Arthur D Little

Innovating in the digital age –
a cross-industry exploration

Digital technology will transform the way innovation gets done

October 2018

Our recent survey of 150 companies and 300+ solution providers revealed five key lessons on "innovating in the digital age"

1 Digital technologies (such as AI, advanced analytics, self-learning systems and IoT) are expected to partly or even completely transform the way innovation gets done, according to 93% of all surveyed companies

2 The most important technologies can be grouped into three families, depending on what they bring to innovators
1. those that boost intelligence, for instance about customer needs;
2. technologies that bring better and faster foresight, e.g. concerning product performance;
3. digital solutions that improve and accelerate collaboration, communication and learning

3 Almost all participating companies expect to fully digitalize their innovation engine or even their entire company; and that this will go hand in hand with the digitalization of their products, services and business models

4 Important barriers are the shortage of "digital thinkers" and capabilities; and because of this relative ignorance many industrial companies still miss a clear view on concrete business benefits and ultimately a strategy for change

5 There is no such thing as a "best practice" that can simply be followed but successful companies tend to follow a threefold approach:
1. Design solutions for broad user adoption for established digital solutions;
2. Run controlled piloting programs for cutting edge digital technology applications;
3. Monitor and experiment with potentially disruptive ones

Source: Arthur D. Little

This report summarizes a unique global and cross-industry investigation into the why, the what and the how of "innovating in the digital age"[1]
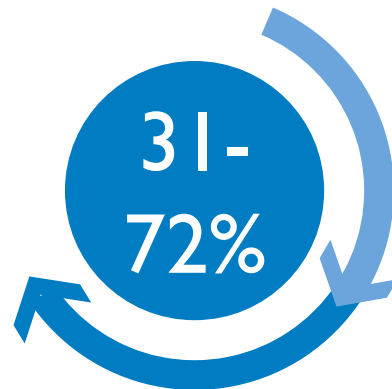
Key statistics from our survey

Digital technology will transform innovation as we know it...
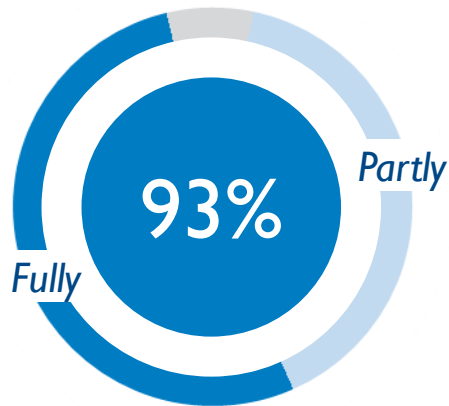
Partly

93%

Fully

Agree that digital innovation will fully or partly transform their organization

**...But what this means is often not clear and differs between company types[2]**

31-72%

Say that their company is still discovering the full potential of digital innovation

And because ultimate benefits for leaders will be enormous...

3.0x innovation overall

2.9x breakthrough innovation
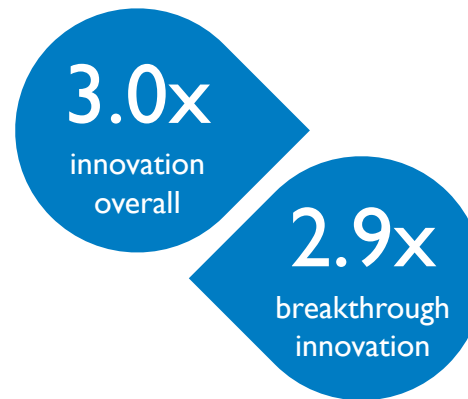
Increase in innovation output from digital technologies under optimal conditions

...Navigating the right transformation journey is crucial
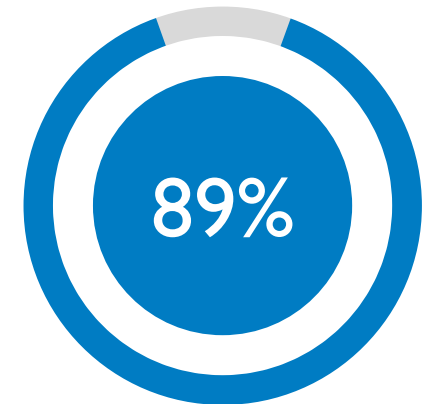
89%

Feel that successful digital innovation will require a new approach to innovation management

1) In this document "digital innovation" refers to the use of digital technologies to improve the end to end process of innovation. More information about how this study was conducted can be found on the last page of this document
2) Our data show that there are four archetypes to explore digital innovation, which each span various industries and which have distinctly different views on digital innovation
Source: Arthur D. Little Innovating in the Digital Age survey

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The impact of digital technology on innovation will generally be much more than incremental and be even transformative for most companies

Digital technology will transform innovation as we know it…
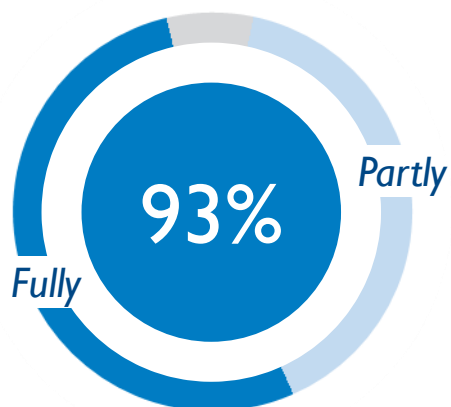
…But what this means is often not clear and differs between company types[2]

And because ultimate benefits for leaders will be enormous…

…Navigating the right transformation journey is key

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Agree that digital innovation will fully or partly transform their organization

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Increase in innovation success rates from digital technologies under optimal conditions

89%
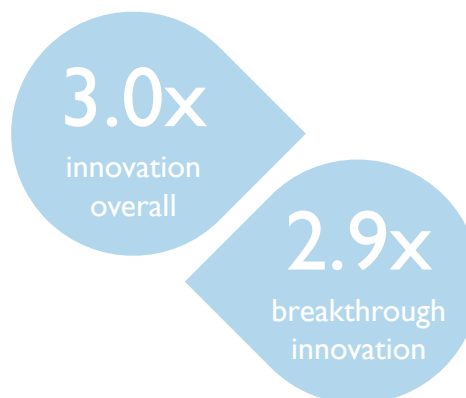
Feel that successful digital innovation will require a new approach to innovation management

▶ The following section illustrates the impact that respondents anticipate specific digital technologies will have on innovation in their organization
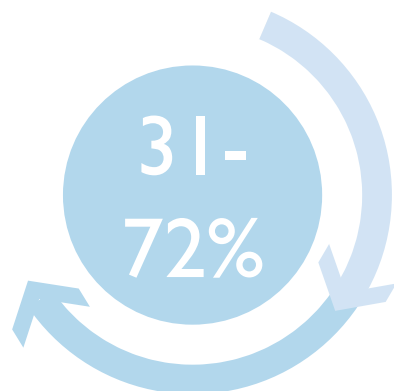
1) In this document "digital innovation" refers to the use of digital technologies to improve the end to end process of innovation
2) Our data show that there are four archetypes to explore digital innovation, which each span various industries and which have distinctly different views on digital innovation
Source: Arthur D. Little Innovating in the Digital Age survey

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Experience over the last decade suggests that everything that can be digitalized, will be. So what does this mean for innovation?

Innovation management framework

Big data / advanced analytics

Cognitive, self learning systems / bots

Virtual modeling / simulation

Virtual workplace / workplace 4.0

eLearning

Connected things

Augmented reality

Additive manufacturing

Collective intelligence / crowd sourcing

End-to-end innovation

Intelligence

Strategy & Portfolio

Solution Development

Marketing

Operations

Ecosystem Management

Competence Management

Value
- **Growth**
- **Profits**
- **P/E Multiple**
- **Efficiency**
- **Market position**
- **...**

Source: Arthur D. Little

Legend: Digital technology building blocks   Components of innovation

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After decades of improving innovation performance, companies still have a lot left to wish for in this area – might "digital" provide an answer?

If only…

| ? | …we would have direct insight in the unmet needs of our customers' customers |

| ? | …we were able to accurately predict customer satisfaction with how he/she applies our new product without even creating a prototype |

| ? | …our people and partners would work and innovate together seamlessly as one global team across entities, functions, regions and job titles |

| ? | …we would be able to ensure that every employee had exactly the right skill set and competencies, no matter how job requirements change |

| ? | …we would be able to bring our people to become more effective innovators through a clever design of their (digital) environment |

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Our study considers nine digital building blocks with the potential to improve or even transform the way innovation gets done

Digital technologies

Big data / advanced analytics	Cognitive, self learning systems / bots	Virtual modeling / simulation	Virtual workplace / workplace 4.0	eLearning
	Connected things	Augmented reality	Additive manufacturing	Collective intelligence / crowd sourcing

Integrating and comprehensively analyzing / interpreting multiple internal and external data sources

Autonomous systems using algorithms to enhance their capabilities over time

Virtual model for all real-world elements (e.g. processes, assets) used in simulation and modelling

Digitization of work place objects to allow for a remote and context-based form of working

Digitally enabled development of individual skill sets and facilitation of behavioral change

Connecting traditionally analogue devices to the internet / other devices

Enhanced visualization and decision-making in highly complex situations

Instant physical reproduction of 3D-models using a wide range of possible materials

Gaining insights from the aggregated intelligence of many internal/ external individuals
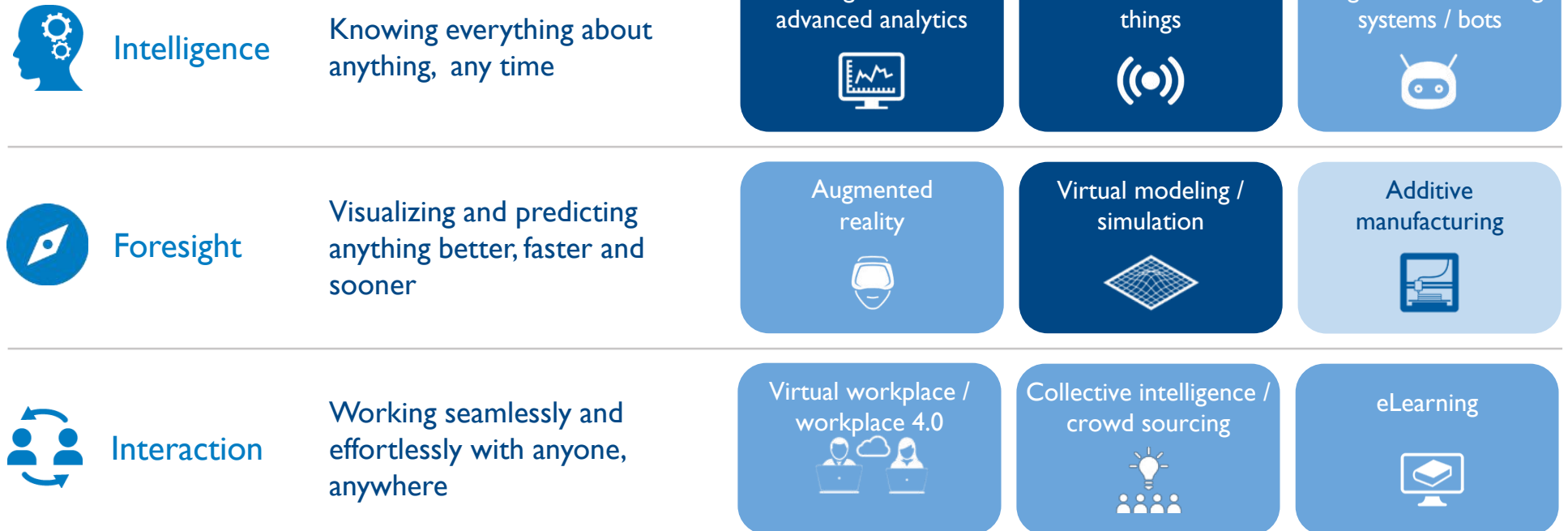
Source: Arthur D. Little

