OIL & GAS

Detecon Trend Report

San Francisco
March 2019

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Introduction

Oil and gas companies need to get ready for new technologies

The development of technologies is getting faster and faster. Buzzwords like “digitization” and “disruption” are conquering one industry after another. But trends are not impacting every industry in the same way. Petroleum companies need to understand which trends are impacting their industry and how they can use new technologies to tackle industry specific problems. Over the past years, petroleum companies needed to deal with relatively low oil prices and shrinking profit margins. Innovations and investments had low priority. But with stabilized energy prices companies now have the resources for investments in innovative technologies. They need to make these investments and apply new technologies to cut long-term costs and assure they are not falling behind in the race with innovative competitors.

Why you should read this trend report:

This report includes a snapshot of some of the most relevant trends in the oil and gas industry from our **Detecon Radar**, that helps you to be prepared for disruption and identify new opportunities for growth.

The Detecon Radar is your “**single source of truth**” for all current and future threats and opportunities.

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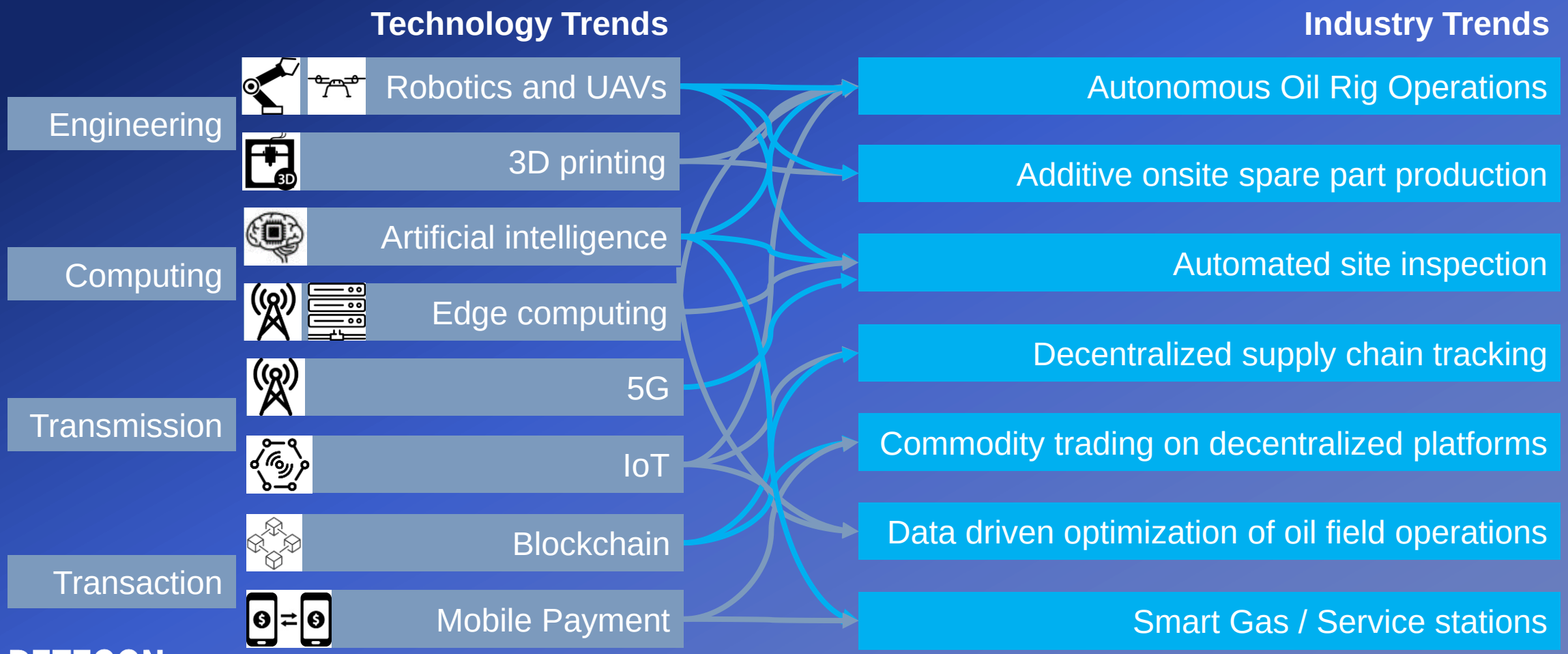
We summarized a large number of technological trends into seven industry specific oil and gas Trends



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Additive onsite spare part production

Detecon's perspective

Additive manufacturing based on 3D printing technology provides various advantages for oil & gas companies. Small batch sizes, as well as high functional demands and component prices make 3D printing a perfect match for the industry.

