IT TREND REPORT 2016

Munich RE ERGO

INTRO

Those who identify the potential of new technologies, trends, and technological progress at an early stage will obtain a competitive advantage and build the foundation for innovation. Constantly increasing technological complexity leads to a growing number of areas that are relevant for our company to keep an eye on. The objective of the IT Trend Radar 2016 is to identify relevant new technologies for ERGO, MunichRE and MEAG and evaluate them from a group perspective. We focus on the innovation potential of individual trends and review their practical suitability for the reinsurance and primary insurance sector. The purpose is to provide a better understanding for trends & correlations and to strategically support the product development. The team heading the Trend Report would be pleased to advise and assist with further analysis and workshops.

Tom Bonaty
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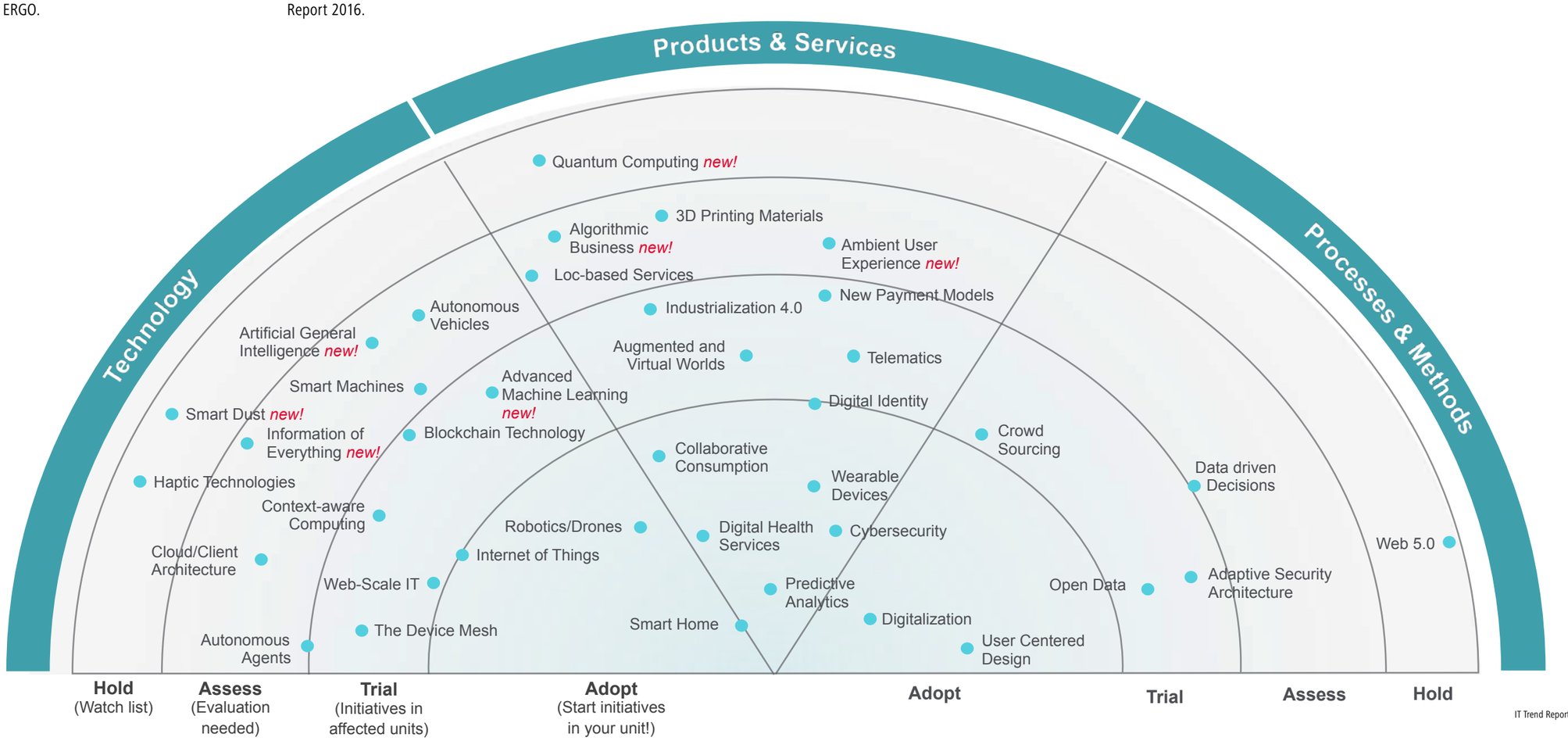
IT TREND RADAR 2016

IT Trend Radar 2016

The Trend Radar provides information about technology driven trends relevant for Munich Re and ERGO. It is a collaborative initiative by Global IT Governance at Munich Re and ERGO IT Strategy. It aims at sharpening awareness, evoking discussion and initiating new business opportunities appealing to all units in both Munich Re and ERGO.

Munich Re (IT Governance) and ERGO (IT Strategy) in cooperation with the Institute of Electronic Business gathered future trends outside of ERGO and aggregated them in the Trend Radar 2016 in order to provide a comprehensive view on technology trends, their maturity and relevance for Munich Re and ERGO. This year is directly involved in the initiative for the first time also MEAG IT. The top trends of the Trend Radar are published in the Trend Report 2016.

- Continuously providing insights of key trends that influence business at Munich Re and ERGO
- Promoting innovative initiatives within Munich Re and ERGO based on trends and developments from the outside
- Intensifying collaboration and interaction between Munich Re and ERGO



OVERVIEW TRENDS / INFOGRAPHIC

10 3D Printing Materials

3D fabricating is a process to make three-dimensional solid objects from a digital model

$49.000.000.000

projected global market for 3D printers and services in 2025[1]

9 Autonomous Agents

Virtual personal assistants such as Apple's Siri or Google Now are part of the ambient user experience, instead of interacting with buttons and menus, users can speak to an app

32% **expected annual growth rate in the global virtual assistant market 2015 – 2022[2]**

8 Information of Everything

everything in the digital mesh produces, uses and transmits information – including sensory and contextual information: information analysis techniques bring meaning to the deluge of information

$19.000.000.000.000

global opportunity to create value in the next decade[3]

7 Digital Health Services

describe the opportunity for remote monitoring of users' health status through smartphones, wearable devices and apps

$5.400.000.000

predicted global revenues from connected fitness trackers alone – in 2016[4]

6 Smart Home

highly connected and automated home technology: household systems are digitally connected and enable monitoring and control from afar – at the office, on vacation etc.

