Digitalization in Tourism for Sustainable Development

❑ What is?
❑ Big data
❑ Blockchain

Dr. Nikos P. Frydas, CEO, SafeNet / 2020 Feb

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Digitalization in Tourism for Sustainable Development

Digitization, Digitalization, … Transformation?

- What is all this? Digital Transformation?
- Digitization: Going from analogue to digital. ✓
- Digitilization ~< Digital transformation (DX)

i-SCOOP

DIGITAL TRAN: Digital transformation, as we use it **today**, is broader than digitalization as a way to move to digital business. RY

Digitization, digitalization and digital transformation: the differences

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Digitalization in Tourism for Sustainable Development

- What is DX?

- Big data

- Blockchain

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Digitalization in Tourism for Sustainable Development

- <u>What is DX?</u>

- Big data

- Blockchain

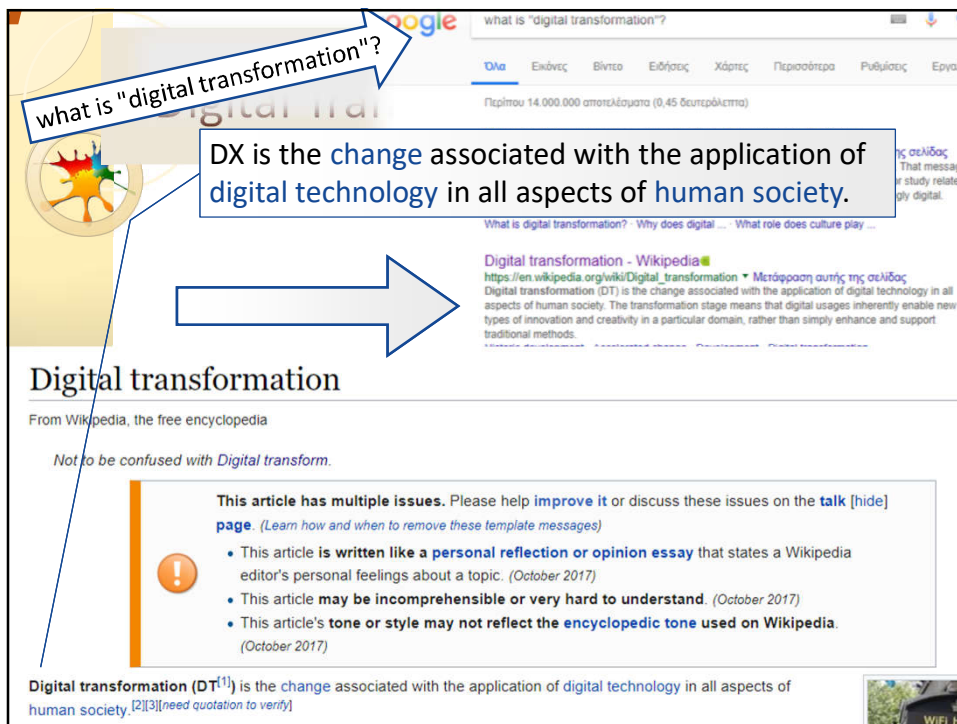© Dr. Nikos P. Frydas - 2020Feb

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Digital Transformation

Dr. Nikos P. Frydas, CEO, Dione Consulting

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what is "digital transformation"?

DX is the change associated with the application of digital technology in all aspects of human society.

Digital transformation - Wikipedia
https://en.wikipedia.org/wiki/Digital_transformation ▼ Μετάφραση αυτής της σελίδας
Digital transformation (DT) is the change associated with the application of digital technology in all aspects of human society. The transformation stage means that digital usages inherently enable new types of innovation and creativity in a particular domain, rather than simply enhance and support traditional methods.

Digital transformation

From Wikipedia, the free encyclopedia

Not to be confused with Digital transform.

This article has multiple issues. Please help **improve it** or discuss these issues on the **talk** [hide] **page**. *(Learn how and when to remove these template messages)*

- This article **is written like a personal reflection or opinion essay** that states a Wikipedia editor's personal feelings about a topic. *(October 2017)*
- This article **may be incomprehensible or very hard to understand.** *(October 2017)*
- This article's **tone or style may not reflect the encyclopedic tone** used on Wikipedia. *(October 2017)*

Digital transformation (DT[1]) is the change associated with the application of digital technology in all aspects of human society.[2][3][*need quotation to verify*]

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what is "digital transformation"?

DX is defined as
the integration of digital technology into all areas of a business
resulting in fundamental changes to how businesses operate
and how they deliver value to customers.

What is digital transformation?

Because digital transformation will look different for every company, it can be hard to pinpoint a definition that applies to all. However, in general terms, we define digital transformation as the integration of digital technology into all areas of a business resulting in fundamental changes to how businesses operate and how they deliver value to customers. Beyond that, it's a cultural change that requires organizations to continually challenge the status quo, experiment often, and get comfortable with failure. This sometimes means walking away from long-standing business processes that companies were built upon in favor of relatively new practices that are still being defined. [Click to Tweet]

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what is "digital transformation"?

Digital integration (everywhere) →
Fundamental changes → Way →
Value to customers

Digital → Change

What is digital transformation? | The Enterprisers Project
https://enterprisersproject.com/what-is-digital-transforma... ▾ Μετάφραση αυτής της σελίδας
Digital transformation is imperative for all businesses, from the small to the enterprise. That message comes through loud and clear from seemingly every keynote, panel discussion, article, or study related to how businesses can remain competitive and relevant as the world becomes increasingly digital. What's not clear to ...
What is digital transformation? · Why does digital ... · What role does culture play ...

Digital transformation - Wikipedia
https://en.wikipedia.org/wiki/Digital_transformation ▾ Μετάφραση αυτής της σελίδας
Digital transformation (DT) is the change associated with the application of digital technology in all aspects of human society. The transformation stage means that digital usages inherently enable new types of innovation and creativity in a particular domain, rather than simply enhance and support traditional methods.
Historic development · Accelerated change · Development · Digital transformation

Digital transformation: online guide to digital transformation - i-SCOOP
https://www.i-scoop.eu/digital-transformation/ ▾ Μετάφραση αυτής της σελίδας
Digital transformation is the profound transformation of business and organizational activities, processes, competencies and models to fully leverage the changes and opportunities of a mix of digital technologies and their accelerating impact across society in a strategic and prioritized way, with present and future shifts in ...
Digital business ... · Digital transformation myths ... · The evolution of digital ...

What is Digital Transformation? | CIO
https://www.cio.com/.../what-is-digital-transformation.ht... ▾ Μετάφραση αυτής της σελίδας
31 Μαΐ 2017 - Using a case study is a poignant way of defining digital transformation. Using an industry familiar to us all is an important means of communicating the importance of digital transformation to the future of every industry.

What is digital transformation? A necessary disruption | CIO
https://www.cio.com/.../digital-transformation/what-is-di... ▾ Μετάφραση αυτής της σελίδας
31 Ιουλ 2017 - Digital transformation requires a radical rethinking of how an organization uses technology in pursuit of net new revenue streams or business models. Successful digital transformation involves cross-departmental collaboration that pairs business-focused philosophies with rapid application development ...