For today the quality of the end product, which is fabricated by using Selective laser melting (SLM) technology, exceeds the foundry and rolling production.

Companies should track new developments, analyse potential use cases and **be prepared** for first tests of the technology in their facilities.

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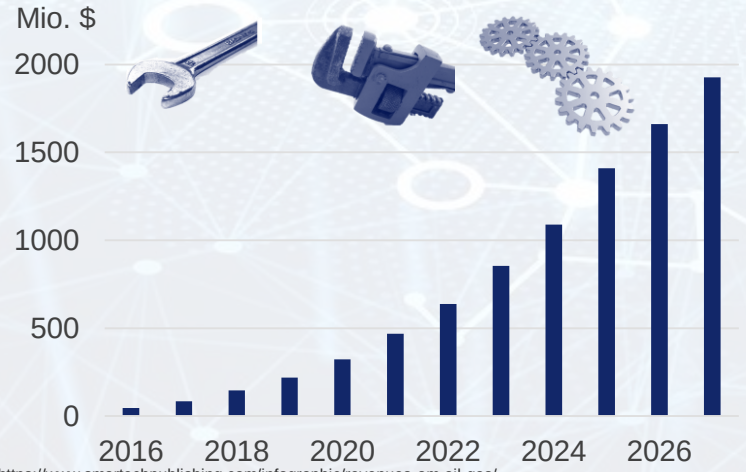
Additive manufacturing of components and spare parts with 3D printing technology

The oil and gas industry requires complex machinery that must fulfil specific performance and environmental standards. In traditional manufacturing processes many components must be fabricated from several constituent parts. Additive manufacturing methods such as 3D printing, in contrast, are able to generate innovative shapes and complex geometries. This enables benefits like optimization of weight and performance as well as reduced down times due to the possibility of on demand onsite spare part production.

Figures & Facts

The revenues of additive manufacturing in the oil & gas industry is expected to reach approximately US $1.9 Billion by 2027.



https://www.smartechpublishing.com/infographic/revenues-am-oil-gas/

Benefits

- Improved characteristics of end products
- Reduced downtime due to reduced delivery time of spare parts
- Flexible and cost-efficient component structures
- Accelerated product development
- Reduces cost of production, maintenance and stock

Challenges

- Norms and safety regulations need to be adapted
- Raises concerns over the proper use of intellectual property

Impact

- Changing relationships between vendors and oil & gas companies

Sources: GE, EY

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Automated site inspection

Automated refinery and pipeline inspection with flight drones and robots

Pipelines and refineries are subject to damages due to great lengths of thousands of miles and the remoteness of their locations. In order to detect potential damages the sites require regular inspection and monitoring. With aerial drones and robots combined with machine learning algorithms, inspection work can be automated in the near future. Traditional inspections by man and therefore long downtimes can be avoided. This leads to an increased cost and time efficiency as well as risk reduction.

Detecon's perspective

The application of drones and robots equipped with (infrared) cameras, microphones and gas sensors enables comprehensive autonomous monitoring. Combined with image recognition and artificial intelligence, anomalies can be detected with an increased time & cost efficiency and investigated with a lower risk for humans.

Potential for efficiency increase is high and some companies are already testing and implementing drone based inspection operations. Upcoming technologies such as 5G and edge computing increase the potential for drones even further. Companies should **act now** in order to make use of the full potential of drone technology.

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Figures & Facts

Reduction of inspection cost through unmanned aerial vehicles (UAVs)	**50%**
Increase of inspection speed for UAVs compared to rope access	**20x**
Number of commercial offshore inspection flights till 4/2017	**> 18 000**

Benefits

- Reduces cost and risk for workers through automated processes
- Reduces inspection and down times
- Increases frequency of inspection
- Enables real-time monitoring 24/7
- Provides flexibility for hard to reach areas

Challenges

- Inspection with drones are restricted by weather conditions, especially wind
- Short flying time due to low battery capacity
- Regulatory uncertainties

Impact

- Higher requirements on IT and telco infrastructure of operators

Sources: dronebelow, rovdrone, technology review , Sky-Futures, Airobotics

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Autonomous Oil Rig Operations

Autonomous robots revolutionize the working on oil rigs.