29% **expected annual growth rate of revenue in the smart home market[5]**

5 Advanced Machine Learning

the science of getting computers to act without being explicitly programmed

98% **of insurance executives familiar with cognitive computing believe that it will play a disruptive role in the industry[6]**

4 Internet of Things

miniscule sensors are attached to objects to make them identifiable by their own unique IP address, to autonomously communicate with one another and provide information

$28.100.000.000

IoT units expected to be installed in 2020[7]

3 New Payment Models

mobile payment is becoming a billion dollar industry, all major tech companies have developed mobile payment services; whereas virtual currencies don't have a legal status or guarantee in any jurisdiction

$3.700.000.000

Global financing amount invested in mobile payments startups in 2015[8]

2 Blockchain Technology

decentralized verification system for transactions of all types that are recorded across a multitude of computers around the world

$1.000.000.000

invested in Bitcoin related tech startups by companies such as AmEx, Bain Capital, Deloitte, Goldman Sachs, Mastercard and the New York Life Insurance Company[9]

1 Algorithmic Business

a company built around smart algorithms – soon these algorithms will be able to work independently, define business processes and predict possible threats.

$60.900.000.000

projected global sales volume of Big Data Solutions in 2020[10]

Sources

1) http://www.smitherspira.com/products/market-reports/printing/the-future-of-3d-printing-to-2025
2) http://www.transparencymarketresearch.com/pressrelease/intelligent-virtual-assistant-industry.htm
3) http://www.weforum.org/agenda/2014/01/are-you-ready-for-the-internet-of-everything/
4) http://www.parksassociates.com/blog/article/pr-march2015-whcc
5) http://www.statista.com/outlook/279/100/smart-home/worldwide#market-revenue
6) http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?infotype=PM&subtype=XB&htmlfid=GBE03710USEN
7) http:// www.idc.com/downloads/idc_market_in_a_minute_iot_infographic.pdf
8) https://www.cbinsights.com/blog/payments-tech-funding-statistics-and-growth/
9) http://money.cnn.com/2015/11/02/technology/bitcoin-1-billion-invested/
10) http://wikibon.com/executive-summary-big-data-vendor-revenue-and-market-forecast-2011-2026/

1 ALGORITHMIC BUSINESS

Algorithms are the DNA of software. They codify the macro steps of how computers already run large parts of the world.
The 'Algorithmic Business' is a term describing companies that build their business models around smart algorithms. These algorithms turn data into actions and insights about consumers. For that it needs a new system architecture of information classification and semantics.

In the digital future these algorithms are able to work independently, define business processes, create a differentiated customer experience and predict possible threats. Therefore, algorithmic business models require target-oriented and self-optimizing algorithms (see: Advanced Machine Learning).

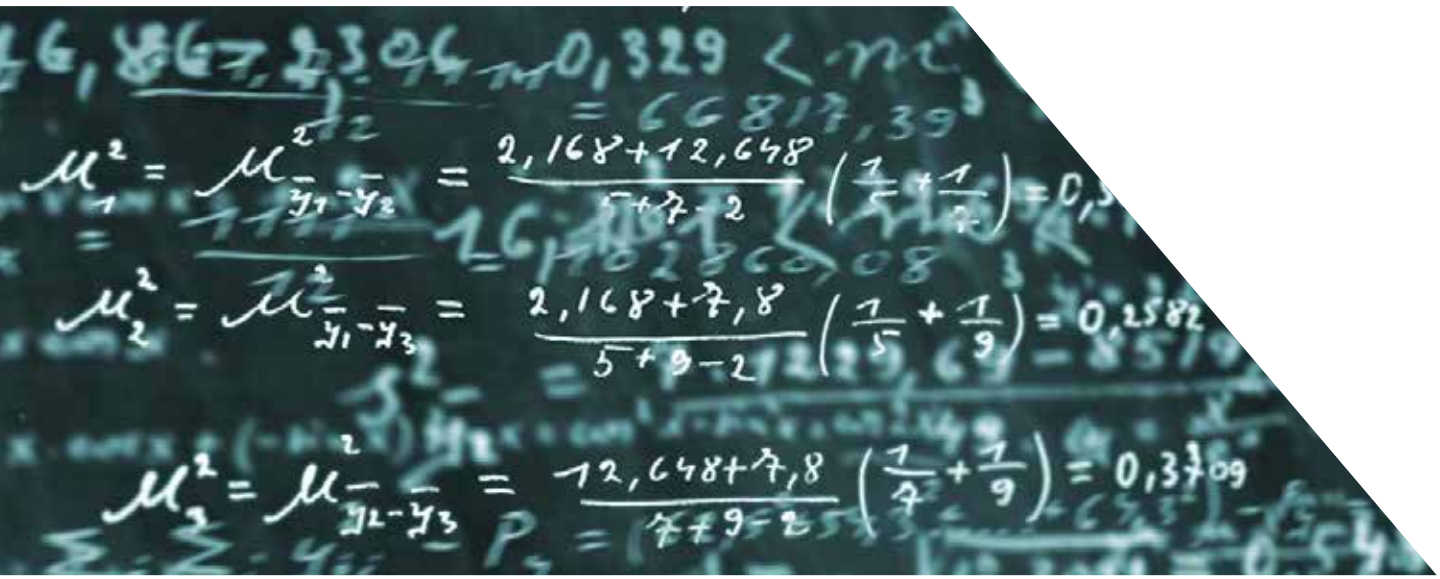
According to Gartner, by 2018 already 20% of all business content will be authored by machines.

50% **of the fastest growing companies** will have fewer employees than smart machines by 2018.

Source: Gartner, 2015

$60.9 billion projected global sales volume of Big Data solutions in 2020.

