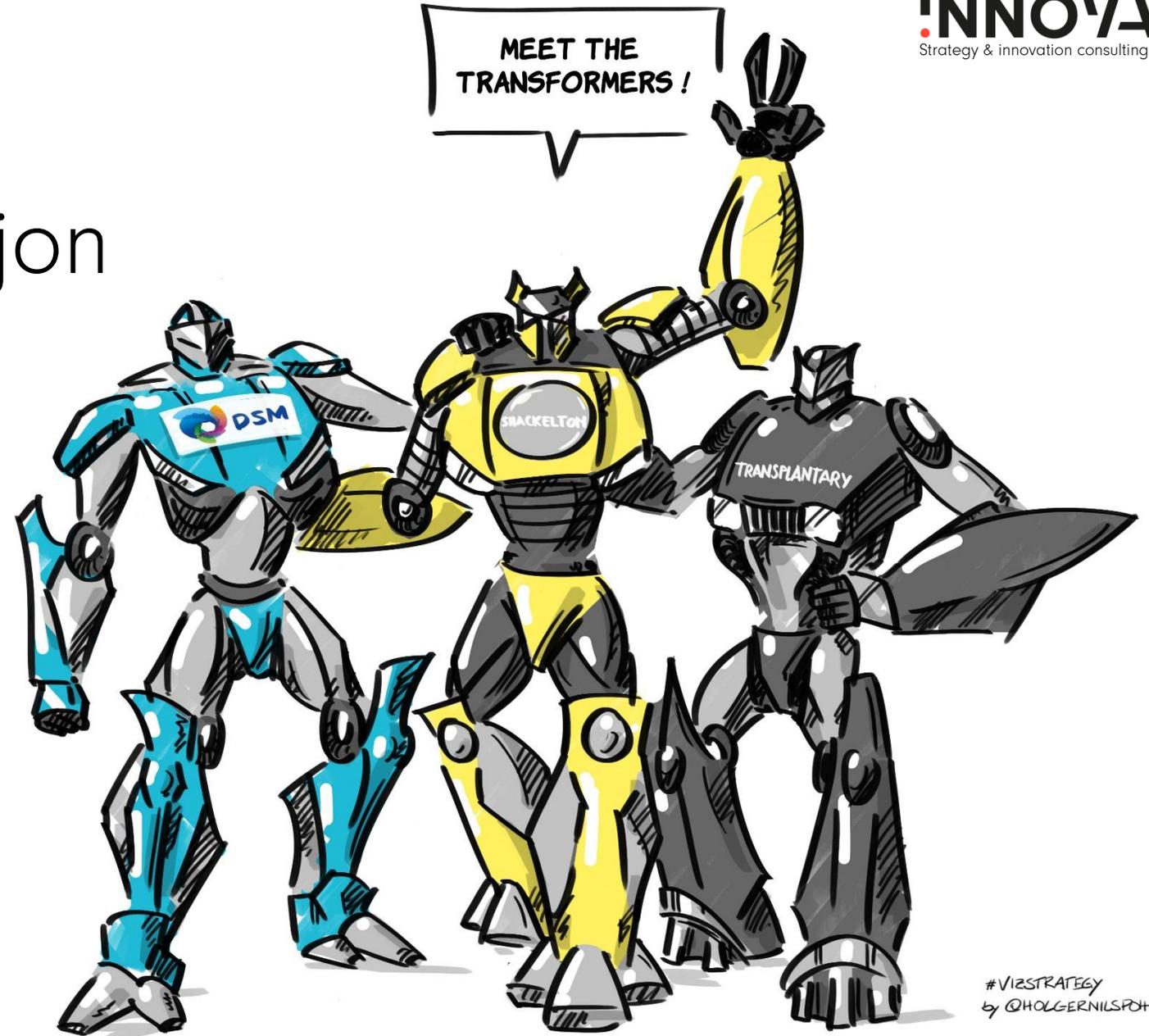


Strategi og innovasjon for fremtiden



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facebook.com/engageinnovate



Christian Rangen

**ENGAGE//
'INNOVATE**



think outside
the planet



INNOVATION
DOCK

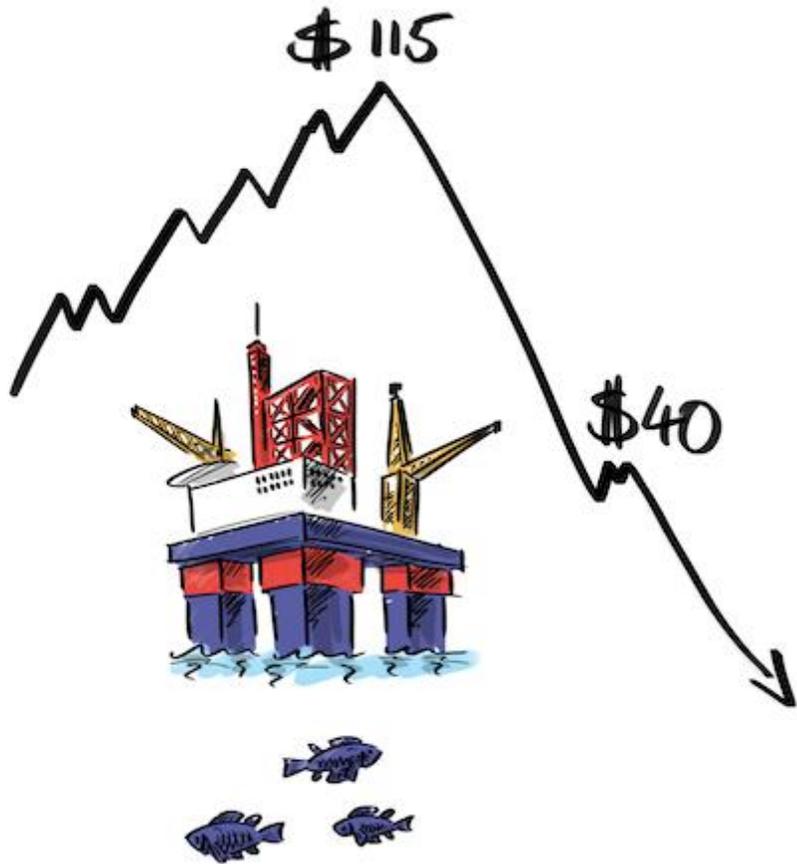
Golden rule:

There Are No Stupid Questions

Golden rule II:

There Are No "Holy Cows"





Hvor står vi?

DN
Dagens
Næringsliv



**Verdens
nordligste
whisky**
Helgeland byr på mer enn en vakker kyststripe.



Fast food
Spis gode
karbohydrater
før krevende
konkurranser.



**DNB om olje- og
offshorebransjen:**

Nedtur til 2018



Forlenger krisen: Konsernsjef **Rune Bjerke** og DNB-ledelsen er nå mer pessimistiske enn de var for noen måneder siden.

**Rammes
av farmasi-
kollaps**

Ole Andreas Halvorsen
eier aksjer i Valeant.



Ny klimarapport:

Verden trenger mer olje om 15 år

INSIDE: AN ESSAY ON THE SUBURBANISATION OF THE WORLD

**The
Economist**

DECEMBER 6TH - 12TH 2014

[Economist.com](http://economist.com)

Technology Quarterly

Shinzo Abe's last chance

Boost your business with a drone

P.D. James, queen of the sleuths

Our books of the year

Sheikhs v shale

The new economics of oil







Have Tesla and Apple disrupted the auto industry past the point of no return?





SNAPPET

Fornybar dominerer ny utbygging i USA

Av 7,2 GW ny energikapasitet fra de tre første kvartal i 2015, sto fornybare ressurser for over 60 prosent, skriver **REnews**.

Folk som bor rundt Persiabukta kan om noen tiår risikere å måtte slite med så høye temperaturer og luftfuktighet at menneskekroppen ikke er i stand til å håndtere det, skriver Dagens Næringsliv om ny studie.

“Jeg har jobbet med olje og gass over lenge tid og ble overvældet over det momentum fornybar energi har, da jeg begynte å sette meg inn mitt nye arbeidsfelt”

Statoils fornybarsjef: - Overvældet over farten



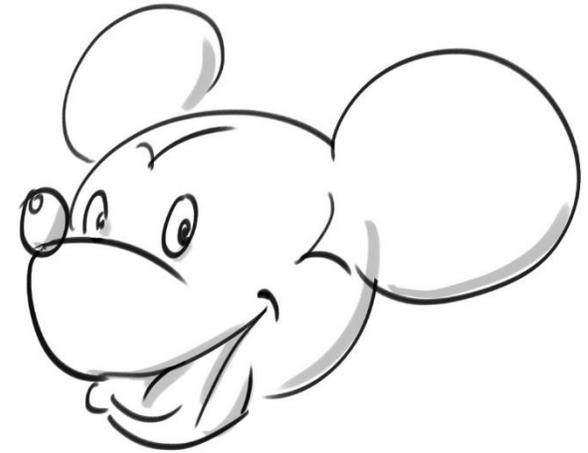
International
Energy Agency
Secure
Sustainable
Together

World Outlook Energy 2015

London, 10 November 2015

Where Are We Headed?

4 SCENARIOS



#1 BOUNCE

Assumption of oil price interval: \$60 - \$95

The current economic downturn is just another cyclical activity. Things will pick up and return to normal. Granted, the oil price is not truly likely to reach its peak of \$115, but don't worry, things will pick up soon enough. We'll be okay...

#2 TRANSITIONS

Assumption of oil price interval: \$40 - \$65

Norway leads the future of energy. Crossing energy frontiers. Norwegian companies across industries all look to various “omstilling” or transition programs. Statoil New Energy Solutions grow to become a national flagship, driving growth around a new industry. Early movers like Umoe, Statkraft, Lyse grow to become international thought leaders. Wind, sun, smart cities, electrical ferries are all small examples of the national transition. The ocean space, fishing and shipping, offshore tech are all booming areas with global growth ahead.

Regretfully, the west coast (oil) region was slow to see the opportunities and fell well back, behind faster moving companies and political entities. Most research programs to go NTNU, Aas and Tromsø. UIS still believes it serves the oil industry and continue to graduate oil and gas engineers left to struggle with lack of relevant jobs and medium-term unemployment.

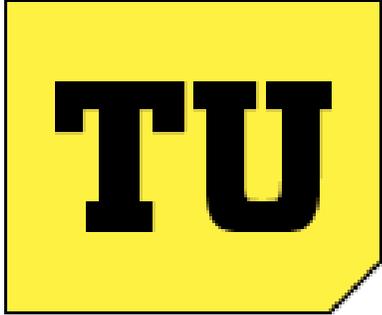
#3 SHOCK

Assumption of oil price interval: \$12 - \$40

The Norwegians never knew what hit them. By the time they realized the structural shift, they had downsized half the oil & gas industry. 40 years of industry building, made redundant in 24 months. It was a shock, really, to slowly wake up to a new economic reality.

The massive oil reserves were still there, but a combination of geopolitics, new energy solutions, consumer behavior, electric vehicles, inflated cost structures and environmental shifts made Norwegians intimately familiar with the notion of "Stranded assets". Oil major got hit by lawsuits, much like tobacco and asbestos companies has before them. Sure, the Norwegians had the capacity the change.... But it was too little and way to slow.

At its peak, the unemployment rate rose to 17% as people struggled to adapt skills from oil & gas into new industries. While employment opportunities did recover, nothing ever rose to fill the high-margin, high-value role the oil industry had enjoyed, causing a generation-long slide in salaries, living standards, tax income and government services



200.000 årsverk kan gå tapt mellom 2014 og 2020, ifølge en splinter ny rapport. Foto: Erlend Tangeraaas Lygre

NEDGANGEN I OLJEINDUSTRIEN

Sjokkrapport advarer: 200.000 årsverk kan gå tapt



Oljeminister Tord Lien hadde ikke forutsett det kraftige oljeprisfallet. Han mener likevel det ikke er grunn til panikk i oljebransjen.

Energi Olje

- Ikke få panikk, ikke få panikk

- Vi har sett oljeprisen falle før, og vi vil se den falle igjen, sier oljeminister Tord Lien.

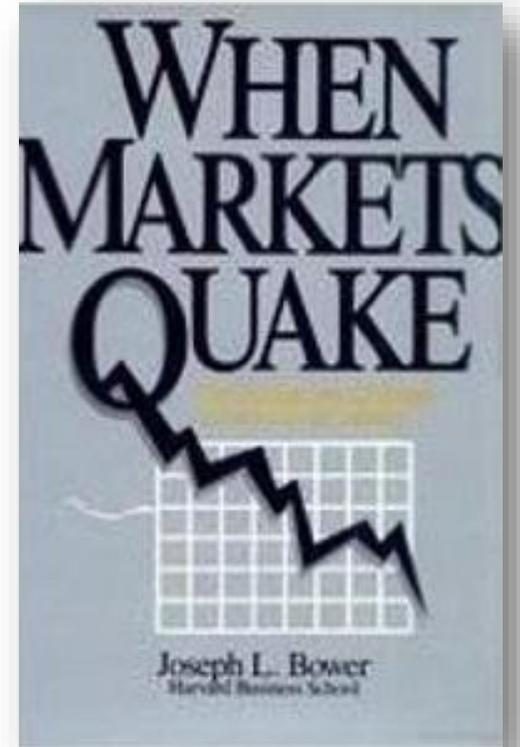
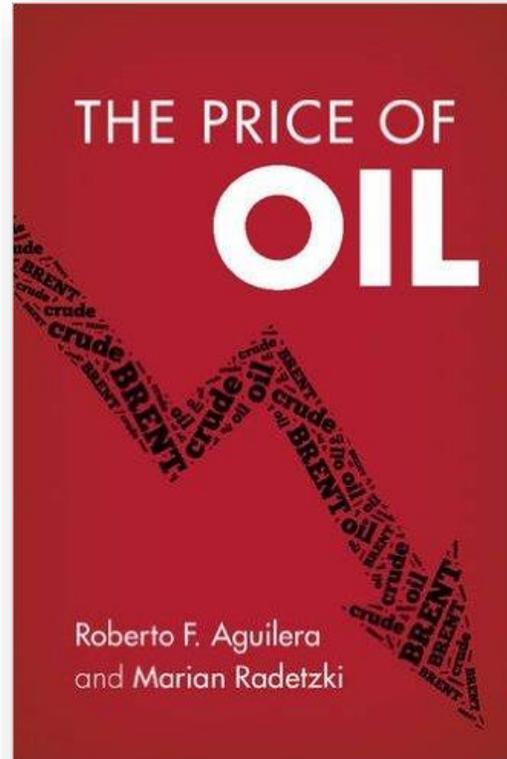
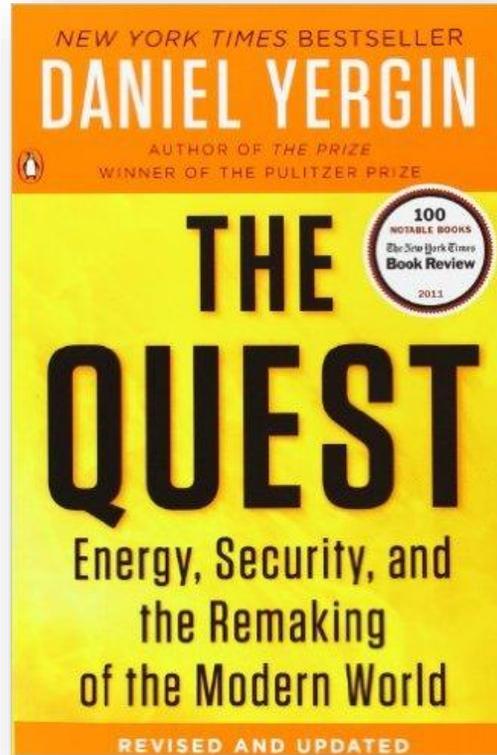
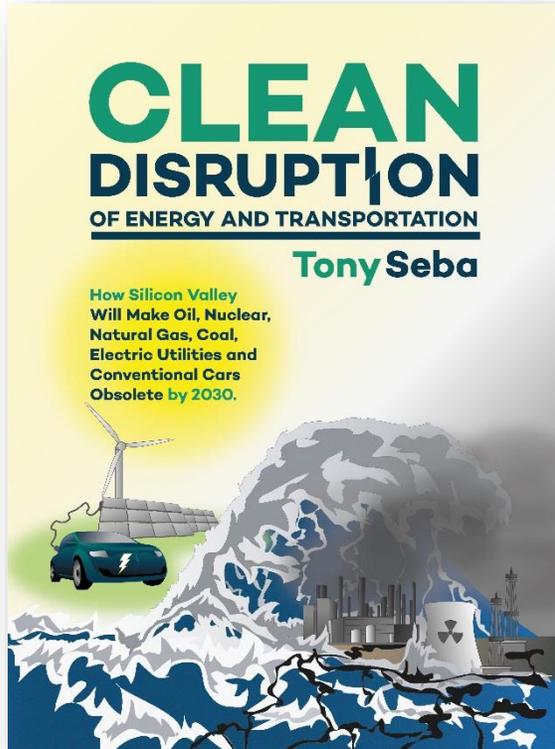
#4 LEADING TRANSFORMATIONS

