past and forecast performance

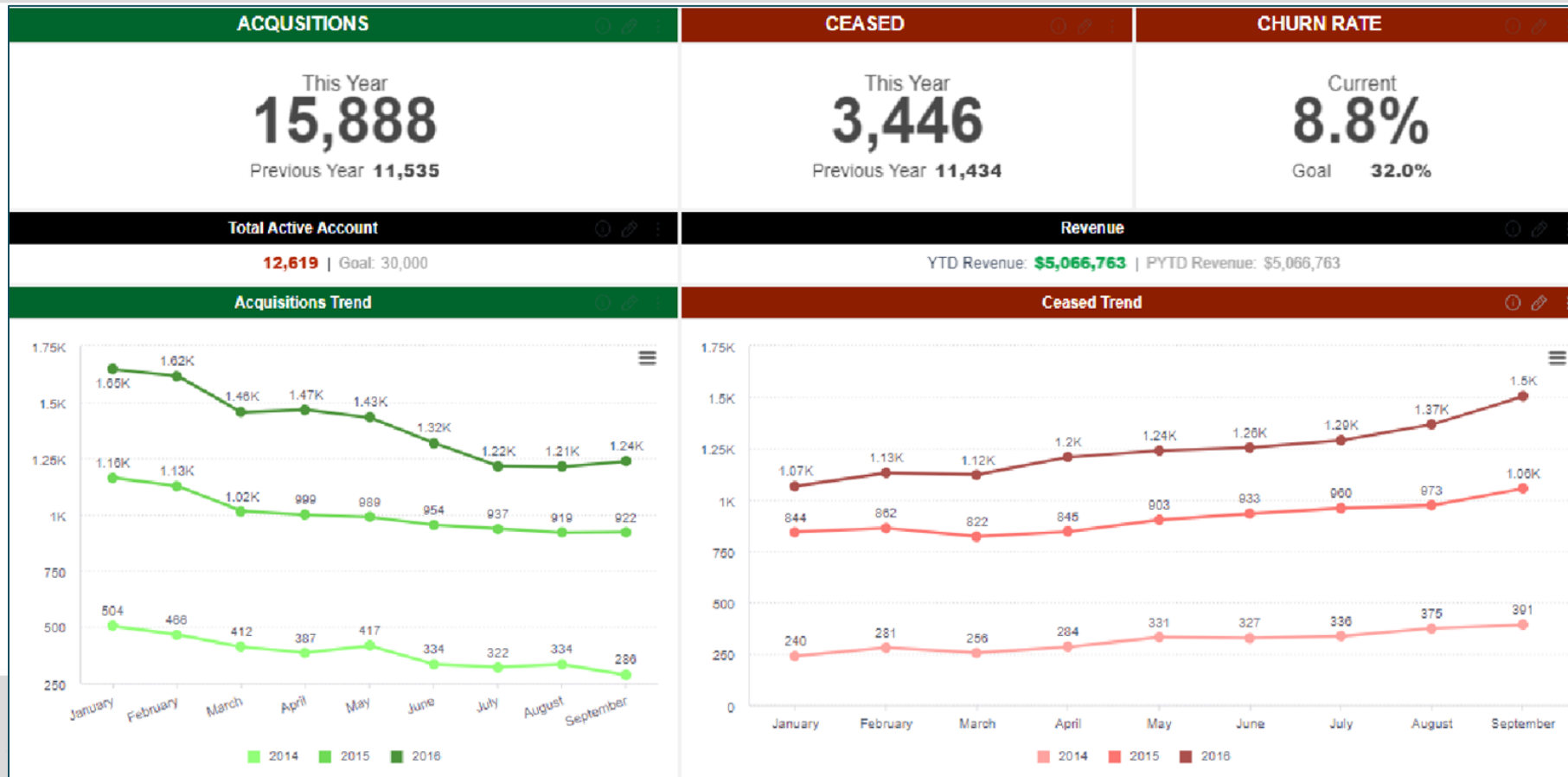
Analytic

- Used by analysts as a way to gain access to a broad
- range of more detailed information