Investments in new technology products are starting again after the recovery of the oil price. A hot topic these days is automated drilling technology. For the main drilling process, high-precision robots can control and execute dangerous and complex tasks automatically. These tasks were traditionally performed by humans under a high level of danger. Industrial robots make drilling for oil faster, safer, and more cost-effective. In the long-term, most operation processes could be carried out by robots.

Detecon's perspective

Work on oil rigs and drilling platforms is labor intensive and dangerous. Robots in combination with artificial intelligence and IoT sensors enable companies to increase the part of automated drilling and production processes. This improves safety and increases efficiency.

Autonomous robots for oil rig operations are still in an early design/development phase.

Companies should evaluate the technical possibilities and state of the art as well as consider pilot projects in order **to be prepared** for the coming technology.

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Figures & Facts

The Automated Floor Systems from Robotic Drilling Systems (Nabors Industries Ltd. acquired RDS in 2017)

Source: http://evolution.skf.com/de/roboter-im-erdoelgeschaeft/

Benefits

- Increased efficiency and huge cost savings due to reduced unscheduled downtimes in the production processes
- Reduction of risk to workers, and installations/assets (HSE)

Challenges

- Integration of the heavy automation robots in the drilling operation process
- Investments will only be made with higher oil prices

Impact

- Complete change of working on oil rigs: e.g. autonomous communication between technology, supplier, etc. and almost no humans interacting during the drilling processes.

Sources: SKF, ARGOS, OFFSHORE TE,

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Commodity trading on decentralized platforms

Modernized trading in the Oil & Gas industry

Due to inherent complexity caused by involvement of third-party intermediaries, the current commodity trading processes are paper & labour intensive. With the use of blockchain technology, all parties involved in the transaction would be able to share data directly via an encrypted distributed ledger without any central authority. The decentralized platform could allow companies the peer-to-peer sharing of trade agreements as well as delivery and payment documents in real time. Current inefficiencies such like fraudulent transactions and duplication of trade & authentication processes can be avoided by a wide application of blockchain.

Detecon's perspective

The blockchain technology allows new ways of commodity trading. In comparison to centralized commodity exchanges, blockchain based trading platforms can process transactions in a cheaper and more cost effective way. The tamper proof ledger prevents fraud & increases transparency as well as security for all parties involved in the business.

Companies **should observe** the new trading alternatives based on blockchain. At the same time, they should be aware that intermediaries (e.g. banks) or national regulation authorities are potential obstacles to the dissemination of blockchain technology in oil & gas industry.

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Figures & Facts

Komgo SA as example for industry initiatives

Founded:	2018
Located:	Geneva
Purpose:	Development of a blockchain based, distributed commodity trading network.
Technical Platform:	Ethereum
Partner:	Shell, Mercuria Energy Group Ltd, SGS, Koch Supply & Trading, ING, BNP Paribas

Benefits

- Increased Security
- Increased Transparency
- Optimized Efficiency due to lower overhead costs
- Enhanced compliance
- Reduced cash cycle time

Challenges

- National regulations and restrictions
- Resistance from third-party authorities
- Low confidence and acceptance of disruptive technologies

Impact

- Automation of manual processes, labor will be replaced by technology

Sources: Blockchain Council, Trafigura, komgo

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Data driven optimization of oil field operations

Data driven decisions increase efficiency and safety

Rising technologies such as low cost sensors, 5G, IoT and AI enable companies to gather large amounts of data along their up- and downstream activities. Real-time data from sub-surface or hard-to-access locations help operators to get a better understanding of the actual asset conditions. This enables them to optimize drilling and production operations. The combinations of reall-time and historic data sets also allows predictions and computer based recommendations for operational decisions in the field.

Detecon's perspective

The ability to gather, analyse and interpret data will become a critical success factor for O&G Companies in the future. Companies that analyze data from their assets in the right way are able to utilize its full potential and optimize processes along the entire value chain.

Companies need to **act now** in order to get experience in this important field. It is also important to start the dialog with traditional vendors as well as new analytics startups. Interoperable systems along the entire value chain and across different vendors enable companies to unlock the full optimization potential of their data.

