

# Factory 2050: Manufacturing with data

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# What's new?

“Imagine every piece of equipment monitoring its own operation, including uptime, downtime, dwell-time, energy usage, malfunction and repair-time. Usage can then be reported with an Internet connection. ...

Technologies exist right now that can do that in order to help end-users manage their assets.”

*Jim Pinto, Automation World, November 2003*

# Industry 4.0 – where IT and OT collide

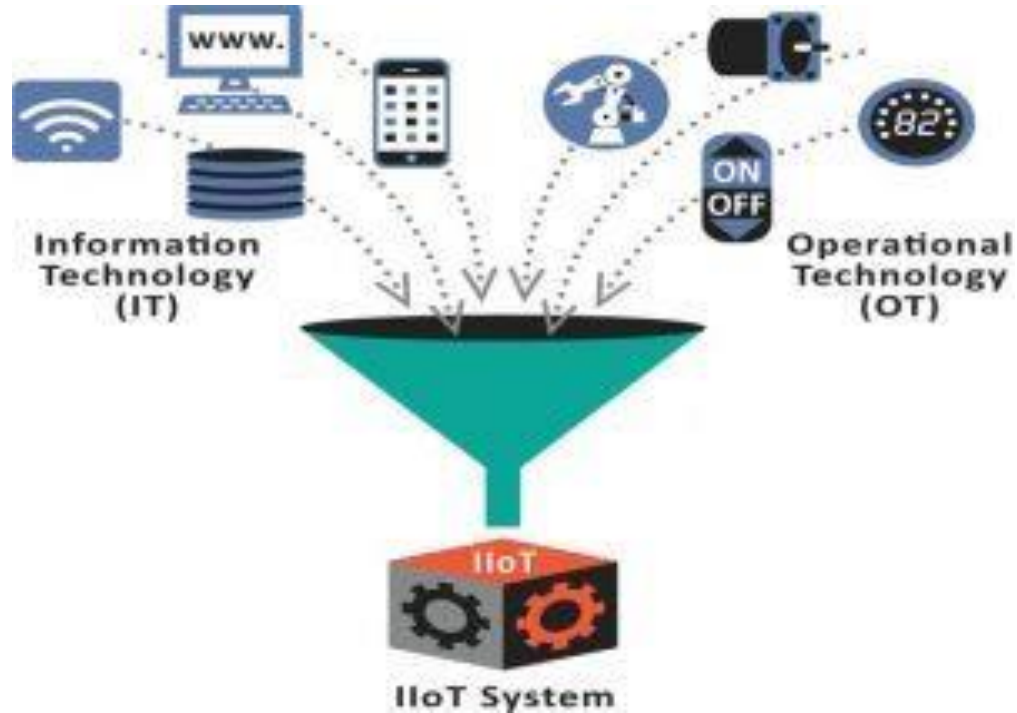
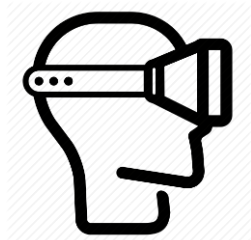


Image credit: Industrial Internet Consortium

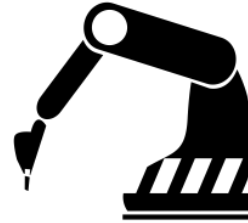
# 5 key industrial digital technologies (IDTs)



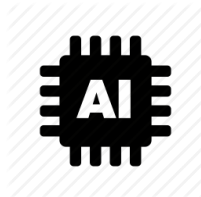
Data, Connectivity and  
the Industrial Internet of Things