We have identified three families of digital technology, each bringing a distinct type of benefit to innovation

Digital technologies – key enablers for Innovation Management

Study results

Digital technologies with a high potential to shape innovation management[1]

Digital technology family:

Intelligence — Knowing everything about anything, any time

- Big data / advanced analytics
- Connected things
- Cognitive, self learning systems / bots

Foresight — Visualizing and predicting anything better, faster and sooner

- Augmented reality
- Virtual modeling / simulation
- Additive manufacturing

Interaction — Working seamlessly and effortlessly with anyone, anywhere

- Virtual workplace / workplace 4.0
- Collective intelligence / crowd sourcing
- eLearning

1) Color indicates the relative potential of each technology
Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews

Legend (prevalence of responses): Very high | High | Significant | Moderate

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Example[1]: Artificial Intelligence enables companies to predict final product characteristics based on raw material properties and process conditions

Predicting product characteristics using Artificial Intelligence

Description
- Artificial neural networks can help predict how final product characteristics are impacted by raw material properties and process conditions

Opportunity
- Faster and more efficient development of novel solutions
- Reduced production costs through improved production throughput

Digital Technology type

| Augmented reality | Big data | Cognitive computing | Collective intelligence |
| Connected things | eLearning | Modelling / simulation | Virtual workplace |

Impact area	Importance	Identified business impacts
Strategy & portfolio		
Intelligence		
Solution development		• Test broad range of options
Operations		• Reduce testing & trial-and-error
Competence management		• Production cost reduced by 8.5%
Innovation ecosystem mgt		
Marketing		

Expected availability

| Available | < 2020 | < 2025 | 2025+ |

Example[1]: Connecting stakeholders throughout the development process increases customer satisfaction and reduces cost

Capturing requirements, modelling, simulation, validation while you design

Description
- An end to end business platform with integrated modelling & simulation connects all functions with real time information and coordination

Opportunity
- Faster and more efficient development of novel solutions
- Reduced production costs through improved production throughput

Digital Technology type

| Augmented reality | Big data | Cognitive computing | Collective intelligence |
| Connected things | eLearning | Modelling / simulation | Virtual workplace |

Impact area	Importance	Identified business impacts
Strategy & portfolio		Risk, timing & cost reduction
Intelligence		Improved product requirements
Solution development		Timing, cost, quality, etc
Operations		Production cost reduced by 25%
Competence management		
Innovation ecosystem mgt		Real time & collaborative
Marketing		Capture & execute voice of customer

Expected availability

| Available | < 2020 | < 2025 | 2025+ |

Source: DASSAULT SYSTEMES. Arthur D. Little
1) More examples and use cases are available on request

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Example[1]: Achieving product differentiation, reducing risk of failure and shortening design cycles through 3D multiphysics simulation

Speeding up and de-risking the engineering of products or experiences

Description

- Tools allowing Electromagnetic, Thermal, Structural simulations in the Design & Engineering platform with theoretical and/or measured data inputs (from models or sensors). Automated simulation processes

Opportunity

- Evaluation of more design alternatives, trade-off studies
- In depth insight into product behavior under realistic operating conditions
- Early fix of flaws in the design cycle

Digital Technology type

Augmented reality	Big data	Cognitive computing	Collective intelligence

Connected things	eLearning	Modelling / simulation	Virtual workplace

Impact area	Importance	Identified business impacts	Expected availability			
Strategy & portfolio		Risk, timing & cost reduction	Available	< 2020	< 2025	2025+
Intelligence						
Solution development		Timing, cost, quality, etc				
Operations		Timing				
Competence management						
Innovation ecosystem mgt		Simulation on-demand				
Marketing		Capture & execute voice of customer				

Source: DASSAULT SYSTEMES. Arthur D. Little
1) More examples and use cases are available on request

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Example[1]: Boosting innovation capacity by adopting integrated simulation and analytics based decision metrics at early stages of R&D

Allocation decisions using big data, scientific & artificial intelligence based simulation platform

Description	■ Company objectively evaluates the vast number of R&D project options at early stages by rapidly simulating each one using advanced big data analytics
Opportunity	■ Red flags are found sooner which reduces R&D costs and enables more projects ■ Failure rate with R&D projects is reduced and market demands are met faster

Digital Technology type

Augmented reality	Big data	Cognitive computing	Collective intelligence

Connected things	eLearning	Modelling / simulation	Virtual workplace

Impact area	Importance	Identified business impacts
Strategy & portfolio		■ 50% lower failure rate in late stages
Intelligence		■ 10x more alternatives evaluated
Solution development		■ 2x pipeline with same resources
Operations		
Competence management		
Innovation ecosystem mgt		
Marketing		

Expected availability

Available	< 2020	< 2025	2025+

Source: SustAnalyze, Arthur D. Little
1) More examples and use cases are available on request

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Example[1]: Early adopters have started to gain significant benefits via a digital delivery model for training and competency management

Employers buy into 'Netflixisation' of executive education

Start-ups offer gamification and other eye-catching alternatives to classroom training

Big ambitions: Jean-Marc Tassetto wants Coorpacademy to be Netflix for corporate learning © Dom Smaz/FT

Jonathan Moules AUGUST 2, 2018

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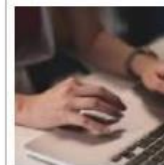
AI can now tell your boss what skills you lack—and how you can get …
MIT Technology Review - 7 Aug 2018
A new AI-powered **tool** developed by **Coursera** aims to be that metric. …. **Coursera** expects the skills-**benchmarking** information, which will be …

Algorithms are coming for their jobs, so workers are teaching …
Los Angeles Times - 4 May 2018
The **Los Angeles Times** Logo … When cybersecurity firm **Malwarebytes** started automating its quality assurance testing last … The company signed up with **Udemy** for Business, an online learning platform that … traders and a handful of computer programmers who, working together, do 10 times the trades.

In the coming three years, companies expect to see significant benefits from digital innovation

Study results
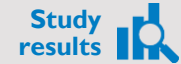
Benefits from the transition to digital innovation *(next 3 years)*

Share of sales from new offerings — 211%

Overall innovation success rate — 194%

Innovation speed — 177%

Breakthrough radical innovation success — 163%

Process improvement — 158%

(100% 150% 200% 250%)
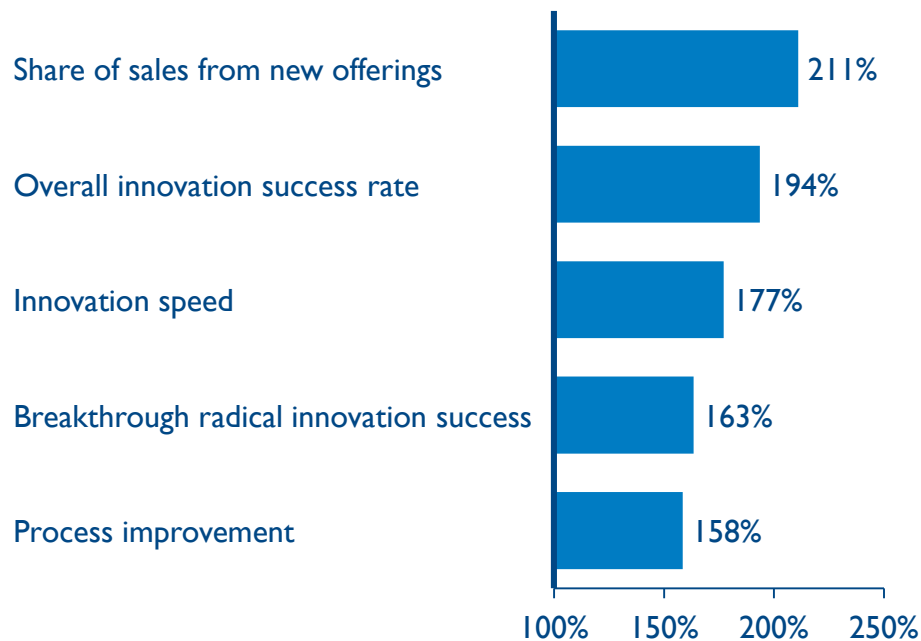
"Big data helps us to recognize opportunities early on"

"We have developed a digital work companion using RFID and other technologies to improve discipline in following best practices"

"[…] allows us to work in garage-like environments to test ideas without needing extensive budgets"

"In an innovation ecosystem, this should help to quickly find the root-cause of complex issues as soon as they arise"

"We will see ever more data sources, and need ever more capabilities to manage and analyze the data to improve innovation success rates and efficiency"

"We have started initial pilots to apply deep learning in formulation science"

"AI will alter the work tasks of innovation staff; we will have to see what capabilities we still need"

▶ These benefits are those estimated by respondents under current conditions. Full benefits can be much larger provided that key challenges are addressed (see following sections)

Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews

Digital technology will impact all aspects of innovation management but exactly how is often still unclear, benefiting leading companies

Digital technology will transform innovation as we know it...
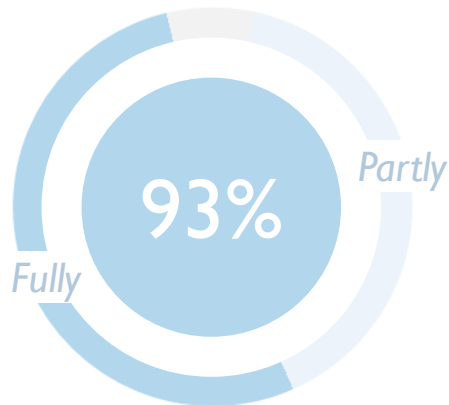
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93%
Partly
Fully