Source: Executive Summary: Big Data Vendor Revenue and Market Forecast, 2011-2026



Examples and Initiatives

Amazon algorithm is the recommendation engine of Amazon, based on „item-to-item" collaborative filtering. It is rumored to provide 10% to 15% of additional revenue on Amazon.com.

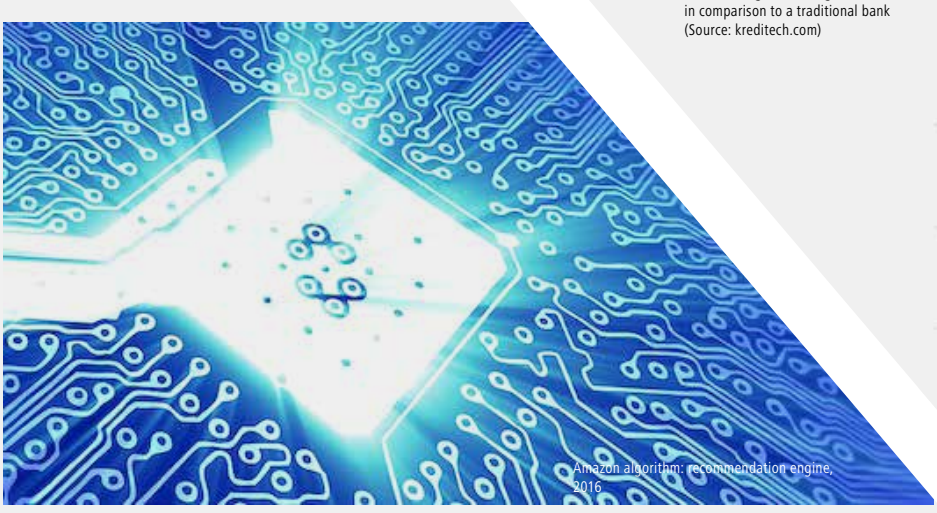
Kreditech is a "digital bank" that provides customtailored financial products based on algorithmic banking. The data-driven technology offers its customers a high convenience through fully online integrated business processes. Founded in 2012, the company raised $92 million in the latest Series C round with PayPal co-founder and early Facebook investor Peter Thiel being one of the leading investors.

BENEFITS

- Better, fast and independent decisions by automated analytical processes.
- Increased efficiency for organizations and employees through Advanced Analytics and cost savings.
- Dynamic and individual customer services.
- Focus on actionable algorithms and meaning of data instead of amounts of data.

CHALLENGES

- Requirement to leverage information sources to drive growth as part of their information strategy.
- By trend, algorithmic business relies on gaining further insights from data in order to predict customer behavior, trends and/or outcomes.
- Information management becomes a key requirement for innovation within rapid information processing.



Amazon algorithm: recommendation engine, 2016

Kreditech digital banking services in comparison to a traditional bank (Source: kreditech.com)

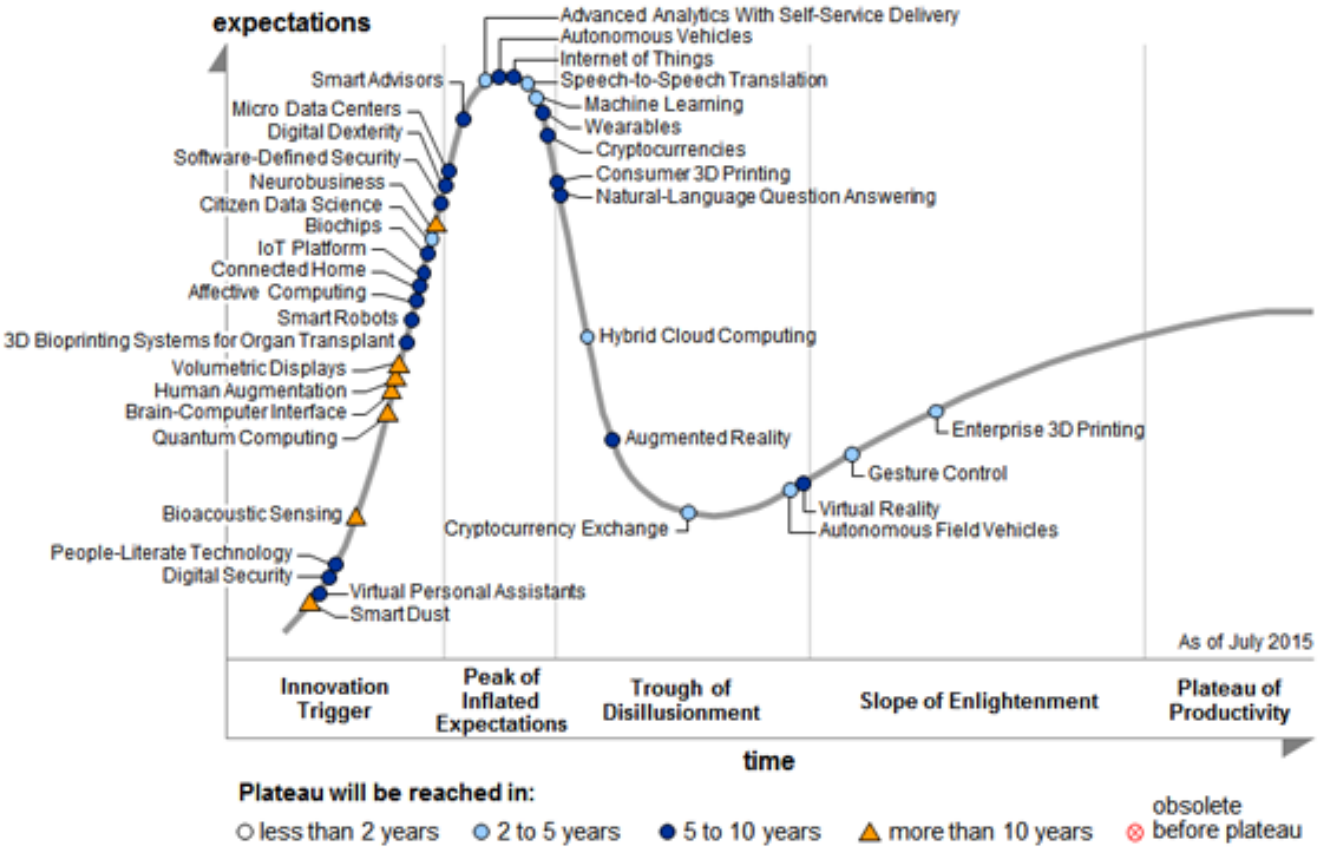
.ıl K		Bank
anyone	Customer	27% with credit score
24/7 access	Availability	9 to 5
35 seconds	Credit Decision	5 to 7 days
15 minutes	Payment	1 to 3 days