Virtual and Augmented Reality



Robotics and Automation

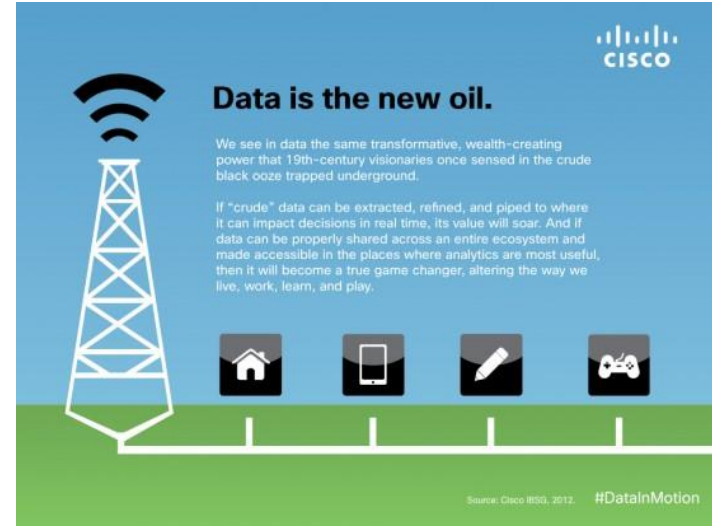


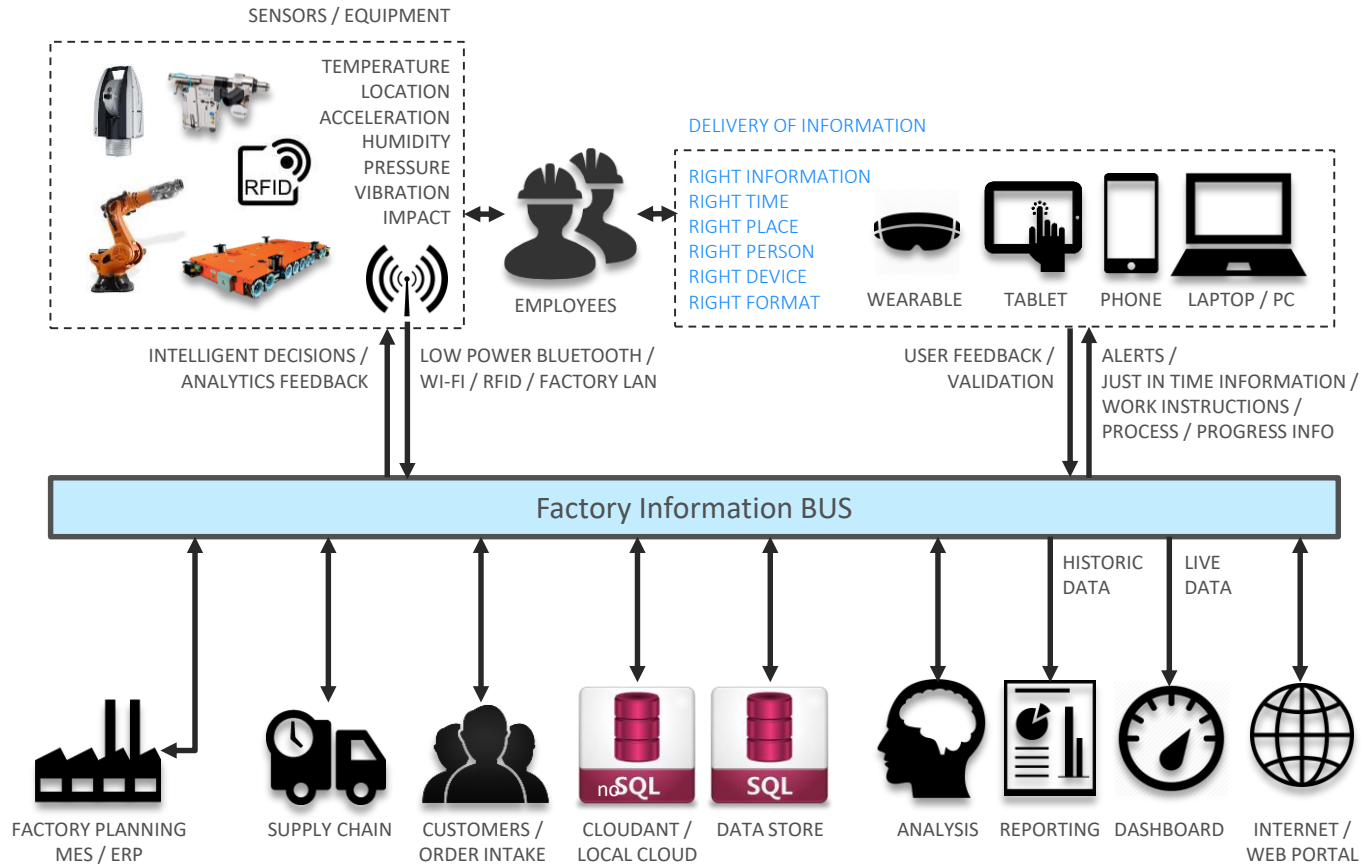
Machine Learning and AI



Additive Manufacturing

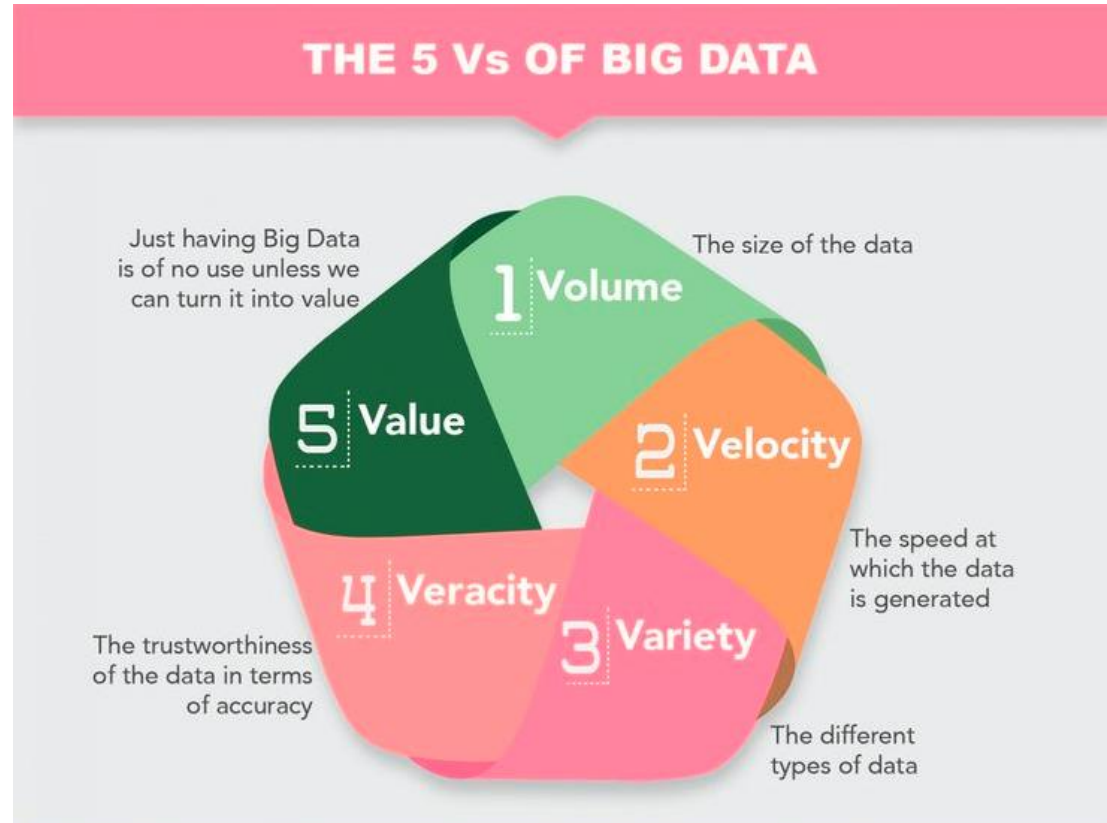






# The 5 Vs of Data

Volume  
Velocity  
Variety  
Veracity  
Value



# Volume of Data

Data volume is the amount of data that is stored or used by networks, organizations, infrastructure, processes, tools or individuals.