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Figures & Facts

Reduction of necessary drilling time through smart borehole sensors by	50%
Increase of production rate for fully optimized digital oil fields	8%
Digital oil field market size 2023 in billion $	28

Benefits

- Increased equipment uptime through predictive maintenance
- Detection of performance anomalies
- Performance improvements due to data-driven insights

Challenges

- High costs upfront for infrastructure setup
- Data protocols need to be standardized across the industry for interoperability
- Clarification of data ownership

Impact

- Utilizing the value of data and unlocking its full potential will become a key competitive advantage in the market

Sources Reuters, Chevron, Marketwatch, Forbes, Oil & Gas Investor, WorldOil

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Decentralized supply chain tracking

Supply chain tracking along the entire value chain based on blockchain technology

With the use of blockchain technology, large parts of crude oil transactions may be digitized. By engaging on a distributed ledger platform, all parties in the value chain may simultaneously view and share data on the status of the transactions, from extraction in the field to the gas station. One player in the industry who wants to bring the petroleum supply chain on the blockchain is IBM. Large energy companies such as Abu Dhabi National Oil Company (ADNOC) are already testing IBM's blockchain based supply chain solution.

Detecon's perspective

Blockchain-based supply chain tracking offers high potential for cost savings and efficiency improvements along the entire supply chain.

Although blockchain-based O&G projects are still in an early phase, companies should **observe the market developments.** This enables them to act quick in the moment when blockchain-based solutions are reaching a level of maturity for the market. Accordingly, the industry is favorable to major changes and likely to operate in a completely different way in the upcoming decade.

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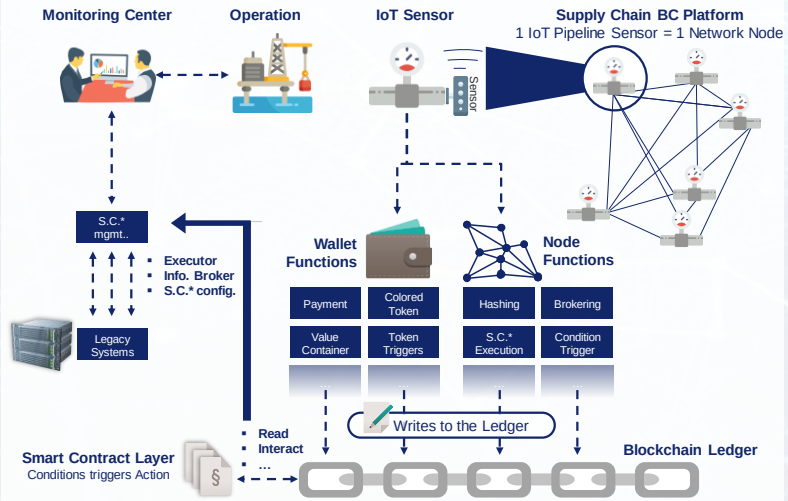
Blockchain technology in O&G



Benefits

- Increases transparency as all involved parties work from the same record book
- Eliminates the risk of routine errors
- Real-time access to trade documents and shipment status

Challenges

- Companies fear loss of strategic advantage due to more transparency
- Electronic bill of lading does not yet have the same standing as a paper document
- Costs for technology adoption

Impact

- Jobs of middle office professionals will be affected

Sources: Bloomberg, IBM, WorldOil, Financial Times, Energyfuse, Kryptomag

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Smart Gas / Service stations

Smart Gas & Service Stations increase the customer experience

By transforming the usual Gas Station to a Smart Gas & Service station, customers will be able to drive into the station while cameras & a platform will be recognizing the cars by LPR. The fuelling will be done by workers & the payment will be automatized in the back (drivers have to be registered on the platform with their licenses), after the fuelling process the drivers will drive out without having participated in the process. Other services would contain paying utility bills, booking movie tickets, and other such services can get clubbed together to increase convenience and boost customer retention.

Detecon's perspective

Self service fuel pumps do already exist. The next level of Transformation is the fully automated gas & service station.
After an era of independence, the trend is moving back towards arranging gas station stops as quick and convenient as possible.

However, the trend is not only caused by the convenience of customers, but also by the automotive movement, which is making the gas station more and more irrelevant.

Companies should work on a Smart Service Station concept to keep their business alive with new services and a better customer experience.