Assumption of oil price: less important

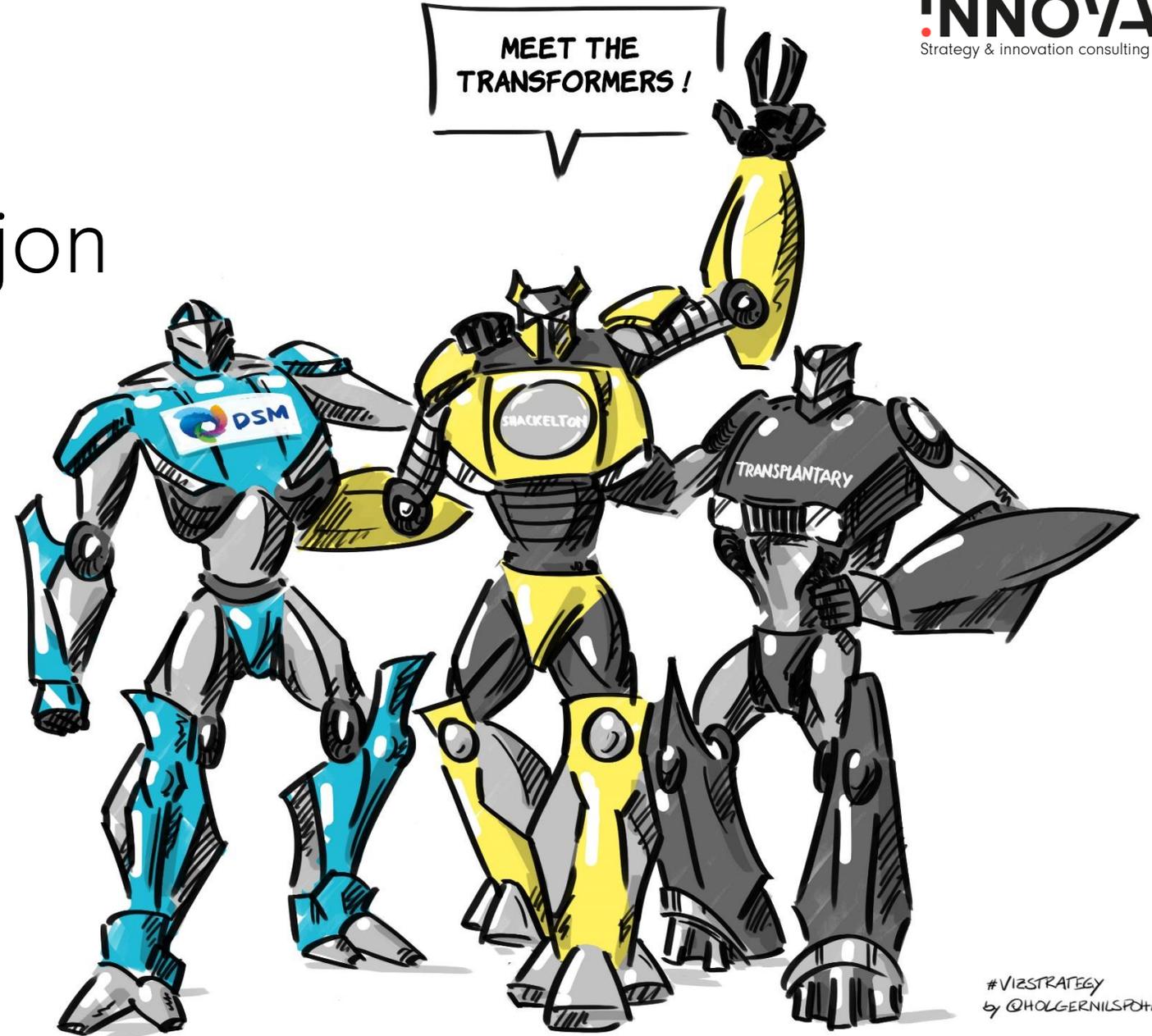
This is our aggressive, innovation-driven scenario

Companies and government align to drive a wave of new growth efforts. Kongsberg CEO, Walter Qvam and his vision of Norway 6.0 gains national momentum. Companies rise from a wave of cost-cutting efforts to launch new growth programs. Innovation becomes the new normal. Strategic transformations are being studied at a national level. Companies are deploying funds and funding mechanisms in entirely new areas, including corporate venturing. Firms aggressively recruit global business developers with new mindsets and new ideas. Industrial technology development around McKinsey's 12 Disruptive technology becomes normal.

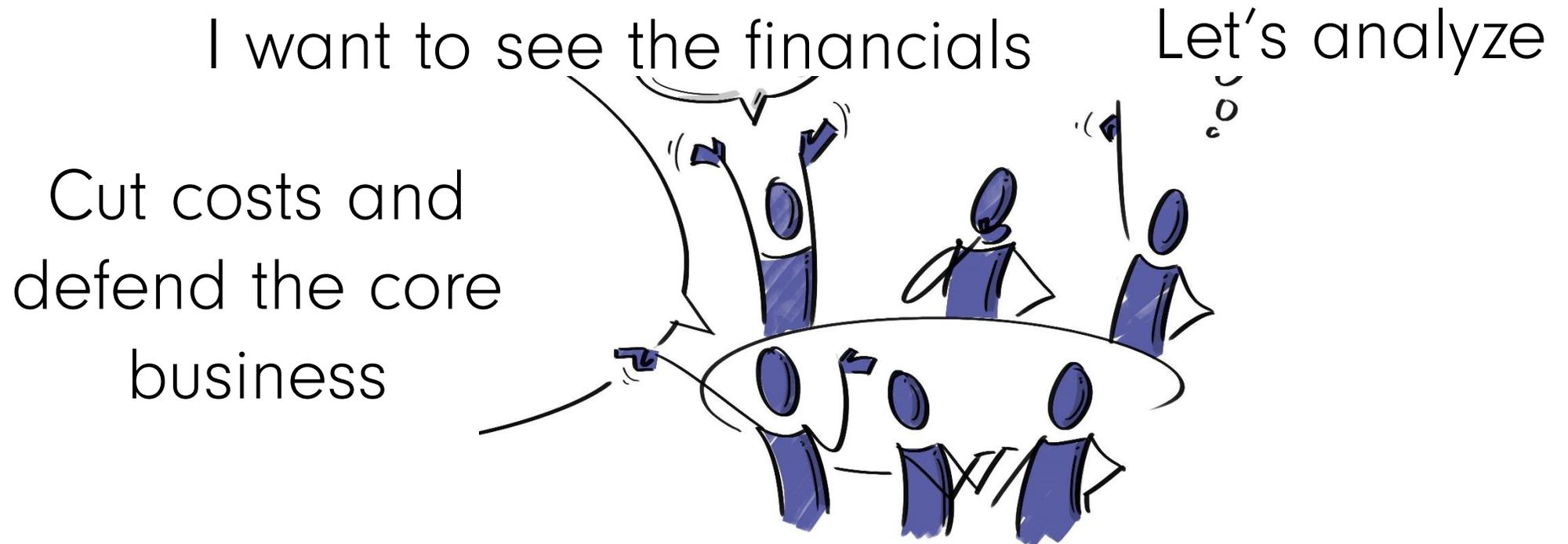
Flagship companies like Tesla Energy, Microsoft Citynext, Google Ventures, DSM are all attracted to Norway. Statoil downsizes to 12.000 people but invests radically in software, systems and advanced robotics systems. Smart City developers all look to Norway, as the country becomes a hotbed of innovation on technology & big ideas. **Norway reinvents itself.**

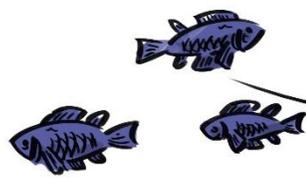


Strategi og innovasjon for fremtiden

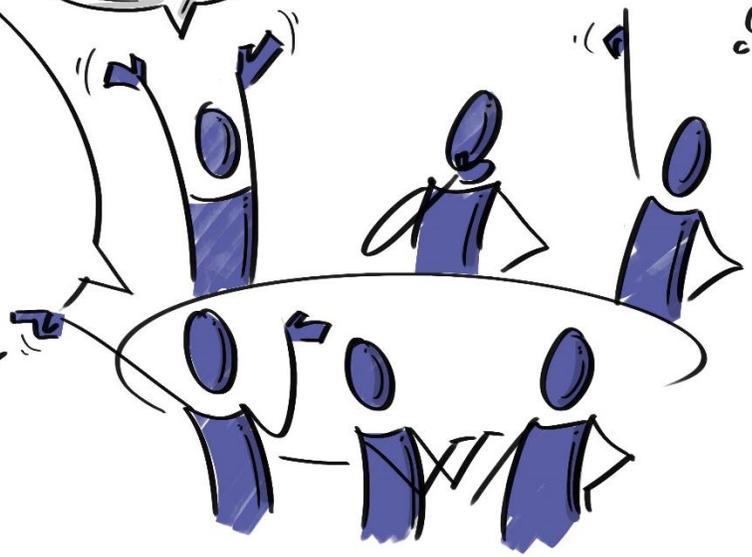


Your typical **Board of Directors** or **Top Management** teams





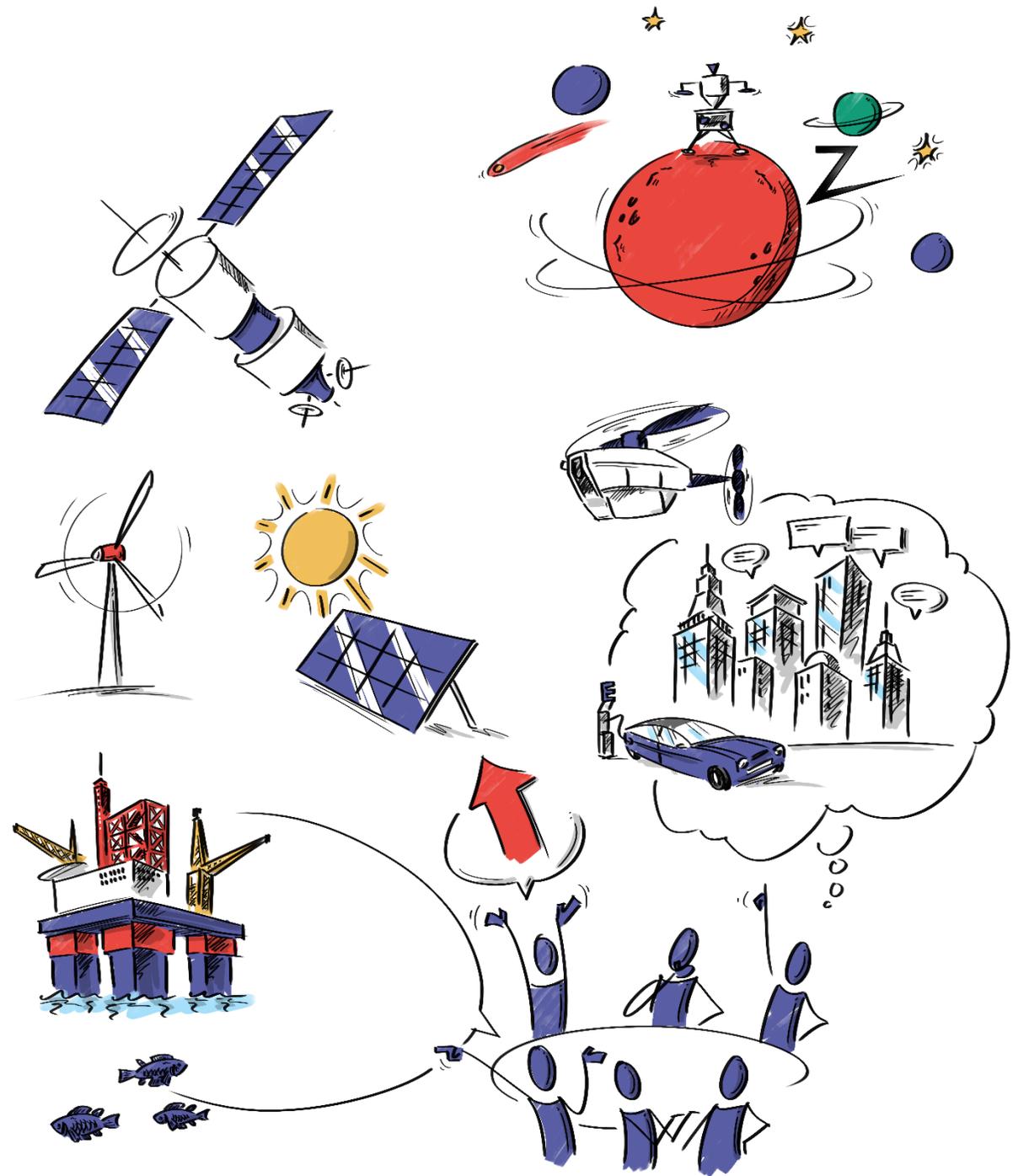
Cost-cutting



Transformasjons- kompetanse



Etablert kjernevirksomhet



Tenk forretningsmuligheter som ligger «just beyond the horizon»



Nærings- og fiskeridepartementet

Gode ideer – fremtidens arbeidsplasser

Regjeringens gründerplan

Omstilling Regjeringens gründerplan

Regjeringen la denne uken frem gründerplanen «Gode ideer – fremtidens arbeidsplasser». Denne nasjonale satsingen er god for en region i omstilling. Om vi velger å ta imot.

En gylden mulighet for regionen

Denne uken, på TV2 God morgen Norge, kunne vi se Christopher Hof-tun i Stavanger-bedriften Zaptec snakke om boring på Mars. Forrige helg, på NRK-programmet Lindmo, fortalte UIS-studentene Suresh og Fritjof om deres sommeropphold hos NASA, støttet av blant annet fylkeskommunen og ONS. Rundt «smart-byen Stavanger» vokser det frem bedrifter, forskning og kompetanselynger med betydelig eksportpotensial. Mange av disse reiser til Stockholm og Barcelona for å jakte nye markeder for våre nye tanker, tjenester og løsninger.

I oljebyen Stavanger i dag vokser det frem en helt ny generasjon bedrifter bygget på vår unike kompetanse og teknologi som har vokst ut fra oljebransjen. Mange av disse er små, lettbevte og har et globalt marked foran seg. Disse støttes tydelig i regjeringens gründerplan. Her vil vi kunne se et stort løft over de neste årene.

Innovasjon i etablerte bedrifter
Små oppstartsselskap er viktige, men også store bedrifter inviteres med i gründerplanen. «Vi vet ikke hvor de nye jobbene vil bli skapt. Innovasjon og nye arbeidsplasser har sitt utspring både fra eksisterende bedrifter og næringer – og fra helt nye ideer», sier næringsministeren. Dette skaper muligheter for stadig mer nytenkning og innovasjon i også etablerte selskap. Rollen som «Chief Innovation Officer», intra- og transformasjonskompetanse blir viktig i regionen fremover.

Regionens ledere må klare å heve blikket fra dagens kostnadsrett, effektivisering og nedbemanning, og tenke forretningsmuligheter som ligger utenfor horisonten. Det inviteres til ytterligere nytenkning i Rogalands næringsliv.

Diamantskip, boring på asteroider, drone-løsninger, industriell 3D-printing, digitale helseløsninger og selvkjørende biler er alle mulige vekstområder for regionen. Gründerplanen skal hjelpe til å utvide lønnsomme vekstbedrifter, med hjelp av blant annet Innovasjon Norges FRAM-program for internasjonal vekst.

Regjeringens oppskrift
Næringsminister Monica Mæland presenterer tre hovedsatsninger fra regjeringen:
► Bedre tilgang på kapital i tidlig fase.

Historisk betinget står vi rustet for fremtiden.



Christian Rangen
Strategirådgiver i Engage/Innovate



Elisabeth Øvstebo
Strategirådgiver i Engage/Innovate



Det bobler av innovasjonslyst i regionen, som hos Future Home i Sandnes, der (f.v.) Bjarne Handeland, Odd Eivind Evensen og Erik Stokkeland utvikler smarte løsninger. FOTO: PÅL CHRISTENSEN

► Økt tilgang på kompetanse. Disse tre vil være sentrale bærebjelker for å «styrke næringslivets omstillingsevne og konkurransekraft».

Men det krever at ledere og bedriftene deltar i arbeidet og de satsningene regjeringen nå inviterer til. I regionen vår finnes kompetanse og det finnes en satsning på nye ting. Historisk betinget står vi rustet for fremtiden, her på Vestlandet.

Nye møteplasser

Regjeringen vektlegger betydningen av nye møteplasser hvor grunder, kompetanse og kapital kan møtes. Dette er hele ideen bak miljøer Dock.

Innovation Dock ble startet januar 2015 for å være en plattform for innovasjon for vekstselskaper i alle faser. Det skal være en møteplass og en yngleplass for ideer, innovasjon og ny vekst. En innovasjonsfabrikk, sier vi, med samarbeidspartnere i

San Francisco, Amsterdam og København.

Som en møteplass ønsker vi rebusjett velkommen for å styrke det kede midler til en sør- og vestlandsregion i kraftig omstilling vil finne dagens arbeidsplasser.

Det er spennende å se at regjering trekker frem potensialet i flere mense VEKST og Start i Norge er re. Med særlig høy andel høykompetent, internasjonal arbeidskraft i regionen vil VEKST kunne være en trigger for flere multikulturelle gründerne i Rogaland. NHO Global Future har lagt et bra grunnlag allerede.

Neste år vil Innovation Dock, fullt utbygget, være en sentral møteplass en viktig brikke i regjeringens visjon for et nytt næringsliv.

I skrivende stund sitter designere, digitale innovatører, utviklere av droneteknologi og smarte hjem-tek-

nologi og romfartseksperter på Innovation Dock for å utvikle nye vekstbedrifter. Etablerte bedrifter lærer om digitale forretningsmodeller med Google X, Lego og Tesla. Nye tanker spirer frem.

Næringsministeren sier: «Gründerkap krever store doser utholdenhet og entusiasme – og det krever kompetanse, nettverk og kapital.» Vi tror Stavanger-regionen deler denne entusiasmen om fremtiden.

Mulighetene ligger foran oss

Regjeringen har lagt frem en god og klok gründerplan. Nå er det opp til oss å gripe tak i de muligheter som ligger foran oss. Norge og Rogaland skal bli et sted der gründerne kommer for å realisere lønnsomme ideer. Det er regjeringens mål. Det er vårt mål.

Christian Rangen og Elisabeth Øvstebo er strategirådgivere i Engage/Innovate, medredaktører i Innovation Dock, høyskoleforelesere og foredragsholdere innen innovasjon og strategi.

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Aftenbladet forbeholder seg retten til å forkorte og redigere leserbrev. De blir redigert etter Vær Varsom-plakatens regler om saklighet

NORWAY203040

Forretningsmuligheter
i det grønne skiftet.





Smarter Homes

Smarter Cities

Kleven bygger diamantskip

Publisert

24. oktober 2014 12:38



DE BEERS

A DIAMOND IS FOREVER

De Beers is definitely innovating and has contracted Norwegian shipbuilder Kleven to build a 113 meter-long diamond exploration ship for use offshore Namibia. This first-of-its-kind vessel will be of MT 6022 design from Marin Teknikk, a proven design from the offshore oil and gas sector.