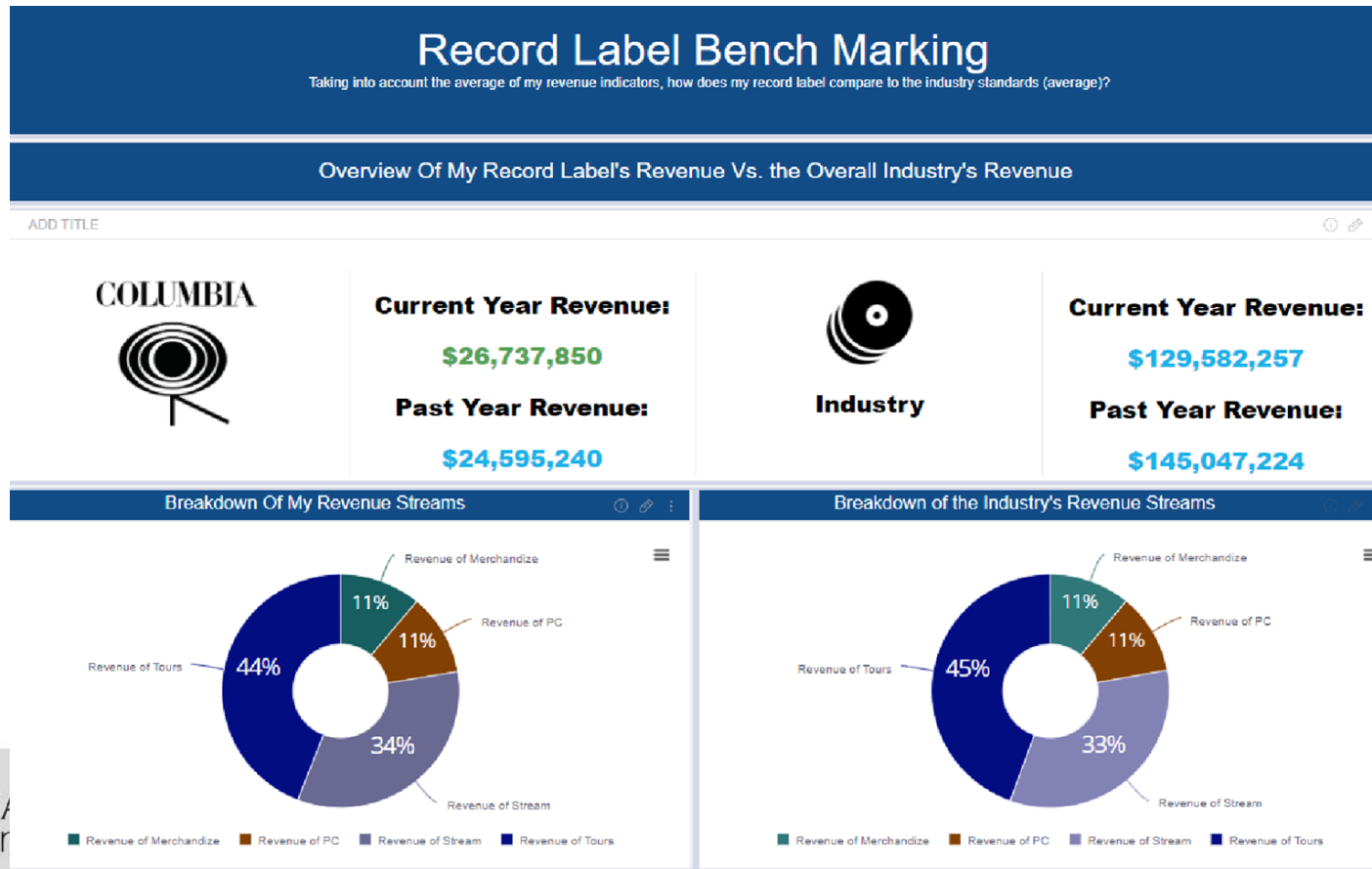
Operational

- Used to monitor the operation of a factory or service
- Display of information is real-time or near-real-time
- Not only display measures but also displays warnings and alerts

Sample Dashboards #1 (Credit: sisense.com)



Sample Dashboards #2 (Credit: sisense.com)



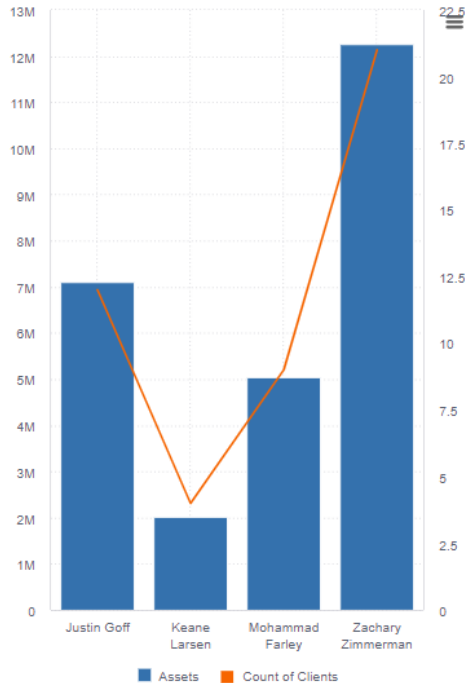
Sample Dashboards #3 (Credit: sisense.com)