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3.0x innovation overall

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Agree that digital innovation will fully or partly transform their organization

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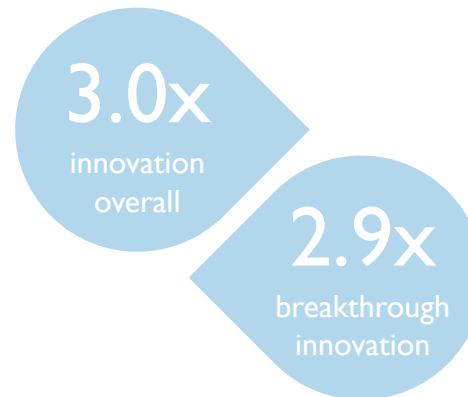
Increase in innovation success rates from digital technologies under optimal conditions

Feel that successful digital innovation will require a new approach to innovation management

▶ This section introduces four distinct archetypes to explore digital innovation – your company falls into one of them; understanding them will help you to navigate challenges & leverage opportunities along your digital innovation journey

Source: Arthur D. Little Innovating in the Digital Age survey

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On average, companies expect most digital technology building blocks to become important to all aspects of innovation…

Study results

Opportunity map of digitally enabled Innovation Management[1)]

Digital Tech. Building Blocks	Better and more agile decision-making	Better and faster insights on business and technology	Better and first time right design and development	Running your operations better and cheaper	Having the right amount and caliber of people, today & tomorrow	Navigating & engaging all relevant partners, existing and new	Design, branding, communication, promotion, consumer experience
	Strategy & Portfolio	**Intelligence**	**Solution Development**	**Operations**	**Competence Management**	**Innovation Ecosystem Mgmt.**	**Marketing**
Big data / advanced analytics							
Connected things							
Cognitive computing							
Augmented reality							
Modeling / simulation							
Additive manufacturing							
Virtual workplace							
Collective intelligence / crowd sourcing							
eLearning							

Color code (Importance): High | Medium | Low

1) Average estimates of all companies of where the impact of each digital technology building block will be highest

Source: Arthur D. Little Innovating in the Digital Age survey

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…while data show that approaches differ markedly between four distinct strategic archetypes to explore digital innovation

Study results

Digital innovation – strategic archetypes[1]

Digital Natives	Pioneers	Traditionalist	Aspirants
■ Digital is (already) in the company's DNA (digital products and services)	■ Companies are optimistic about benefit and quickly explore technologies	■ Industry sees little impact today, thus multi-year plan for digitally-enhanced IM is followed	■ No complete vision for digital transformation / vision not specified in time
■ Digital technologies are established in innovation	■ Digital technologies are selectively used in innovation	■ Digital technologies are piloted in innovation	■ Digital technologies are selectively piloted in innovation
■ Typical industries include: – Information technology – Telecom – Media	■ Typical industries include: – Process industry – Transport & logistics – Consumer electronics	■ Typical industries include: – Utilities – Financial services – Process industry	■ Typical industries include: – Manufacturing – Food & Beverage – Engineering

▶ These strategic archetypes are not maturity levels – there can be good reasons to be and stay in one and the same archetype. They represent clustering of similar companies based bottom-up statistical analysis of responses

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Certain archetypes occur more frequently in certain industries; no industry is dominated by Digital Natives

Distribution of archetypes over industries

- **Chemicals and Pharma:** Companies in this segment are most likely to be Pioneers or Traditionalists; few are Digital Natives

- **Consumer Goods & Food:** Companies in this segment are most likely to be Traditionalists or Aspirants; some are Pioneers and few are Digital Natives

- **Industrial, Manufacturing & Engineering:** Companies in this segment are most likely to be Aspirants or Traditionalists; some are Pioneers or Digital natives

- **Utilities & Networks:** While this segment has the greatest proportion of Digital Natives, companies in this segment are more likely to be Pioneers or Traditionalists

Chemicals & Pharma

Consumer Goods & Food

Utilities & Networks

Industrial, Manufacturing & Engineering

Digital Native
Pioneer
Traditionalist
Aspirant

Source: Arthur D. Little Innovating in the Digital Age survey

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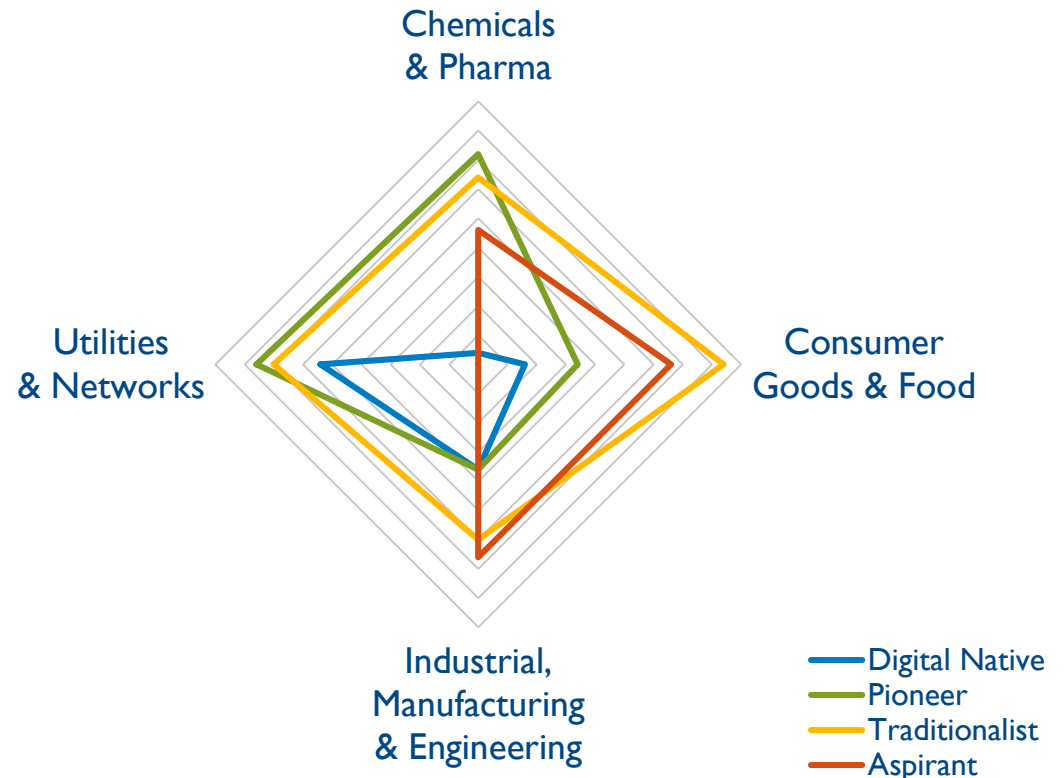
Companies within a strategic archetype look differently at the impact of digital innovation compared to those in others

Study results

Impact of digital innovation, % agreeing with statement

Digitally enhanced innovation will have a bigger impact than traditional innovation
- 81%
- 80%
- 36%
- 50%

Their organization is still discovering the potential of digital
- 31%
- 50%
- 51%
- 72%

For digitally enhanced innovation to be successful their organization needs a new approach to innovation management
- 56%
- 80%
- 36%
- 59%

Legend:
- Native
- Pioneer
- Traditionalist
- Aspirant
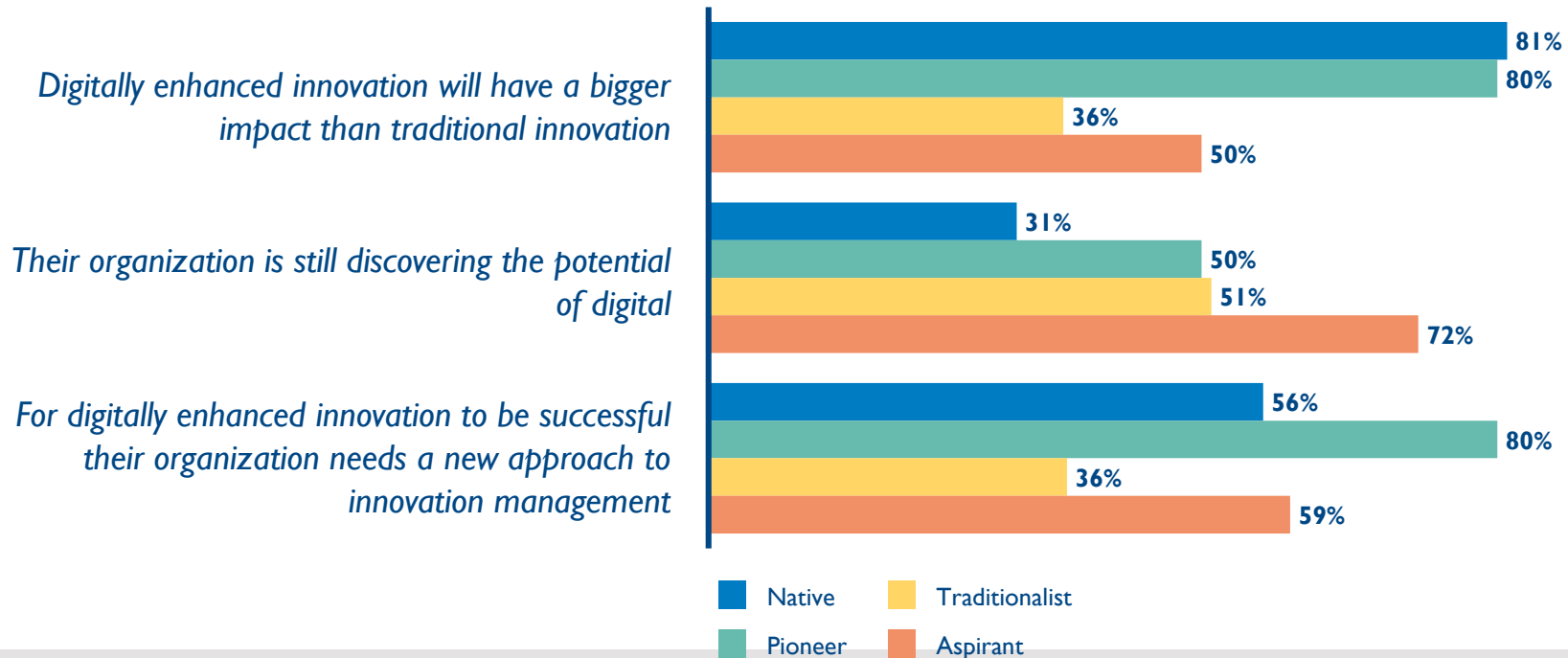
> Digital Natives and Pioneers see the highest impact of digital innovation but believe a lot more work is need to manage it. Traditionalists are much more conservative whereas Aspirants seem to struggle to make sense of it all

Source: Arthur D. Little Innovating in the Digital Age survey

Digital Native companies are amidst the corporate digital transformation and IM has a key role in the future positioning and success of the firm