"Underwater mineral exploration is a new segment for Kleven, and we look forward to working closely with De Beers on the realisation of this highly advanced vessel. Our offshore experience and expertise combined with De Beers competence and innovative strategy on this field has led to the development of this unique vessel," says Ståle Rasmussen, CEO of Kleven.



Cage Farming



Plastic Cages

AKVA group is the world's leading supplier of plastic cages. Polarcirkel cages are designed for rough conditions and more than 42,000 cages have been delivered.



Steel Cages

Wavemaster is also the world's leading supplier of steel cages and provide an ideal platform for fish farming. More than 12,000 cages is delivered since 1985



Nets

The EcoNet is made from very strong but light weight PET being virtually escape proof, predator proof and has a 20-year lifespan compared to nylon nets that often only last 4-6 years.

the second Wavemaster 850 Panorama ever sold. The first one was sold to Grieg Seafood late autumn last year, and is already in operation. These barges are the world's largest steel feed barges, with a holding capacity of 850 tons salmon feed and 12 parallel feed lines.

14.11.2014

AKVA group ASA:

Company presentation

AKVA group ASA has prepared a new company presentation. The company plans to participate in an upcoming investor seminar in London in week 47 where this company presentation will be used.

29.04.2014

Cermaq goes for EcoNet

Cermaq Norway has recently signed a contract with AKVA group for delivery of Polarcirkel EcoNets and Plastic Cages for a complete salmon farm in Northern Norway. The contract totals 14,5 MNOK and delivery will be in 2Q/3Q - 2014.



Net Cleaning Systems

Akvasmart Net Cleaners with 2 discs can easily be operated from the cage by a single person. Larger cleaners can be operated using a crane, winch, cap



Feed Barges

AKVA group is today the leading supplier of feed barges with decades of experience and more than 250 barges delivered in many regions of the world.



Feed Systems

The central feed system concept was invented by AKVA group in 1980 and Akvasmart CCS is the most popular and reliable feed system worldwide.

[News archive](#)

Low cost renewable energy

powering your business





Future proof.

Being able to communicate with other devices, makes it possible for the SMART to become even more intelligent, efficient and save power. The charger speaks all the languages in the device universe fluently, and upgrades its brain wirelessly.

If you upgrade your electrical system from 230V to 400V to increase capacity, the SMART follows. No need to change anything. No need to buy anything. Just turn it back on and it is ready to operate at a new and faster speed.

For owners of larger installations, we will offer SMART PRO software tools, enabling you to monitor and optimise your installed charging stations on the fly, saving time and money in the process.



Interested to know more about ZapCharger Smart and how it



Zaptec har utviklet en fullisolert galvanisk transformator ned i så liten størrelse at den kan integreres i en ladekabel til en elbil. Zapcharger portable er dermed den første ladekabelen med innebygget elektronisk transformator. Foto: Zaptec

ZAPTEC - NORWEGIAN TECH AWARDS 2015

Stavanger-selskapet Zaptec løser elbilenes ladeproblemer

Kandidat 2 til Norwegian Tech Awards 2015: Har utviklet den første ladekabelen med elektronisk trafo.





Avbildet er Scatec Solars solpark i Kalkbult i Sør-Afrika. Foto: Scatec Solar

Næringsliv Solenergi

Kraftig vekst for Scatec Solar

NORDIC OCEAN RESOURCES



Photo: NTNU

[ENGEØ RUTILE](#)

[ENGEØ RUTIL NORSK](#)

[ENGEØ REPORTS 2014](#)

[KVINNHERRAD QUARTZ](#)

[KELIBER LITHIUM](#)

[ØKSFJORD PENINSULA NI,
CU, PGE](#)

[NORDIC OCEAN
RESOURCES](#)

NORDIC OCEAN RESOURCES AS (NORA) IS THE CURRENT SOLE COMPANY IN NORWAY WITH FOCUS ON SEABED MINERALS

Through NORA, Nordic Mining targets to be a pioneer for future development within the area of subsea mineral resources. In 2012, the Norwegian University of Science and Technology (NTNU), Statoil and NORA entered into a joint cooperation project regarding seabed mineral resources. The project is targeting knowledge increase within marine mineral resources and will focus on current knowledge and future areas for research.

Globally, the interest for marine mineral resource has increased strongly over the last years, and a race to secure prospective exploration areas has started among countries and certain industrial companies. The Norwegian Exclusive Economic Zone (EEZ) is an interesting area for

FACTS

OWNERSHIP: 85% by Nordic Mining ASA
15% by Ocean Miners AS

LICENSE STATUS: Positioning for licenses in Norwegian EEZ and international waters

TARGET RESOURCES: Seabed massive sulfides, and other seabed mineral deposits

[REPORTS](#)

David Cameron says seabed mining could be worth £40bn to Britain

Prime minister says UK can be at head of industry but chooses American defence firm to exploit new Pacific licence



David Cameron gives the seal of approval to the seabed mining industry in London on Thursday. Photograph:

Reuters



Black Hornet into UK Core
[Read more >>](#)

Prox Dynamics is now hiring
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Events & Conferences 2015
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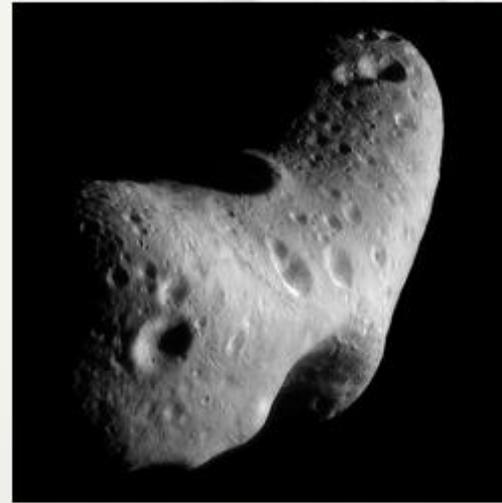
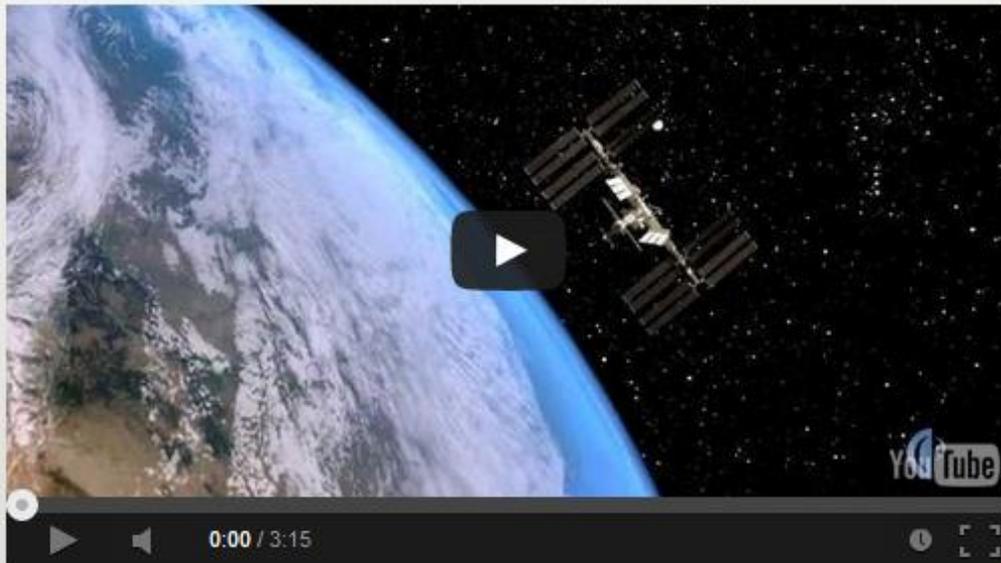
For general questions on Unmanned, or special requests, contact:

press@nordicunma



What if the greatest discovery of natural resources didn't take place on Earth?

There are near-limitless numbers of asteroids and more being discovered every year. More than 1,500 are as easy to reach as the Moon and are in similar orbits as Earth. Asteroids are filled with precious resources, everything from water to platinum. Harnessing valuable minerals from a practically infinite source will provide stability on Earth, increase humanity's prosperity, and help establish and maintain human presence in space.



“I see the same potential in **Planetary Resources** as I did in the early days of **Google**.”



- K. Ram Shriram

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Courage or Capital: The final obstacles for sustainable asteroid mining

Planetary Resources and Accenture discuss the future of asteroid mining.

OVERVIEW





**PLANETARY
RESOURCES**

6742 185TH AVE NE





Prospecting

Using tiny scouts to locate and evaluate space resources

[Learn More](#)

FALCON 9 & DRAGON TO RETURN ASTRONAUTS TO SPACE





EMERGING SPACE

THE EVOLVING LANDSCAPE OF 21ST CENTURY AMERICAN SPACEFLIGHT

New NASA Strategy for private space industry development

New Landscape of Space Exploration: Emerging Space Companies

Today's space companies aim to develop viable businesses to provide services such as human space travel and habitation—currently the domain of government agencies. The re-emergence of private investment in space, coupled with ongoing government investment, combines for a promising future in space exploration.

A belief in space exploration and economic development drives the current wave of space entrepreneurs, who seek a revolutionary change in our relationship with space, and are motivated by their mission. They do not necessarily view exploration as movement towards one singular accomplishment (such as a moon landing), but as the development of sustainable and diverse economic activities in space. This requires new capabilities enabled by new technologies, but also existing capabilities (like access to space) available at lower costs and prices. By developing these products and services, they aim to open new markets for space experiences and industrial activity.

The following is an overview of emerging space companies and their visions of space exploration. Many of these companies are entrepreneurial, but several (Sierra Nevada, Boeing, and ULA) are accomplished aerospace firms seeking to drive new markets. In addition, there are many other emerging space companies in supplier, component, and services segments. This is a dynamic industry with frequent changes and the companies plan to provide more than one type of service, for example, in addition to providing orbital launch services, SpaceX also intends to provide crew and cargo launch services to Mars sometime in the 2030s.

Company	Vehicle(s) or Spacecraft	Services
Blue Origin	New Shepard, Bionix Spacecraft	Suborbital and orbital launch services including human spaceflight
Masten Space Systems	Xeon, Xogdor	Suborbital launches of small payloads
Virgin Galactic	SpaceShipTwo, LauncherOne	Suborbital launches of small payloads, suborbital human spaceflight, and air-launched nanosatellite launches
XCOR Aerospace	Lynx	Suborbital launches of small payloads, suborbital human spaceflight, and nanosatellite launches
Orbital Sciences Corporation	Pegasus, Taurus, Antares, Cygnus	Orbital launches of satellites and ISS cargo
SpaceX	Falcon 9, Falcon Heavy, Dragon	Orbital launches of satellites and ISS cargo, with orbital human spaceflight planned by 2017
Stratolaunch Systems	Stratolauncher	Air-launched orbital launch services
United Launch Alliance	Atlas V, Delta IV	Orbital launch services
Planet Labs	Dove, Flock 1	Frequent imaging of the Earth and open access to acquired data via website
Skybox Imaging	SkySat	Frequent imaging and HD video of the Earth, data analysis, and open access to acquired data via website
Bigelow Aerospace	BA 330	Inflatable habitats for use in orbit or on the Moon
Boeing	CST-100	Crewed LEO transportation
Sierra Nevada Corporation	Dream Chaser	Crewed LEO transportation
Space Adventures	Soyuz	Crewed LEO and lunar expeditions
B612 Foundation	Sentinel	Detection and characterization of potentially hazardous asteroids
Inspiration Mars Foundation	Inspiration Mars	Crewed Mars flyby expedition
Moon Express	Moon Express	Prospecting and mining lunar resources
Planetary Resources	Arkyd 100, Arkyd 200, Arkyd 300	Prospecting and mining asteroid resources

Table 2. List of emerging space companies, grouped by destination.

113TH CONGRESS
2D SESSION

H. R. _____

(Original Signature of Member)

To promote the development of a commercial asteroid resources industry for outer space in the United States and to increase the exploration and utilization of asteroid resources in outer space.

IN THE HOUSE OF REPRESENTATIVES

Mr. POSEY (for himself and Mr. KILGUS) introduced the following bill; which was referred to the Committee on _____

A BILL

To promote the development of a commercial asteroid resources industry for outer space in the United States and to increase the exploration and utilization of asteroid resources in outer space.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*
3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the "American Space Tech-
5 nology for Exploring Resource Opportunities In Deep
6 Space Act" or the "ASTEROIDS Act".

The ASTEROID ACT



SpaceX
CEO

Main theme for ONS 2014

CHANGES



Elon Musk: Keynote on Energy leadership – and spaceX

Meld. St. 32

(2012–2013)

Melding til Stortinget

Mellom himmel og jord:
Norsk romvirksomhet for næring og nytte





MENY



Statoil

Statoil... in outer space?



VOL: ON

Deep Drilling on Mars: Two Concepts and Prospects. Christopher Hofman^{1,2,3,4,5}, Pascal Lee^{1,2,5}, Brage W. Johansen^{1,4}, Brian J. Glass², Christopher P. McKay², John W. Schutt¹ and Kris Zacy⁶. ¹Mars Institute, NASA Ames Research Park, Bldg 19, Suite 2047, Moffett Field, CA 94035, USA, Email: christopher.hofman@marsinstitute.net, ²SETI Institute, Mountain View, CA 94043, USA, ³University of Stavanger, 4036 Stavanger, Norway, ⁴Space&Energy, 4021 Stavanger, Norway, ⁵NASA Ames Research Center, Moffett Field, CA 94305, USA, ⁶Honeybee Robotics, Pasadena, CA 91103, USA.

Summary: Deep drilling is anticipated to be an important activity in the future exploration of Mars, to search for any past or extant life in expected deep martian aquifers. Our review and analysis of deep drilling approaches that might be applicable to Mars identifies two promising concepts: 1) coiled tubing drilling, and 2) mole drilling.

Background and Motivation: The search for biosignatures and life on Mars is guided by NASA's subsurface of Mars is an attractive astrobiological target, because it is expected to offer on both global and regional scales (volcanic provinces) physical and chemical conditions that should allow liquid water to be abundantly present within the topmost 10 km of the martian crust. In spite of harsh if not forbidding conditions for terrestrial life at the surface of Mars today, the notion that there might be a thriving deep biosphere on Mars merits serious consideration, if only because an estimated 50% to 66% of the Earth's total biomass resides in a deep biosphere [2]. To first order, life on Earth is subsurface life.

In 2012, following an international planetary drilling workshop convened by Norway's Space & Energy network in Stavanger, Norway [3], the Mars Institute, in collaboration with NASA, several academic and industry partners in Norway (Space & Energy network, Statoil, University of Stavanger), and the company Honeybee Robotics in the USA, initiated a 1-year study of Deep Drilling on Mars [4]. Although Deep Drilling is a distant opportunity and goal in Mars exploration, planning for this long lead time activity should begin early and build on growing synergies between the space and energy industries on Earth in the exploration of extreme environments.

The objectives of our study were to review and analyze systematically past and current ideas about deep drilling on Mars, and to identify (if possible) a limited set of concepts that might offer reasonable promise of feasibility for Mars.

Challenges to Deep Drilling on Mars: Our preliminary assessment of the suitability of a drilling concept for Mars was established by examining how well it might perform given the specific set of challenges presented by operating on Mars, including conditions expected to be encountered both at the surface and in the subsurface.

Deep drilling on Mars faces first the obvious challenge of distance from the Earth and constraints on equipment mass. Mars is an extremely remote and isolated drilling site by terrestrial standards, requiring transportation across interplanetary space, EDL (entry, descent, and landing), and surface deployment drilling standards. Aside from this surface access difficulty, the greatest technical challenges facing deep drilling on Mars compared to deep drilling on Earth stem from the low pressure and temperature conditions prevailing in the surface and near-surface environments on Mars. These physical challenges translate in turn into significant system development, operational, and logistical challenges [5,6].

Included in the challenges are the fact that the deep subsurface geology of Mars remains very poorly known, at least by terrestrial deep drilling standards. NASA's InSight mission scheduled to launch 2016 will be the first geophysical lander to study Mars's deep interior [7], hence an important milestone in developing concepts for deep drilling systems to start de-veloping at the extreme conditions encountered at the martian subsurface and identifying Strategic Knowledge Gaps (SKGs) to deep drilling.