Overview

ADD TITLE

Assets: **26.43M**

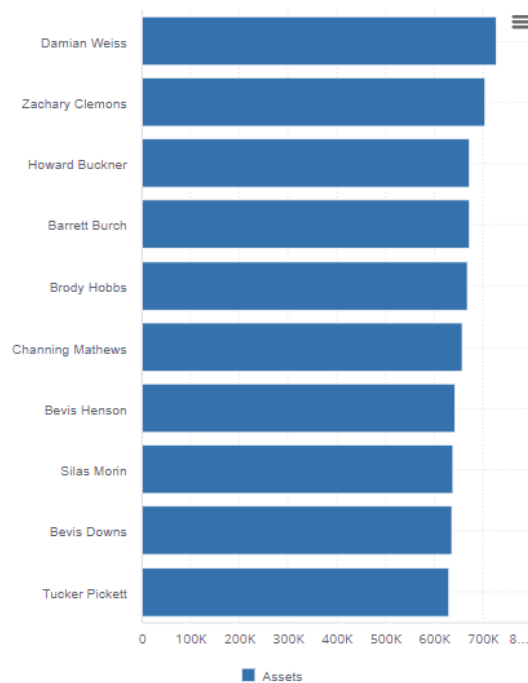
Asset Management by Manager



ADD TITLE

Number of Clients: **47**

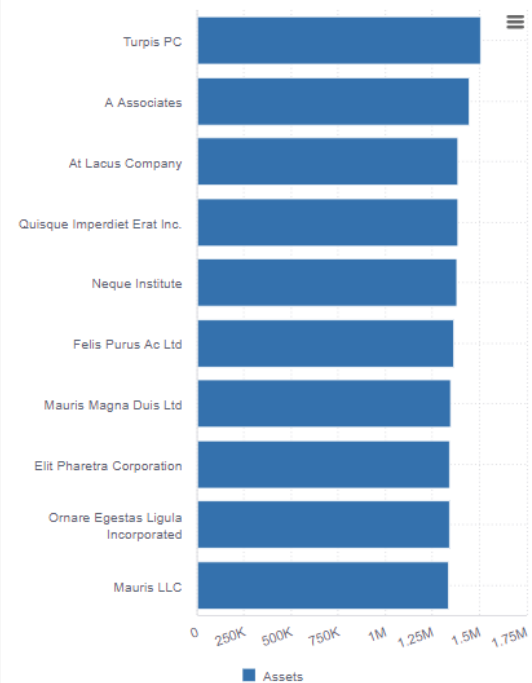
Top 10 Clients by Assets



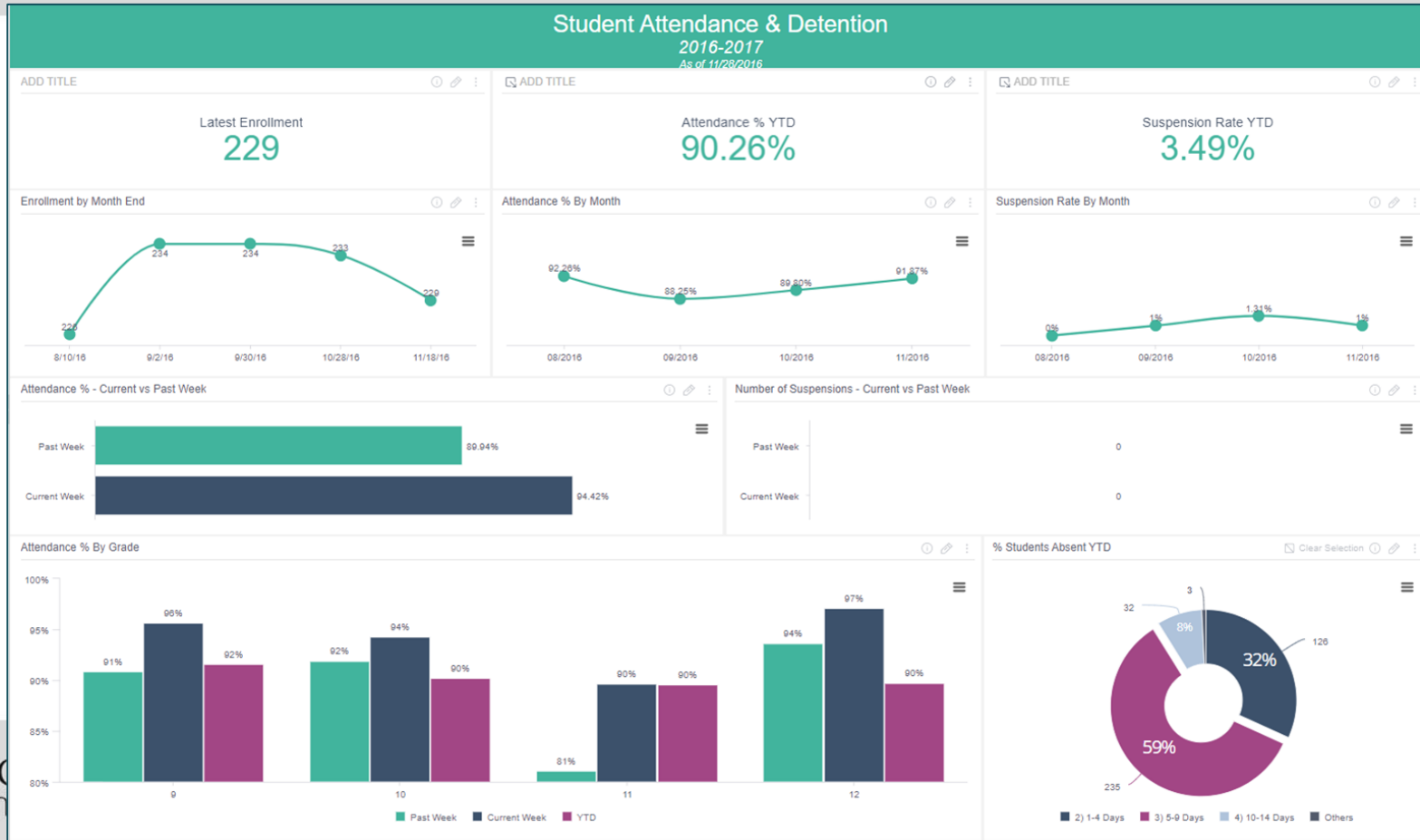
ADD TITLE

Average Assets per Client: **\$562,438**

Top 10 Assets Owned



Sample Dashboards #4 (Credit: sisense.com)



Dashboards versus Reports

- Minimal interactivity (Navigation should not be needed or at least kept to a minimum)
- Minimal analysis
- Require minimal cognitive effort
- Focus on quick communication of **key data**
- Individual visualisations should work together to communicate effectively.
- Click through to reports for more substantial analysis

Navigation Methods

BI Navigation Methods

- Drill-Down
 - Navigating to a report with **more detail** following the levels of a pre-defined dimension hierarchy.
- Example:
 - Yearly sales
 - Quarterly sales
 - Monthly sales
 - Daily sales

Drill-Down - Example

Camp Performance

Examine invoicing figures by Camp Location hierarchy.

Camp Region	KPI	Invoiced
Asia	✓	\$120,474,325
Australia	!	\$97,832,651
Europe	✓	\$191,560,001
Latin America	✗	\$1,602,199
North America	✗	\$59,474,670
		\$470,943,846

 Reset Report

Camp Performance

Examine invoicing figures by Camp Location hierarchy.

Start > Camp Region: North America

Camp Country	KPI	Invoiced
Bermuda	✗	\$61,644
Canada	!	\$17,935,402
United States	✓	\$41,477,624
		\$59,474,670

 Reset Report

Camp Performance

Examine invoicing figures by Camp Location hierarchy.

Start > Camp Region: North America > Camp Country: Canada

Camp Name	KPI	Invoiced
Camp Fortune	✗	\$196,334
Georgian Peaks	✓	\$7,381,135
Gressoney St Jean	✗	\$169,706
Gurgl	✗	\$14,036