Archetype characteristics – Digital Native

Digital enhanced-innovation helps us to create new and better services

What they do

>8% of revenue is spent on innovation

155m USD spend on digital innov. until 2020[1]
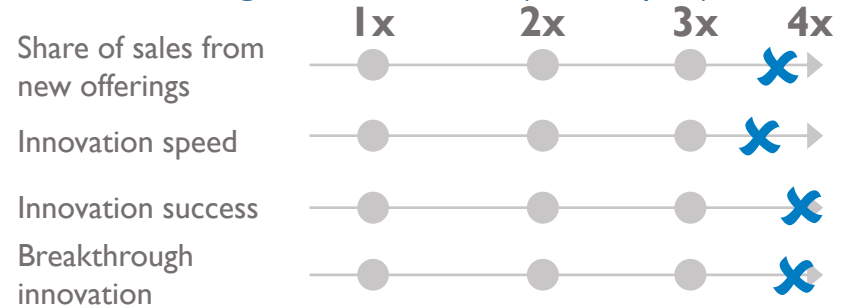
Top-3 things they do for digitally-enhanced innovation

- Clear responsibilities for digitally enhanced innovation
- Defined technology strategy for
- Corporate wide digital transformation

Top-3 digital technologies

- Big data / advanced analytics
- Connected things
- Cognitive, self learning systems /

What they get

Benefit of Digital Innovation (in multiples)

	1x	2x	3x	4x
Share of sales from new offerings	●	● ✗	●	
Innovation speed	●	● ✗	●	
Innovation success	●	●	● ✗	
Breakthrough innovation	●	●	● ✗	
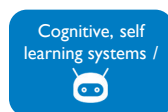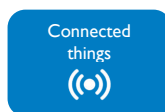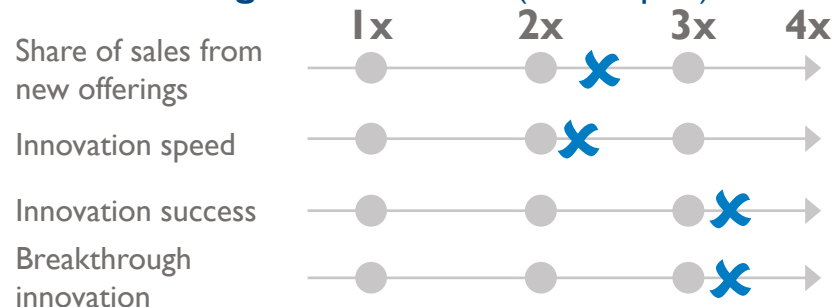
Example Use-Case

Integrated simulation along the entire design process

Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews

1) ADL analysis shows that there is only an indirect relationship between overall innovation spend and spend on digital innovation and that this relationship differs considerably between types of digital technology applications (data not shown). What is the optimal amount of digital innovation spend is therefore highly specific to each company

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Many companies see the huge potential of digitally-enhanced IM and despite their overall digital transformation pioneer digital IM

Archetype characteristics – Pioneer

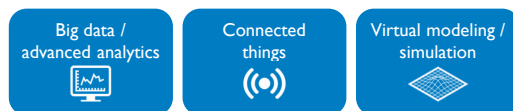**"With digitally-enhanced innovation we can catch-up with the market"**

What they do

5,8% of revenue is spent on innovation

122m USD spend on digital innov. until 2020[1]
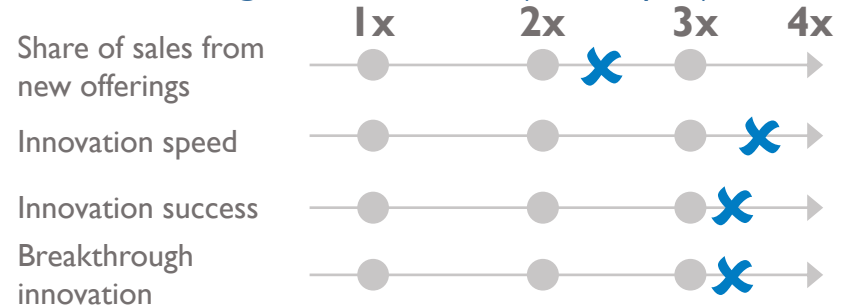
Top-3 things they do for digitally-enhanced innovation

- Explore many different technologies and ways of working
- Individual owernship for the introduction of technologies
- Incentive system for introducing new digital technologies

Top-3 digital technologies

Big data / advanced analytics	Connected things	Virtual modeling / simulation

What they get

Benefit of Digital Innovation (in multiples)

	1x	2x	3x	4x
Share of sales from new offerings				✕
Innovation speed				✕
Innovation success				✕
Breakthrough innovation				✕

Example Use-Case

Artificial Intelligence research platform

Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews

1) ADL analysis shows that there is only an indirect relationship between overall innovation spend and spend on digital innovation and that this relationship differs considerably between types of digital technology applications (data not shown). What is the optimal amount of digital innovation spend is therefore highly specific to each company

Traditionalists have little need to have digitally enhanced IM today, but see a huge potential in the future – the transformation of physical products

Architype characteristics – Traditionalist

Digitally-enhanced innovation has today little impact on our industry

What they do

5,6% of revenue is spent on innovation

75m USD spend on digital innov. until 2020[1]

Top-3 things they lack for digitally-enhanced innovation

- No clear vision and strategy exists on digital technologies
- Nobody in the organization is responsible for driving it
- The incentive system does not promote activities

Top-3 digital technologies

- Big data / advanced analytics
- Connected things
- Virtual modeling / simulation

What they get

Benefit of Digital Innovation (in multiples)

	1x	2x	3x	4x
Share of sales from new offerings	●	● ✖	●	
Innovation speed	●	●	● ✖	
Innovation success	●	●	● ✖	
Breakthrough innovation	●	●	● ✖	

Example Use-Case

Better manage daily operations using analytics

1) ADL analysis shows that there is only an indirect relationship between overall innovation spend and spend on digital innovation and that this relationship differs considerably between types of digital technology applications (data not shown). What is the optimal amount of digital innovation spend is therefore highly specific to each company

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Aspirants are in industries with generally low IM budgets, but see the opportunity to use digitally-enhanced IM improve the market position

Architype characteristics – Aspirant

Study results

> **Our industry is still discovering the potential, but it will be massive and we need to prepare**

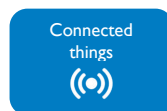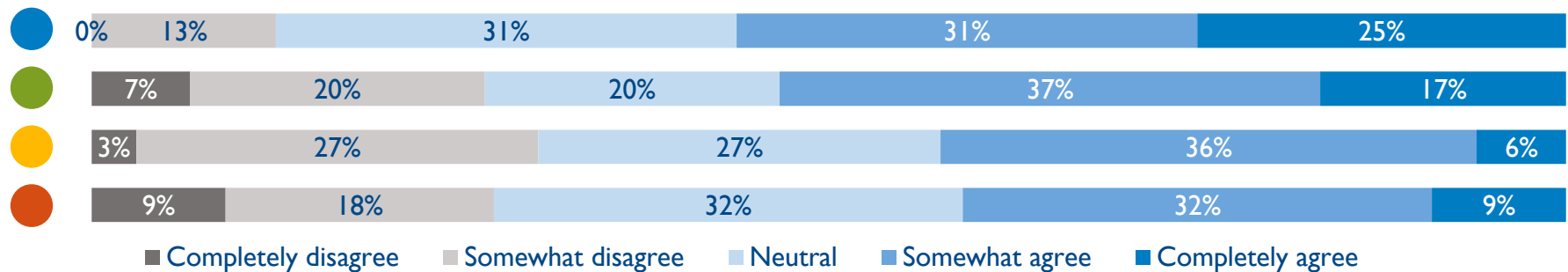### What they do

<4%% of revenue is spent on innovation

18m USD spend on digital innov. until 2020[1]

Top-3 things they lack for digitally-enhanced innovation

- Not the right capabilities
- No use-cases are available
- No clear vision and strategy exists on digital technologies

Top-3 digital technologies

- Big data / advanced analytics
- Connected things
- Virtual modeling / simulation

What they get

Benefit of Digital Innovation (in multiples)

	1x	2x	3x	4x
Share of sales from new offerings	●	✖	●	
Innovation speed	●	✖	●	
Innovation success	●	●	✖	
Breakthrough innovation	●	●	✖	
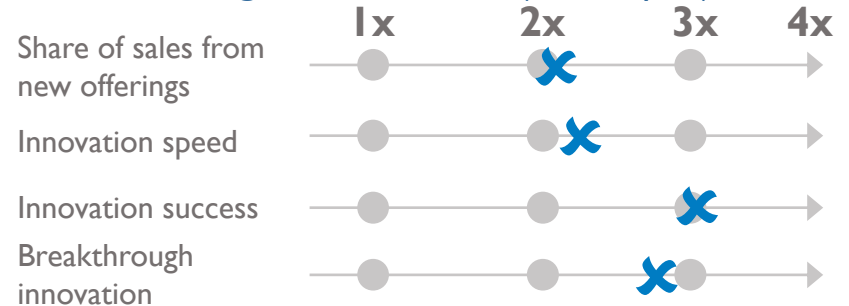
Example Use-Case

Process simulation using data and analytics

Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews

1) ADL analysis shows that there is only an indirect relationship between overall innovation spend and spend on digital innovation and that this relationship differs considerably between types of digital technology applications (data not shown). What is the optimal amount of digital innovation spend is therefore highly specific to each company

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Companies have very different views on innovation and expected investments in digitalization, depending on the archetype they are in

Satisfaction and future spend per strategic archetype

Study results

"I am satisfied with the value that our innovation activities bring to our company activities bring to our company":

	Completely disagree	Somewhat disagree	Neutral	Somewhat agree	Completely agree
🔵	0%	13%	31%	31%	25%
🟢	7%	20%	20%	37%	17%
🟡	3%	27%	27%	36%	6%
🔴	9%	18%	32%	32%	9%

■ Completely disagree   ■ Somewhat disagree   ■ Neutral   ■ Somewhat agree   ■ Completely agree

"How much does your company expect to spend on digital innovation in the next three years?"