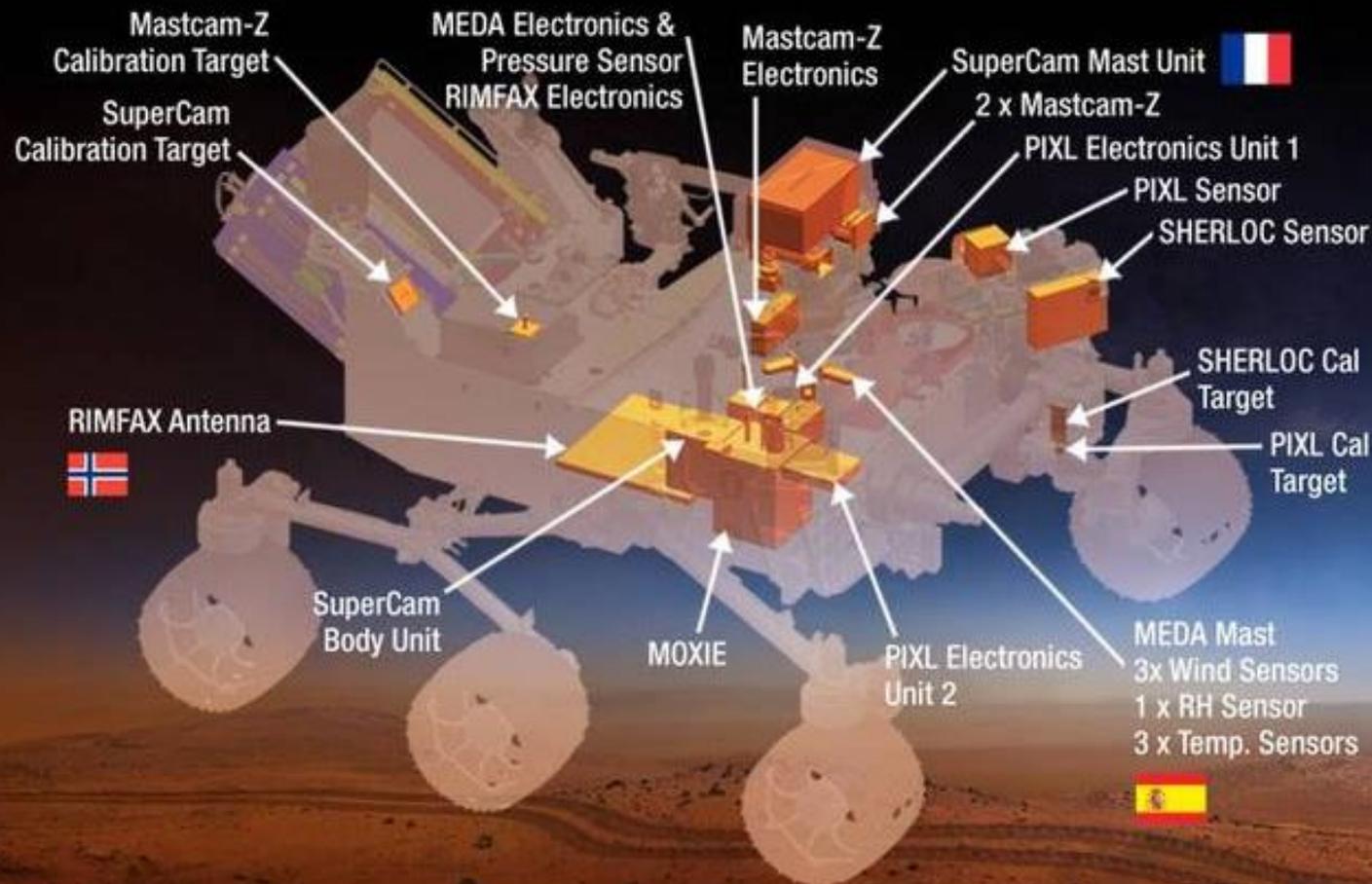
Requirements of Deep Drilling on Mars: An important requirement we placed on candidate Mars deep drilling systems is that they be able to reach a depth of at least 2 km. Current models of the 3D distribution of H₂O on Mars suggest that, in general, aquifers would be accessible at depths of order 2 to 7 km from the local surface, although in some locations (e.g., the floor of Valles Marineris), they might be reached at depths of only 1 to 2 km [4]. To implement a successful deep drilling campaign on Mars with autonomous systems, several complex technologies must be developed, integrated and work together [8]. Conceptually the following systems will be needed: 1) An autonomous unit at ground level that can assemble, control and operate the drilling process; 2) A drilling method that can achieve 1-2 km down/up/diagonally to explore the subsurface geology and 3) Topside or in situ sensors that can identify and analyze biosignatures or life.

In this study we reviewed past, current and future extraterrestrial drilling concepts and integrated ad-



Deep drilling on Mars research, published 2015

Mars 2020 Rover



I konkurranse med over 40 instrumenter plukket NASA nylig ut sju som skal være med på neste tur, deriblant utstyr fra Tau. FOTO: NASA

Ryfylke-antenne sendes til Mars

[INTRO](#)[OVERVIEW](#)[PROGRAM](#)[TECHNOLOGY](#)[ABOUT](#)[NEWS](#)[MEDIA](#)[CONTACT](#)

We Are Going Back to the Moon to Get Water

There are billions of tons of water ice on the poles of the Moon. We are going to extract it, turn it into rocket fuel and create fuel stations in Earth's orbit. Just like on Earth you won't get far on a single tank of gas, what we can do in space today is straight-jacketed by how much fuel we can bring along from the Earth's surface. Our fuel stations will change how we do business in space and jump-start a multi-trillion dollar industry.

Much like gold opened the West, lunar water will open space like never before.





Shackleton planlegger å bruke vann fra månen til å lage rakettdrivstoff. Dette skal de transportere til drivstoffstasjoner som går i bane rundt jorda. Illustrasjon: Shackleton Energy Company

SHACKLETON ENERGY COMPANY

Vil lage rakettdrivstoff av vann fra månen

Det skal gjøre solenergi fra verdensrommet økonomisk.

Av [Ina Andersen \(@inaandersen\)](#)

Publisert 16. februar 2015 kl. 20:18 - Oppdatert 17. februar 2015 kl. 10:42

annonse:



NORWAY'S ENERGY & TECHNOLOGY WORKSHOP For Off-World Industrialization



“....dette er trolig det mest ambisiøse, mest langsiktige, visjonære og teknologisk kompliserte prosjektet vi har sett...”



NÆRINGS- OG FISKERIDEPARTEMENTET

- Senior Rådgiver



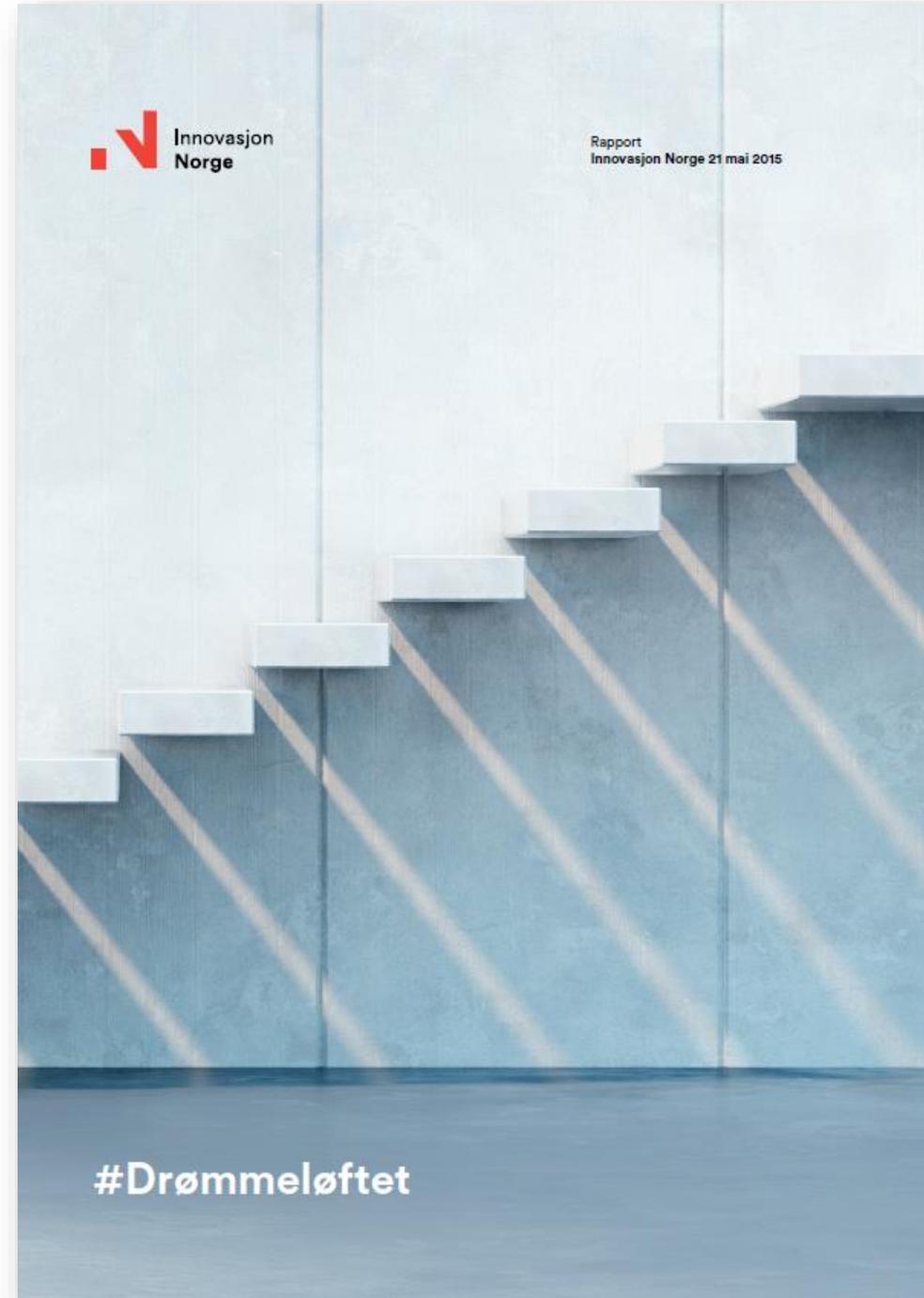
Drømmeløftet

Solcelle energi fra rommet

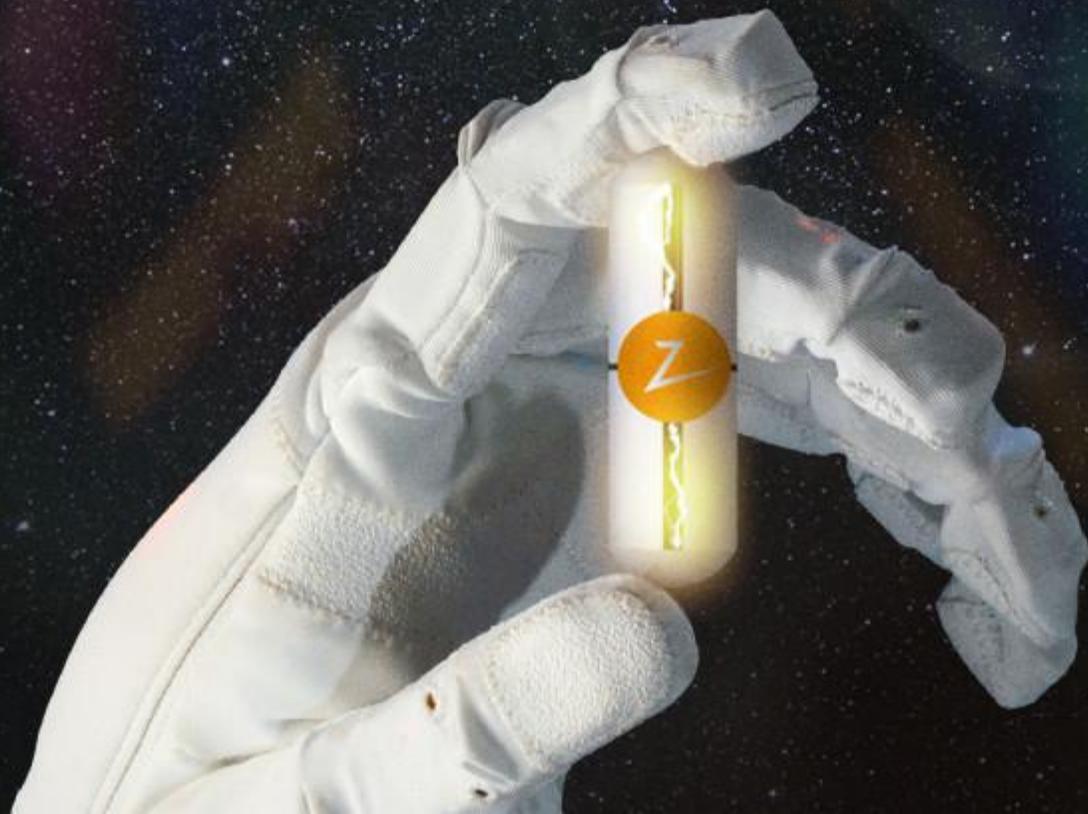
Industrielle operasjoner på månen

3D-print og produksjonsfasiliteter

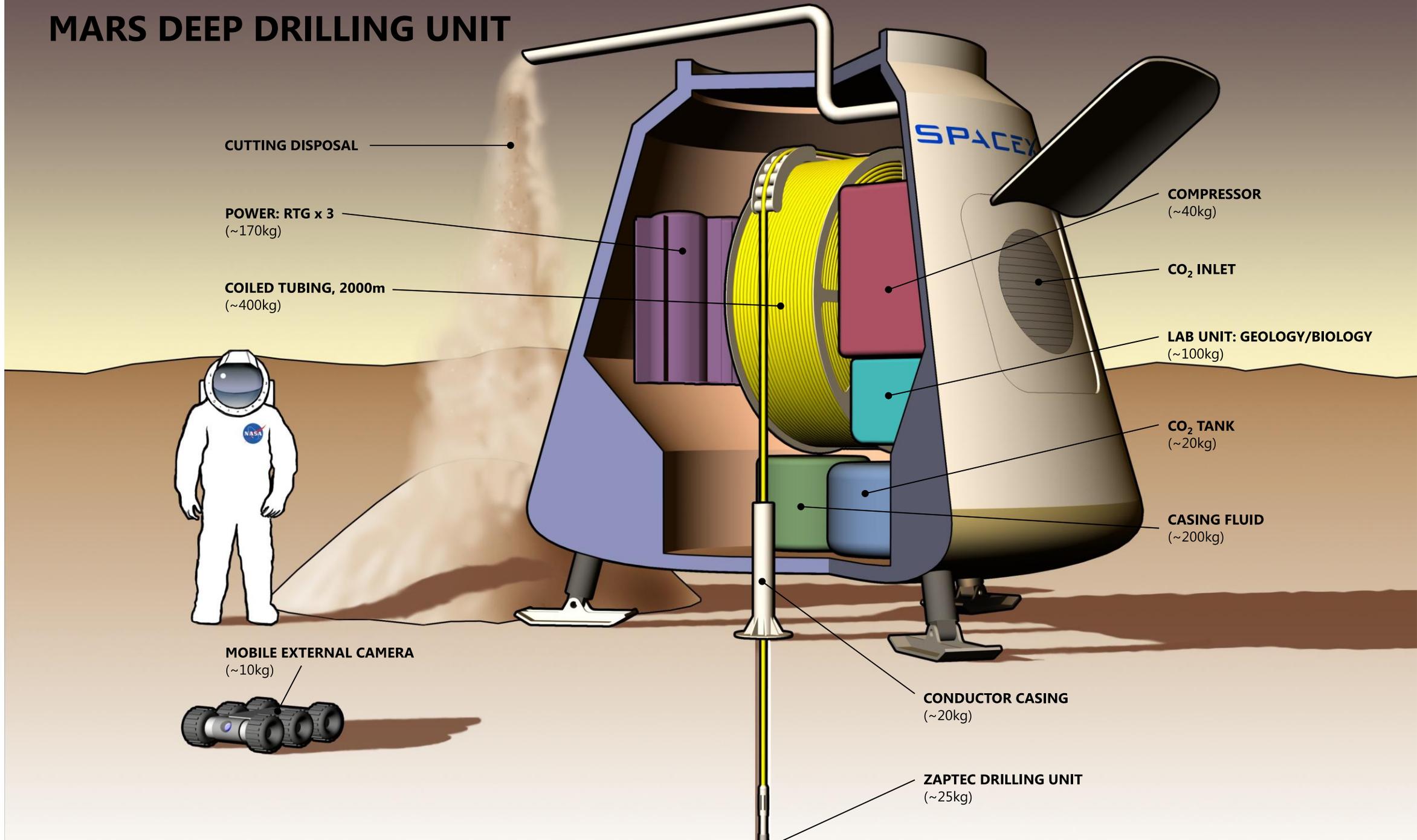
Boring på Mars og Asteroider



Yes. We are going to Mars.



MARS DEEP DRILLING UNIT





Norwegian Tech Awards

Teknologivinnere: Administrerende direktør i Zaptec Brage W. Strømme og sjefsingeniør Øyvind Wetteland mottok Norwegian Tech Award 2015. Foto: Tommy Strømme

«Jumping to the next curve» «Norge 6.0» - Nasjonalt program de neste 25 år

Ambisiøst, langsiktig nasjonalt program

- *«Neste vekstkurve»*
- *Myndigheter og næringsliv*
- *Nasjonale virkemidler*

6.0



5.0



4.0



3.0



2.0

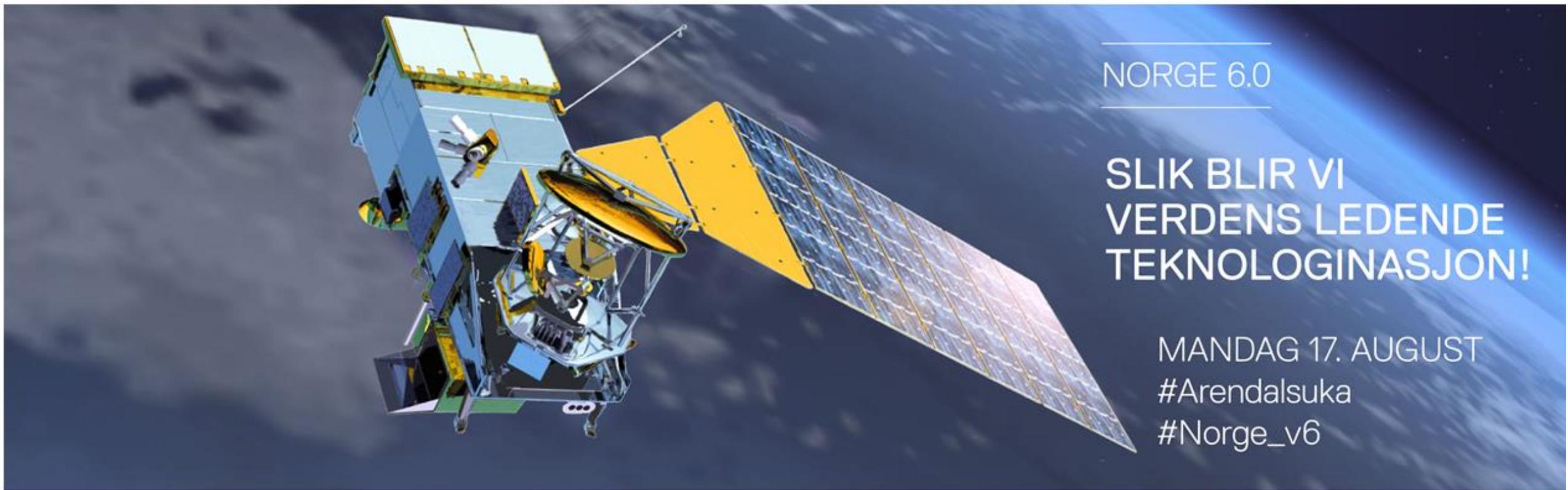


1.0



Starte med kompetanseoppbygging

- *Systematisk stipendordning*
- *Internasjonalt samarbeid*
- *Verdensledende lærested*
- *Test- og utviklingsfasiliteter*

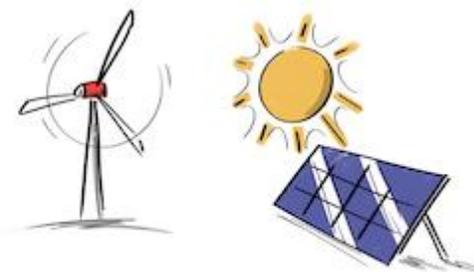


NORGE 6.0

SLIK BLIR VI
VERDENS LEDENDE
TEKNOLOGINASJON!