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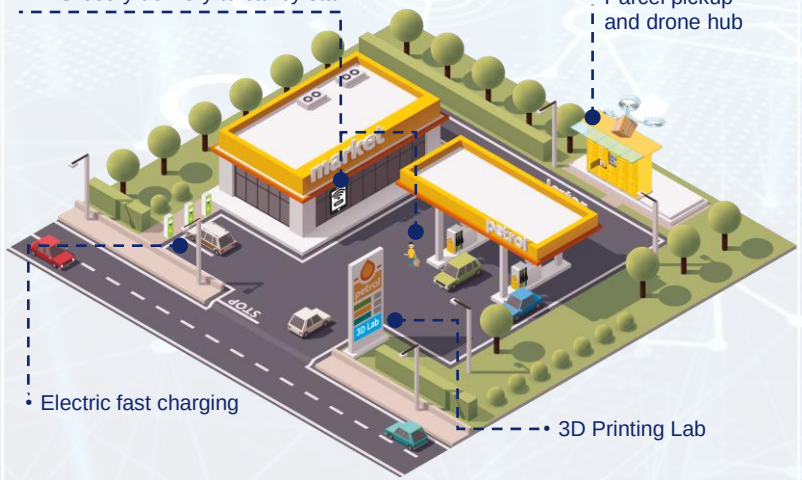
Future Gas Station

- Mobile payment inside the car
- Grocery delivery to car by staff
- Parcel pickup and drone hub
- Electric fast charging
- 3D Printing Lab



Benefits

- Increased convenience for customers
- Maximizing impulse sales opportunities through next generation, pump-TV-enabled fuel-dispensers
- Predictive Planning of workflows

Challenges

- Coordination of partners from different industries
- Development of new processes to deal with autonomous cars
- Complex and cost intensive infrastructure

Impact

- Changing role of gas stations for the surrounding community

Sources: Detecon

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Companies need to handle the trends depending on the trends maturity.

Act now

- Automated site inspection
- Data driven optimization of oil field operations

- Immediate implementation of technology is recommended
- Be highly pro-active
- Get into contact with potential vendors

Be prepared

- Smart Gas / Service stations
- Autonomous Oil Rig Operations
- Additive onsite spare part production

- Continuous tracking of technology and being able to adapt quickly
- Analyze first proof of concepts and internal conditions for implementation

Observe

- Commodity trading on decentralized platforms
- Decentralized supply chain tracking

- Check on regular basis for maturity and market penetration level

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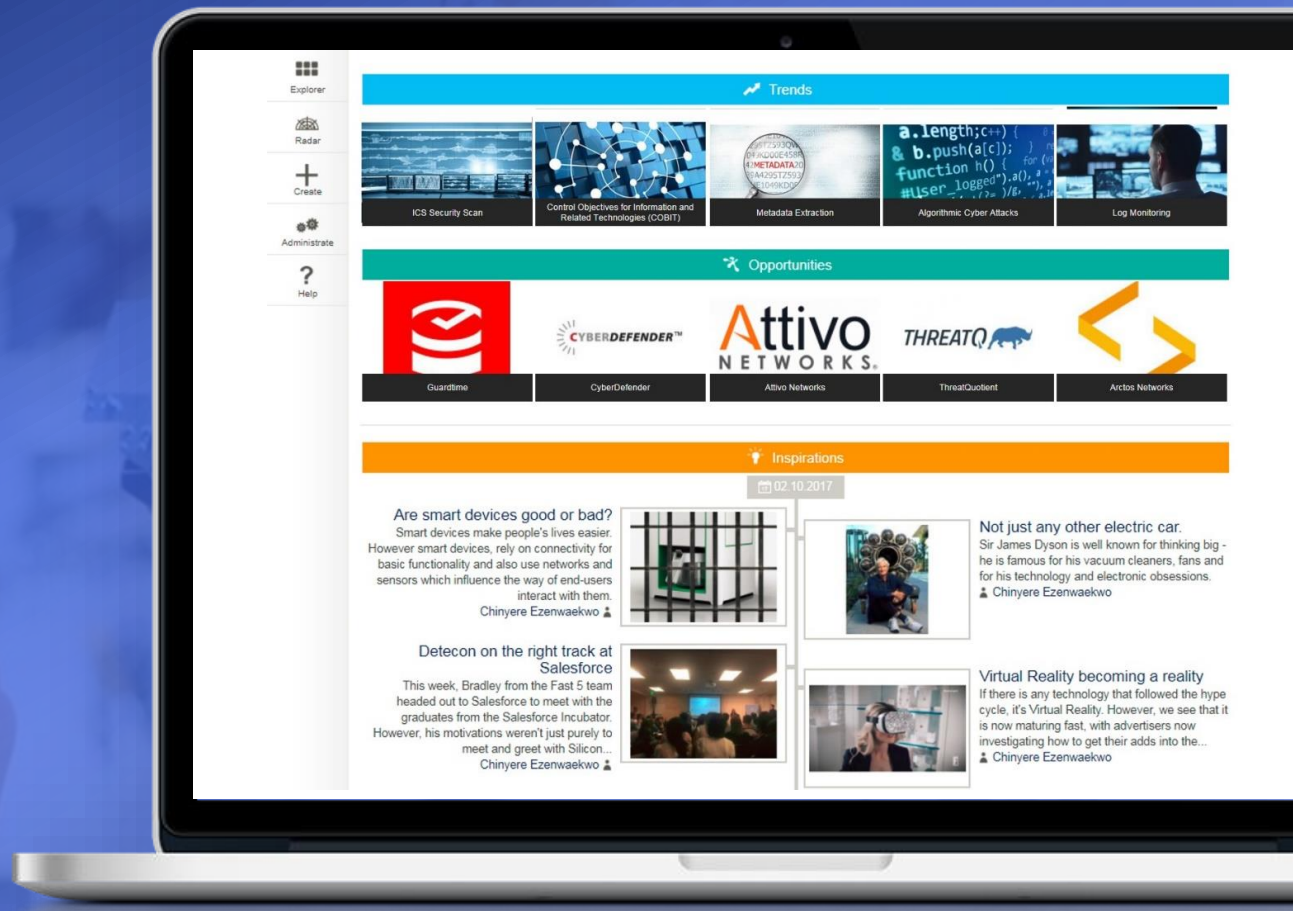
DETECON Trend Radar