## Manufacturing Challenges

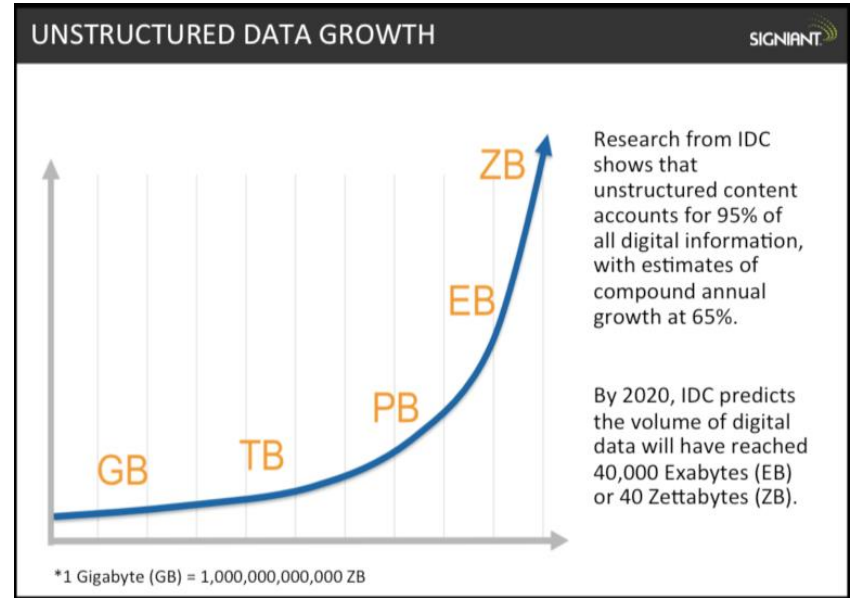
Collection – how do we harvest the relevant data?

Transfer – How do we transfer the data?

Processing – Edge or centralised – or both?

Storage – local, centralised, cloud

Review – keep it up to date...



*The world produces 2.5 quintillion bytes a day, and 90% of all data has been produced in just the last two years.*



# Data Velocity

The rate of change of data sets.

Normally applied to data at rest because data in motion has no velocity of change. (Avoid the rabbit hole!)

- Helps determine how the data will be captured and stored.
- Helps define how quickly decisions should be made.

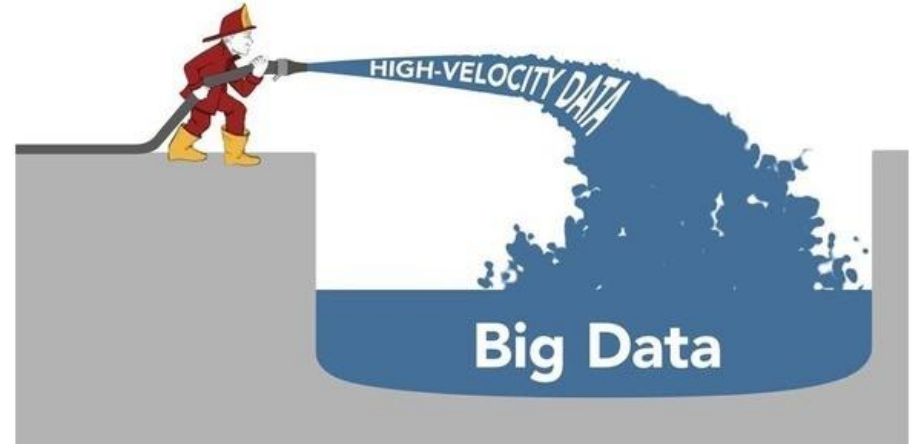
## Comparing High-Velocity Data & Big Data

### High-Velocity Data

- Real-Time
- Performance & Volume Challenges
- Use Cases: Operations & Analytics