Million USD

0   20   40   60   80   100   120   140   160   180   200

Low estimated spend is partly explained by the fact that these companies claim not to have a suitable vision/strategy and/or a good view on relevant use cases for digital innovation

■ Digital Native
■ Pioneer
■ Traditionalist
■ Aspirant

Source: Arthur D. Little Innovating in the Digital Age survey

Arthur D Little

26

The are many barriers that stand in the way of creating a digital innovation engine – but overcoming these will bring enormous benefits

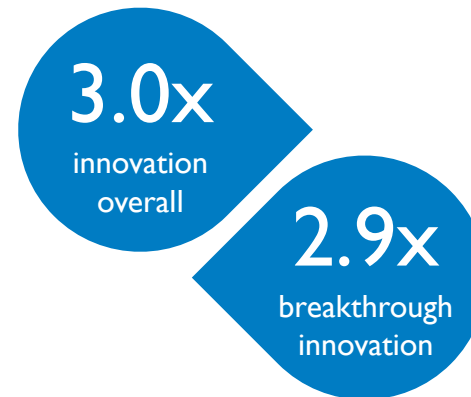**Digital technology will transform innovation as we know it...**
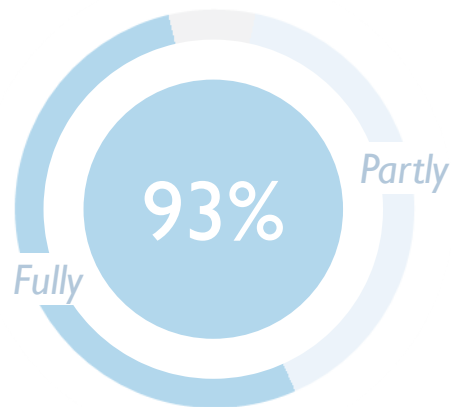
Fully
93%
Partly

Agree that digital innovation will fully or partly transform their organization

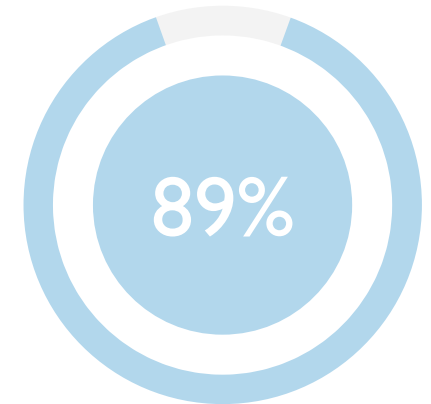**...But what this means is often not clear and differs between company types**

31-72%

Say that their company is still discovering the full potential of digital innovation

And because ultimate benefits for leaders will be enormous...

3.0x innovation overall

2.9x breakthrough innovation

Increase in innovation success rates from digital technologies under optimal conditions

...Navigating the right transformation journey is key

89%

Feel that successful digital innovation will require a new approach to innovation management

> This section identifies the most common barriers to digital innovation that is keeping each archetype from reaching full benefits from digital innovation

Arthur D Little

Companies believe that expected benefits from digital innovation could be significantly higher under optimal conditions….

Study results

Benefit realization from the transition to digital innovation, average results

Overall impact on innovation performance:
(All benefits, compared to today)

100%

1.7x ø **+** **0.7x** ø **=** **2.4x** ø

Breakthrough radical innovation success	213%	76%	289%
Overall innovation success rate	191%	105%	296%
Process improvement	176%	97%	273%
Share of sales from new offerings	164%	77%	241%
Innovation speed	159%	76%	235%

100%   150%   200%   250%   300%

"Speed of innovation is no longer an objective, it is a given. But we struggle to ensure concerted efforts and consistency across our businesses and between hard- and software development"

"Digital technology enables us to offer new value-added services complementing our hard-ware innovations"

■ Expected improvements under current conditions   ■ Expected additional improvements under optimal conditions

▶ Under optimal conditions (i.e. optimal budget, resources, capabilities, etc.) respondents are confident that benefits from digital innovation would increase significantly – and offer leaders additional room to differentiate from others

Source: Arthur D. Little Innovating in the Digital Age survey

Arthur D Little

…if only they were able to overcome a wide range of barriers that are currently holding them back

Roadblocks for digital innovation

Study results

What is lacking today, % of responses:

	Very Significant		Partially Significant	Not Significant
Digital thinkers	24%	47%	23%	6%
Suitable capabilities	19%	45%	29%	8%
Clarity on benefits	18%	44%	26%	11%
Clear use cases	17%	34%	38%	11%
Support in the organization	17%	30%	36%	17%
Ownership	11%	42%	31%	15%
Strategetic priority	11%	36%	34%	19%
Vision and strategy for DI	11%	32%	35%	21%
Incentives to execute	9%	41%	32%	18%
Governance and accountability	8%	36%	36%	21%

■ Very Significant ■ Partially Significant ■ Not Significant
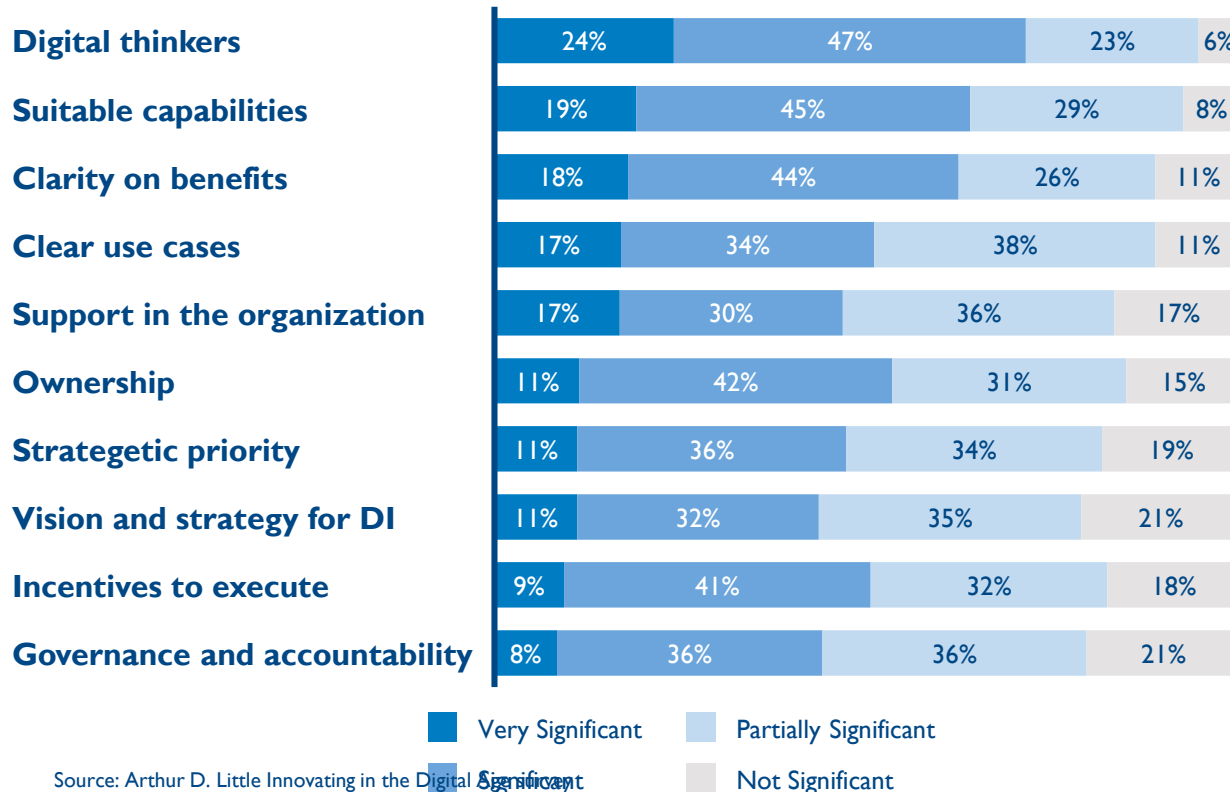
Source: Arthur D. Little Innovating in the Digital Age survey

Risk of Digitally-Enhanced Innovation

78% % of respondents that indicated they were concerned about the risks in safety, security, compliance and IP

"We have too few digital thinkers who can spot truly important digital opportunities"

"Where do we find world-class competencies? Not in our industry"

"How do we align the transformation journeys across units and functions?"

"Working with lots of digital solutions providers sounds nice until something goes wrong"

"We have a strategy now, but little operationalization"

"We spend too much budget to maintain and optimize existing systems (i.e. legal)"

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Companies struggle with similar barriers but differences in importance between archetypes suggest that many can be (partly) resolved

Barriers for digital innovation by archetype, % respondents[1]

Study results

	Digital natives	Pioneers	Traditionalists	Aspirants
Digital thinkers	57	70	76	82
Suitable capabilities	61	67	60	72
Clarity on benefits	73	31	68	82
Clear use cases	40	35	60	77
Incentives	50	44	32	48
Ownership	47	50	56	47
Organizational support	44	63	40	38
Strategetic priority	19	44	56	54
Vision and strategy	25	40	36	68
Governance & accountability	33	52	40	46

▶ Even when there is a guiding vision and strategy, getting clarity on benefits remains challenging for most, also the Natives. Pioneers struggle with getting support from other parts of the organization. Aspirants require a good vision

Source: Arthur D. Little Innovating in the Digital Age survey

1) Only "Very Significant" and "Significant" scorings are shown

Significant — Very significant (×4 categories)

Arthur D Little 31

How can these findings be used to overcome hurdles and get started with digitally-enabled innovation?

Overcoming roadblocks for digital innovation

What is lacking today, % of responses:

	Very Significant	Significant	Partially Significant	Not Significant
Digital thinkers	24%	47%	23%	6%
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- Digital competence management and workplace design

- Start with potential, end with solutions
- Learn from today's "art of the possible"
- Start experimenting

- Generate a target picture
- Iterative solution development
  - Leverage available solutions
  - Initiate Proof-of-Concept Projects
- Quick wins & visible progress

- Adoption Engineering
- Fit-for-purpose governance approach

Legend:
- Very Significant
- Significant
- Partially Significant
- Not Significant

Source: Arthur D. Little

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While >90% of respondents believe that digital technology will transform their industry, >50% also said they were still discovering its full potential

Where to start?

- Stay away from the solution, start with the potential. Identify opportunities and evaluate the business potential

- Learn from today's "art of the possible", but continue to think in terms of the big picture: unlimited Intelligence, Foresight and Interaction

- Start experimenting – not by following a fixed implementation plan but rather by launching a limited set of pilot projects

Case example – "digital pilot factory"

Pilots to evaluate the potential of digital technologies

Data glasses to assist in maintenance

Exoskeletons to reduce the physical impact on employees

Cameras to assist in checking vehicles & infrastructure for potential damage

…After several successful proof-of-concepts, technologies are rolled out company-wide (in this case to all maintenance facilities)

Key benefits:
- Learn: understand digital technologies and validate their potential
- Develop: cultivate fit-for-purpose solutions that generate real value
- Support: get early buy-in from key stakeholders

Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews

Arthur D Little

There is not one common end-state for digital innovation and companies need to carefully plot and follow their transformation journey

Digital technology will transform innovation as we know it...
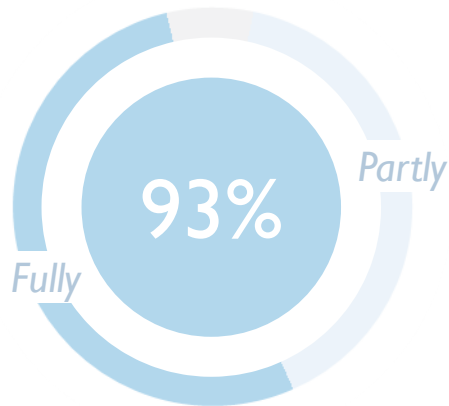
...But what this means is often not clear and differs between company types

And because ultimate benefits for leaders will be enormous...