An Overview of all Relevant Trends and Startups in One Tool

Browse through all trends, technologies and startups with an impact on your corporate environment

Powered by itonics shaping innovation



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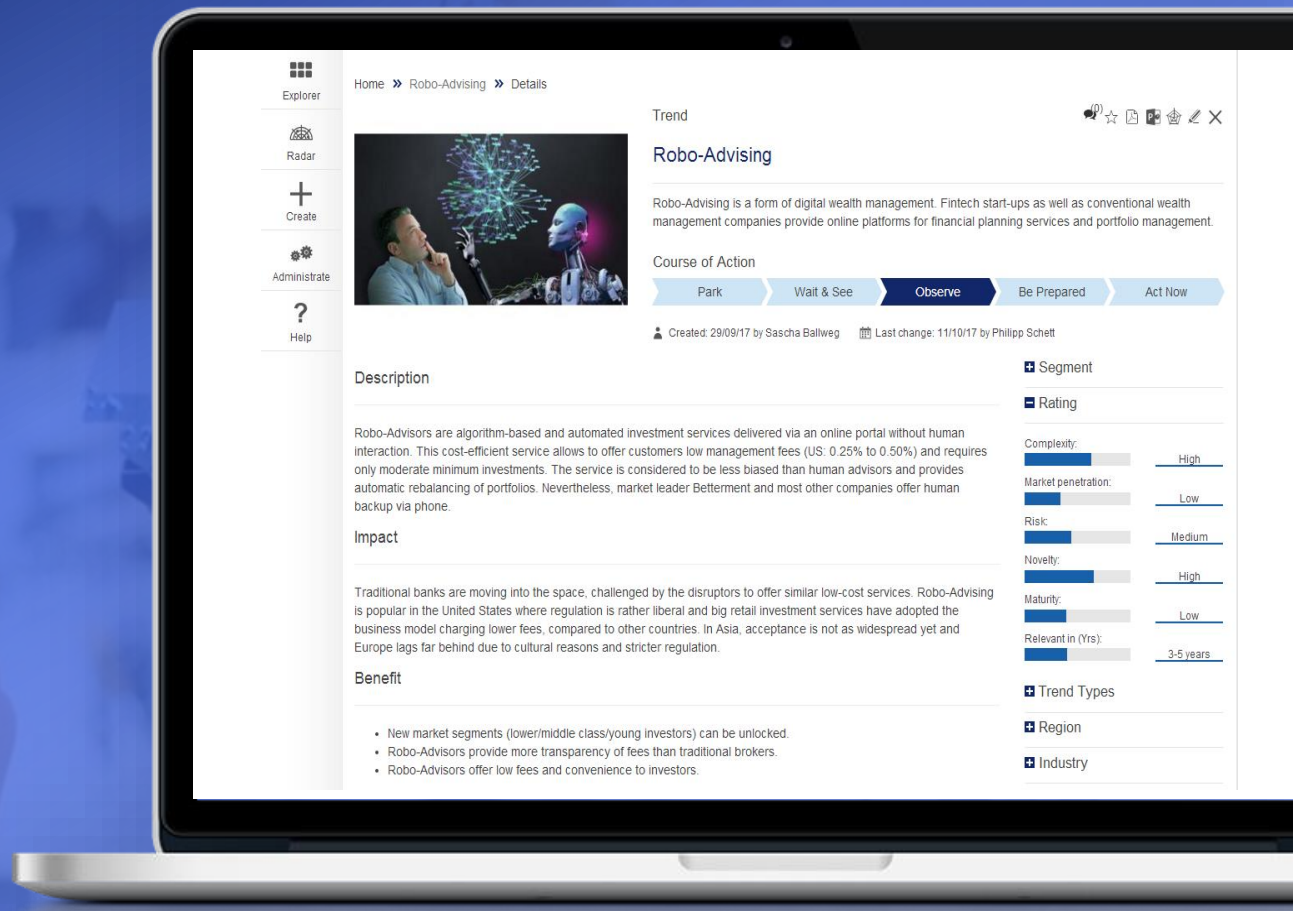
Collaborative Evaluation