2 BLOCKCHAIN TECHNOLOGY

Blockchain technology provides a shared, trusted and secure public ledger to record financial transactions / digital assets and 'smart contracts'. These are recorded independently – not in one place but distributed across a multitude of computers around the world. The records are condensed (into blocks) and interlinked (to form chains), using complex cryptographic algorithms.

Thus Blockchain records are locally decentralized in a peer-to-peer network but still constitute a logically centralized immutable set. No central authority or trusted third party is required to secure transactions.

The idea has already been in use for Bitcoin. A total of US$ 1 billion has been invested already in Bitcoin-related tech start-ups by companies such as American Express, Bain Capital, Deloitte, Goldman Sachs, Mastercard, the New York Life Insurance Company and the New York Stock Exchange. As demonstrated in Gartner's Hype Cycle for Emerging Technologies cryptocurrency exchange are expected to reach the plateau of productivity within 2 to 5 years (see fig. X).



Gartner Hype Cycle for Emerging Technologies (Source: Gartner; August 2015)

Examples and Initiatives

Nasdaq is testing a new use of blockchain transaction technologies for the stock markets in favor of creating a more secure and efficient stock trading system. Potentially, the transfer can be provided without fearing manipulation by third parties. By introducing the blockchain to the trading of financial assets, Nasdaq aims to replace the verification process previously done manually by lawyers through a more secure technology.

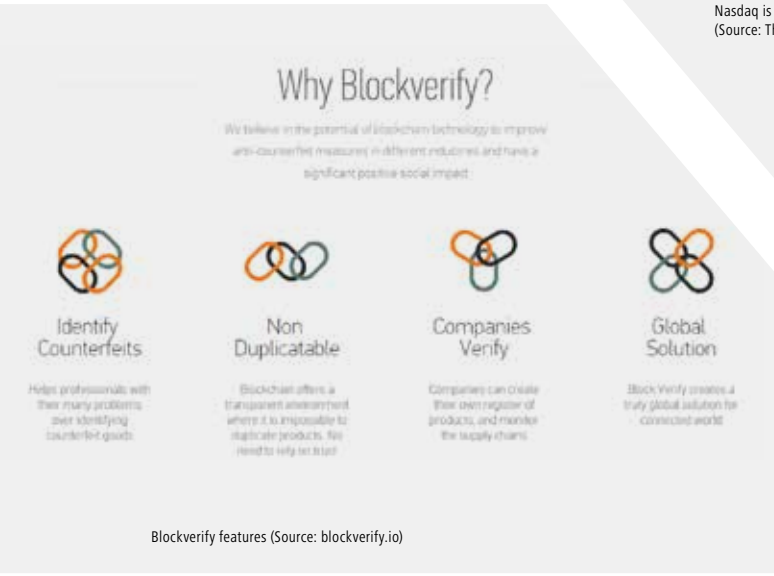
Blockverify provides a blockchain-technology-based solution to track products along the supply chain. By implementing the blockchain technology in this sector, companies are provided with a transparent environment that makes it impossible to duplicate products. Further, companies can create a product register, monitor supply chains and identify counterfeit products.

BENEFITS

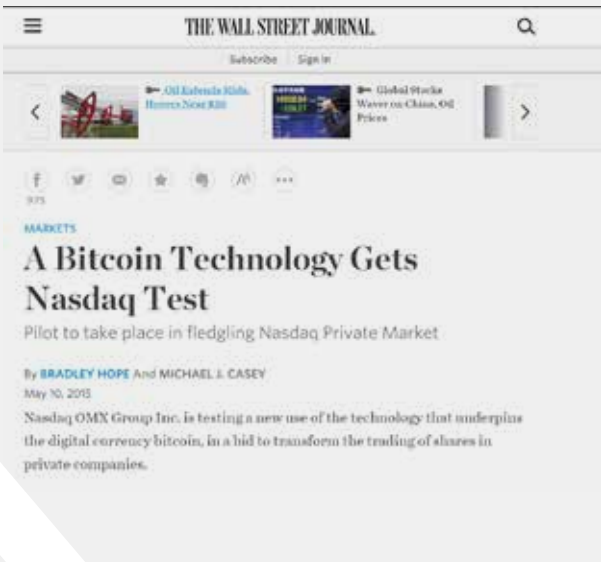
- Advantages of a blockchain ledger lie in the verification of portfolio data between primary and reinsurance.
- Automated smart contracts or transactions become frictionless and can be processed more quickly with less bureaucracy (e. g. identity validation).
- Chance for new insurance models emerge: peer-to-peer insurances or smart policies (e.g. automatic pay-outs based on a climate data feed for crop insurances).

CHALLENGES

- Decentralization of insurances (e. g. peer-to-peer models, mutual insurances): The competition can increase with non-insurance players that could employ the blockchain technology for new insurance models, which requires early adoption of the technology.
- Insurances have to figure out use cases for blockchain technology as an integral part of their future IT strategy.



Blockverify features (Source: blockverify.io)


THE WALL STREET JOURNAL.

MARKETS

A Bitcoin Technology Gets Nasdaq Test

Pilot to take place in fledgling Nasdaq Private Market

By BRADLEY HOPE And MICHAEL J. CASEY

May 10, 2015

Nasdaq OMX Group Inc. is testing a new use of the technology that underpins the digital currency bitcoin, in a bid to transform the trading of shares in private companies.