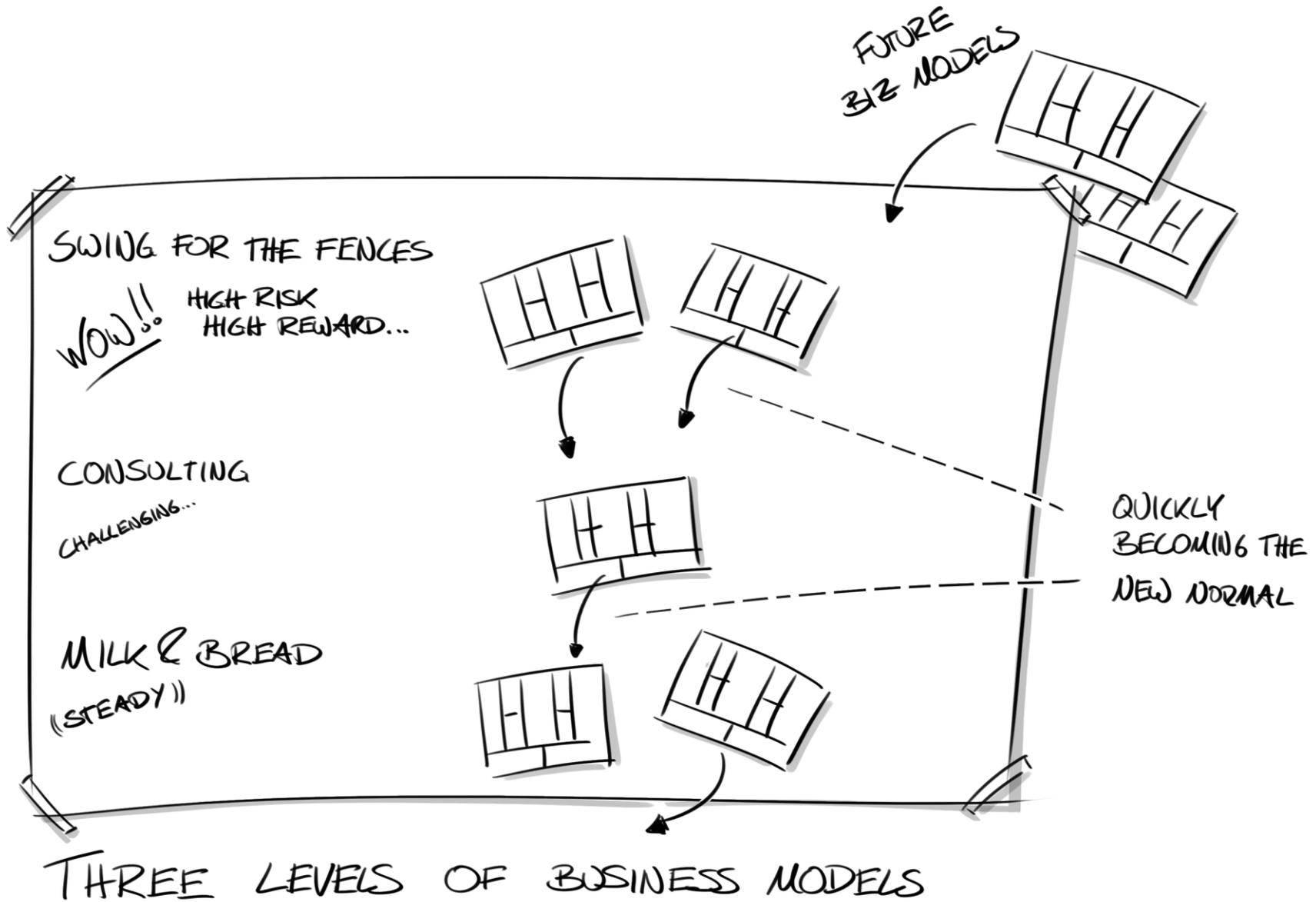
MANDAG 17. AUGUST
#Arendalsuka
#Norge_v6

Vi er allerede i gang!!

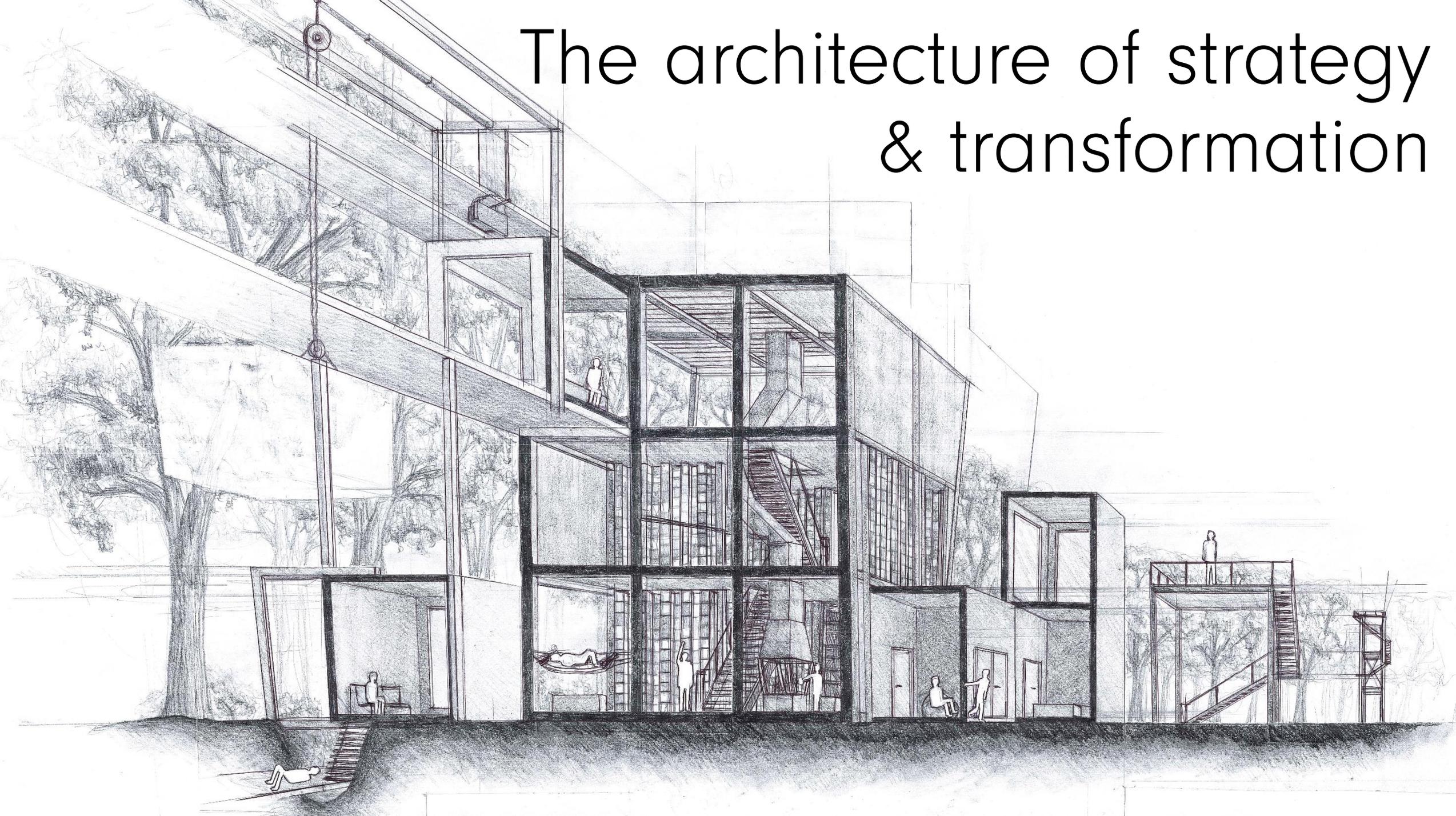


“Det skulle vært forbudt å
fokusere på
kjernevirksomhet”





The architecture of strategy & transformation



1

Escape dominant logic



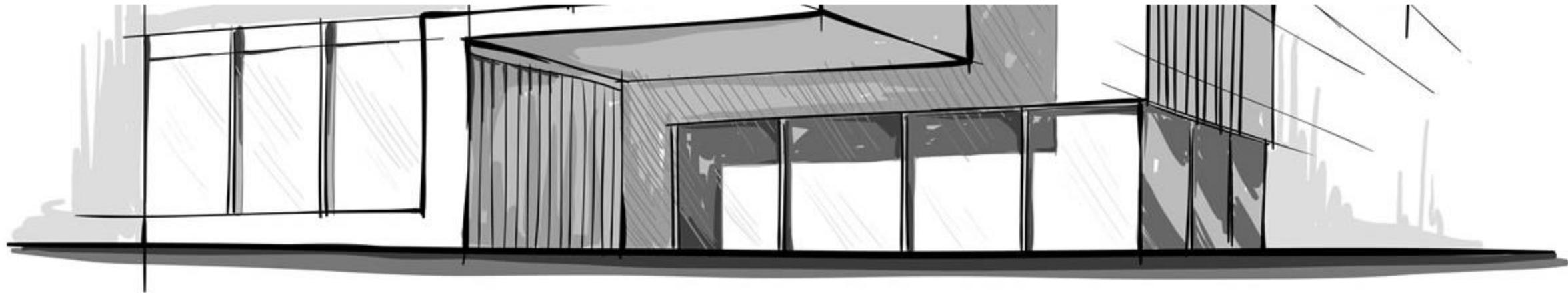
2

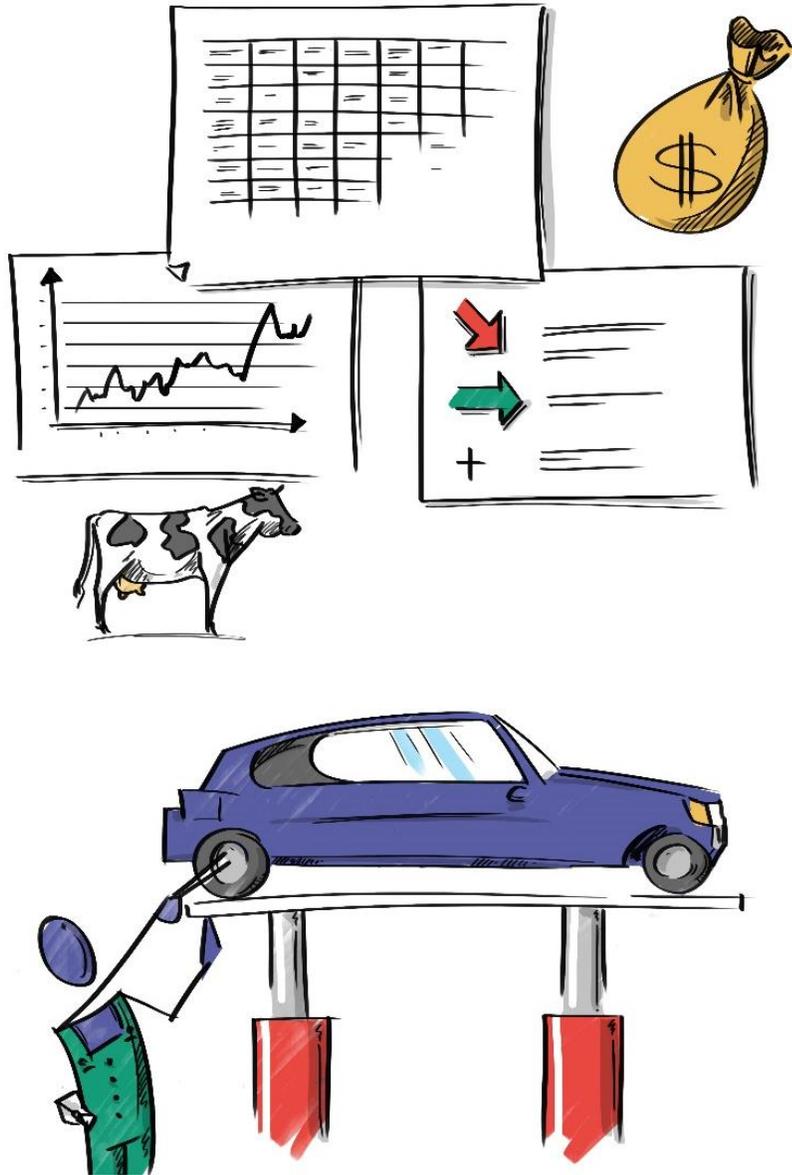
Design a structure for transformation



3 kinds of innovation

Clay Christensen, Harvard





Efficiency-based innovations

LEAN, Simplify

Cut costs, Downsizing,

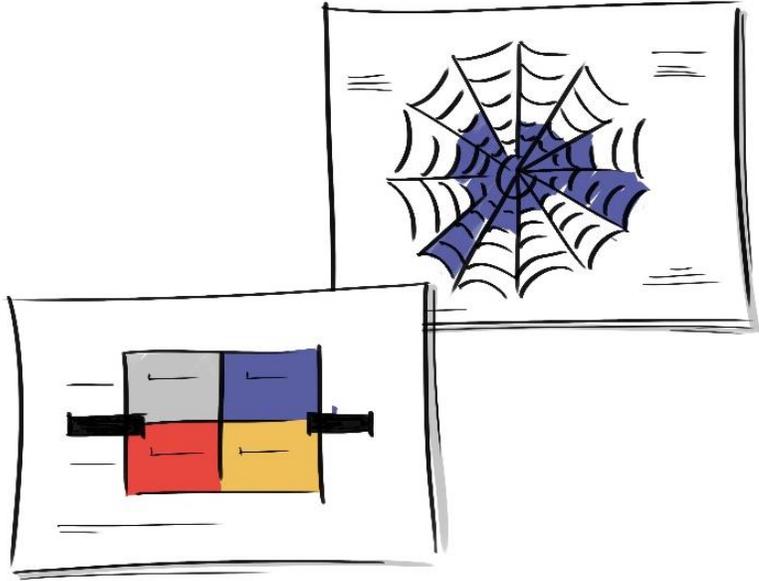
Frees up, preserves capital

STEP: Statoil Technical Efficiency Program

Performance – improving innovations

Improve what already is
Product upgrades
Limited use of capital

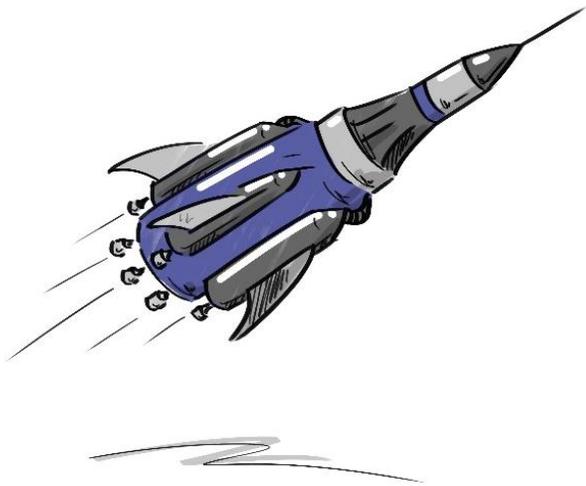
Nordan: Smart Doors

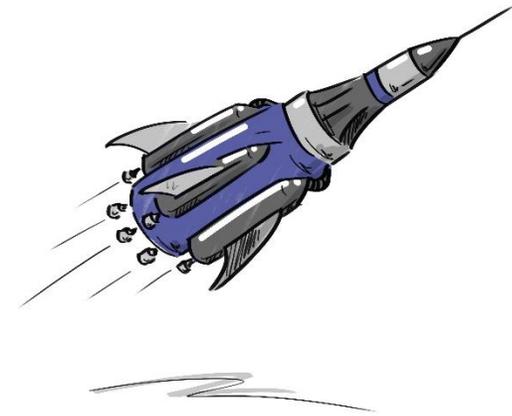
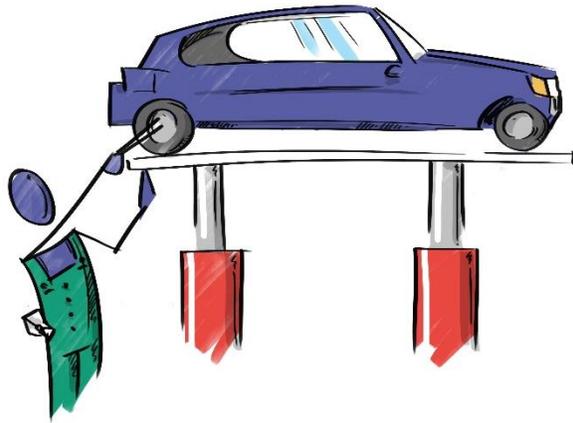
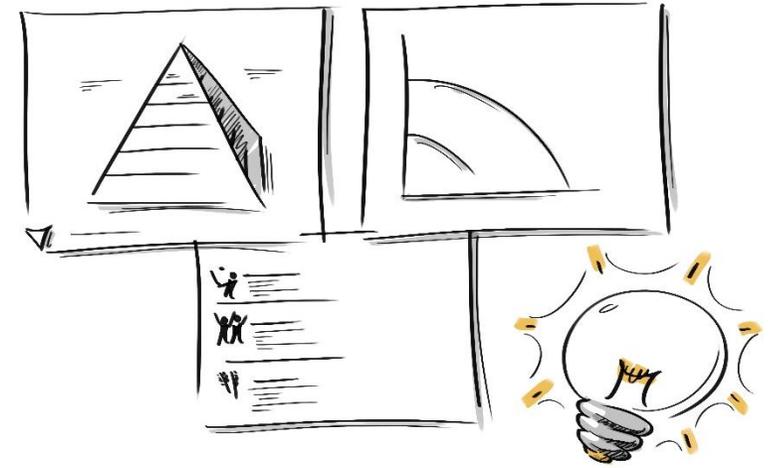
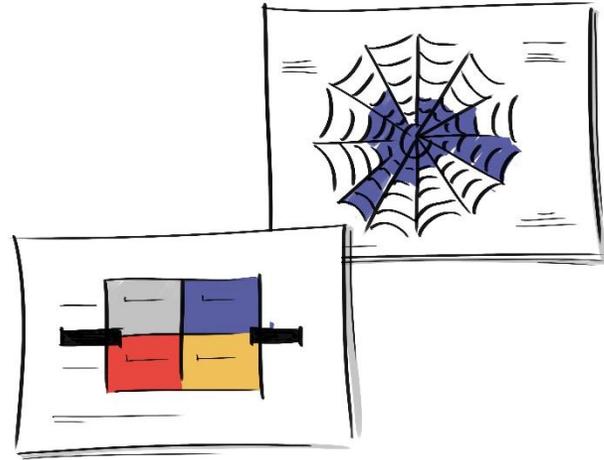