What digital transformation really means | InfoWorld

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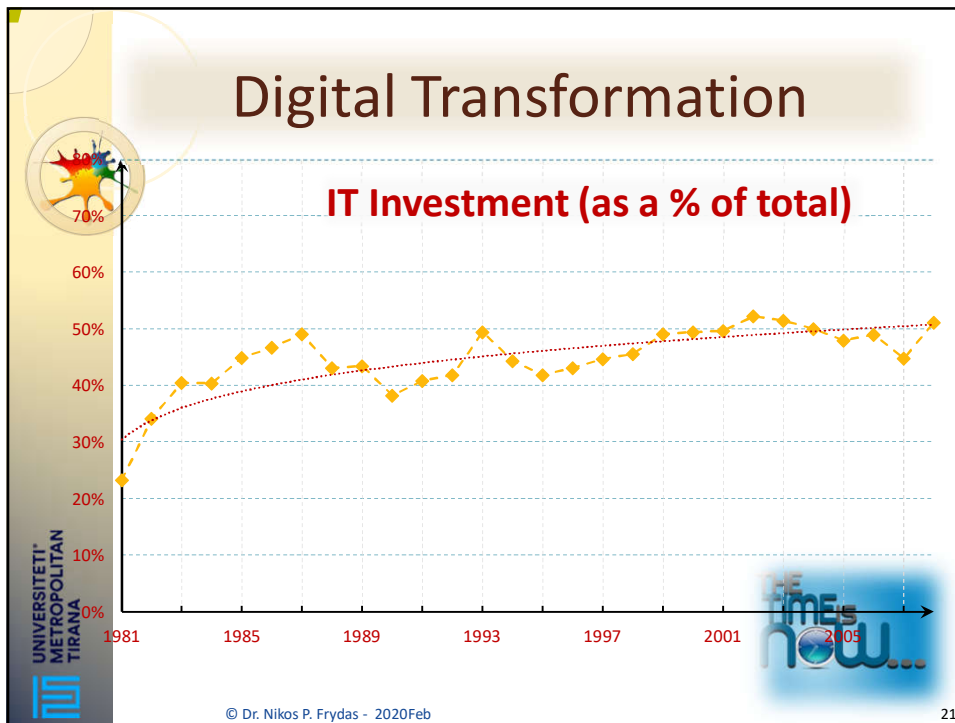
21
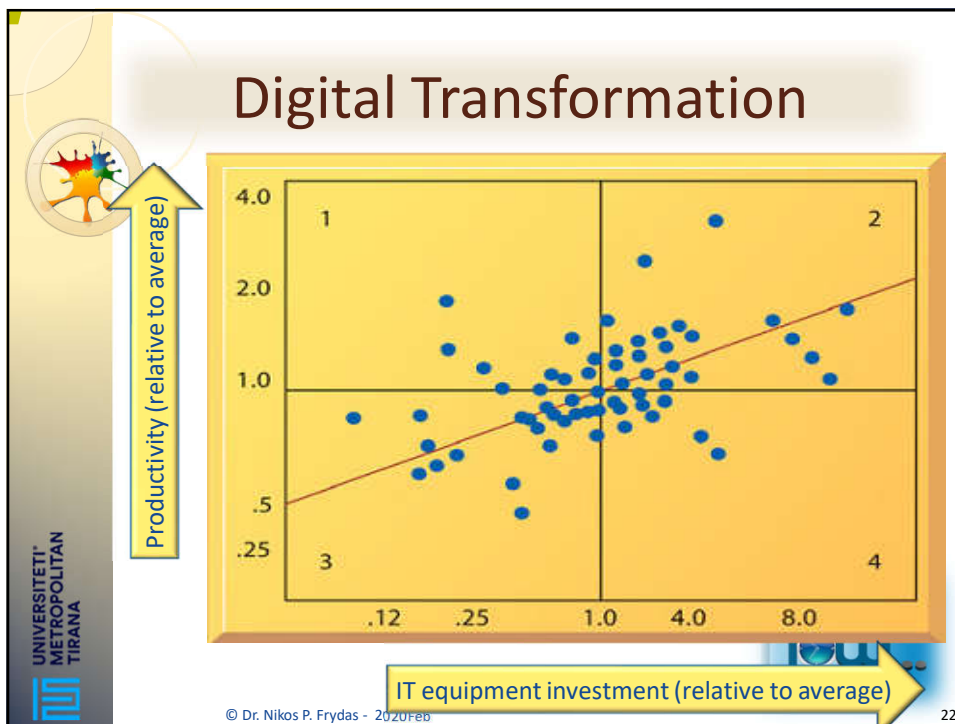
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Digital Transformation

How IT-savvy should CEOs (and rest top brass) be?

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Digital Transformation

Harvard Business Review

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MANAGING YOURSELF

The Seven Skills You Need to Thrive in the C-Suite

by Boris Groysberg

MARCH 18, 2014   2014

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What executive skills are most prized by companies today? How has that array of skills changed in the last decade, and how is it likely to change in the next ten years? To find out, I surveyed senior consultants in 2010 at a top-five global executive-search firm. Experienced search consultants typically interview hundreds (in many cases thousands) of senior executives; they assess those executives' skills, track them over time, and in some cases place the same executive in a series of jobs. They also observe how executives negotiate, what matters most to them in their contracts, and how they decide whether to change companies. (For more on how executives set their work-life priorities, see this.)

Here are the seven C-level skills and traits companies prize most:

1. **Leadership**. The skills cited as most indispensable for C-level executives—not just CEOs—are those that jointly constitute leadership. One consultant described the search for a chief information officer in these terms: "Whereas

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2. **Strategic thinking and execution**. "Strategic foresight"— the ability to think strategically, often on a global basis—was also frequently cited. One consultant stressed the ability to "set the strategic direction" for the organization; another equated strategic thinking with "integrative leadership." Others emphasized that strategic thinking also calls for the ability to execute a vision, which one respondent called "operating savvy" and another defined as "a high standard in execution." One consultant pointed out that strategic thinking is a relatively new requirement for many functional C-level executives, and another noted that the surge in attention to strategic thinking occurred in the decade 2000-2010. [BA1]

3rd after Leadership & Strategic Thinking

3. **Technical and technology skills.** The third most frequently cited requirement for C-level executives was technical skills —specifically, deep familiarity with the particular body of knowledge under their auspices, such as law, financials, or technology. Many respondents stressed technology skills and technical literacy. "A C-level executive needs to understand how technology is impacting their organization and how to exploit technology," one respondent asserted. Others stressed financial acumen and "industry-specific content knowledge." In contrast to popular wisdom, many technical skills are not declining but increasing in importance.

4. **Team- and relationship-building**. Many consultants emphasized team-related skills: building and leading teams and working collegially. "A world-class leader must be able to hire and develop an exceptionally strong leadership team—he/she cannot succeed as a brilliant one-person player," one asserted. Another said that today's executive must be "more interested and skilled in developing his/her team, less self-oriented." Executives no longer sit behind closed doors," one consultant said; instead they must be "team-oriented, capable of multitasking continuously, leading without rank, resisting stress, ensuring that subordinates do not suffer burnout—and do all of this with a big smile in an open-plan office." One consultant characterized the entire company as a team and described the executive's job as "leading and developing the company's team, from the leadership down to the 'troops.'"

5. **Communication and presentation**. Collectively, the consultants said the ideal C-suite candidate possesses the power of persuasion and excellent presentation skills—which one consultant called "the intellectual capability to interact with a

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Harvard Business Review

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LEADERSHIP

The End of Delegation? Information Technology and the CEO

by Bob L. Martin, Gene Batchelder, Jonathan Newcomb, John F. Rockart, Wayne P. Yetter, and Jerome H. Grossman

FROM THE SEPTEMBER–OCTOBER 1995 ISSUE   1995

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Information technology risks are becoming increasingly entangled with business risks, and it is the CEO's responsibility to distinguish between them and not to delegate.

Harvard Business Review

Latest   Magazine

LEADERSHIP

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FROM THE SEPTEMBER–OCTOBER 1995 ISSUE

Before becoming president and CEO of Wal-Mart Stores' International Division in 1992, **Bob L. Martin** was chief information officer of Wal-Mart for ten years.

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Digital Transformation

I expect my CIO to have a rock-solid business view of technology and my line managers to demonstrate that they understand technology and are using it.

Harvard Business Review

Latest   Magazine

LEADERSHIP

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Jonathan Newcomb is president and CEO of Simon & Schuster, the publishing operation of Viacom in New York City.

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Digital Transformation

Gene Batchelder is senior vice president and chief financial officer of GPM Gas Corporation, a Phillips Petroleum Company subsidiary that is located in Houston, Texas.