Nasdaq is testing bitcoin technology (Source: The Wall Street Journal, 2015)

3 NEW PAYMENT MODELS

Mobile payment refers to the function of making payments with one's smartphone or other wearable smart devices. According to Gartner, the projected number of mobile payment users will exceed 450 million by 2017.

With the mobile payment sector becoming a billion dollar industry, all major tech companies have developed mobile payment services for their customers. Moreover, new players are entering the market, e.g. utilizing virtual currencies such as Bitcoin. Virtual currencies are a type of digital money which is created and controlled by its developers.

An emerging trend is instant payment. instant payment refers to a electronic payment solution that enables users to carry out authorized transaction in real-time. Especially cross-border instant payment is a rising trend with huge market potential

$2849 billion
Projected global mobile transaction market in 2020.
Source: Future Market Insights, 2015

$3.7 billion
Global financing amount
invested in mobile payments startups in 2015.
Source: CB Insights, 2015

Source: visa.com

Examples and Initiatives

MobiKwik is a digital wallet that was developed for various mobile transactions scenarios, e. g. paying in online shops, transferring money to a friend or paying one's life insurance.
Founded in 2009, the Indian start-up already has more than 25 million users together with a retail network of 50.000 partners and processes ca. 60 million mobile payment transactions per month.

Square is a mobile payment company that offers Point-of-Sale Software for every part of a running business, e.g. credit card processing, sales monitoring, inventory management and creation of sales reports.
The company cooperates with Navy Federal, Creditera, Gravity Payments, Starbucks and Whole Foods among others.

BENEFITS

- The reduction of physical payment generates more and better data of consumer payment habits.
- New payment models create new insurance products, i.e.: protection of your online wallet.
- Reduced response time for claims process and other insurance related services
- Mobile payment provides users a faster and more comfortable way to pay for online services, i.e. on demand insurances.

CHALLENGES

- Insurance companies can be placed at a competitive disadvantage by the inability to adapt to mobile payment technologies.
- New transaction processes create new security vulnerabilities and data privacy uncertainties.

Square Dashboard (Source: squareup.com)

MobiKwik App
(Source: mobikwik.com)

4 INTERNET OF THINGS

The ‚Internet of Things' is becoming a buzzword and the technology trend with repercussions across the business spectrum. By connecting to the internet, billions of everyday devices – from fitness bracelets to industrial equipment – the Internet of Things merges the physical and online worlds, opening up a new opportunities and challenges for companies and consumers.

The vision of the Internet of Things (IoT) is to connect devices and daily consumer objects, enable information gathering and management of these devices to increase efficiency, new services or achieve other health, safety or environmental benefits.

The IoT is also a relevant field for many other trends e. g. Smart Home, Healthcare and Fitness Tracking (quantified self) – and the Industrial Internet of Things (Smart Factory, "Industry 4.0").

28.1 billion
IoT units in 2020
(Source: IDC, 2015)

$2,712 billion
market revenue in 2015

$7,065 billion
market revenue in 2020
(Source: IDC, 2015)

In 2020, there will exist **a black market** for **fake sensor & video data** valued at over **$5 billion**
(Gartner 2016)

Examples and Initiatives

Lumkani's smart alert

Lumkani's early-warning system of connecting smoke detectors to reduce damage by shack/slum fires in urban settlements

Grillo: a sensor system detecting earthquakes

Grillo measures data through IoT technologies, sends geo-located alerts to people all over the world.

BENEFITS

- New services can emerge such as remote health monitoring for elderly patients and pay-as-you-use services.
- Reduced loss costs, claims and expenses and dynamic, optimized pricing in insurance products.
- Increased availability and quality of more consumer data, enabling more customization and (micro) targeting.

CHALLENGES

- Current lack of standards.
- Privacy and security concerns move into focus.
- Require a shift from reactive restitution to proactive protection and prevention and to repeated interactions (life cycle).

Source: lumkani.com, 2016

Source: Grillo App, 2015

5 ADVANCED MACHINE LEARNING

Machine-based learning is described as the science of getting computers to act without rules-based programming. One of the goals in this field is the replication of cognitive capabilities of the human brain and the development of algorithms / computer programs that teach themselves.

Technologies based on machine learning will be able to not only collect data, but learn based on the data. Through this process much of the initial analysis prior done by humans will switch to being completed by machines.

Advanced Machine Learning uses new data in order to improve programs and adjust program actions according to recognized patterns in new data. Advanced Machine Learning is related to the trends Algorithmic Business and Autonomous Agents.

98% **of insurance executives familiar with cognitive computing**

believe that it will play a disruptive role in the industry.

Source: IBM Institute for Business Value, 2015

$13.7billion

Expected global cognitive computing market 2020.

Source: Allied Market Research, 2015

Examples and Initiatives

The Artificial-intelligence system Quill provides data-based intelligent storytelling narratives by generating natural language through data analysis. The sys-tem is able to write reports in seconds with a quality of a human author using data from specific data sources.

How Quill Works (Source: narrativescience.com)

Osaro Website (Source: osaro.com)

Osaro develops automation solutions for computer and robotic systems driven by advanced machine learning software.

TensorFLow logo

TensorFlow is a machine-learning technology used in various Google products such as Gmail, Google Photos, speech recognition and Search.
Recently Google open-sourced the framework for developers in order to foster and accelerate research on machine learning.

BENEFITS

Automated data analysis & increasing effectiveness of process and products, including

- Detection of more granular or predictive information
- Increased effectiveness of existing products
- Provision of deep insights for better risk assessment
- Reduction of processing times and operational costs
- Improved decision making

6 SMART HOME

Making homes "smart" is an emerging trend that has gone from button-press security systems to controlling and observing your home from anywhere. Smart Home is a highly connected and automated home. Not only computers are connected but also machines and control centres for heating, cooling, lighting and security are part of home networks.

The idea of a Smart Home system is a seamless interaction to reduce human work and energy costs.