Collaborative evaluation and selection of relevant trends and technologies

Import and Export

PDF, Excel, PowerPoint.



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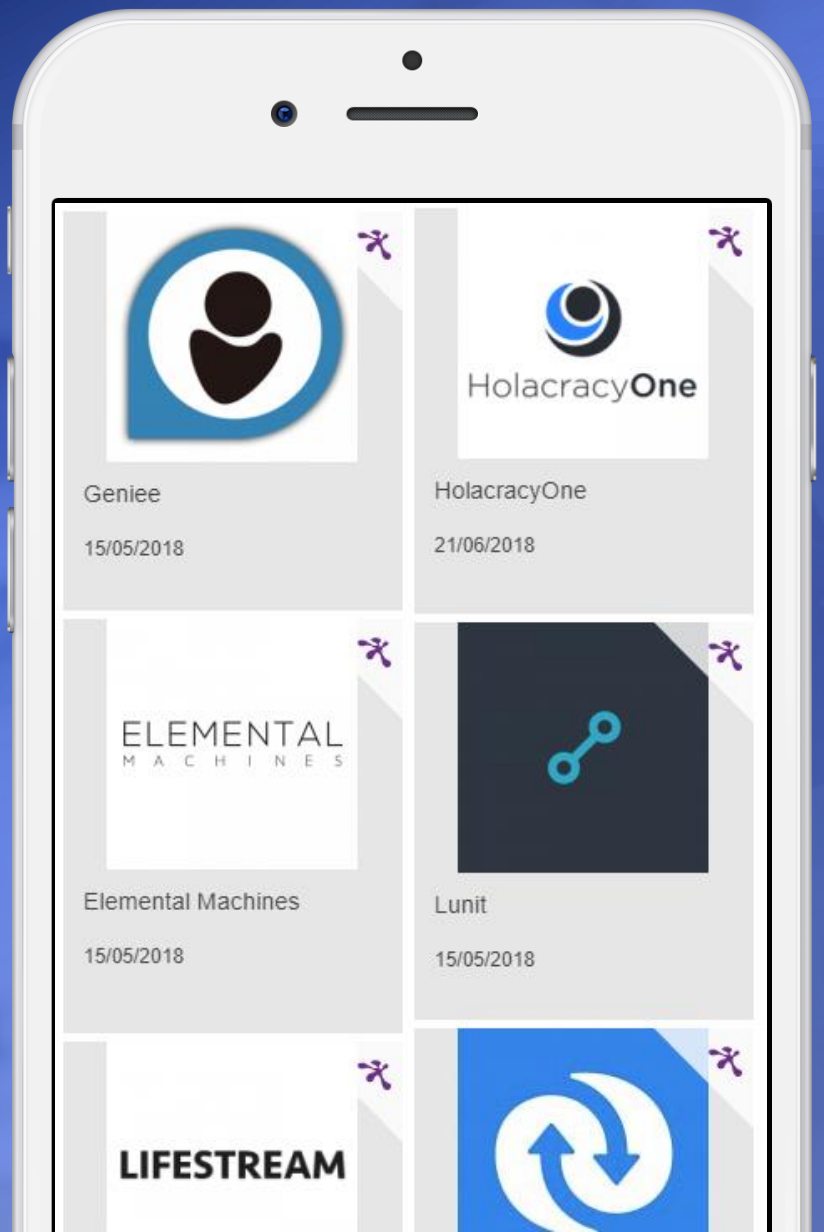
DETECON Trend Radar