...**Navigating the right transformation journey is key**

93%

Fully   *Partly*

31-72%

3.0x
innovation overall

2.9x
breakthrough innovation

89%

Agree that digital innovation will fully or partly transform their organization

Say that their company is still discovering the full potential of digital innovation
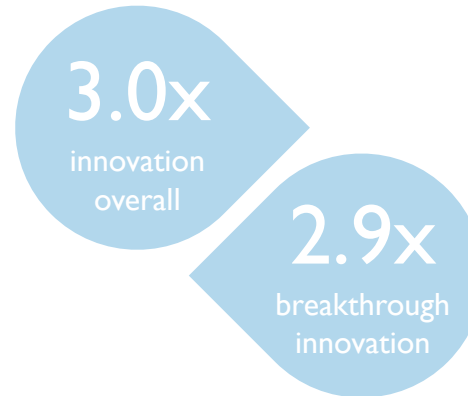
Increase in innovation success rates from digital technologies under optimal conditions

Feel that successful digital innovation will require a new approach to innovation management

This section provides different roadmaps for digital transformation in innovation based on archetypes as well as specific objectives in terms of digitalization of both companies' innovation engines and product portfolios

Source: Arthur D. Little Innovating in the Digital Age survey

Arthur D Little

Most participating companies today already use digital technologies in the way they innovate and in what they offer to the market…

Study results

Digital innovation transformation – where companies are today
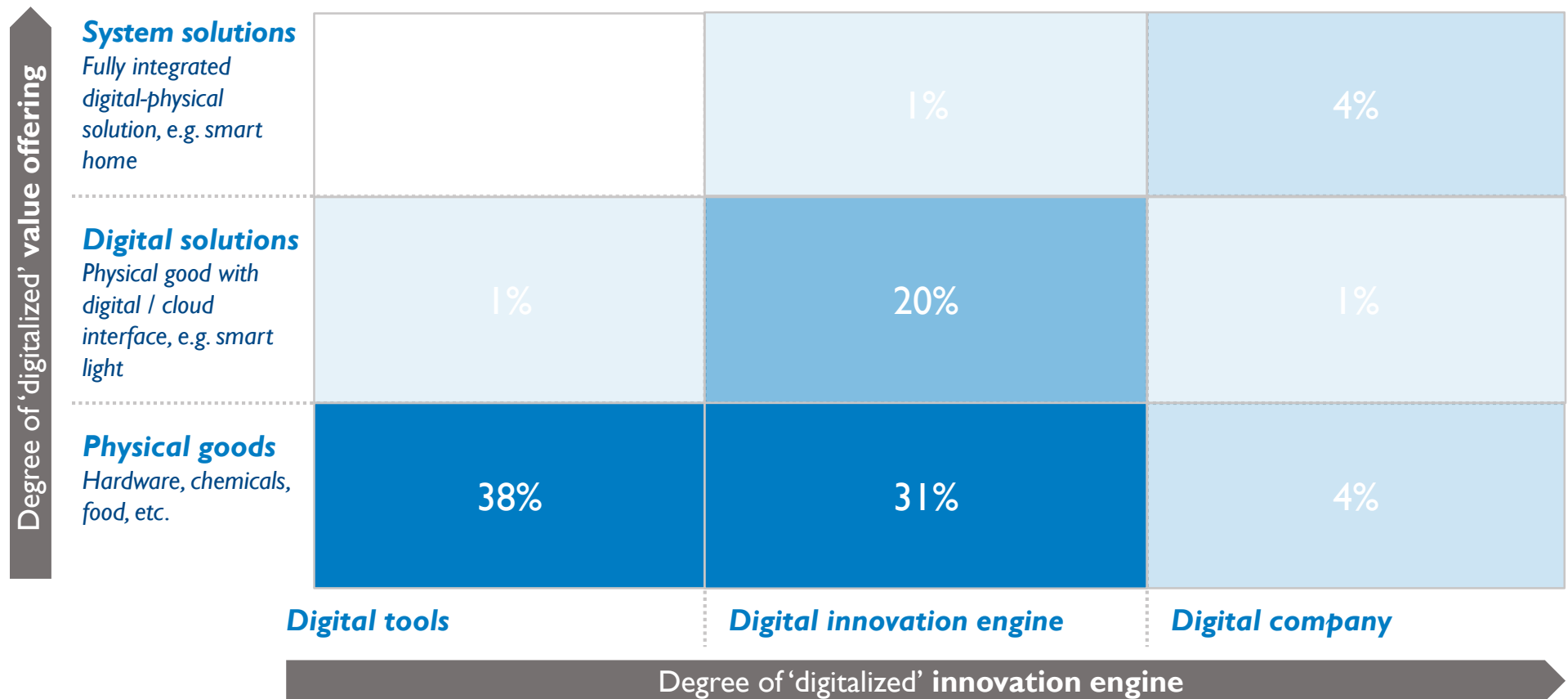
Degree of 'digitalized' value offering

	Digital tools	Digital innovation engine	Digital company
System solutions — Fully integrated digital-physical solution, e.g. smart home		1%	4%
Digital solutions — Physical good with digital / cloud interface, e.g. smart light	1%	20%	1%
Physical goods — Hardware, chemicals, food, etc.	38%	31%	4%

Degree of 'digitalized' **innovation engine**

Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews
Note: Preliminary as obtaining a more robust and granular opportunity map will be one of the goals of our broadcast survey

…but almost all expect to further "digitalize" both their innovation engine and their offerings – significantly!

Study results
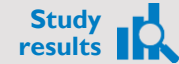
Digital innovation transformation – where companies hope to be in three years
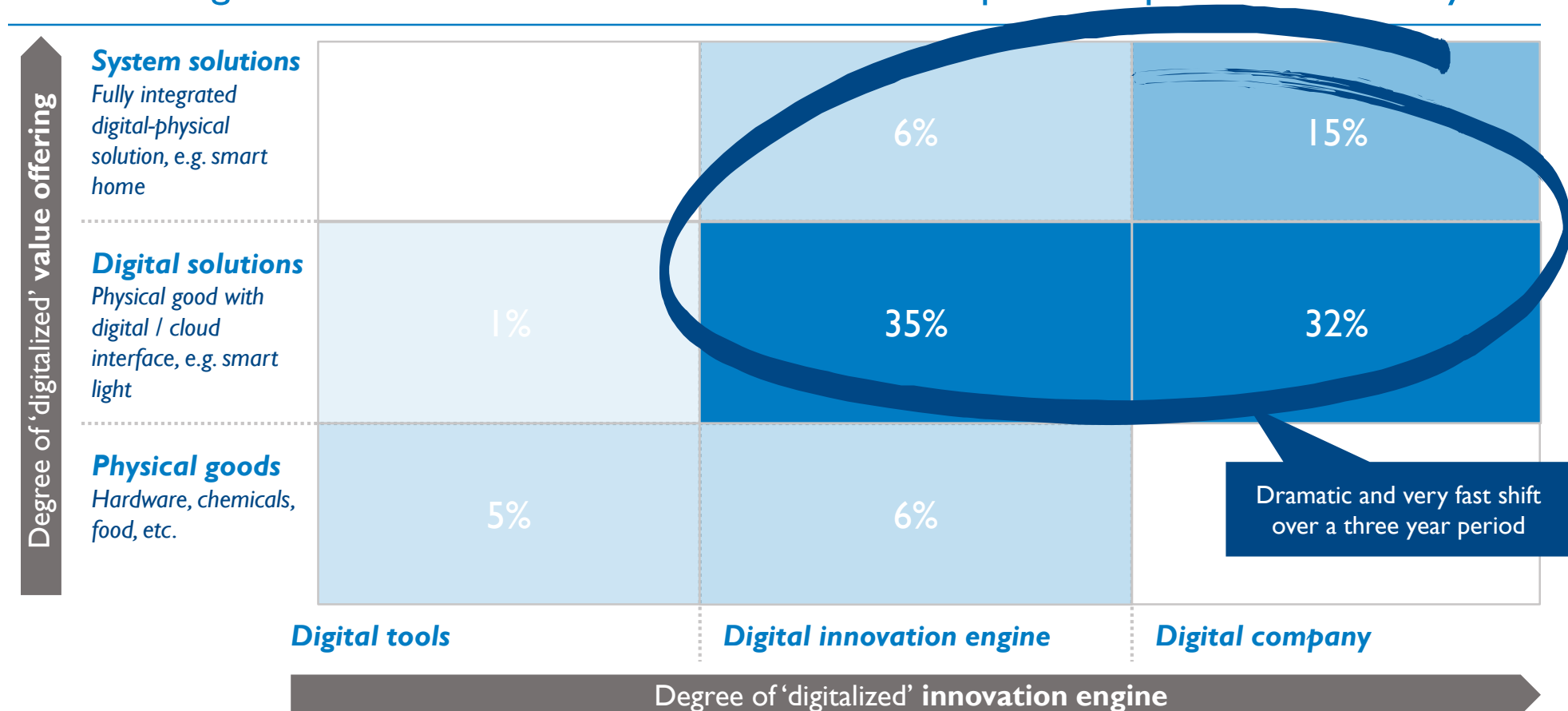
Degree of 'digitalized' value offering

System solutions
Fully integrated digital-physical solution, e.g. smart home

Digital solutions
Physical good with digital / cloud interface, e.g. smart light

Physical goods
Hardware, chemicals, food, etc.