My advice to CEOs is this: Your IT function should be run by a great general manager, not by the traditional technology manager. No company can afford to overlook the role information technology can play in spurring organizational change and shaping core business processes. You can no longer delegate the IT function to the back office. Rather, you need to see it as a vital business within your business, run by people with commercial backgrounds who know how to make decisions that are based on ever changing competitive imperatives.

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Digital Transformation

John F. Rockart is the director of the Center for Information Systems Research at the Massachusetts Institute of Technology's Sloan School of Management in Cambridge, Massachusetts.

More important than what the CEO *knows* about information technology is how he and key members of the organization *think* about it and about their respective roles in ensuring that the organization uses it effectively. The CEO of 1995 must incorporate the capabilities of IT into his "theory of the business," to use Peter F. Drucker's term ("The Theory of the Business," HBR September-October 1994). Equally important, the CEO must see to it that key managers envision their roles appropriately.

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Harvard Business Review

LEADERSHIP TRANSITIONS

The Secrets of Great CEO Selection

by Ram Charan

FROM THE DECEMBER 2016 ISSUE

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Digital Transformation

When the directors of one of the world's largest technology companies were seeking a new CEO, they winnowed a field of 20 candidates down to two strong ones: an insider who understood technology and had successfully run a P&L center, and a proven CEO with stellar performance at two nontech companies. Two questions loomed: If they chose the CEO, would he have the expertise and intuition to make fate-changing technology decisions? If they chose the insider, who was untested as a chief executive, would he be able to expand into the broader role? The board members bet that the tech-savvy candidate would grow into the job, and so far their choice is proving to be right.

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Digital Transformation

Thank you

Dr. Nikos P. Frydas
nfrydas@cantab.net

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Digitalization in Tourism for Sustainable Development

- What is DX?

- <u>**Big data**</u>

- Blockchain

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Big Data

Big Data in Tourism & City life ???

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Big Data

Big Data in Tourism & City life ✓✓✓

- Big Data = larger sets of data,
  - … that can be analysed (with computers) to …
  - … reveal
    - patterns
    - trends
    - associations.
  - usually on human behaviour.
- BD is also about more complex sets of data:
  - unstructured text (e-mails, comments, etc.)
  - images,
  - audio & video.

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Big Data

Big Data

- What do we do with big Data?

  … we extract Information.

- Two questions:
  1. Can anyone do it?

     No. We need Knowledge!
  2. Relation Data◁▷Information / Knowledge?

  Data◁▷Information / Knowledge

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Big data

Big Data Analytics: Case study

- Pharmaceutical expenditure (ОГА), Greece 2005
- Pilot: 4 months, 2 districts, +60K prescriptions:
  - Collection
  - Preparation
  - Input
  - Processing
  - Presentation
  - Interpretation
  - Storage

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Big data

Data Analytics: Case study

- Pharmaceutical expenditure (ОГА), Greece 2005
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- Selection of the correct & relevant data.
- All data regarding a certain population.

Very crucial stage!

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Big data

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> Conversion of data in a format suitable for further processing.
> *For example, are all data countable, by a computer?*

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Big data

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> Data must be digitized, if they are not already in digital form:
> - Scanning
> - Optical Character Recognition (OCR).
> - Error detection & correction.

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Big data

Data Analytics: Case study

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Data participate into
- filtering,
- logical operations,
- arithmetic operations &
- other operations
  to extract the desired information.

averages

trends

correlations

etc.

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Big data

Data Analytics: Case study

- Pharmaceutical expenditure, Greece 2005
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Extracted information and selected data are presented in a form suitable for the next stage (e.g. a graph).

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Εικόνα 2: % Συνταγών, ανά ηλικία ασθενούς

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% Αξίας

$R^2 = 98,9\%$

Σε έναν ετήσιο προϋπολογισμό της τάξης των 600Μ€, το 4% είναι 24.000.000 € ετησίως! Δηλαδή, ο ΟΓΑ δίνει ετησίως 24.000.000 € για περιπτώσεις όπου ο ασθενής φαίνεται να χρησιμοποιεί, σε ένα μήνα, περισσότερα από δέκα διαφορετικά φάρμακα (της ίδιας, ή διαφορετικής περιεκτικότητας).

Φάρμ/Ασθ/Μήν

Εικόνα 8: % Αξίας για > Φάρμακα/Ασθενή/Μήνα

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Big data

Πίνακας 67: Αποκλειστική Προτίμηση σε 1ψ#ATC, από τους Ιατρούς που έδωσαν αριθμό Δ.Α.Τ.

ημ. ΑσΤα 1 = 109 / 731 (15%	Σημαντικ. Ιατρός	#N/A																	ΔενΒ
245.468 = € Φαρ. Σημ.Ιατρ.	5	30,00 €																	Ανευ
5.615 = # Συντ. Σημ.Ιατρ.	7.292	319.395																	Παιδ

Κωδικός Ιατρού	Ιδιώτ. Ιατρός	Ειδικότητα Ιατρού	# Συν-ταγ.	Αξία Φαρ-μάκων	ΠΕΠΤ %€	ΑΙΜΟ %€	ΚΑΡΑ %€	ΔΕΡΜ %€	ΟΥΡΟ %€	ΟΡΜΟ %€	ΛΟΙΜ %€	ΝΕΟΠ %€	ΜΥΟΣ %€	ΝΕΥΡ %€	ΠΑΡΑ %€	ΑΝΑΠ %€	ΑΙΣΘ %€	ΔΙΑΦ %€	Κανον. Απόκλ. ATC
T030158	OXI	ΑσΤα	24	3.484,39										100%					374%
Σ025427	OXI	ΑσΤα	7	753,91										100%					374%
B907684	OXI	ΑσΤα	6	691,42										100%					374%
N154318	OXI	ΑσΤα	11	519,86													100%		374%
P700190	OXI	ΑσΤα	7	235,60													100%		374%
Σ122309	OXI	ΑσΤα	5	154,43										100%					374%
Λ600977	OXI	ΑσΤα	28	879,21	1%									97%					371%
Ξ212575	OXI	ΑσΤα	17	1.656,00	2%									98%					366%
M092058	OXI	ΑσΤα	6	1.964,66	1%	1%				0%		97%	0%						363%
I331558	OXI	ΑσΤα	9	560,93			3%							97%					362%
X131701	OXI	ΑσΤα	14	1.313,42	0%		4%							96%					359%
M019106	OXI	ΑσΤα	5	1.831,87					0%		4%	95%							356%
Π309227	OXI	ΑσΤα	16	578,30	4%		78%												355%
N326440	OXI	ΑσΤα	21	1.459,44			5%						0%	84%					350%
N328310	OXI	ΑσΤα	9	458,83			0%					7%					92%		345%
Π686979	OXI	ΑσΤα	8	453,02	4%				4%					92%					342%
Σ070090	OXI	ΑσΤα	48	2.607,18	1%	6%	88%							1%		0%			340%
M012353	OXI	ΑσΤα	18	665,10	3%	4%	86%								1%				339%
H754867	OXI	ΑσΤα	11	462,98		1%	90%						7%	1%					339%
A249248	OXI	ΑσΤα	8	900,79	1%		3%			0%		7%	89%						332%
Ξ320766	OXI	ΑσΤα	12	3.100,20	3%	0%	6%				89%	2%							330%
A754867	OXI	ΑσΤα	38	1.786,70	3%	8%	86%			0%							2%		322%

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Big data

Data Analytics: Case study

- Pharmaceutical expenditure (ΟΓΑ), Greece 2005
- Pilot: 4 months, 2 districts, +60K prescriptions:
  - Collection
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  - Storage

> Extracted information and selected data, presented in a suitable form, are interpreted by the intended recipients. Conclusions are drawn, which usually lead to decisions.