Happo-one Hakuba	✗	\$416,164
Hochficht	✗	\$78,681
Jisan Forest Resort	✗	\$301,832
Mont Orford	✓	\$9,156,998
Nakiska	✗	\$97,517
Quebec City	✗	\$49,398
Sun Peaks	✗	\$73,601
		\$17,935,402

BI Navigation Methods (cont.)

- Drill-Up (a.k.a. Roll-Up)
 - The reverse of “drill-down”
 - Navigating to a report with **less detail** following the levels of a pre-defined dimension hierarchy.
- Example:
 - Yearly sales
 - Quarterly sales
 - Monthly sales
 - Daily sales

Drill-Up - Example

 Reset Report

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BI Navigation Methods (cont.)

- Drill-Through
 - Navigating from a summary report to report that shows the **detailed transactions that made up the summary**.

Camp Performance for Selected Region

Camp Region	Camp Country	Invoiced
Asia	Armenia	\$30,053,858
	Japan	\$78,947,701
	Kazakhstan	\$3,809,155
	Korea, Democratic Peoples Rep	\$188,898
	Malaysia	\$80,486
	Mongolia	\$656,008
	Myanmar (Burma)	\$486,505
	Pakistan	\$5,683,691
	Papua New Guinea	\$187,933
	Philippines	\$348,522
	Sri Lanka	\$31,567
		\$120,474,325

Camp Performance for Selected Region > Invoiced Details
Show Filter Values

Invoiced Details

Camp Country: Sri Lanka

Camp Name	First Name	Last Name	Invoiced Amount	Cancellation Fee	Cost of Camp
Banff	Brian	Beaulieu	\$5,350	\$0	\$4,544
	Dasha	Kadulova	\$5,350	\$0	\$4,544
	Jonathan	Beaulieu	\$5,083	\$0	\$4,544
	Parker	Vaile	\$5,350	\$0	\$4,544
	Ryan	Dockman	\$5,350	\$0	\$4,544
	Samuel	Lieff	\$5,083	\$0	\$4,544
Banff			\$31,567	\$0	\$27,264
			\$31,567	\$0	\$27,264

BI Navigation Methods (cont.)

- Drill-Across
 - Navigating from a report based on one set of dimension attributes and measure(s) to a new report with the **same set of dimension attributes** but with **different measure(s)**.