Market-creating innovations

Create new business models+
Create new customers
Put capital to use
Most value is created

Shackleton, Zaptec, Lyse Fiber





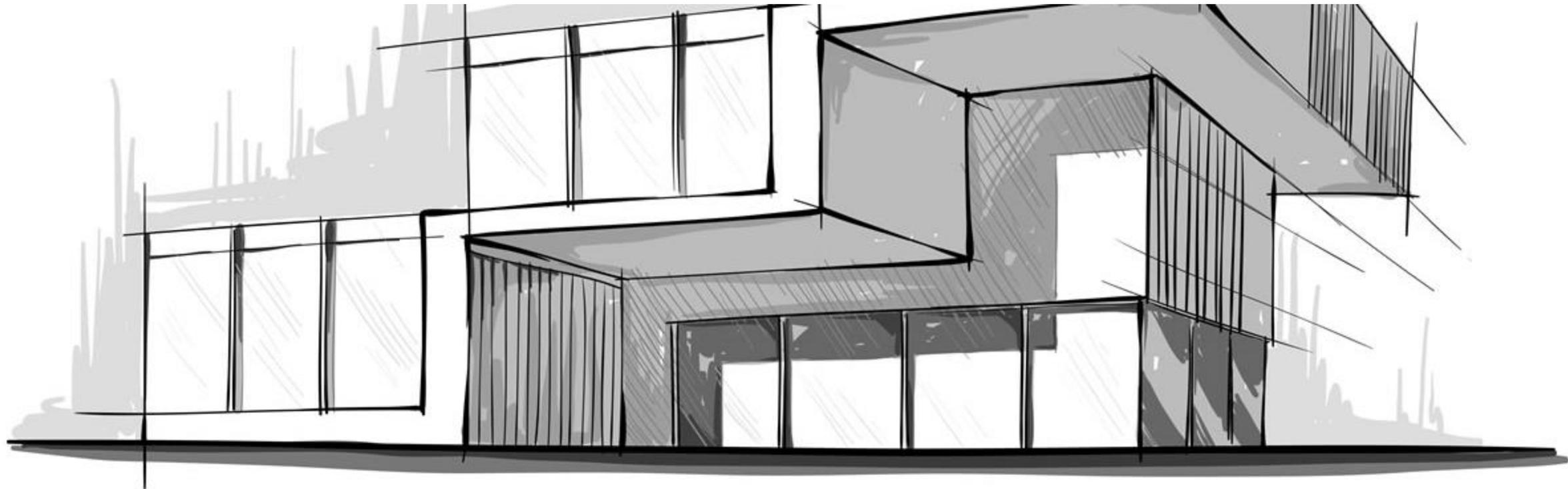
...most understand

...many think about

...few grasp

What leaders do

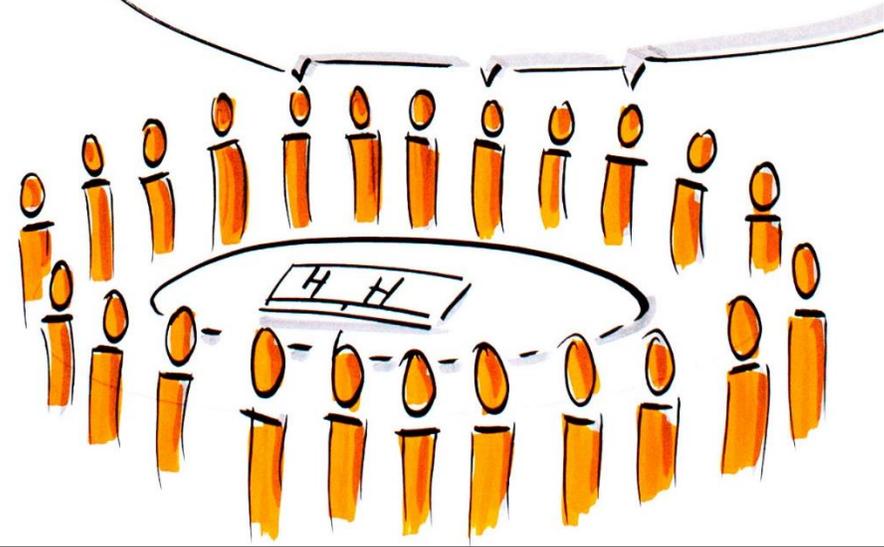
Hermana Ibarra, INSEAD



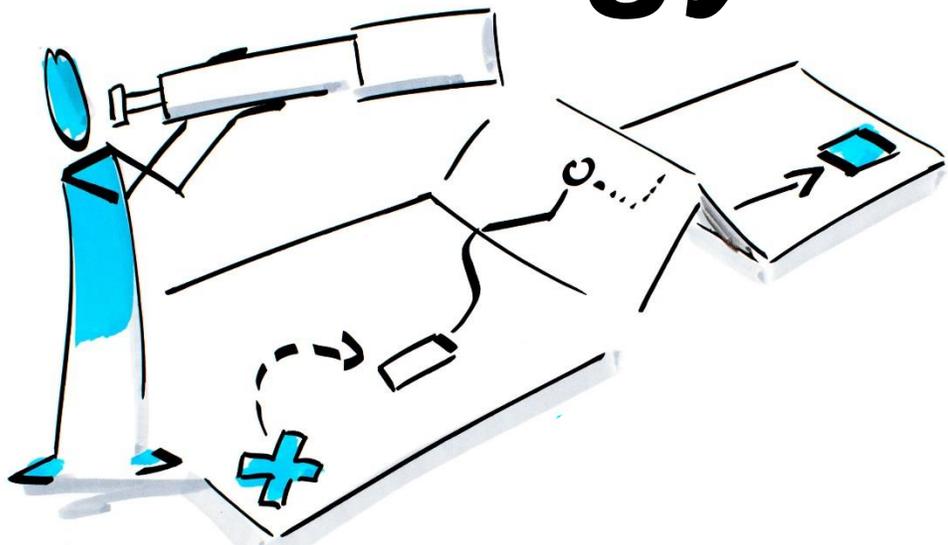
“Doer”



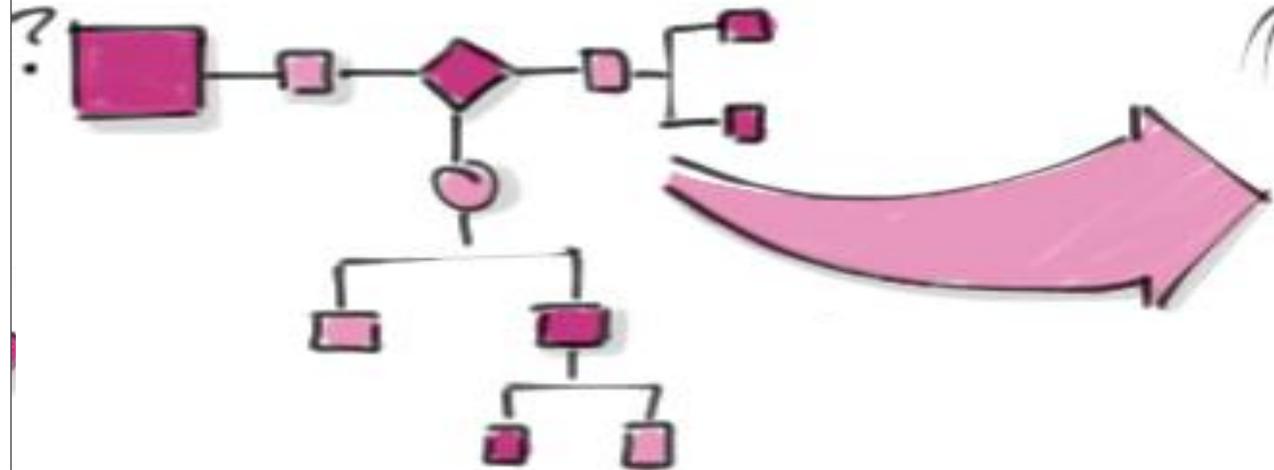
“Mobilizer”

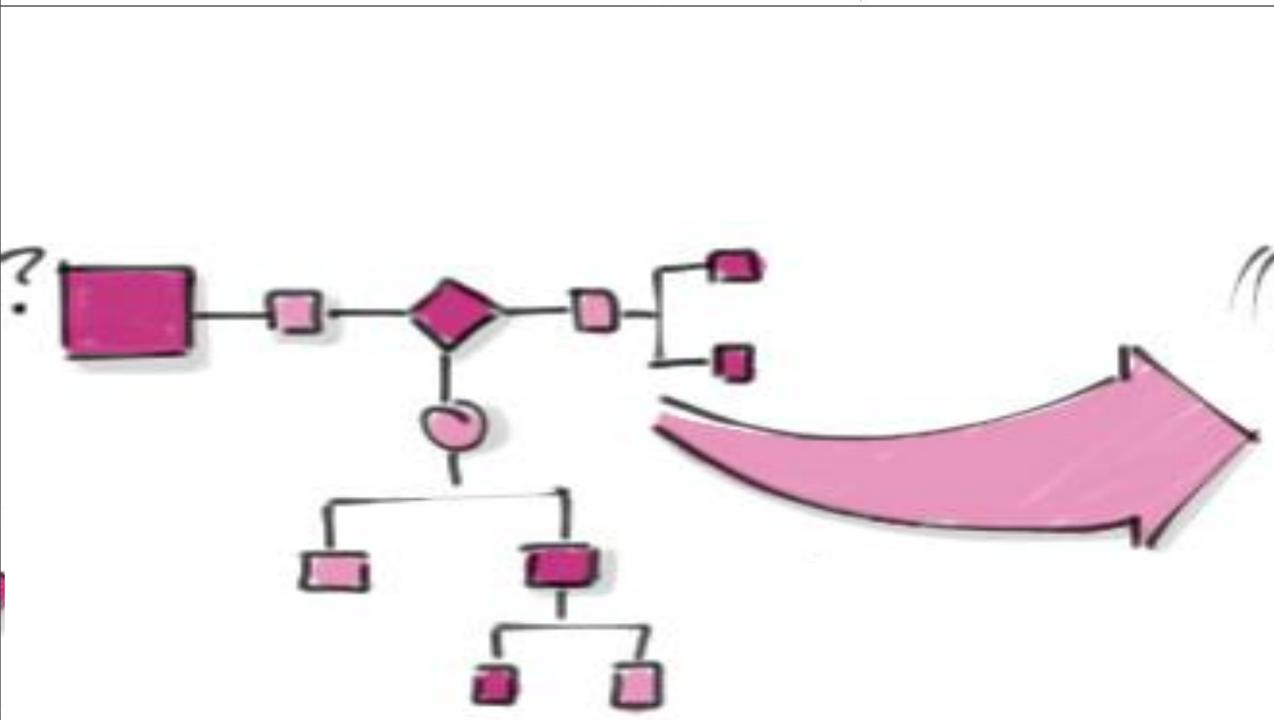
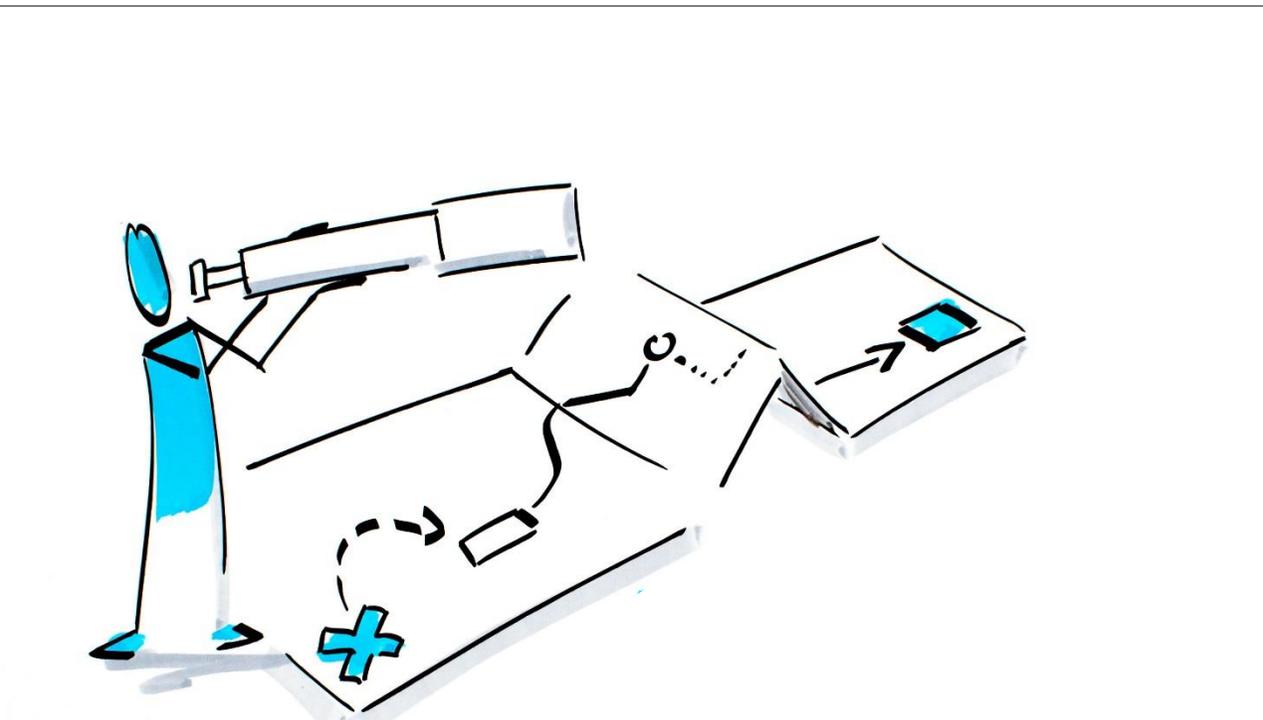
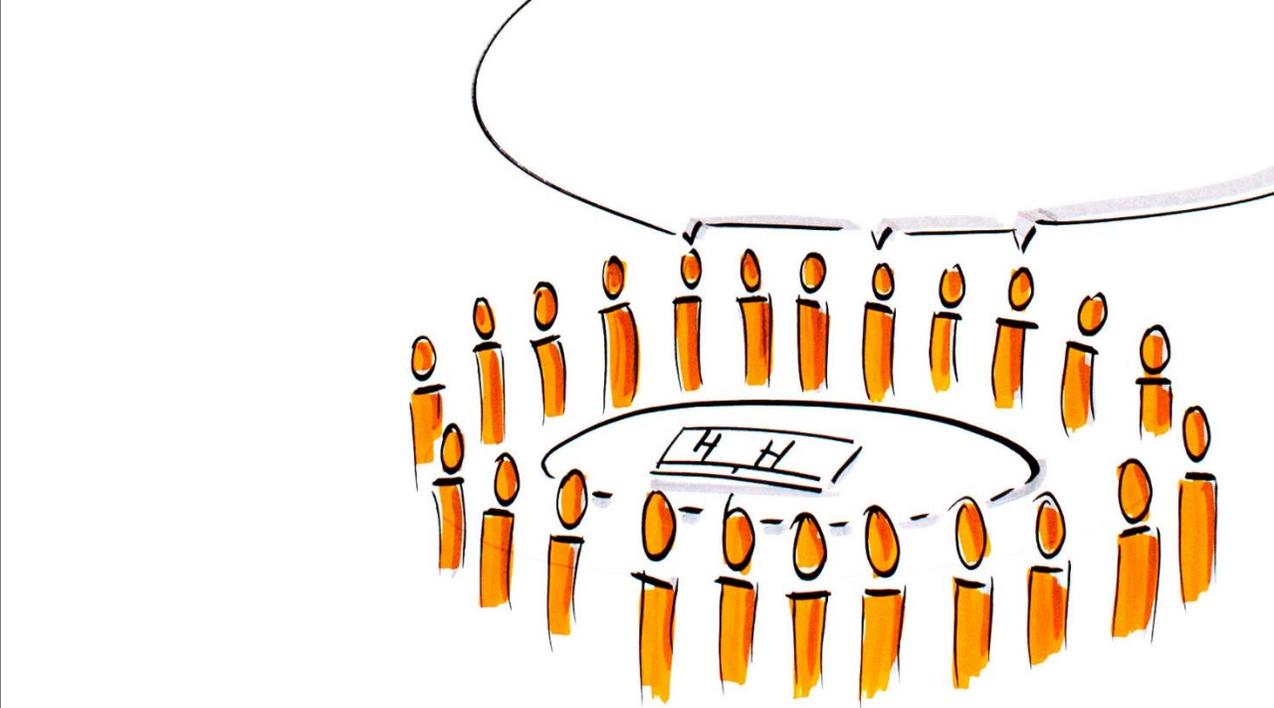
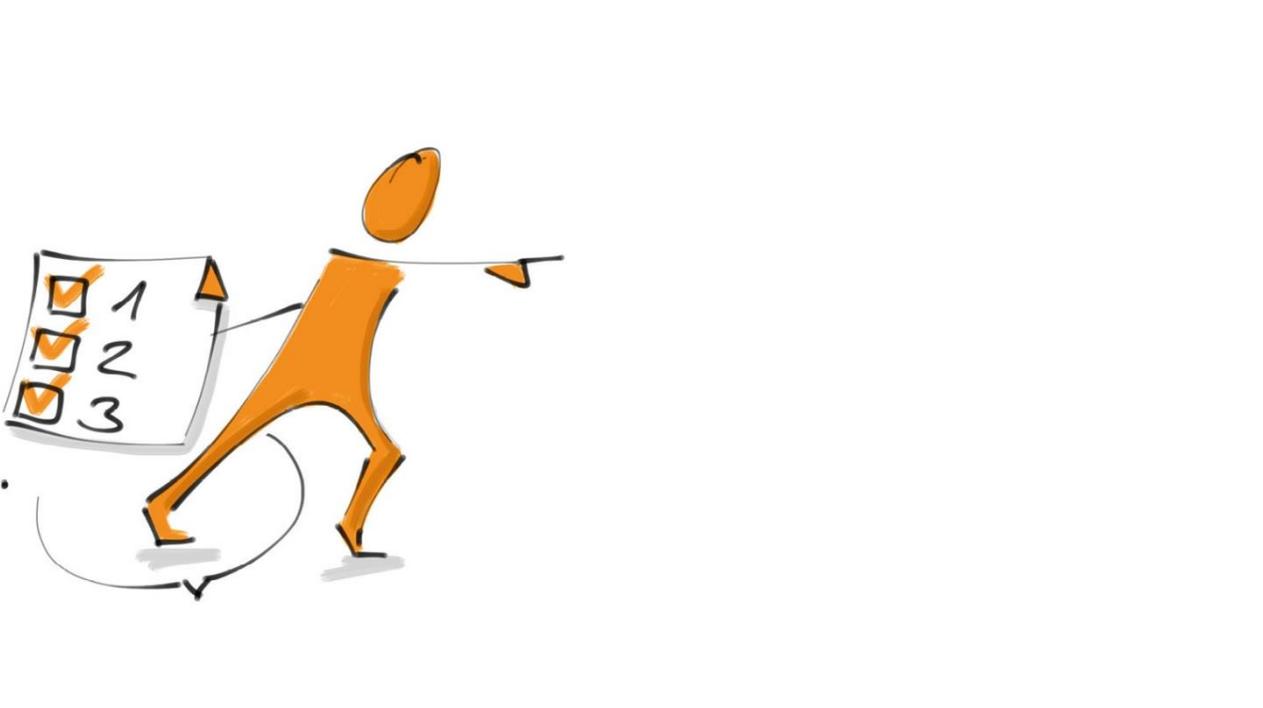