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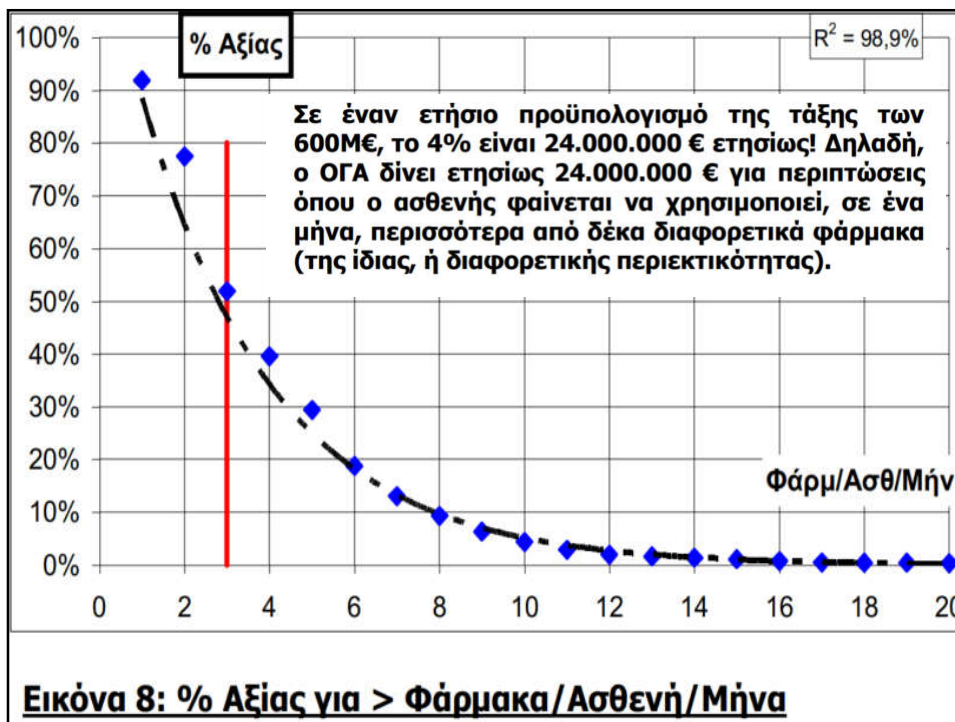
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Big data

Data Analytics: Case study

- Pharmaceutical expenditure, Greece 2005
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  - Input
  - Processing
  - Presentation
  - Interpretation
  - Storage

It is paramount to store the
1. data
2. methodology used
3. extracted information &
4. conclusions,
for future use.

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Big data

Data Analytics: Case study II

- Global InterNet Trend Report

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Big data

Total number of **Processed Reports** about Illegal or Harmful Content
and as a percentage of all reports processed (inset)

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Big data

Number of reports **Transmitted to Law Enforcement**
and as a percentage of the Total Resulting Hotline Actions (inset)
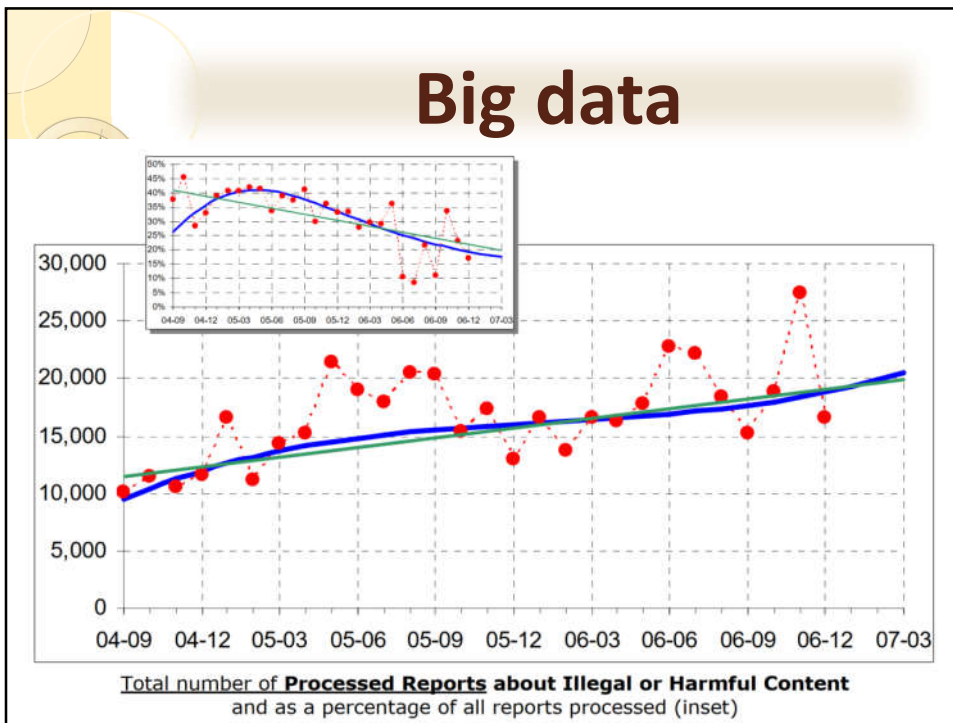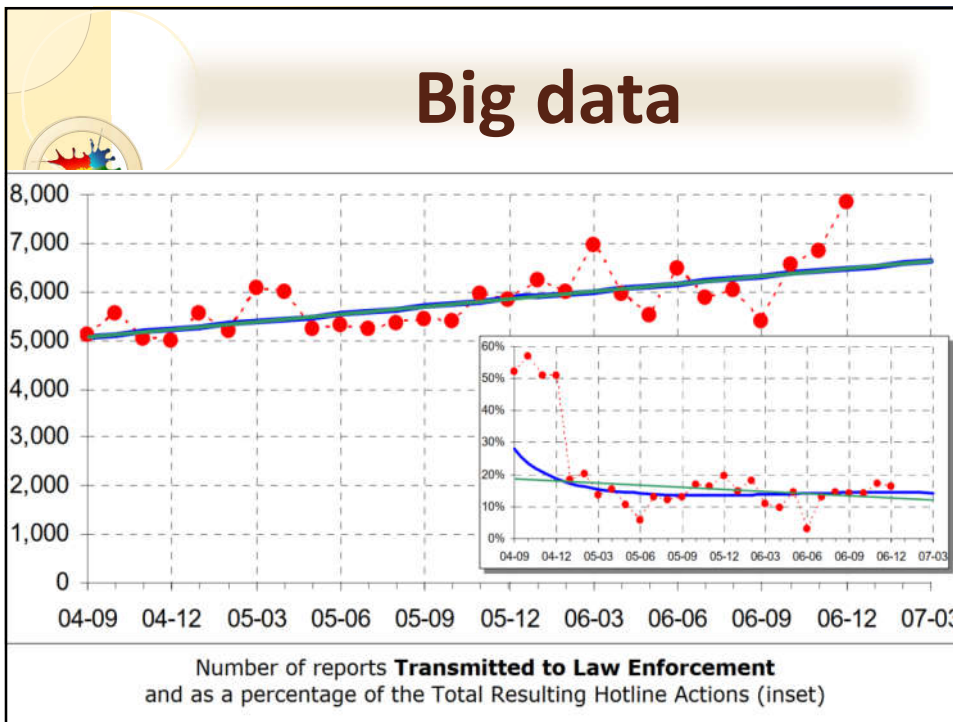
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Big data

Data Analytics ➔ Big Data Analytics:

- Examples of "data":
  - Internet clickstream data,
  - Web server logs,
  - Social media content,
  - Text from customer emails,
  - Text from survey responses,
  - Mobile-phone call-detail records,
  - Data captured by sensors connected to the IoE,
  - **Many other**, not thought of, as yet.

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Big data

Data Analytics ➔ Big Data Analytics:

- Special systems are needed for two reasons:
  - Size of data &
  - Nature of data (unstructured).
- Business benefits include:
  - New opportunities for sales & business,
  - Better marketing,
  - Better customer service,
  - Better operational efficiency,
  - Competitive advantages over rivals,
  - etc.