### Big Data

- Batch Process
- Volume Challenge
- Use Case: Analytics



# Variety

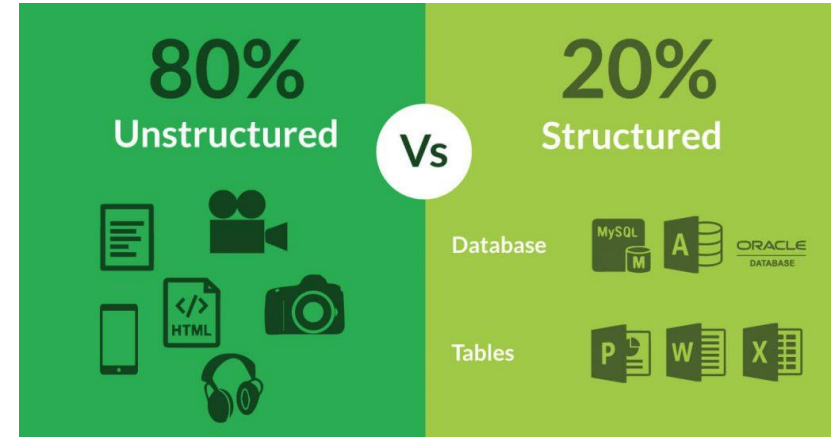
Different types of data: e.g. Structured, Semi Structured, Unstructured

Typical human-generated unstructured data includes:

- Email (semi-structured)
- Text files
- Social Media
- Website
- Mobile data
- Communications
- Media
- Business applications.

Typical machine-generated unstructured data includes:

- Satellite imagery
- Scientific data
- Digital photos and video.
- Sensor data



# Value

The monetisation of data

Value depends on many things...