Mobile Ready UX

The Detecon Trend Radar User Experience is optimized for any device.



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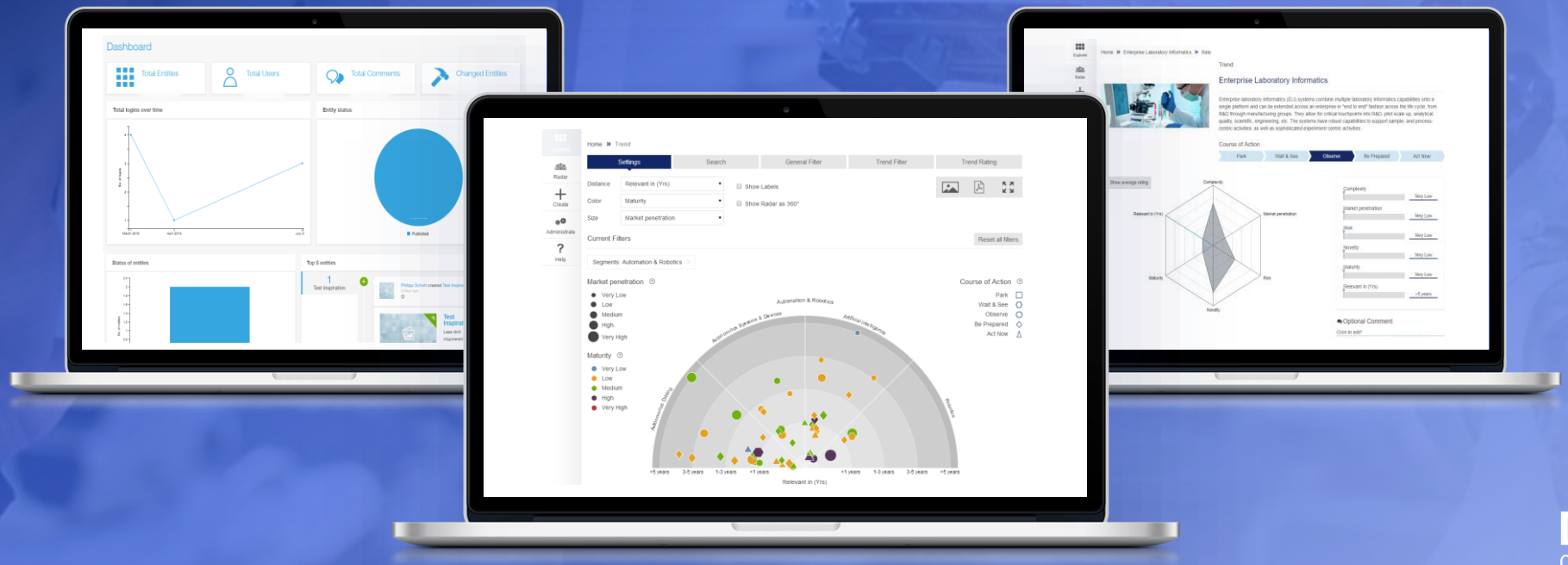
Centralized Scouting and Monitoring

Collaborative identification, selection, structuring and evaluation of trends, technologies and startups

Dynamic Data Visualizations

Visualization of trends, technologies, centers of gravity and fields of action



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Detecon is the leading consulting company that unites management know-how with great digital technology expertise.

- More than **20 000 projects completed** worldwide
- **1 200 employees** in our offices worldwide
- Clients in more than **165 countries**
- Colleagues from more than **40 countries**

Our clients in the energy industry

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