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Big data

Data Analytics ➜ Big Data Analytics:

- 3Vs of big data:
  - **V**olume: Amount of data available.
  - **V**ariety: Type and nature of the data.
  - **V**elocity: Speed at which they are processed.
- 4th V:
  - **V**eracity: The quality & value of the data.

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10 PB, @ 50Mbps
> 60 years

Big data

Velocity

real-time
near real-time
periodic
batch
table

MB — GB — TB — PB ➜ **V**olume

social video
photo web
database audio
unstructured mobile

Variety

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Big data

Big Data Analytics:

- Are Big Data useful in Tourism?

  - Customer experience

  - Strategic marketing

  - Reputation

  - Market research

  - Revenue management

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Big data

Big Data Analytics:

- Are Big Data useful in Tourism?

  - Customer experience

  - Strategic marketing

  - Reputation

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  - Revenue management

'Word of mouth': Social media, online reviews, service usage, etc.
Decisions on services:
- Current
- To be phased-out
- New
- Technology to be used.

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Big data

Big Data Analytics:

- Are Big Data useful in Tourism?

  - Customer experience

  - Strategic marketing

    Identify trends among customers:
    - Where are they?
    - When to advertise?
    - What they want (more/less/other)?

  - Reputation

  - Market research

  - Revenue management

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Big data

Big Data Analytics:

- Are Big Data useful in Tourism?

  - Customer experience

  - Strategic marketing

    There are customer reviews online, all over the place: Prospective customers check them out, of course.
    Tourism businesses may:
    - Combine above data with internal customer feedback to determine strengths & weaknesses.
    - Take relevant decisions to improve!

  - Reputation

  - Market research

  - Revenue management

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Big data

Big Data Analytics:

▪ Are Big Data useful in Tourism?

- Customer experience

- Strategic marketing

- Reputation

- Market research

  Info about competition from online sources (customers & businesses).
  Decisions on services:
  - Competitors do not offer.
  - etc.

- Revenue management

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Big data

Big Data Analytics:

▪ Are Big Data useful in To

- Customer experience

- Strategic marketing

- Reputation

- Market research

- Revenue management

  To sell the right product, to the right customer, at the right moment, for the right price, via the right channel. [1]
  Predict & anticipate demand by combining: [1]
  - Internal data:
    - past occupancy rates,
    - room revenue
    - current bookings, etc.
  - External data:
    - local events,
    - flights
    - school holidays, etc.

[1] https://www.revfine.com/big-data-travel-industry/

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Big data

Big Data is here to stay?

- Healthcare: Early illness detection
- Education: Improve students results.
- Banking: Customer spending patterns.
- Manufacturing: Reduce downtime.
- Retail: What you want to buy this year.
- Politics: ➔ ➔ ➔ ➔ ➔ ➔ ➔ ➔ ➔
- Spying: ➔ ➔ ➔ ➔ ➔ ➔ ➔ ➔ ➔

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Big data

Big Data is here to stay?

The Cambridge Analytica Files
Big data

Cambridge Analytica: how did it turn clicks into votes?

Alex Hern
@alexhern
Sun 6 May 2018 08.00 BST

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735 276

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Cambridge Analytica: how 50m Facebook records were hijacked

The Cambridge Analytica Files
Big data

Alex Hern
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Sun 6 May 2018 08.00 BST

f 🐦 ✉ 735 276

Big Data

1
Approx. 32,000 US voters ('seeders') were paid $2-5 to take a detailed personality/ political test that required them to log in with their Facebook account

2
The app also collected data such as likes and personal information from the test-taker's Facebook account, as well their friends' data, amounting to over 50m people's raw Facebook data

3
The personality quiz results were paired with their Facebook data – such as likes - to seek out psychological patterns

Friend's data

User's data

4
Algorithms combined the data with other sources such as voter records to create a superior set of records (initially 2m people in 11 key states*), with hundreds of data points per person.
These individuals could then be targeted with highly personalised advertising based on their personality data

Guardian graphic. *Arkansas, Colorado, Florida, Iowa, Louisiana, Nevada, New Hampshire, North Carolina, Oregon, South Carolina, West Virginia

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▶ stop auto-play

Chris Soghoian
Principal technologist, ACLU | 🔗 *theguardian* | NSA FILE

Cell phones, laptops, Facebook, Skype, chat-rooms: all allow the NSA to build what it calls 'a pattern of life', a detailed profile of a target and anyone associated with them.

And the number of people caught up in this dragnet can be huge.

You don't need to be talking to a terror suspect to have your communications data analysed by the NSA. The agency is allowed to travel "three hops" from its targets — who could be people who talk to people who talk to people who talk to you. Facebook, where the typical user has 190 friends, shows how three degrees of separation gets you to a network bigger than the population of Colorado. How many people are three "hops" from you?

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Digitalization in Tourism for Sustainable Development

- What is DX?

- Big data

- <u>Blockchain</u>

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Given the huge power of blockchain, it's no surprise many of today's major tech players like Microsoft, Amazon, SAP, and IBM have all introduced a version of blockchain-as-a-Service to go with their cloud offerings. If you've already invested in virtualization

5 Predictions On How Blockchain Will Drive Digital Transformation

Daniel Newman Contributor ⓘ
CMO Network -
Exploring all things Digital Transformation

A Day Without Banks — And Bank Robberies

Goodbye, Currency Exchange Fees

Cloud Storage

Secure Data — No, Really

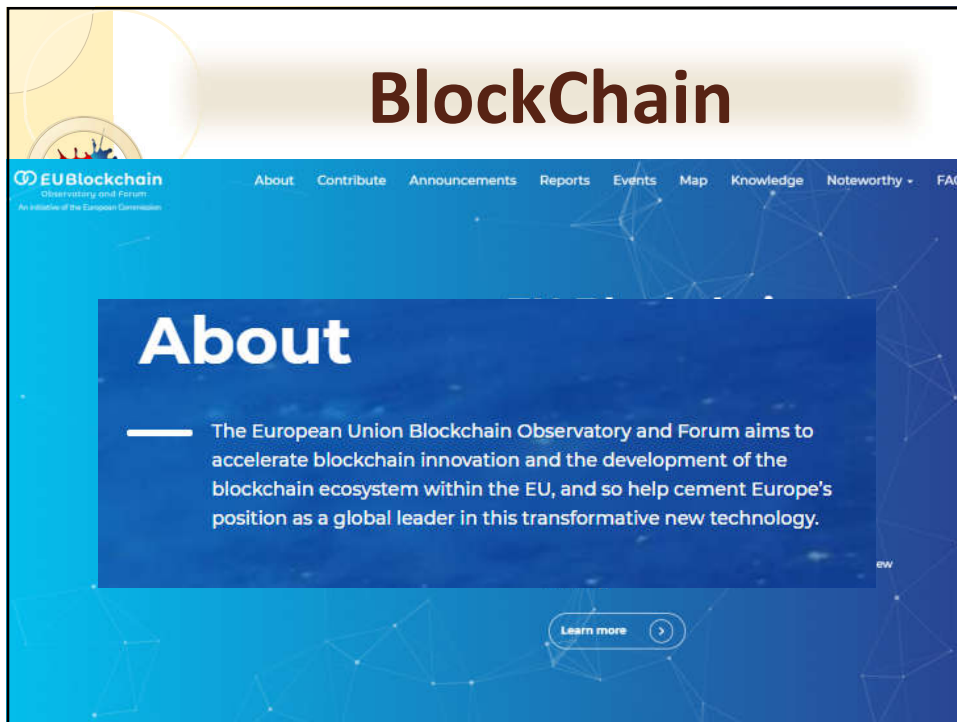Following A Product From Source To Store-shelf

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transactions at every step of the product's journey. What does that mean? Businesses can now track an item's history — and quality — all the way back to its form as raw materials. This isn't just good information to have — it allows businesses to better evaluate how their vendors are handling their goods, how quality is impacted, and to pinpoint any issue in quality at any time. Imagine knowing exactly which factory the cotton in your jeans came from — the quality of the cotton when it was harvested — and even the date it was picked. Yes, blockchain can get that specific. And there is almost no