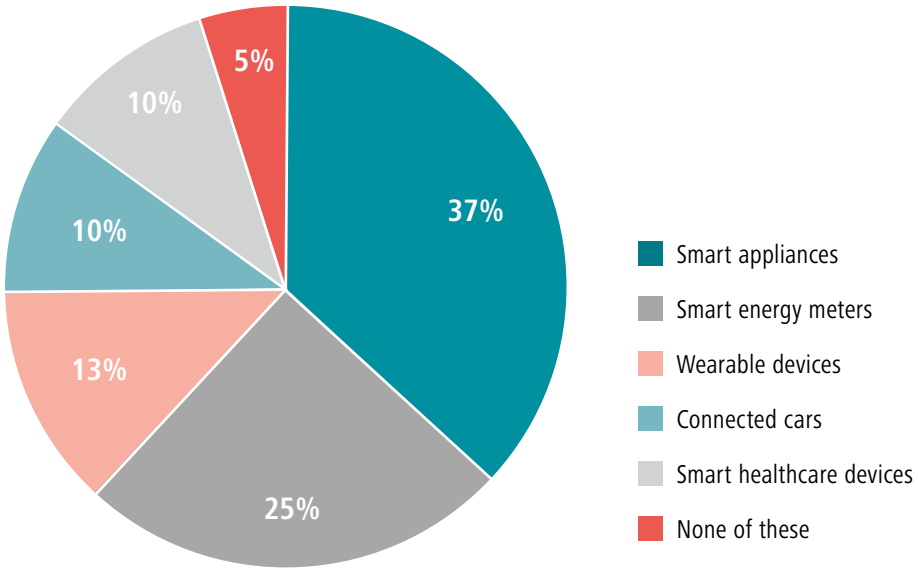
By 2022, the falling cost of adding sensing and communications to consumer products will mean that a family home in a mature, affluent market could contain several hundred smart objects. These will enable a wide range of new digital business opportunities as well for the insurance market.

17% **Expected annual growth rate for**
the revenue in the smart home market.
Forecast 2015-2020.

Source: RnR Market Research, 2015

$58.7billion
Expected market value
of the global smart home market in 2020.

Source: MarketsandMarkets, 2015



Connected devices likely to be used within the next five years.

Source: GSMA, KRC research, 2015

Examples and Initiatives

Digitalstrom: smart home system

Intelligent building automation system that connects existing electronic devices and domestic lighting.

Nuki: smart bluetooth key

Nuki is connected to your door lock via Bluetooth. The door is opened when the user returns home and closed after leaving.

Netflix "The switch": smart home connector

Connects devices and gets the home ready for the "Netflix mode" at the touch of a button (turns on the TV, dims the lights).

BENEFITS

- Damage reduction and prevention for buildings and household insurances: Smart Home applications provide more safety using sensors to prevent dangers in early stages leading to fewer claims for insurance companies.
- Smart Home services enable new products especially in the health care sector.
- Flexible household insurance based on tracked application data.

CHALLENGES

- Data protection: hacking and security losses are relevant. Also people might not want insurance companies to know every last detail of their private lives.
- Development of a multi-layered security strategy.

7 DIGITAL HEALTH SERVICES

Digital Health Services describe the opportunity for remote monitoring of users' health status through advanced smartphones and apps or smart wearables like smart watches.
Doctors or health insurance funds have the opportunity to see the users' condition in real-time. Digital Health Services allow to monitor movement activity, heartbeat, or sleeping activity.

Diseases might be recognized at an early state as well as accidents by elderly persons (especially if they're living alone). As a side effect home care becomes cheaper: people can continue living a relatively independent life for a much longer time. And new care products emerge, e.g. care robots can alleviate the care burden of chronically ill persons' family members.

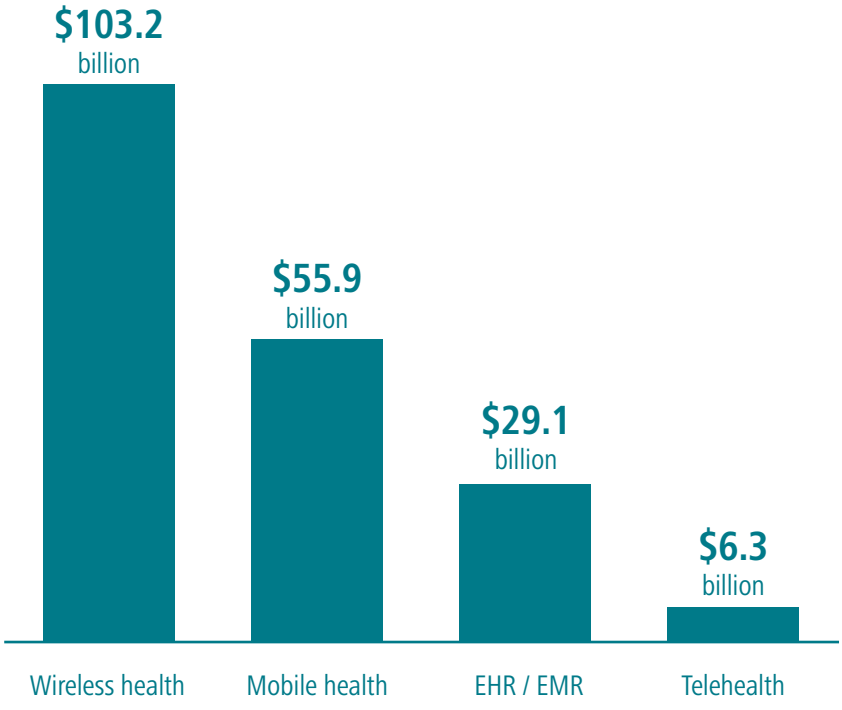
$5.4 billion
Global revenues from connected fitness trackers by 2019.

Source: Parks Associates

More than 75%
of all patients expect to use digital services in the future.

Source: McKinsey Digital Patient Study, 2014

Global digital health market forecast 2020 (by segment).



Sources: Accenture; Allied Market Research; Arthur D. Little; GSMA Intelligence; HIS; MarketsandMarkets, 2014

Examples and Initiatives

Medtronic: Remote Monitoring System for patients with implantable pacemakers
received FDA approval for its app-based system

e-Celsius: Performance health monitoring system
uses a pill that measures body temperature and is able to store up to 80.000 data sets per pill.