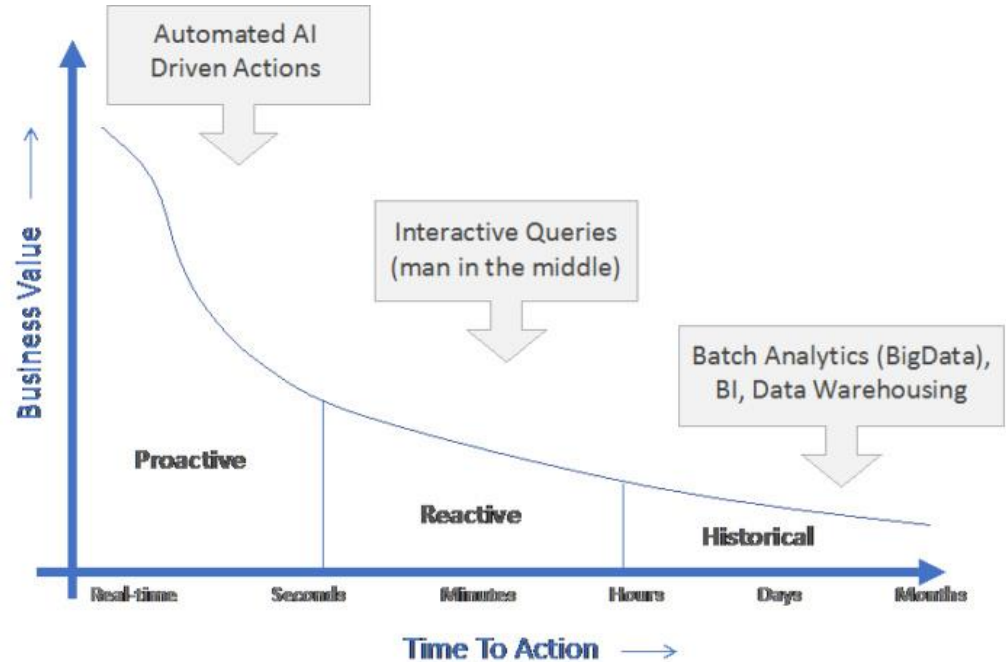
The right data

The right place

The right time

The right person

The right device



# Value

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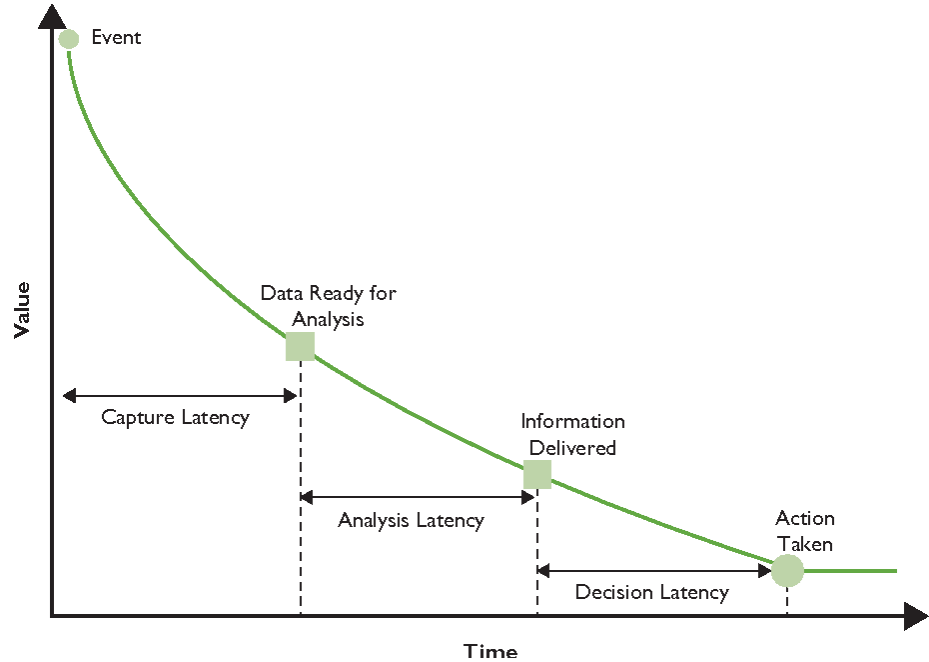
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# Veracity of Data

Data veracity is the degree to which data is accurate, precise and trusted.

Bias – a challenge for AI

Data Lineage – where has it come from

Bugs – confidence in software

Abnormalities – true or artefacts

Information Security – injection and substitution

Sources – linked to lineage

Uncertainty

Out of Date – ow quickly does it become historic

Human Error – how was it collected

Precision – see next page...



# Excel example

Excel was designed in accordance to the IEEE Standard for Binary Floating-Point Arithmetic (IEEE 754).



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The IEEE 754 floating-point standard requires that numbers be stored in binary format. This means a conversion must occur before the numbers can be used in calculations.

If the number can be represented exactly in floating-point format, then the conversion is exact. If not, then the conversion will result in a rounded value which will represent the original value.

Do you know what your algorithm is doing to your data?

# Data or Metadata

Is Data the only source of value?

Metadata: Structured data about data...



It can reveal a lot about your organisation, its activities and your production...

*“Metadata is summary information about data. Think of a photograph shot with your phone. The content of the photo is the data. The metadata is information about where the photo was taken, the time it was taken, direction and how large the file is,”*

Stewart Baker, general counsel to the NSA has said, *“Metadata absolutely tells you everything about somebody’s life. If you have enough metadata, you don’t really need content.”*



# Challenges with Data

## Cybersecurity

### Knowing

what to collect

when to collect it

### Gaining insights from it

Current+ Historical = Future (?)

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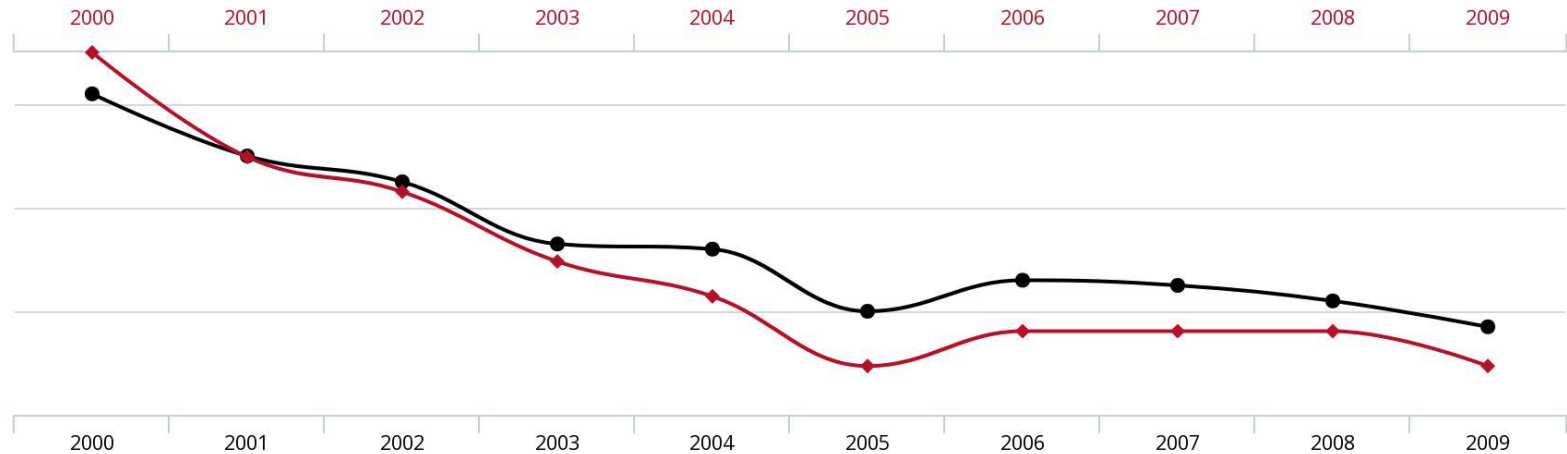
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"After analyzing all your data, I think we can safely say that none of it is useful."