Exploring all things Digital Transformation

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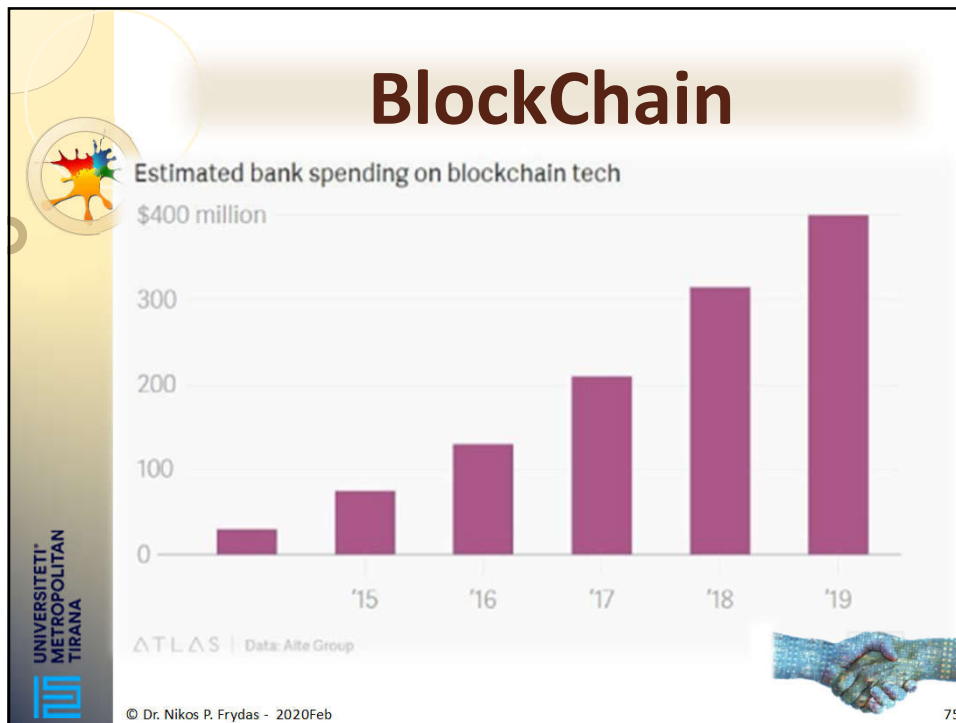72
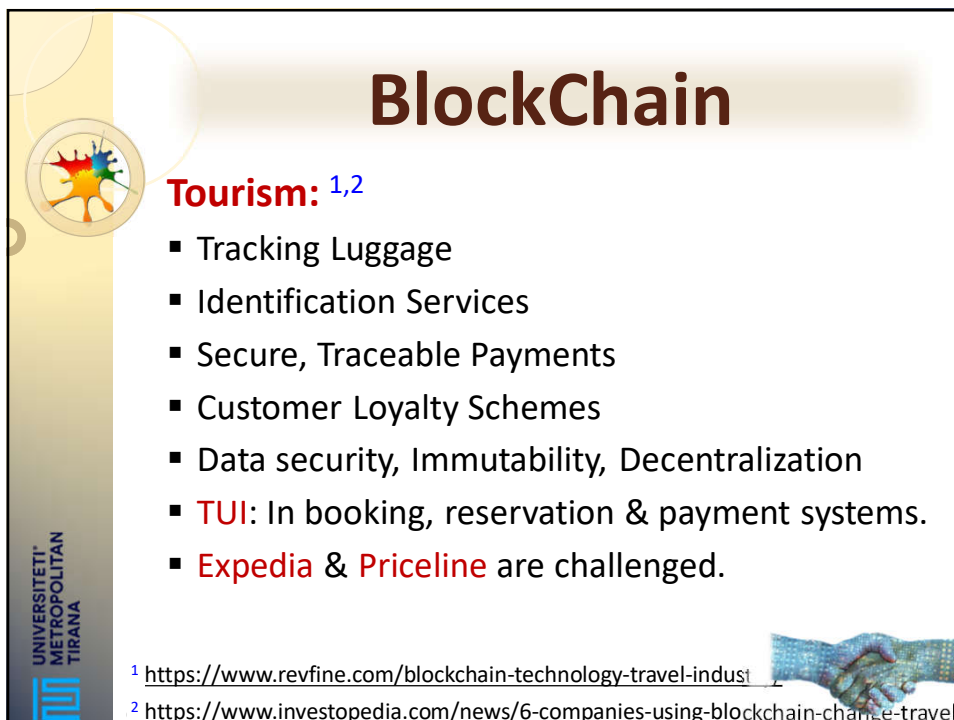
BlockChain

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BlockChain

Tourism: [1,2]

- Tracking Luggage
- Identification Services
- Secure, Traceable Payments
- Customer Loyalty Schemes
- Data security, Immutability, Decentralization
- TUI: In booking, reservation & payment systems.
- Expedia & Priceline are challenged.

[1] https://www.revfine.com/blockchain-technology-travel-indust...

[2] https://www.investopedia.com/news/6-companies-using-blockchain-change-travel-...

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Rotterdam launches blockchain development lab

Thursday, 21 September 2017 | Software, Big Data & IoT

Digital Ship

The Municipality of Rotterdam and the Port of Rotterdam Authority have jointly launched a field lab for the development and testing of applications based on blockchain technology. The new applied research lab has been christened

"There's this huge buzz about blockchain, but actually, there aren't that many fully functional applications," said Maarten Struijvenberg, Rotterdam's deputy mayor for economic affairs.

"We'll be changing this with BlockLab. This is important, because we need real innovations to launch the next economy. And blockchain can help us realise them."
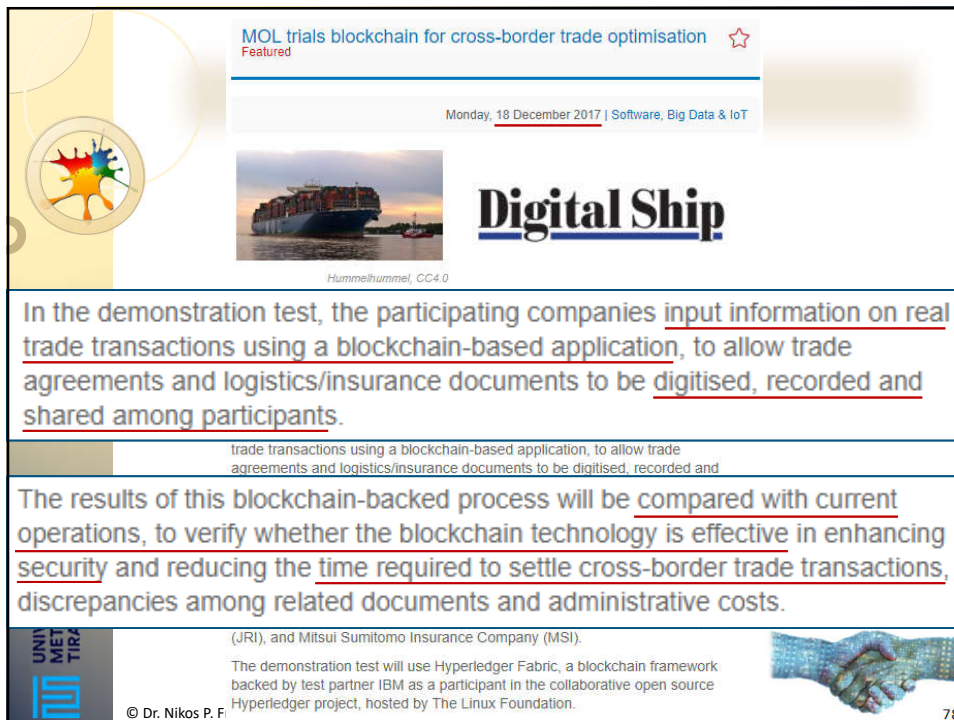
opening of the centre was a blockchain application for stock financing in the port logistics sector, which was developed in partnership with Exact and ABN AMRO.