Evolent Health: sells software as well as advisory services, and information technology to hospitals. The technology they use gathers and crunches relevant data about patients so that doctors can treat them better at lower costs.

BENEFITS

Digital health services help to provide an efficient support and more customer centricity, including

- prevention of diseases, regeneration and support in case of chronic diseases
- real-time health records
- simplification of complex business and clinical models
- Patient control and access to health information
- Lower costs through better understanding the customers needs

CHALLENGES

- Ongoing risk analysis and management is needed to provide relevant and safe data (life cycle).

Meditronic
Source: Meditronicheart.com

E-Celcius
Spurce: Bodycap-medical.com

Source: evolenthealth.com

8 INFORMATION OF EVERYTHING

Information is the lifeblood of Digital Business. Information has always existed everywhere but has often been isolated or unavailable. Nowadays through the Internet of Things we have a huge amount of data that is not only nearly fully encompassing but also potentially valuable.

The ‚Information of everything' describes everything in the digital mesh produces, uses and transmits information – including sensory and contextual data.

Graph databases as well as other emerging semantic data classification and information analysis techniques will bring meaning to the often chaotic flood of information.

According to a report of the World Economic Forum, more than 5 billion people and 25 billion devices will be connected to the internet, generating virtual amounts of information.

$19 trillion

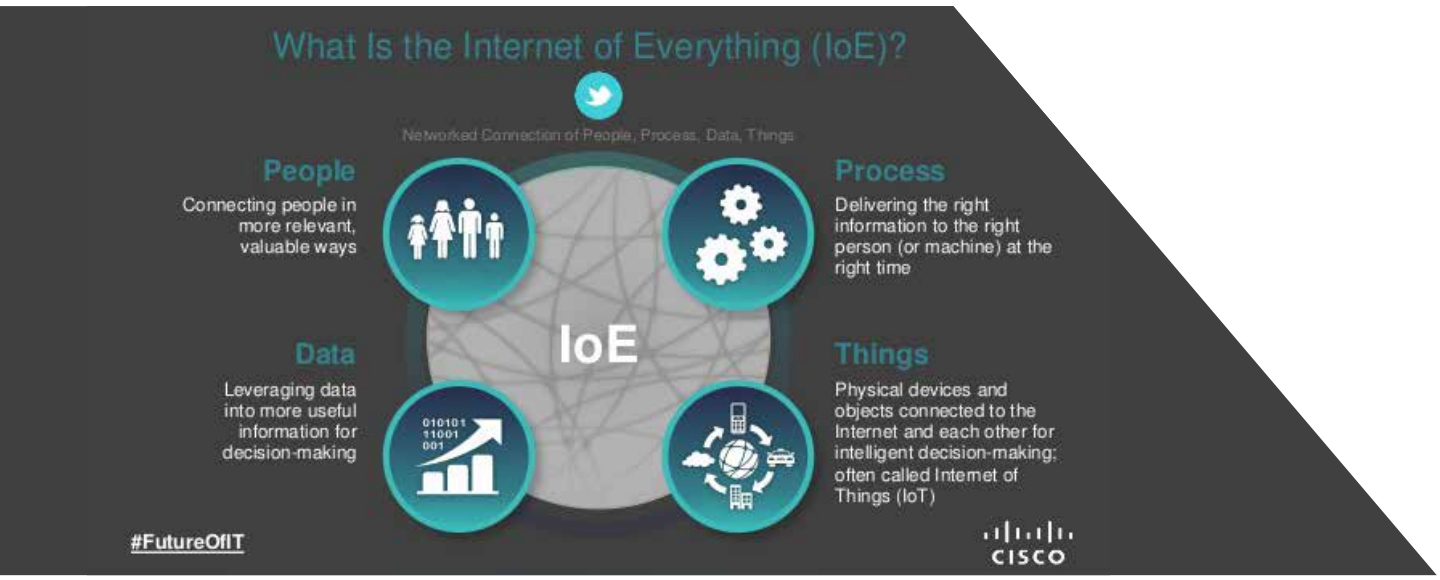
Global opportunity to create value in the next decade

Source: World Economic Forum, 2015

44 zettabytes

Projected volume of data in the digital world

Source: IDC, 2014



Source: Cisco, 2013

Examples and Initiatives

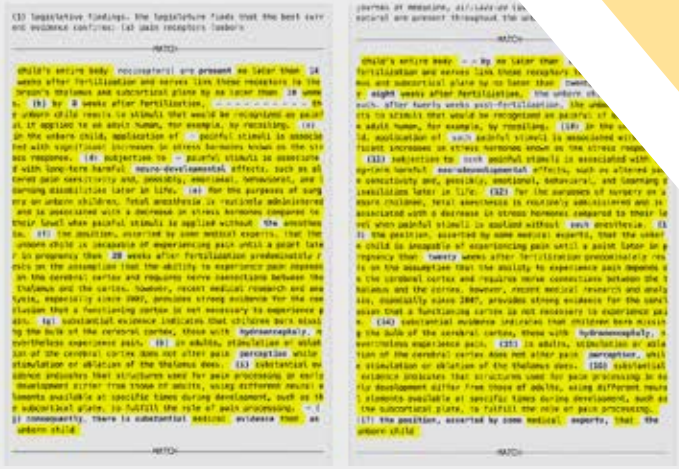
IBM Watson Health combines clinical, research and social data helping physicians gain insights from the data from medical records, research to fitness bands and provide patients with personalized treatment. The Watson Health Cloud brings together medical data into one cloud-based thinking hub and combines traditional analytics with the advanced cognitive capabilities of Watson to turn this data into knowledge about patients and treatment methods.

The Legislative Influence Detector (LID) helps discovering insights about the origin and diffusion of policy ideas and the real influence of various lobbying organizations. Since reading legislative bills manually takes quite a bit of time, LID users are provided with the possibility of investigating text matches for large sets of text. The algorithm checks the texts for similarities and returns the best matches with a highlighted text for further review.