# Be wary of jumping to conclusions

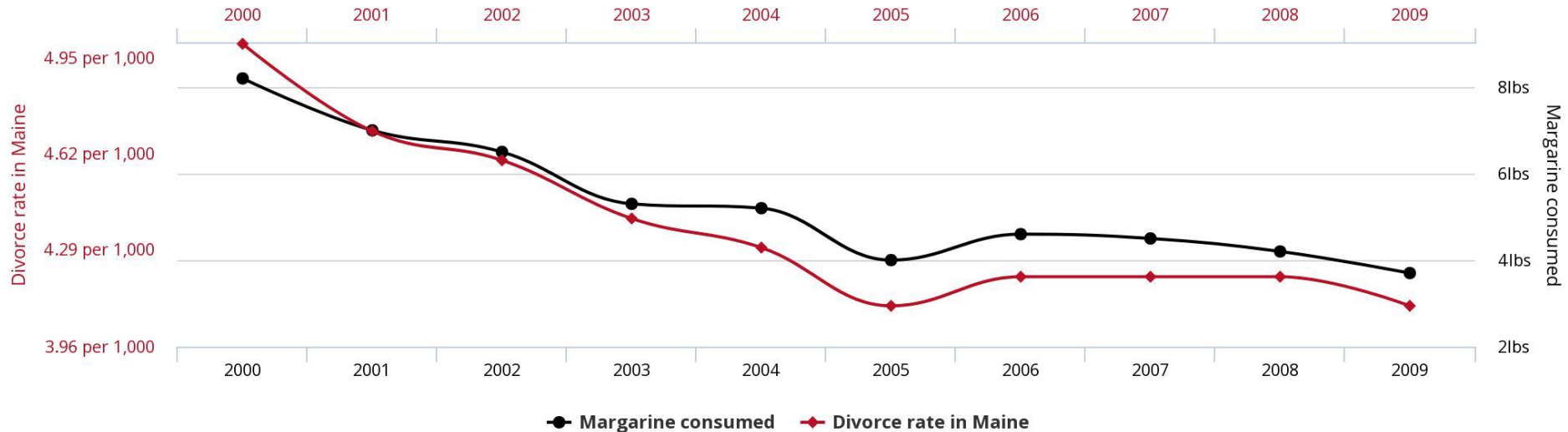
$r=0.992558$



tylervigen.com

# Be wary of jumping to conclusions $r=0.992558$

## Divorce rate in Maine correlates with Per capita consumption of margarine



tylervigen.com



Some of My Quotes

“Data has no intrinsic value. It is only of value if it supports the effective execution of the Business Functions of the enterprise.”

Data is the new oil. It's only useful when it's refined!

Jess Greenwood, Contagious

The Economist

The world's most valuable resource is no longer oil, but data

The data economy demands a management framework, not only



Unlocking the Power of Payment Data

Like oil, data has no value unless it can be refined into something useful

Actionable insight is the product of data

Confidential yoyo



Thank you.

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