“Strategyzers”



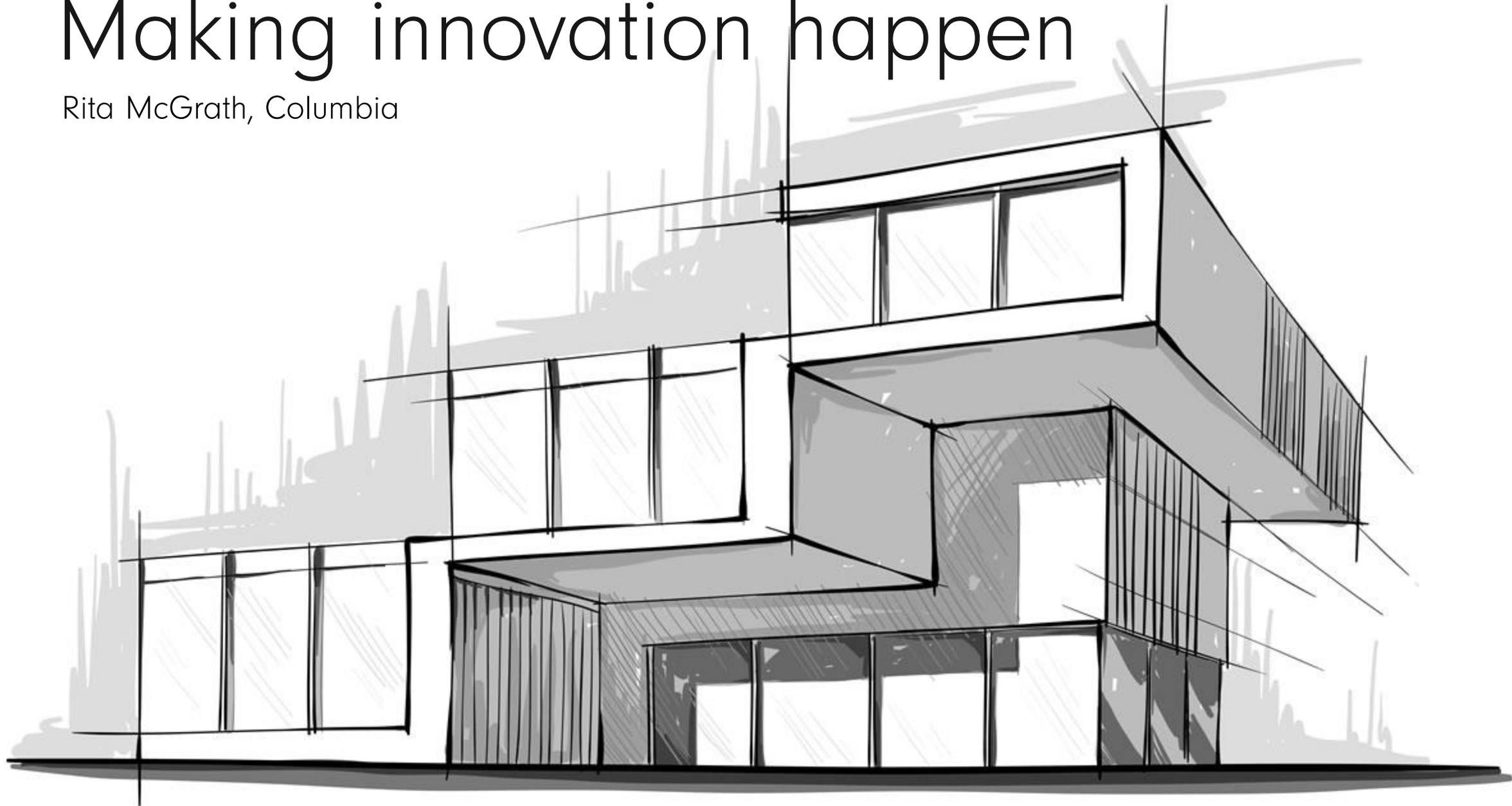
“Architects”





Making innovation happen

Rita McGrath, Columbia



“The problem is

NOT

new ideas”



The problem is
the system,
processes,
methods, tools
and resource
allocation.



...it's the **HOW** of
the organization



Innovation proficiency

Ideas & Discovery

Idea development
Follow exponential technologies
Trend hunting
Basic research

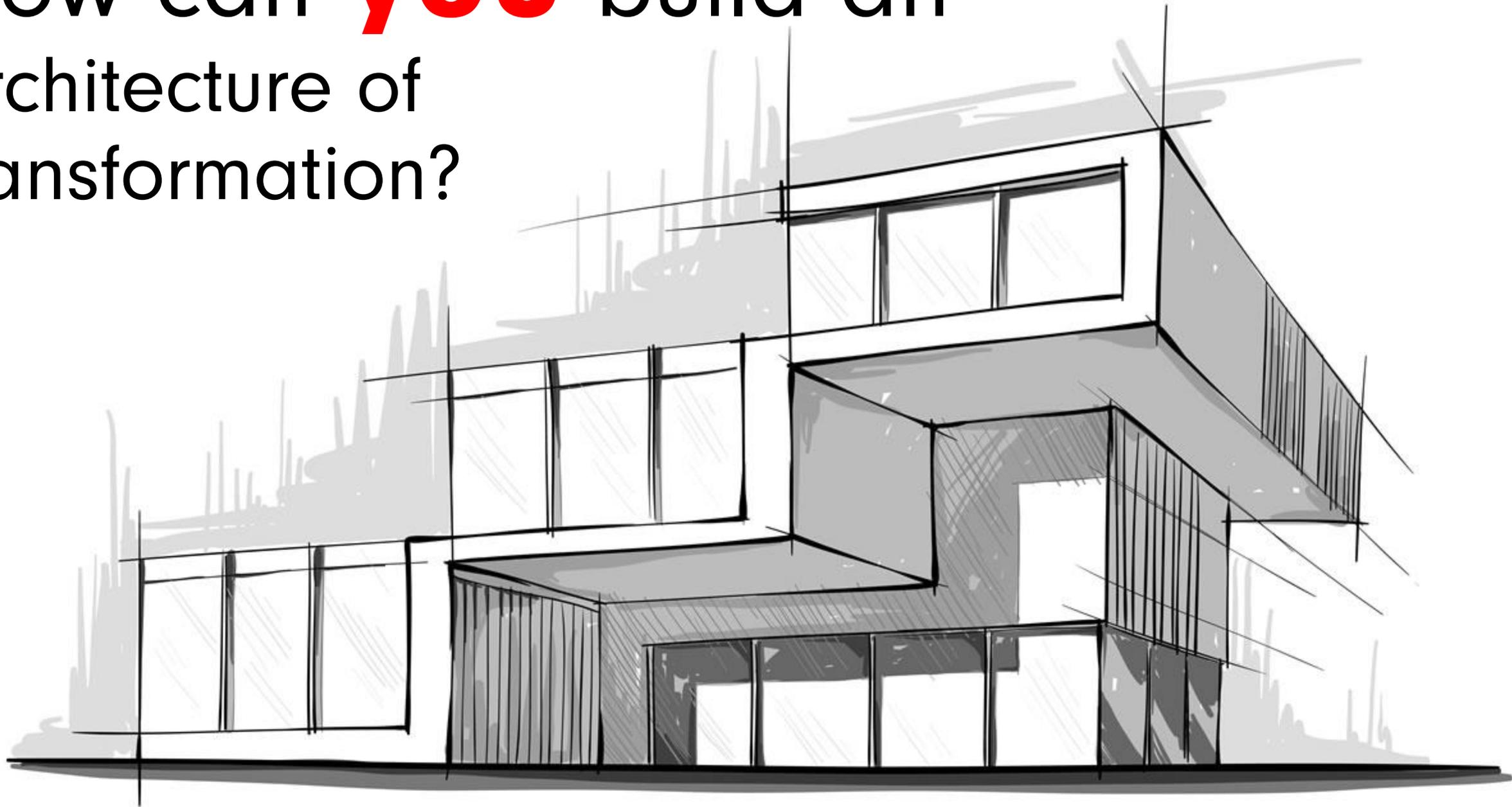
Incubation

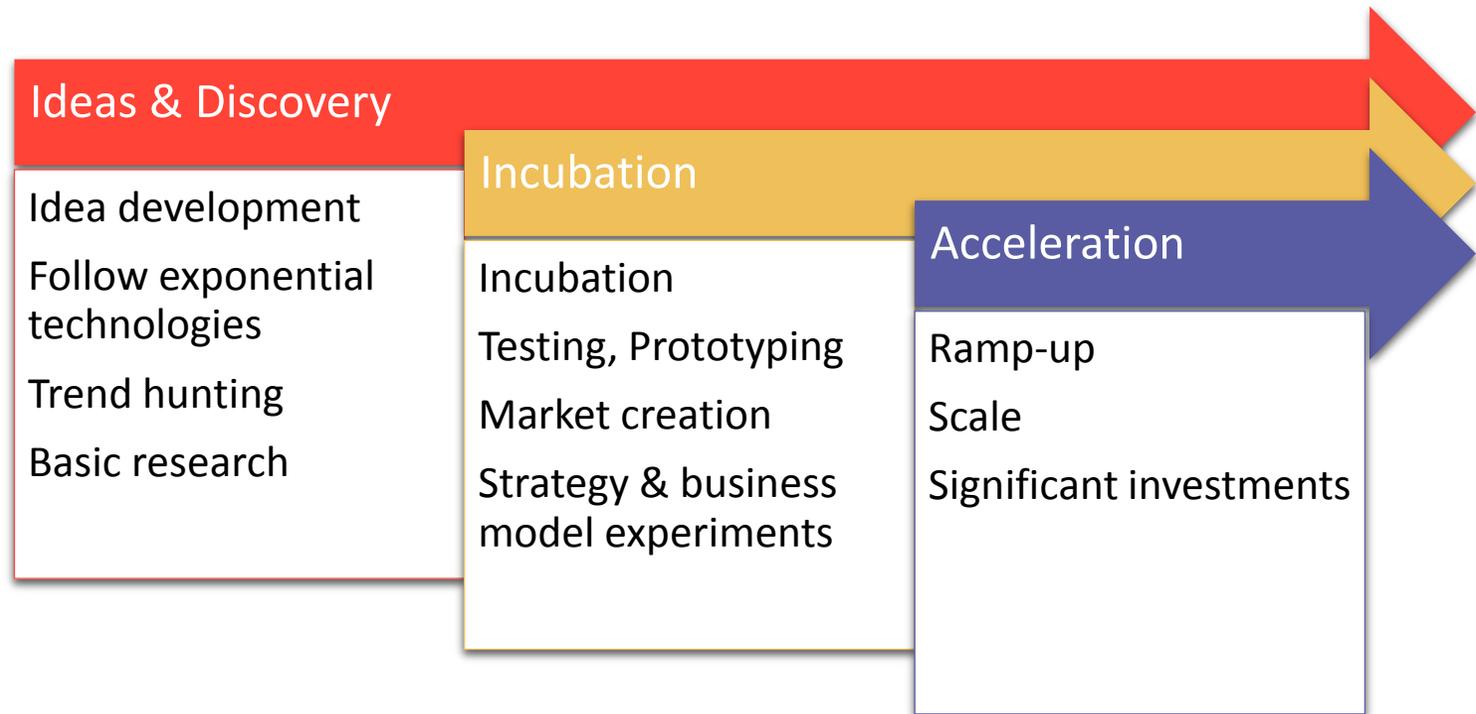
Incubation
Testing, Prototyping
Market creation
Strategy & business model experiments

Acceleration

Ramp-up
Scale
Significant investments

How can **you** build an
architecture of
transformation?