The team will also work with the Rotterdam University of Applied Sciences to develop a curriculum intended to create an influx of talented new blockchain researchers going forward.

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MOL trials blockchain for cross-border trade optimisation ☆
Featured

Monday, 18 December 2017 | Software, Big Data & IoT

Digital Ship

Hummelhummel, CC4.0

In the demonstration test, the participating companies input information on real trade transactions using a blockchain-based application, to allow trade agreements and logistics/insurance documents to be digitised, recorded and shared among participants.

trade transactions using a blockchain-based application, to allow trade agreements and logistics/insurance documents to be digitised, recorded and

The results of this blockchain-backed process will be compared with current operations, to verify whether the blockchain technology is effective in enhancing security and reducing the time required to settle cross-border trade transactions, discrepancies among related documents and administrative costs.

(JRI), and Mitsui Sumitomo Insurance Company (MSI).

The demonstration test will use Hyperledger Fabric, a blockchain framework backed by test partner IBM as a participant in the collaborative open source Hyperledger project, hosted by The Linux Foundation.

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BlockChain

… a famous application?

- … it is a digital payment system.
- … a consensus Network that enables a new payment system and completely digital money.
- … the 1st decentralized P2P payment network.
- From a user perspective, Bitcoin is:
  - pretty much like cash for the Internet.
  - a computer program that provides a personal Bitcoin wallet and allows a user to send and receive bitcoins.

[2] https://bitcoin.org/en/

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BlockChain

What is Peer-to-Peer (P2P)?

- … architecture used in computing & networks.
- Peers are, for example, computers.
- Peers are equally
  - privileged &
  - strong.
- Peers are a team: They make available to the rest, a part of their resources:
  - Processing power,
  - disk storage &
  - network bandwidth.
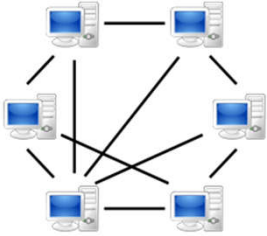
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BlockChain

What is Peer-to-Peer (P2P)?

- Peers are, both
  - suppliers &
  - consumers
  of resources
- … in contrast to the Client-Server model.

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BlockChain

A book or other collection of financial accounts.

What is? [1,2]

- A distributed Ledger technology.
- The Ledger records transactions & contracts.
- Cryptography is used to keep records secure.
- The records are accessible to all participants.
- No single participant controls the data.
- Allows transaction privacy.
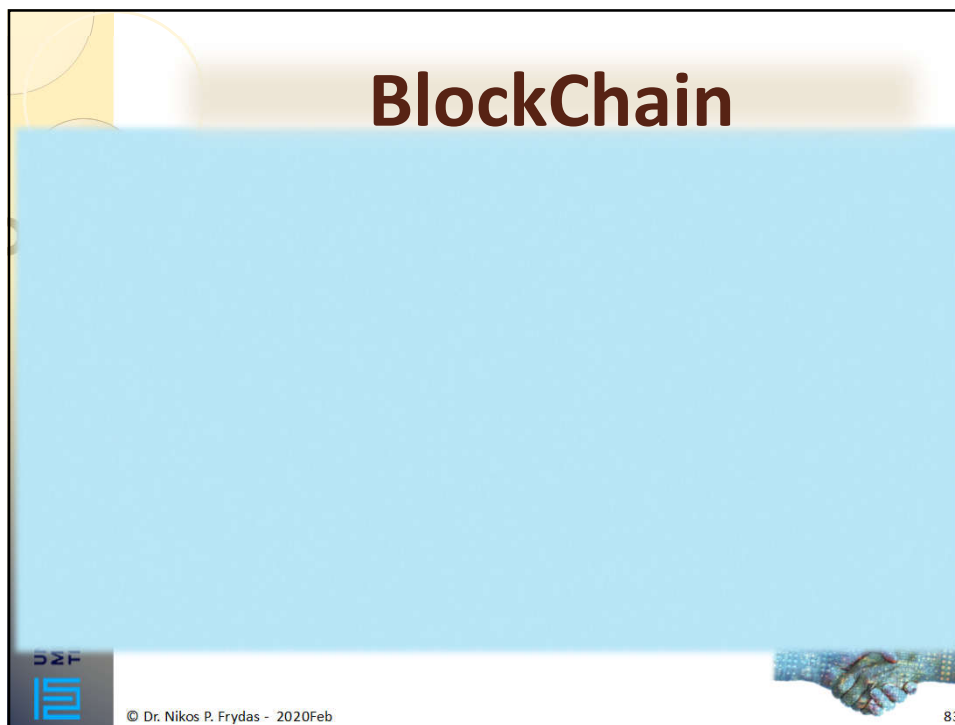- Allows auditing to verify how an agreement was executed.

[1] ENISA, *Distributed Ledger Technology & Cybersecurity*, 12/2016

© Dr. Nikos P. Frydas - 2020Feb   [2] HBR, *The Truth about Blockchain*, 1/2017

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BlockChain

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BlockChain

What platform is needed?

We want a record book (ledger) which
- can't be falsified,
  - is transparent, to all interested parties &
  - is not controlled by a single entity.
- Must be online, open & be secure.

➔ encryption, but who has the keys?

- Open & secure: ➔ ~ digital signature.
- Transparent: ➔ P2P net of willing participants.
- Falsification proof: ➔ Computationally difficult.

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BlockChain

What platform is needed?

chain of blocks ⟹ Once some data have been recorded inside the blockchain, it becomes very difficult to change it.

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BlockChain

What platform is needed?

a. Data
b. Hash of data, digitally signed.
c. Hash of block (1).

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BlockChain

What is a hash?

- It is the 'fingerprint' of a file.
- Typically, 8-9 characters; file is any size.
- Very easy & fast to obtain.
- Say, break the file into blocks add the 1st block to the 2nd, shift by 8 positions, add the 3rd, etc.
- Impossible to get the file from the hash.
- If file changes, even by 1 bit, hash changes.

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BlockChain

What is a digital signature?