Total Invoiced by Region and Gender



Invoiced Amount	Gender		
Camp Region	Female	Male	Total
Asia	\$49,322,356	\$71,151,969	\$120,474,325
Australia	\$21,913,736	\$75,918,915	\$97,832,651
Europe	\$58,751,572	\$132,799,922	\$191,551,494
Latin America	\$506,173	\$1,096,026	\$1,602,199
North America	\$19,828,976	\$39,645,695	\$59,474,670
Total	\$150,322,813	\$320,612,526	\$470,935,339

Cost of Camp by Region and Gender

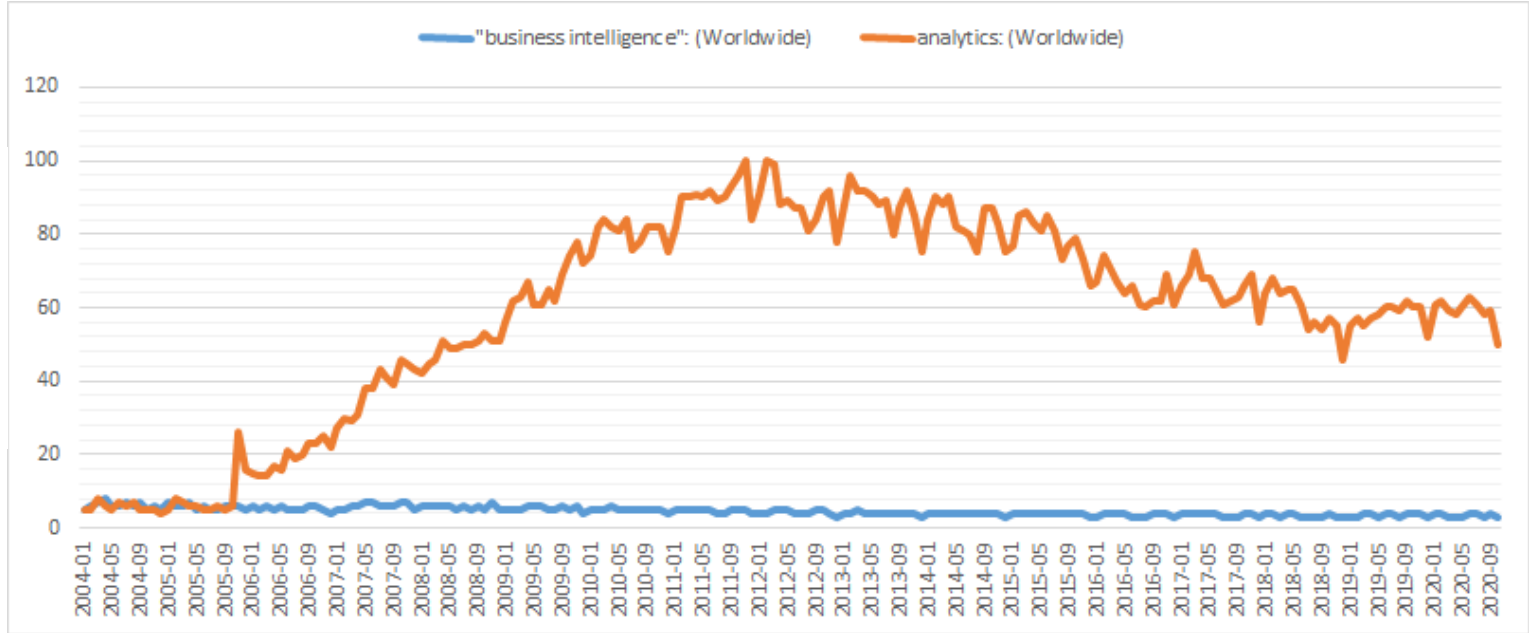
Cost of Camp	Gender		
Camp Region	Female	Male	Total
Asia	\$3,236,357	\$2,641,974	\$5,878,331
Australia	\$3,298,812	\$2,582,820	\$5,881,632
Europe	\$5,509,377	\$8,360,785	\$13,870,161
Latin America	\$314,781	\$681,662	\$996,444
North America	\$2,094,308	\$2,967,848	\$5,062,156
Total	\$14,453,635	\$17,235,088	\$31,688,724

Trends in BI Systems

Business Intelligence vs Analytics

Business Intelligence vs Analytics - Interest over time

Google Trends



Source: trends.google.com

Business Intelligence vs Analytics (cont.)

- Davenport and Harris state that:
“...analytics are a subset of what has become to be called business intelligence” (2007 p. 7)
- Business analytics is not new
 - Price drops in hardware and software has made the technology that enables “Analytics” more accessible to more organisations

Business Intelligence vs Analytics (cont.)