	Digital tools	Digital innovation engine	Digital company
System solutions		6%	15%
Digital solutions	1%	35%	32%
Physical goods	5%	6%	

Degree of 'digitalized' innovation engine

Dramatic and very fast shift over a three year period

Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews
Note: Preliminary as obtaining a more robust and granular opportunity map will be one of the goals of our broadcast survey

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Companies differ in their digital transformation priorities for the coming three years

Study results

Digital innovation transformation – three distinct roadmaps
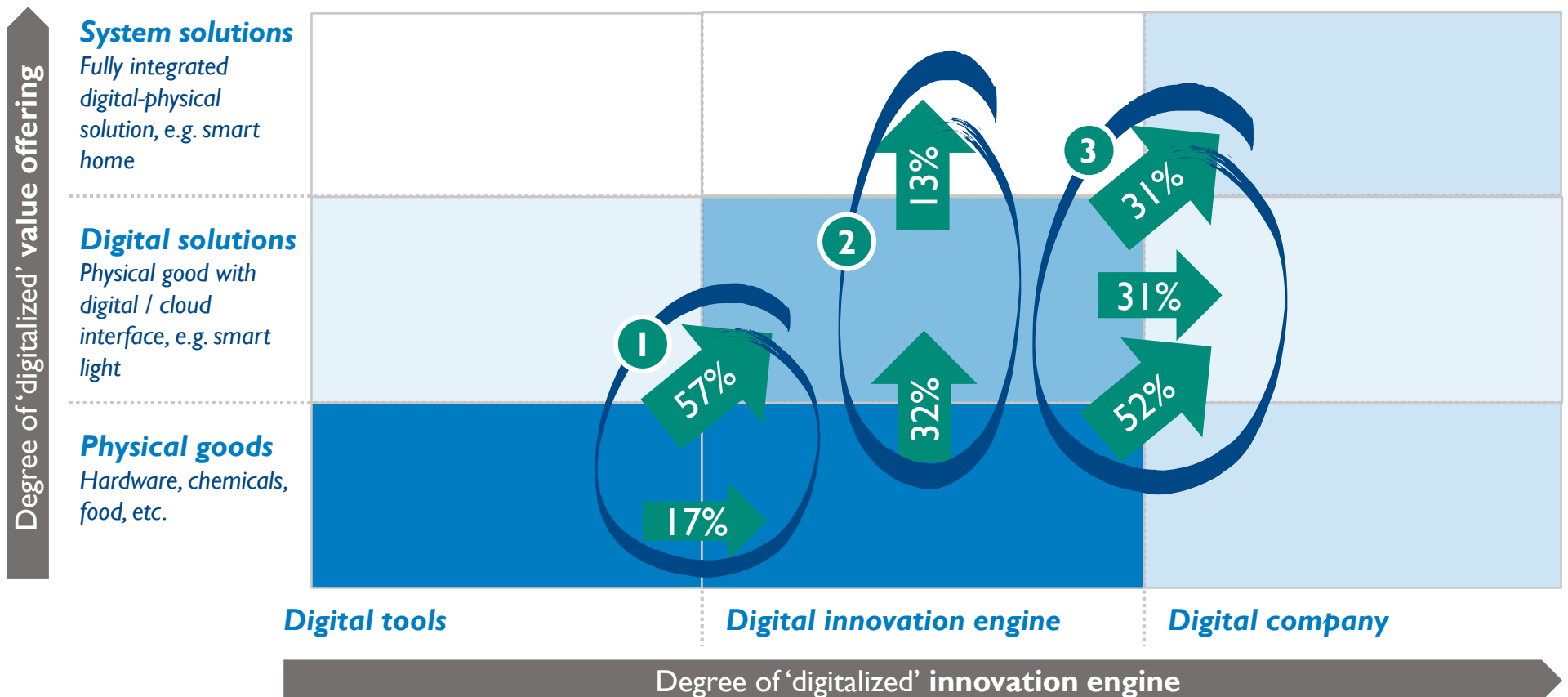
Degree of 'digitalized' value offering

System solutions
Fully integrated digital-physical solution, e.g. smart home

Digital solutions
Physical good with digital / cloud interface, e.g. smart light

Physical goods
Hardware, chemicals, food, etc.

1 — 57%
17%

2 — 13%
32%

3 — 31%
31%
52%

Digital tools   **Digital innovation engine**   **Digital company**

Degree of 'digitalized' innovation engine

Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews
Note: Preliminary as obtaining a more robust and granular opportunity map will be one of the goals of our broadcast survey

These three transformation roadmaps differ in which priorities companies will apply in building on their experience built so far

1 **"Initiate"**

- Archetypes: >90% Aspirants
- Innovation spend: Lowest average innovation spend (<7.5% of total revenue)
- Managing transformation: Nearly all will focus on globally integrated innovation management
- Priorities going forward:
  - Replicate first successes
  - Develop a vision which allows more focus and eventually higher budgets
  - Broaden applications using proven solutions

2 **"Leverage"**

- Archetypes: >70% Traditionalists
- Innovation spend: Large variance amongst respondents
- Managing transformation: ~70% will focus on globally integrated innovation management; ~30% prefer a Business Unit approach
- Priorities going forward:
  - Use experiences in digital innovation to develop new services and business models
  - (Even) higher need for common strategy and roadmap for service and business model innovation
  - Manage security and IP

3 **"Expand"**

- Archetypes:
  - ~40% Pioneers
  - ~40% Traditionalists
  - ~20% Digital Natives
- Innovation spend: Highest average innovation spend
- Managing transformation: ~80% will focus on globally integrated innovation management
- Priorities going forward:
  - Further develop digital business models and integrated solutions throughout value chain
  - Focus on winning "winner takes all" battles

Source: Arthur D. Little Innovating in the Digital Age survey; executive interviews

The majority of respondents manage digital innovation deployment globally and believes this is also the right level to steer transformation

Who is involved in managing deployment…?

% of respondents answering:

Many mention the CEO or CTO to be the preferred responsible leader

- Nobody responsible — 26%
- CTO/CIO*/Head R&D — 42%
- Managed at BU level — 15%
- Chief Digital Officer — 13%
- Chief Information Officer — 15%
- Digital Innovation Committee — 18%

Multiple responses were possible
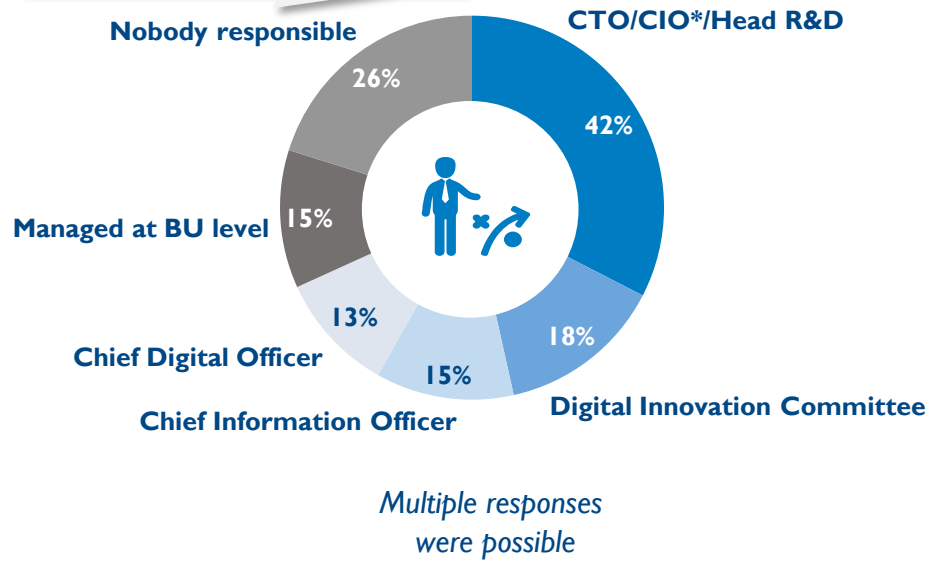
At what level should transformation happen…?

% of respondents answering:
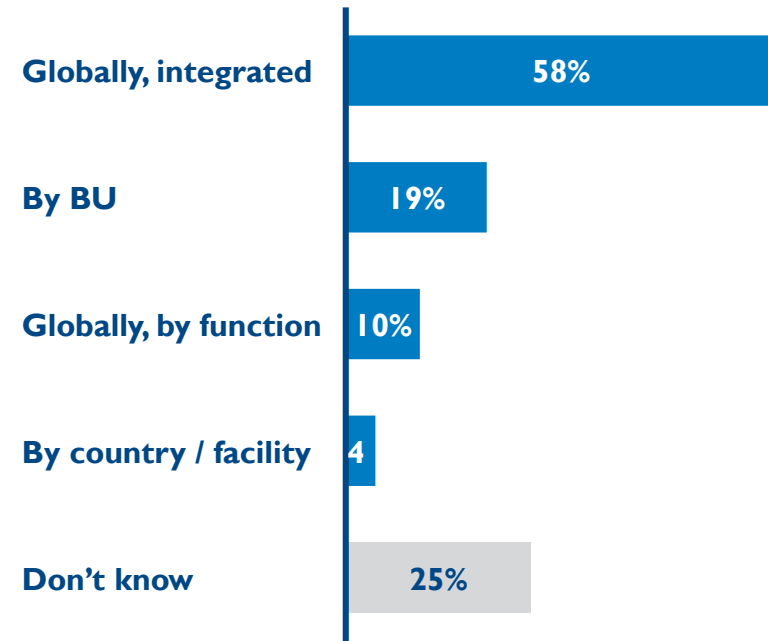
- Globally, integrated — 58%
- By BU — 19%
- Globally, by function — 10%
- By country / facility — 4
- Don't know — 25%

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Extensive technology scanning suggest that most known applications are in Intelligence and Foresight, with Interaction mostly as "next gen"

Analysis results

Spread of identified use cases prevalence – suggested focus by roadmap type

Technologies that are…⮥		Key	Pacing	Emerging
		■ Well embodied in products & processes ■ High competitive impact	■ Experimentation by some players ■ Competitive impact likely high	■ At the early stage of emergence in other applications ■ Potential competitive impact unknown, but promising
Technologies that bring…⭥				
Intelligence	Knowing everything about anything, any time	~15%	~15%	~10%
Foresight	Visualizing and predicting anything better, faster and sooner	~10%	~15%	~10%
Interaction	Working seamlessly and effortlessly with anyone, anywhere	~5%	~10%	~10%

Source: Arthur D. Little

Legend (prevalence of use cases examined): ■ Wide-spread ■ On the rise ■ Still uncommon

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"Next gen" example: if Blockchain can help to digitally transform business processes by providing efficiency, validity and trust ….

Classic centralized world	"New" Blockchain world

	"Source of trust"	Central Authority		**Network** i.e. heterogeneous peers: human or machine
	Information storage	Centralized		**Decentralized**
	Steering	Discrete by authority		**Continuous** by individual peers
	Security	Non-transparency & integrity of central authority		**Encryption & transparency** (principle of consensus)
	Incentive	Pre-defined & fixed rewards		**Individual benefits** (easy, trusted transactions)

Source: Arthur D. Little

Arthur D Little

… then how about its impact on innovation? We believe that there is enormous potential for first-moving innovators willing to experiment

Applying Blockchain in Innovation – reasoning by analogy

If Blockchain is a…

Raw-data repository
Store all relevant, decentral information including a validity check

Process manager
Inherently provide logic for process steps

Common basis
Integrated with different, distributed systems, ensuring real-time synchronization

Value repository
Digital storage for physical assets enabling and validating transactions

New platform
Fully distributed exchange with no transaction costs, full transparency and real-time transactions

…already capable of…

ADL case examples !