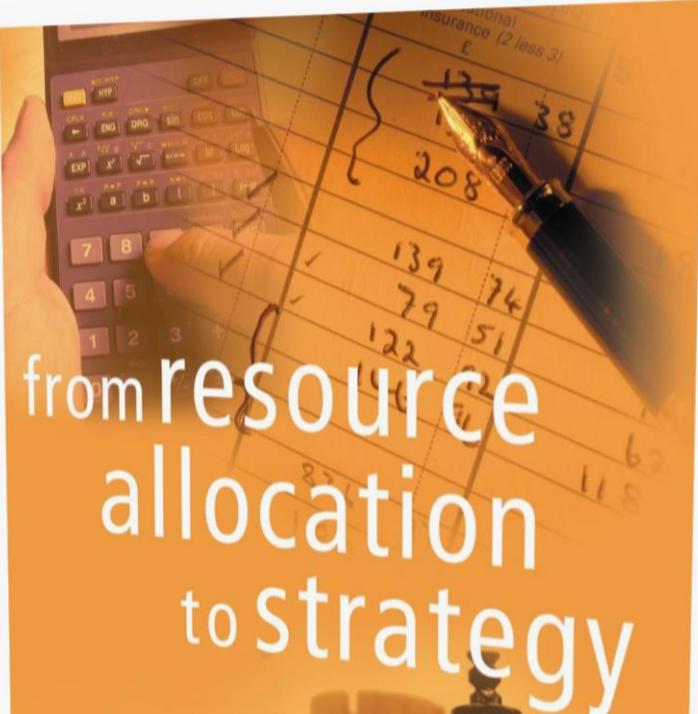
From a singular logic

to a system logic

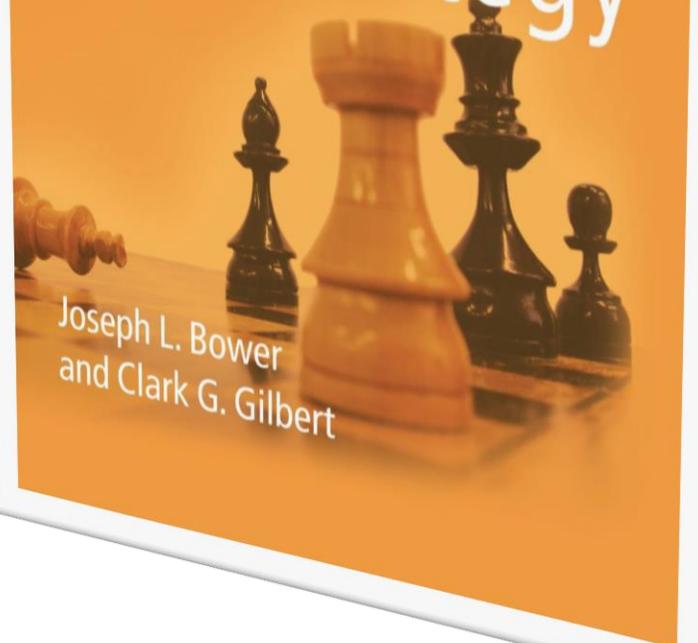
JOSEPH L. BOWER

Managing the Resource Allocation Process

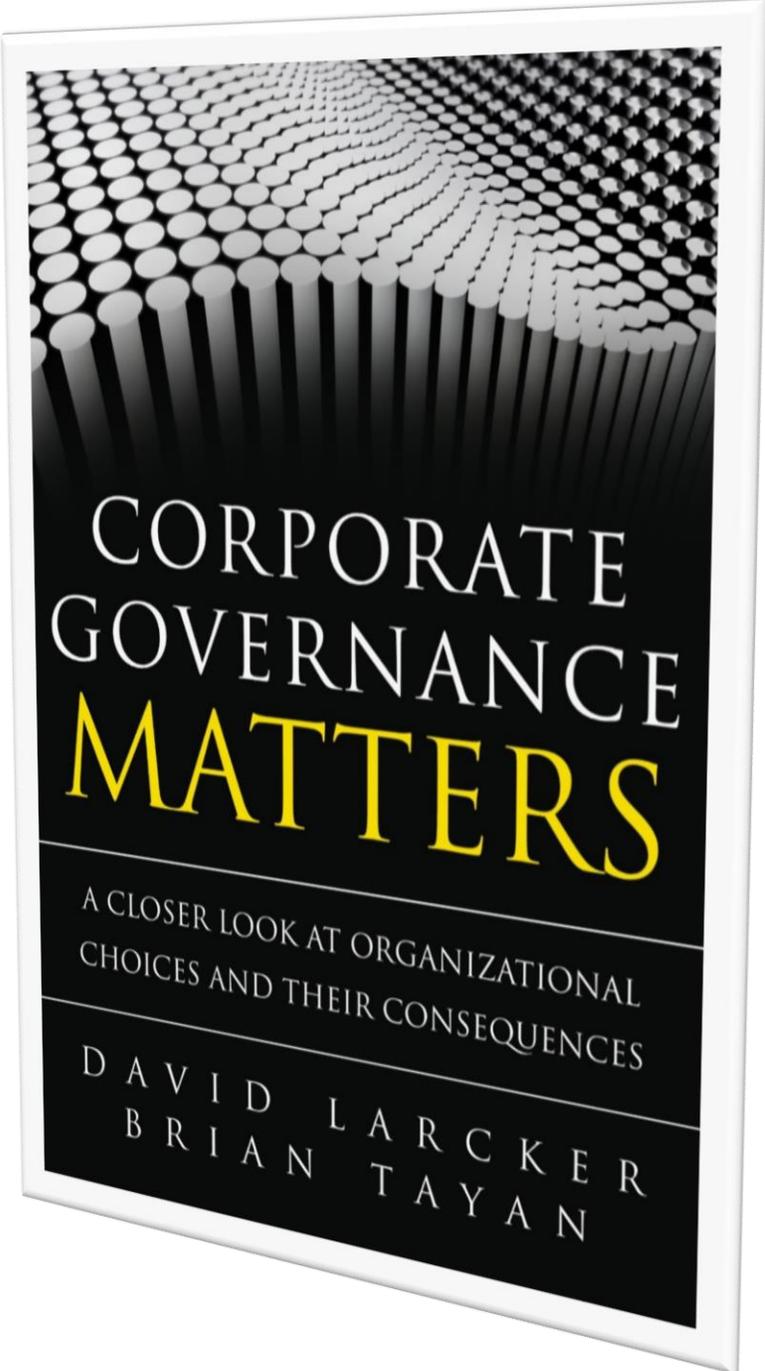
Harvard Business School Classics



from resource
allocation
to strategy



Joseph L. Bower
and Clark G. Gilbert



CORPORATE
GOVERNANCE
MATTERS

A CLOSER LOOK AT ORGANIZATIONAL
CHOICES AND THEIR CONSEQUENCES

DAVID LARCKER
BRIAN TAYAN

M + S + M



M + S + M



Architecture

Money + Structure + Mandate



Architecture



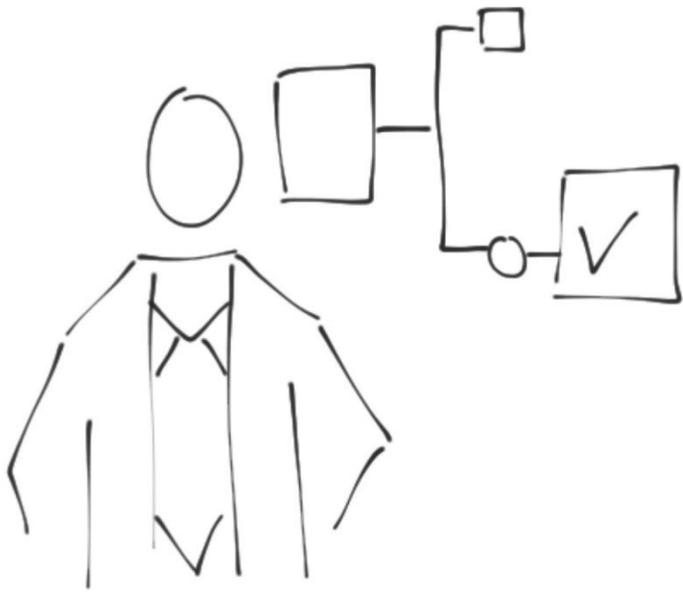
Money

#1

We have easy access to minor investment funds
for new ideas and new ventures

#2

As a company, we are truly great at making explorative investments



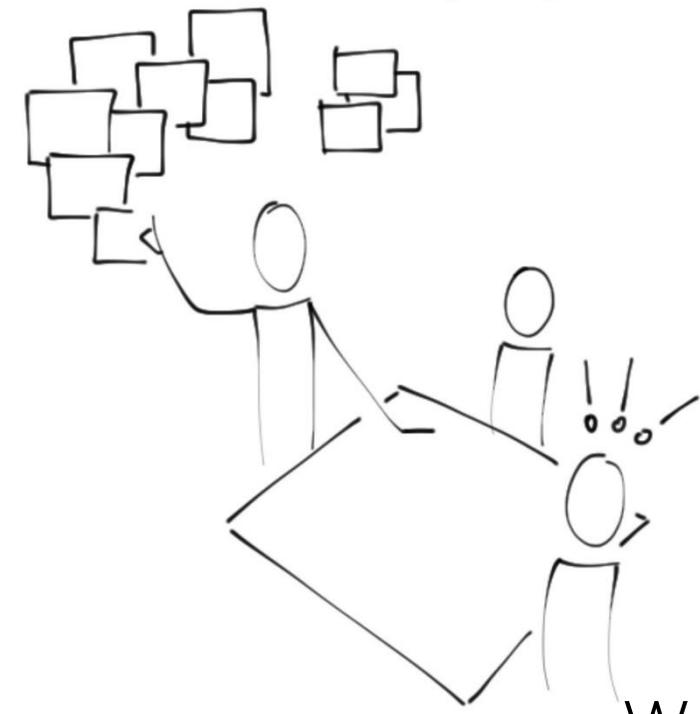
Structure

#3

We have a unit (person, team, department) responsible for entirely new business development

#4

We have a corporate structure for early ventures, strategy experiments, growth, spin-ins, spin-outs for new businesses



Mandate

#5

We have an explicit growth ambition from the Board of Directors and Top Management

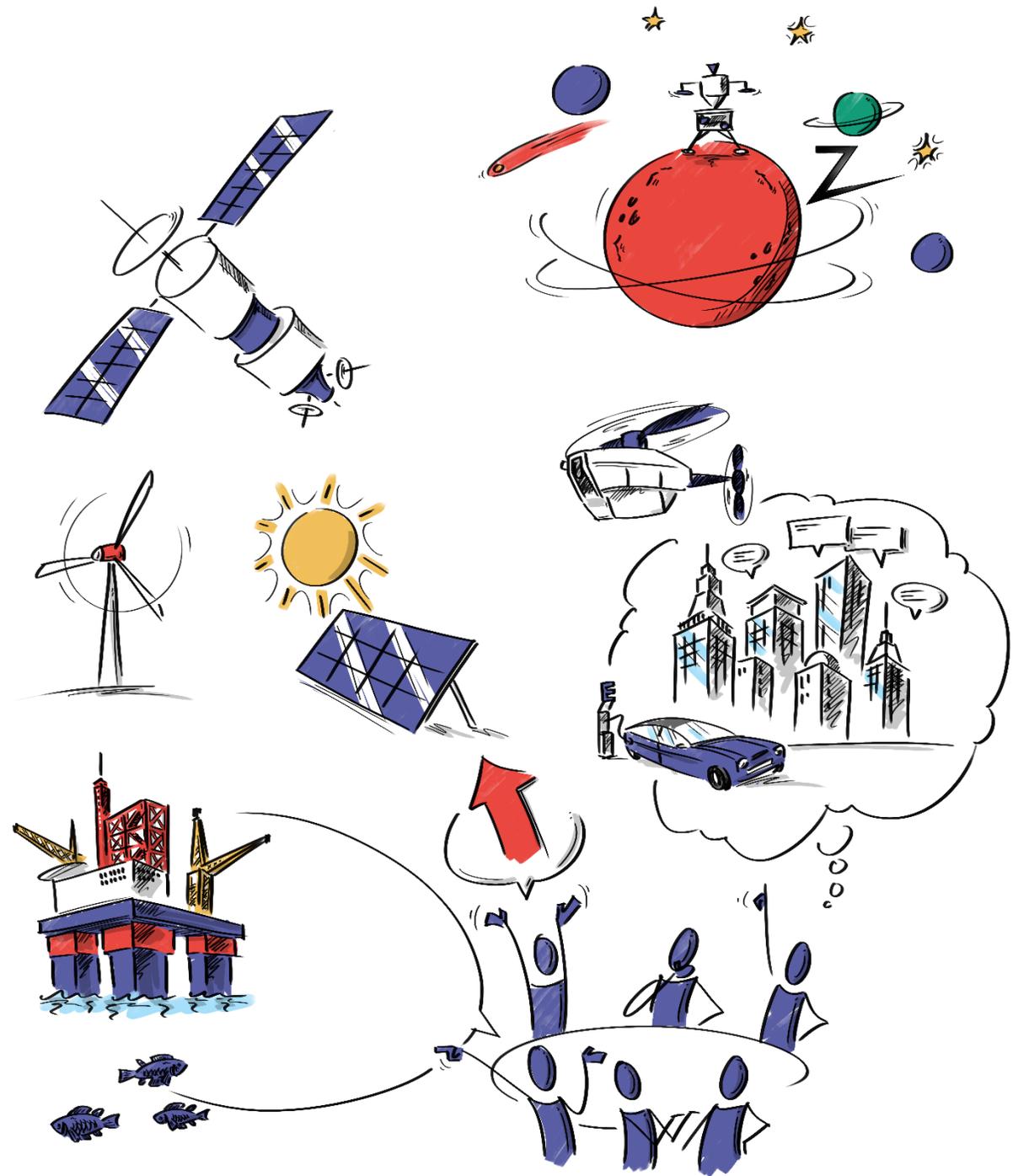
#6

We have a license to think big, dream big and take calculated strategic risks

Transformational
capacity



Legacy core
business



Your turn;
Designing a
transformation

Designing a transformation

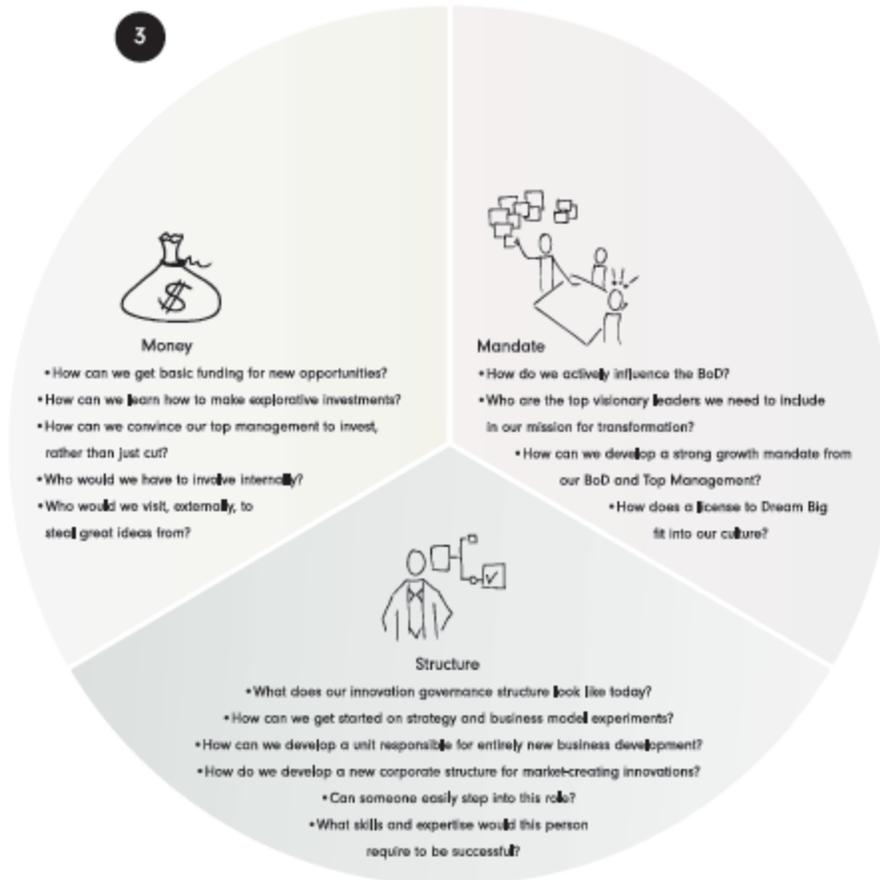
1 What does "Market-creating innovations" mean to our company?

2

Money	Please use 1-5 scale, 5 being the highest
#1 We have easy access to minor investment funds for new ideas and new ventures	1 2 3 4 5
#2 As a company, we are truly great at making explorative investments	1 2 3 4 5
Structure	
#3 We have a unit (person, team, department) responsible for entirely new business development, outside our current core business	1 2 3 4 5
#4 We have a corporate structure for early ventures, strategy experiments, growth, spin-ins, spin-outs for new businesses	1 2 3 4 5
Mandate	
#5 We have an explicit growth ambition from the Board of Directors and Top Management	1 2 3 4 5
#6 We have a license to think big, dream big and take calculated strategic risks	1 2 3 4 5
SUM	

Company name: _____

3



Transformation architecture



Transformation Architecture - developed by Strategy Tools for the Next Generation

ENGAGE//
INNOVATE

Designing a transformation

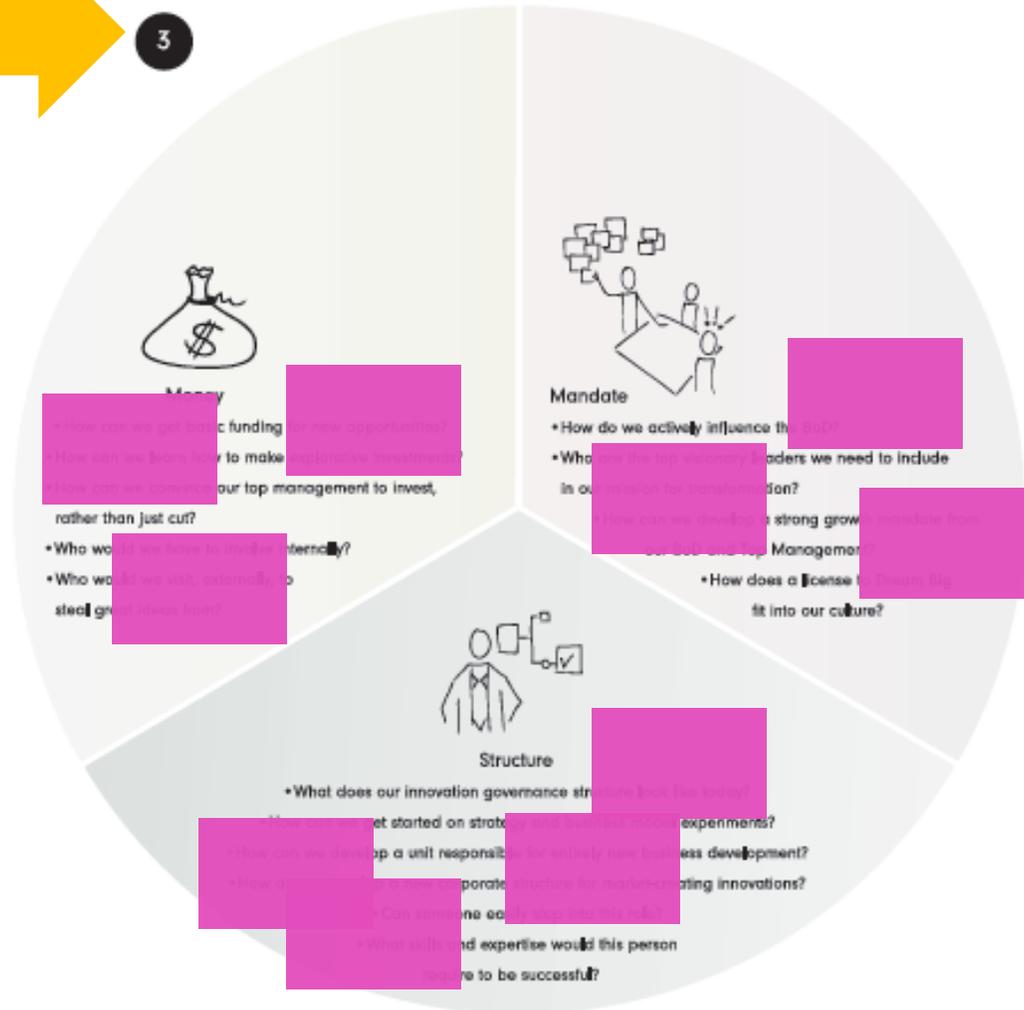
Company name: _____

1 What does "Market-creating innovations" mean to our company?

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Money	
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Mandate	
#5 We have an explicit growth ambition from the Board of Directors and Top Management	1 2 3 4 5
#6 We have a license to think big, dream big and take calculated strategic risks	1 2 3 4 5
SUM	

3



**Uro i
markedene**

Innovasjonssjef Aud Trondvoll fra Kongsberg Gruppen småprater i lunsjen med Statoils nylig avgåtte innovasjonssjef, Ole Dokka. De mener norsk oljeteknologi lett kan få anvendelse i andre bransjer. Alle foto: Tomas Alf Larsen



Bare én prosent er optimister

Oljebransjen er i krise, og bare én prosent av rogalandsbedriftene ser svært store muligheter for alternativ anvendelse av sin teknologi. Noen håper på romfart.



Jonas Gahr Støre ✓

@jonasgahrstore

TWEETS

3 132

FØLGER

14,8 K

FØLGERE

74 K

FAVORITTER

13



Jonas Gahr Støre @jonasgahrstore · 2. jun.

Lytter til Christian Ringen ved Innovation Dock i Stavanger om omstilling og nyskaping, interessant og utfordrende!



*"Lytter til Christian Ringen...
om omstilling og nyskaping.
Interessant og utfordrende"*

- Jonas Gahr Støre, 2. juni 2015

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