- In reality not much changes. “Analytics” is primarily “old wine in new bottles”.
- Analytics are still DSS, therefore decision-centred design, adaptive / evolutionary development methods, data visualisation techniques, good data governance, etc. still apply
- There is concern about user of the output of analytics being able to interpret it correctly.
 - Practitioners can help fill the “interpretation gap”

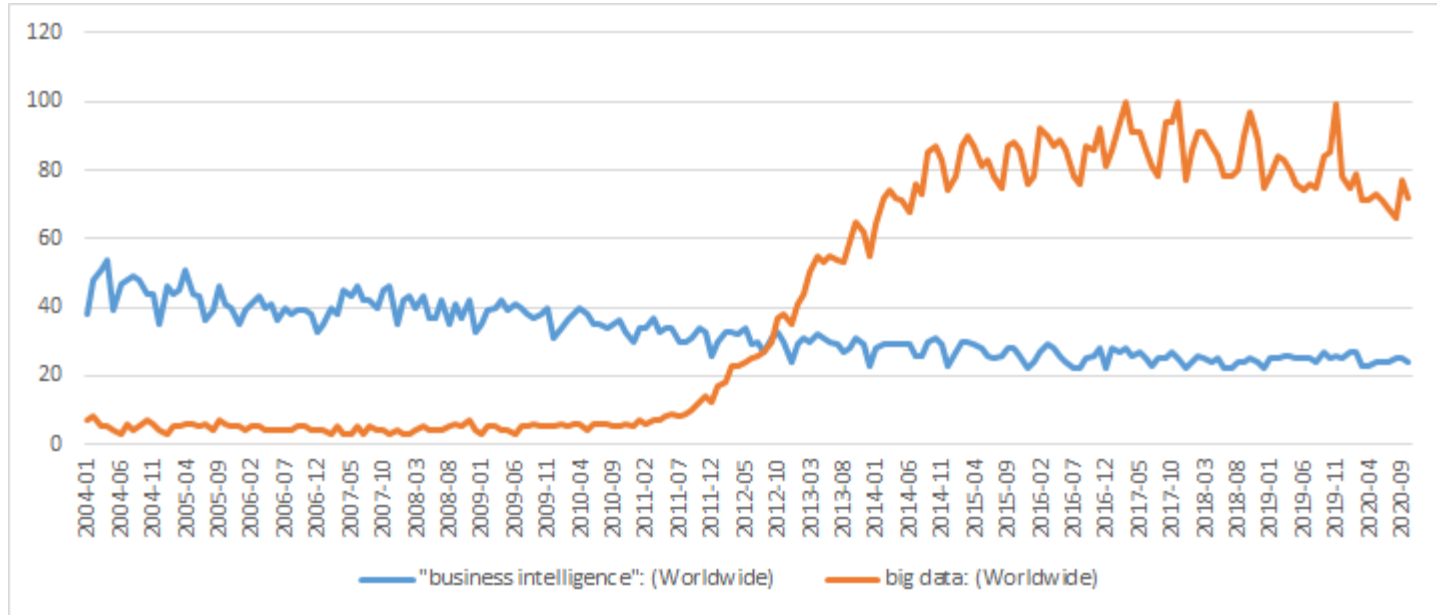
Big Data

- In 2001 Doug Laney, a Meta Group analyst, wrote about the data management challenges facing business in terms of **Volume**, **Velocity** and **Variety**
- Laney and Bayer (2012) formalised the definition:
“Big data is high volume, high velocity, and / or high variety information assets that require new forms of processing to enable enhanced decision making, insight discovery and process optimization.”
- Some vendors have jumped on the bandwagon and added more Vs (e.g. **Veracity**, **Value**, etc.)