- You sign digitally, a file. How?
- Obtain the hash of the file.
- Encrypt the hash, with your secret key.
- Send file & encrypted hash.
- Recipient receives file and calculates hash.
- Receives also encrypted hash.
- Decrypts hash with their own key.
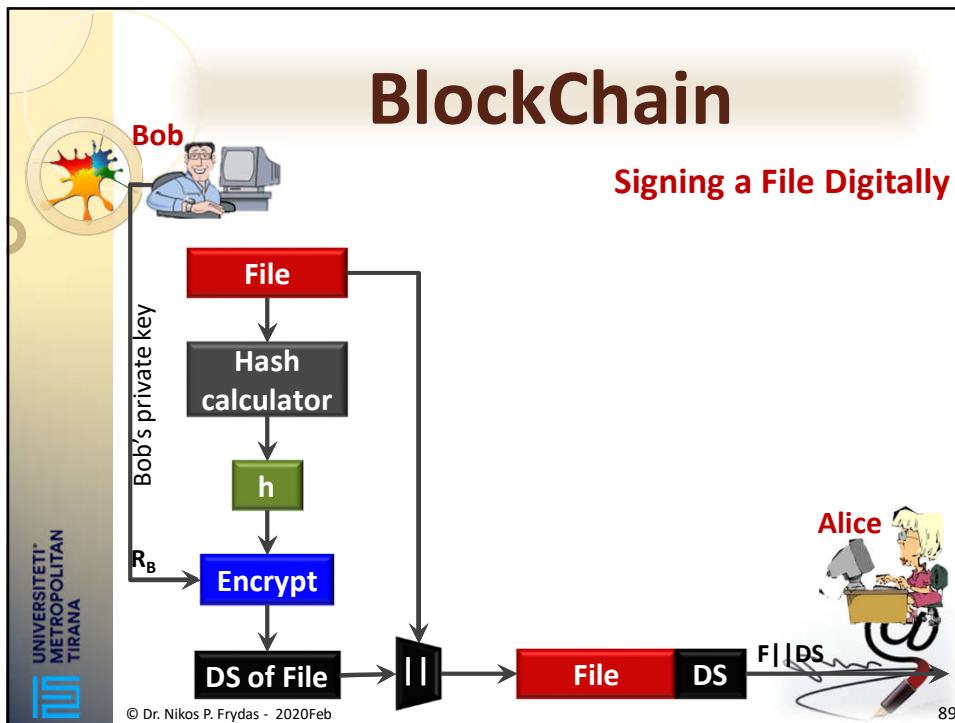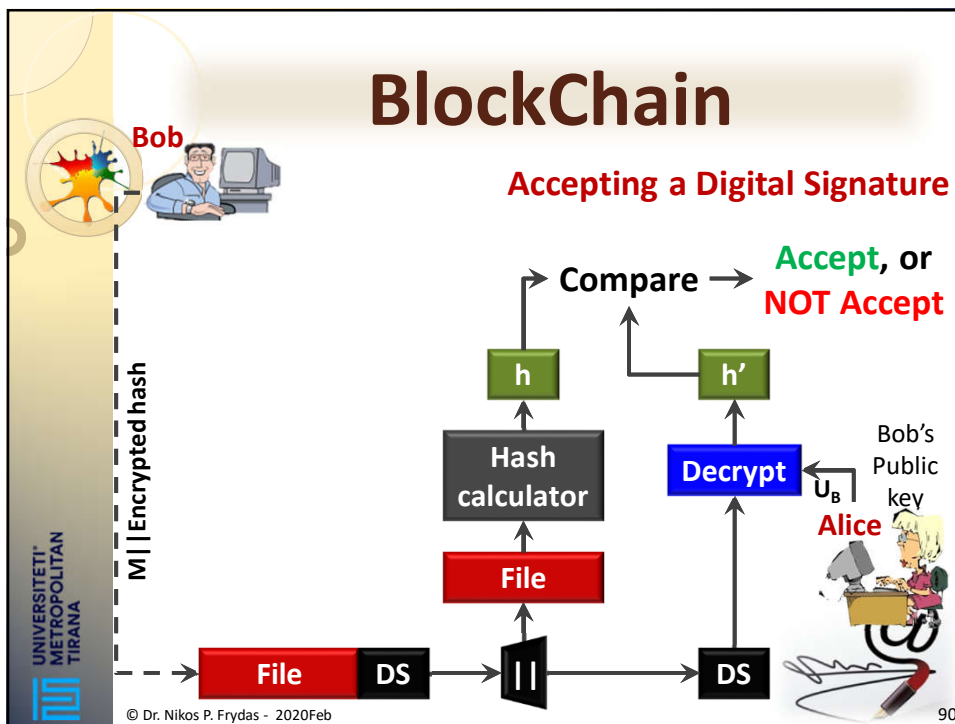- If hashes agree, then ✓, else hacked.

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BlockChain

Signing a File Digitally

Bob

Bob's private key

File

Hash calculator

h

R_B

Encrypt

DS of File

File | DS

File | DS

F||DS

Alice

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BlockChain

Accepting a Digital Signature

Bob

M||Encrypted hash

Compare → **Accept**, or **NOT Accept**

h

h'

Hash calculator

Decrypt

U_B

Bob's Public key

File

Alice

File | DS | DS

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BlockChain

What is a private & a public key? (1/5)

- When you encrypt a file you use a password, **K**.

- How do you send this password to Alice?

- Public key encryption allows Bob & Alice to

  create a common key, w/o sending the key!

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BlockChain

What is a private & a public key? (2/5)

- Suitable integers 3 & p=17 are chosen.
- Bob chooses R_B, his secret key, say 15 (<p).
- Bob calculates 3^{15} and divides by 17.
- Quotient is 844.053,35...
- Remainder of the integer division:
- 3^{15} = 17 x 844.053 + 6. Then U_B = 6, Bob's public.
- This is published: Everybody will know.

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BlockChain

What is a private & a public key? (3/5)

- Go from the public key to the private?

- Only by trial & error. No mathematical solution.

- For big p (~300 bits): Computationally impossible.

- So our secret keys remain secret.
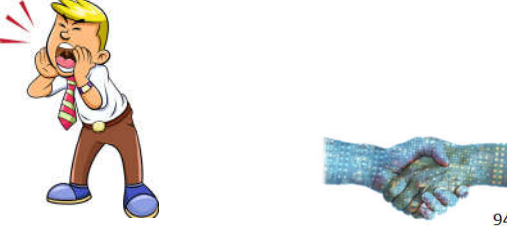
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BlockChain

What is a private & a public key? (4/5)

- Alice (and everybody else) does the same:

- Say, $R_A = 9$, $3^9 = 17 \times 1.157 + 14$. $U_A = 14$.

- Published.

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BlockChain

What is a private & a public key? (5/5)

- Calculate common key, K?
- Bob calculates K with what he has:
- $(U_A)^{(R_B)} = 14^{15} = 17 \times$ quotient + **11**.
- Bob obtains **K = 11**.
- Alice calculates K with what she has:
- $(U_B)^{(R_A)} = 6^9 = 17 \times$ quotient + **11**.
- Alice obtains **K = 11**.

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BlockChain

What platform is needed?
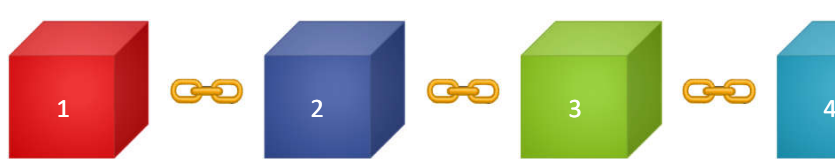

a. Data (D)
b. Hash (h) of previous block (1).
c. Obtain H = hash of D||h
d. Digitally sign H.
e. … and that is block (2).

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BlockChain

What platform is needed?

a. Data (D)
b. Hash (h) of previous block (1).
c. Obtain H = hash of D||h||nonce
d. Digitally sign H.
e. ... and that is block (2).

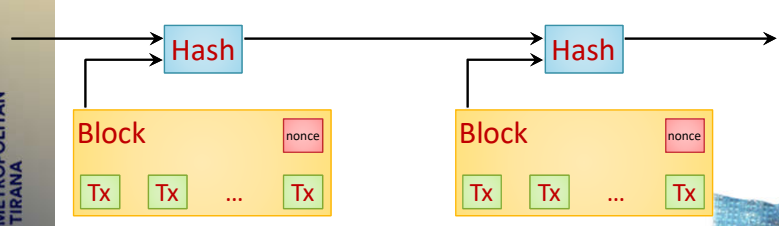© Dr. Nikos P. Frydas - 2020Feb

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BlockChain

Timestamp Server [2]

- Nonce is chosen, by trial & error, so that
- Hash (as a number) is < than a given small *number*.
- This is achieved by trying values of the nonce.
- From 0,1,2,etc., until hash = 00000...0*number*.

[2] Nakamoto S., *A Peer-to-Peer Electronic Cash System*, 4/2014
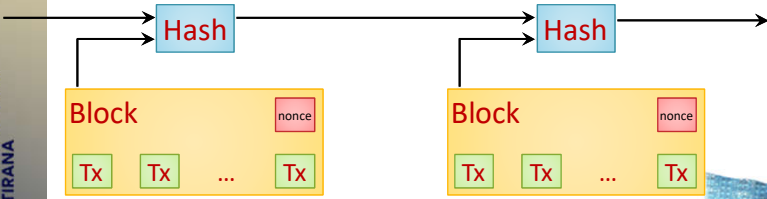
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BlockChain

Timestamp Server [2]

- The effort with the nonce is called *Proof of Work*.
- This makes impossible for someone to redo all.
- As the hacker is trying to recalculate all …
- New transactions are added at a faster speed.

[2] Nakamoto S., *A Peer-to-Peer Electronic Cash System*, 4/2014

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