BENEFITS

A better understanding of themselves and their customers enables more purposeful and target-group-specific actions including:

- Improved business practices
- Improved assessment of risks
- Individualized and innovative customer products
- Reduction of operational costs



Result of the Legislative Influence Detector analysis (Source: dssg.uchicago.edu)

IBM Watson Health data sources (Source: Youtube.com)

9 AUTONOMOUS AGENTS

Autonomous smart agents or virtual personal assistants (VPAs) are on the rise and are becoming a more sophisticated technology, enhanced through (advanced) machine based learning.

VPAs such as Apple's Siri or Google Now are part of the ambient user experience, instead of interacting with buttons and menus users can speak to a smart app, which is an intelligent agent.

Autonomous agents are on the verge of becoming a valuable asset in the workplace as well as for personal purposes. In the near future intelligent agents will be able to provide the users with dynamic and contextual information and augment human activity.

$5.1 billion

Global virtual assistant market volume forecast for 2022.

Source: Transparency Market Research, 2015

31.8% **Global virtual assistant market**

compound annual growth rate (CAGR) 2015 – 2022

Source: Transparency Market Research, 2015

Siri on Ios 9 (source: apple.com)

Examples and Initiatives

Apple Proactive is an intelligence technology implemented in its latest iOS. The system provides the user with the most relevant information and suggests actions at a particular moment based on usage patterns i.e. most relevant contacts, launching your yoga app for your morning workout or reminding you about something when you get in your vehicle or display local news based on your location.

Amazon Echo is a voice activated personal assistant for the connected home. It can be placed anywhere around the house and processes human speech via a sophisticated voice recognition technology. The device runs on Amazon Web Services, offering various services like music streaming, radio or programmable tasks using IFTTT.

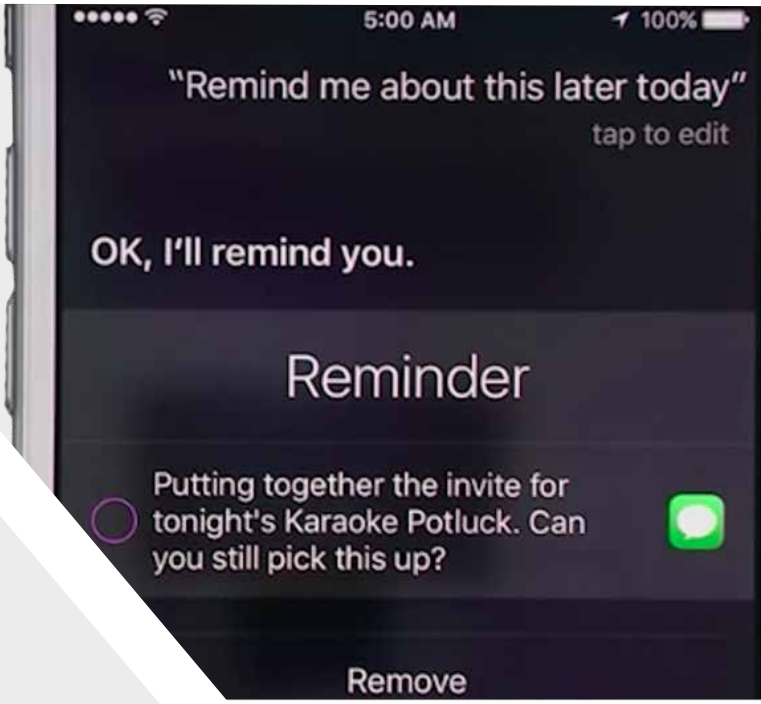
BENEFITS

- Automation of coordinative tasks reduces failure rates and saves time
- Operational cost savings
- Autonomous agents work around your schedule to provide you with services whenever you need them
- The collected data from Autonomous Agents contains marketing relevant customer information

CHALLENGES

- Risk of insurance claims through technology failures with more severe damages
- Potential damages from uncontrolled data collection is a major challenge for businesses

Amazon Echo
Source: Amazon.com



Proactive is a IOS 9 intelligence that supports the user by predicting the context of use (Source: Youtube.com)

10 3D PRINTING MATERIALS

3D printing is a process of manufacturing three-dimensional solid objects from a digital model.

These technologies have primarily been used in the field of prototyping for industrial design. But nowadays, the quality of 3D printing has vastly improved. Simultaneously, printer and supply costs have dropped to a level that broadens the appeal of 3D printing to a wide range of businesses, schools and private consumers. Also, 3D-printable material now includes human tissue, food, glass. This opens new markets!

Siemens predicts that 3D printing will become 50% cheaper and up to 400% faster in the next five years.

$49 billion

Projected global market for 3D printers and services in 2025.

Source: Transparency Market Research, 2015

+300%

Projected global market growth for 3D printing technology in the next decade.

Source: Transparency Market Research, 2014

Figure X: the three most common reasons companies are pursuing 3-D printing (Source: Gartner; November 2014)

Examples and Initiatives

Airbus has started using 3D printing, also called Additive Layer Manufacturing (ALM) for tooling, prototyping and manufacturing parts used in test flights but also in commercial aircraft, using the technology for its new Airbus A350 XWB.

3D printed aircraft part (Source: airbusgroup.com)

3D printed Ratchet Wrench (Source: NASA)

NASA is using the 3D printing technology for printing tools based on a design file which is transmitted from Earth to a 3D printer at the ISS. Furthermore a NASA team is currently testing a 3D printed high performance rocket engine under space-like conditions.

Biobots was founded in 2014 by two graduates of the University of Pennsylvania. Biobot 1 is a 3D bioprinter that builds 3D living tissues out of human cells. The company has introduced the desktop 3D printer onto the market in 2015 at a competitive price of $US 10,000.

Desktop 3D printer from Biobots (Source: biobots.io)

BENEFITS

- Quick production of complex products with minimal lead times
- On-demand customization
- Quick product tests
- Use of 100% of the raw material, leading to minimal, if not zero, waste.

CHALLENGES

- Added complexity to some supply chains
- Liability concerning product quality in areas of biotechnology or pharmaceuticals
- Legal issues of copyright infringement

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