Business Intelligence vs Big Data

Business Intelligence vs Big Data - Interest over time

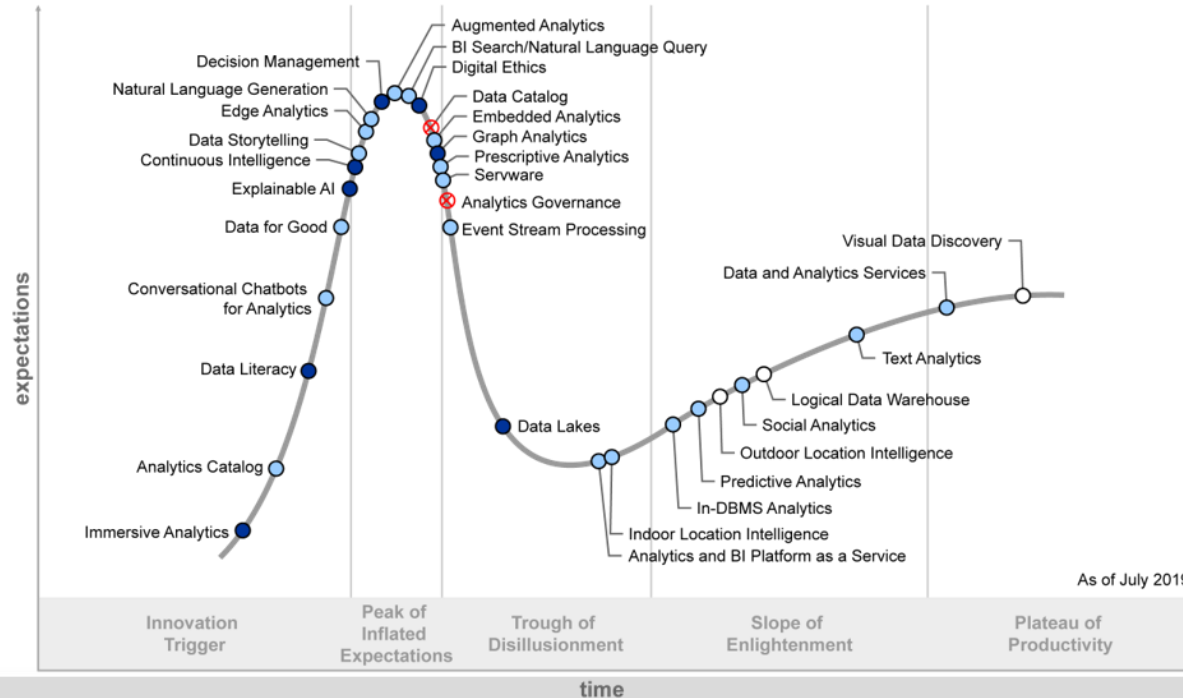
Google Trends



Source: trends.google.com

Trends in Analytics and Business Intelligence

Hype Cycle for Analytics and Business Intelligence, 2019



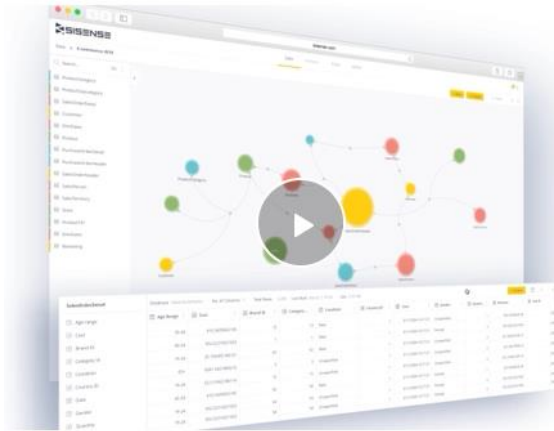
Gartner®

Source: [Gartner](https://www.gartner.com/en/hype-cycle-for-analytics-and-business-intelligence)



MONASH
University

Source: Gartner
ID: 369713



A Radically Different Business Analytics Platform

The Sisense analytics platform slashes the time it takes to build, embed, and deploy intelligent analytics apps that unleash user creativity and engagement. Whether it's interactive dashboards, self-service analytics, or white-labeled BI apps, Sisense delivers the industry's lowest TCO at scale, all on a hybrid-cloud platform.

Start Building

Self-Service BI (cont.)

- An approach to BI that provides business users with tools and infrastructure to create reports and perform data analysis without a need to rely on IT Department.
- It is based on a “*just give them access to everything they will ever need and they’ll be satisfied*” approach to business intelligence
 - Ackoff (1967) says that approach does not work.
- It is a response to **too long to deliver / never delivered DW and BI projects**
 - Unfortunately it is harder to deliver than it sounds.

Factors for Successful Self-Service BI

- **A deep understanding of user requirements**
 - This is not often done. No need to understand requirements if we're giving them everything
- **Intuitive and easy to use end-user tools**
 - Most BI tools, even today, most are not intuitive and easy to use. Adequate training is not often provided.
- **Users must understand data structures and analysis methods**
 - This requires well-written business metadata and training. Rarely either of these are done well.
- **Provision of new data must be timely**
 - Slow IT delivery problem has not gone away

Cloud DW and BI

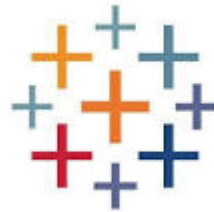
- DW and BI delivered as **software-as-a-service**
 - Data mart data is stored in a remote managed server
 - BI application delivered to user via a web browser
- Cloud DW and BI is becoming more popular
 - Increased confidence in the cloud
 - Lower cost – Only pay for space and user access
 - Faster deployment – Often no need to involve IT
 - Greater use of other cloud-based services means source systems are now also in the cloud

Cloud DW and BI (cont.)

- Still limited in terms of scale and functionality
 - Only relatively small volumes of data can be stored
 - Automated data modelling can limit analysis options
- Need to be aware that these systems are being implemented.
 - Some departments just do it to consciously exclude IT
- Similar problems to those faced by self-service BI implementations
 - Inadequate metadata, application training and user analysis and reporting skills
- The generic nature of standard data models applied means data mart may not exactly match user / business requirements
 - Opportunity to customise data model and reports

Narrative BI

- Narrative BI extends the traditional BI output of tables, charts, reports and dashboards to include a narrative or description that supports the data.
- “data journalism” and infographics
- Not new
- A number of vendors have added narrative BI to their products:
 - e.g. Yellowfin (Storyboards), Tableau (Storypoints)



Why have driving fatalities decreased in the United States?

The fatality rate has declined over the past 35

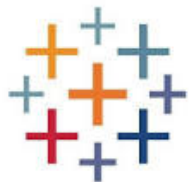
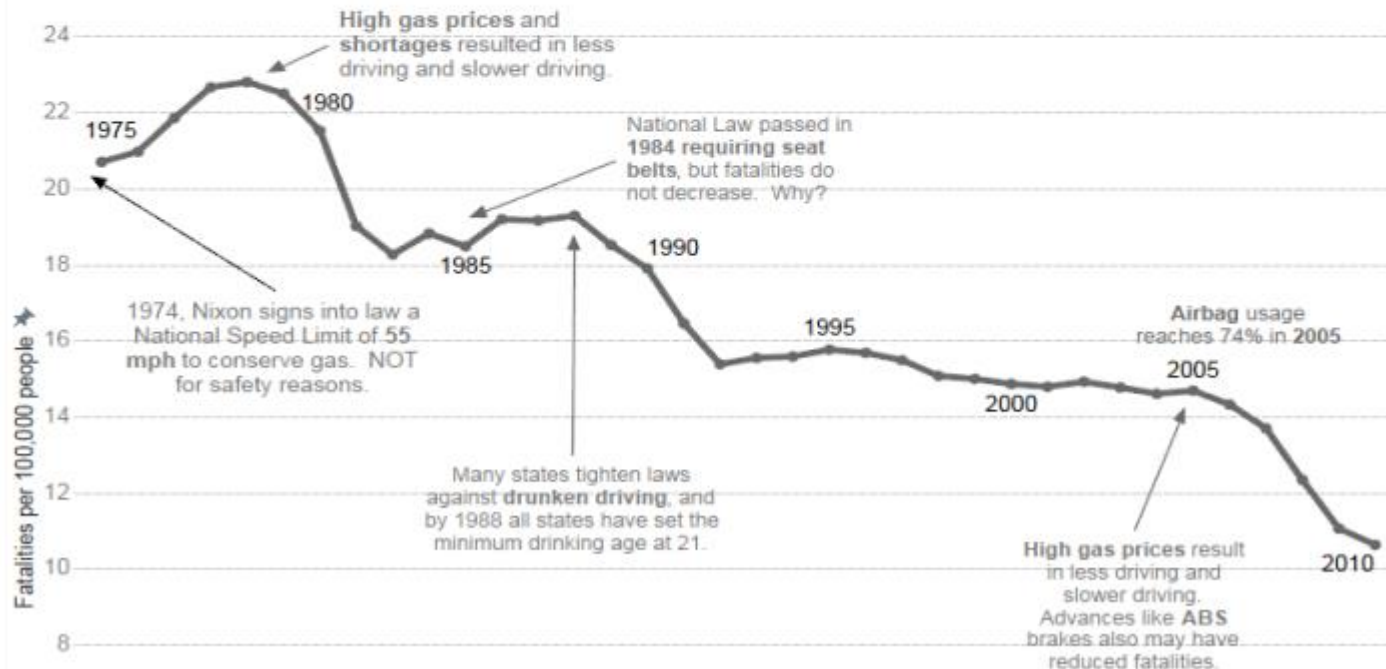
In 1974 - Speed Limits were introduced.

A late 70's gas shortage signaled a top.

Seatbelt laws had minimal impact.

But in 1988 something changed...

And by the 2000's safety equipment came



MONASH
University

Source: [tableau](#)

Conclusion

- The DW and BI marketers are telling us about the many new technologies they offer
 - The reality is that some of those technologies are genuinely new while other are just existing technologies with a new name
- Whether the technology be new or old, applying the core theories, concepts and principles of DW and BI will always increase chances of success
- Read vendor and consultant marketing material critically
 - Their objective often is to sell products and services

References

1. Ackoff, R. L. (1967). Management Misinformation Systems. *Management Science*, 14(4), B-147 – B-156.
2. Alter, S. (1977). A taxonomy of decision support systems. *Sloan Management Review*, 19(1), 39.
3. Davenport, T. H. (2006). Competing on analytics. *Harvard Business Review*, 84(1), 98–107.
4. Davenport, T. H., & Harris, J. G. (2007). *Competing on analytics: The new science of winning*. Boston, MA, USA: Harvard Business Review Press.
5. Few, S. (2012). *Show me the numbers: Designing tables and graphs to enlighten* (2nd ed.). Burlingame, CA, USA: Analytics Press.
6. Few, S. (2013). *Information dashboard design: Displaying data for at-a-glance monitoring* (2nd ed.). Burlingame, CA, USA: Analytics Press.
7. Meredith, R., Remington, S., O'Donnell, P., & Sharma, N. (2012). Organisational transformation through Business Intelligence: theory, the vendor perspective and a research agenda. *Journal of Decision Systems*, 21(3), 187–201. doi:10.1080/12460125.2012.731218
8. Reinschmidt, J. & Francoise, A. *Business Intelligence Certification Guide*, IBM International Technical Support Organization, San Jose, CA, 2000.