Simplifying administration of inter-company service provisioning (incl. controlling)

Real-time tracing of end-to-end supply chain across value network

Trusted identity creation for integrated customer journey and customer data monetization

…could it also be used for…?

Value chain innovation
Using end-user application data in upstream new product development for better and/or customized solutions (e.g. in specialty chemicals)

Business model innovation
Creating a co-owned and secure data sharing platform for collaborative business model innovation (e.g. in smart cities / buildings / hospitals /…)

Sustainable innovation
Developing 100% guaranteed "green labeled" product portfolio fully traceably sourced from sustainable sources

Source: Arthur D. Little

Arthur D Little

Given the importance of Digital Innovation and the current uncertainties and challenges, we recommend a three-step approach going forward:

What it may bring   *How it could be done*   *How to make it work*

1 Develop target picture for Digital Innovation

2 Map (digital) technology applications

3 Define and execute Digital Innovation roadmap

Iterate

- Potential for enhanced innovation performance and business model offerings

- Target picture for Digital Innovation

- Mapping of the "art of the possible" and internal barriers

- Business logic for digital innovation:

  1. "Smart-stitching" commercially available solutions → *Deploying user-centric solutions to manage innovation*

  2. Piloting new applications → *Piloting towards "next practice" innovation*

  3. Monitor/experiment with (potential) disruptive technologies → *Strengthen digital ecosystem innovation capabilities*

- Digital Innovation roadmap

Source: Arthur D. Little

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It is not just about technology but also about user adoption – and innovation has many "users"!

Technology enables, it provides the tools to help us work more effectively...
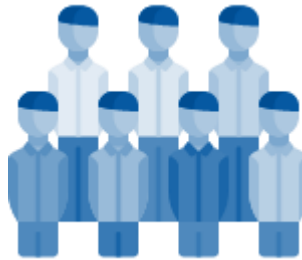
…Ultimately, the **people** will **define** the **speed** for adoption and **unlock value** for the organisation **from new technology** and ways of working...
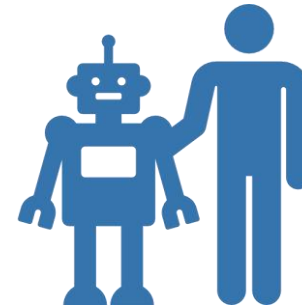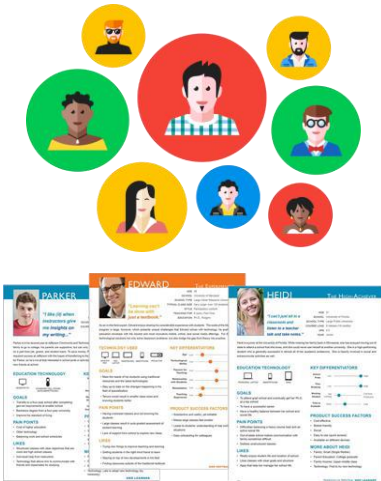
… **Adoption Engineering** brings the two together to ensure that whilst **technology will enables**, it is the **people** that **transform**
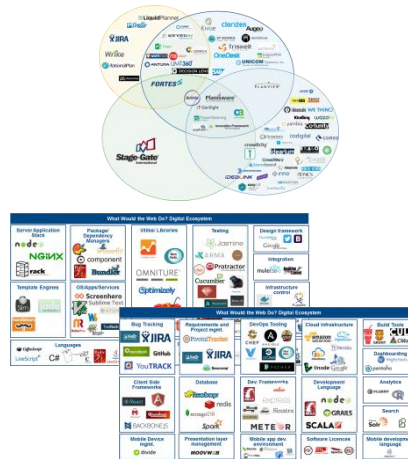
Arthur D Little 45

A user-experience-driven "smart stitching" approach works best for digital solutions that are already commercially available

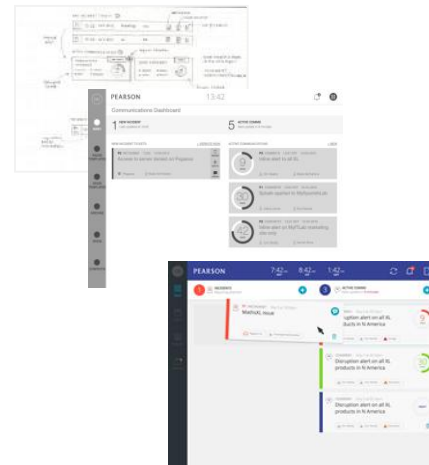## How to make it work: commercially available solutions

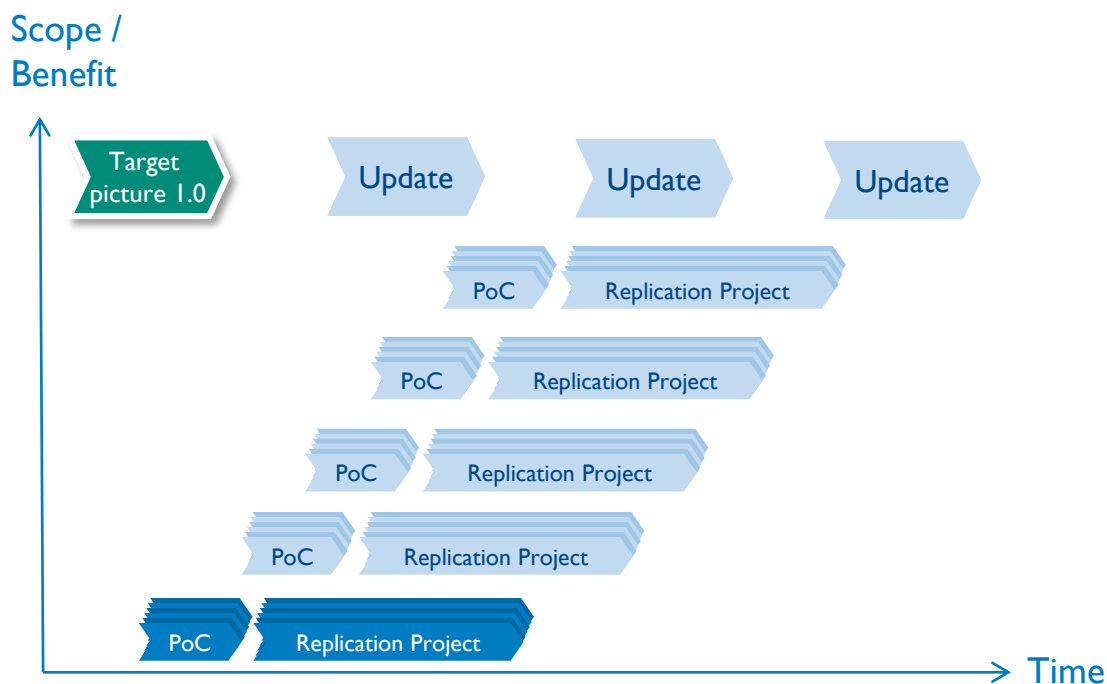| User Personas & Journeys	Architecture & Stitching	Iterative Design	Single System Perception

> In many cases combining commercially available solutions is a fast and economical way to tackle key business needs with digital solutions

Source: Arthur D. Little

Cutting edge technology applications ("next practice") should be deployed in a piloted approach

How to make it work: "next practice" applications

Scope / Benefit (y-axis)

Target picture 1.0

Update — Update — Update

PoC — Replication Project
PoC — Replication Project
PoC — Replication Project
PoC — Replication Project
PoC — Replication Project

Time (x-axis)

- **Proof-of-Concept Projects (PoCs):**
  - Centrally financed
  - Criteria: 1-2 years payback, priority application areas, high replication potential, available technology
  - Various technologies and vendors involved
  - Replication decision and plan

- **Replication Projects**
  - Central co-financing (20% - 30%)
  - Integrated in strategic and operational planning and control
  - IT-architecture and standardization decisions
  - Make-or-buy decisions

> Pilot projects foster visibility and generate momentum through quick wins. Simultaneously, the create clarity regarding the best approach to and true value of digital innovation

Source: Arthur D. Little

Arthur D. Little can help you every step of the way along your company's digital innovation transformation journey

1. Anticipate!

UNDERSTAND

Technologies, ecosystem opportunities, customer needs & breakthrough solutions
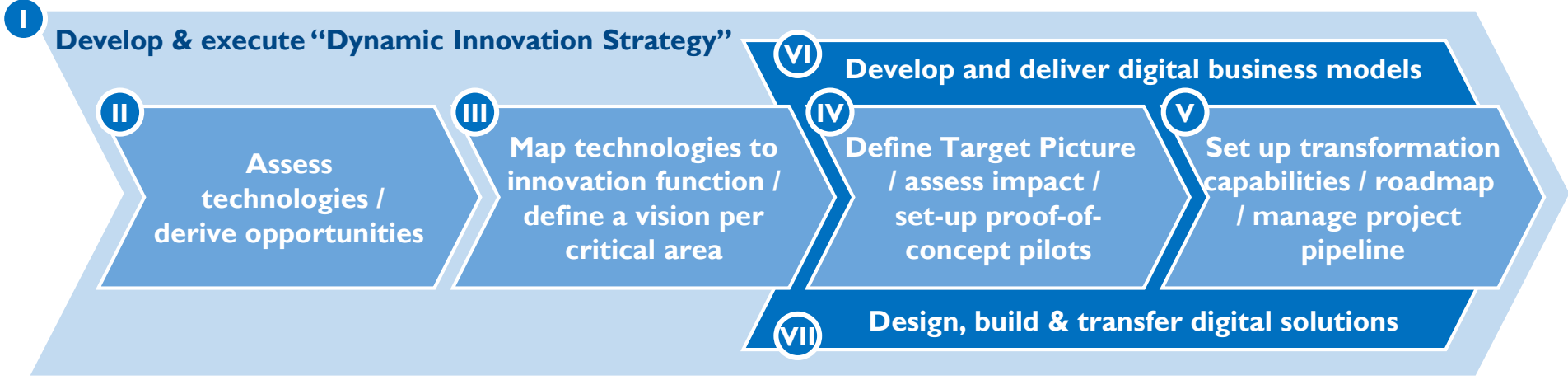
2. Innovate!

DESIGN

"Digital Innovation" target picture, built on solutions that work

3. Transform!

SHAPE

Ecosystem and Innovation engine evolving continuously towards target picture

High-level approach

I. **Develop & execute "Dynamic Innovation Strategy"**

II. **Assess technologies / derive opportunities**

III. **Map technologies to innovation function / define a vision per critical area**

IV. **Define Target Picture / assess impact / set-up proof-of-concept pilots**

V. **Set up transformation capabilities / roadmap / manage project pipeline**

VI. **Develop and deliver digital business models**

VII. **Design, build & transfer digital solutions**
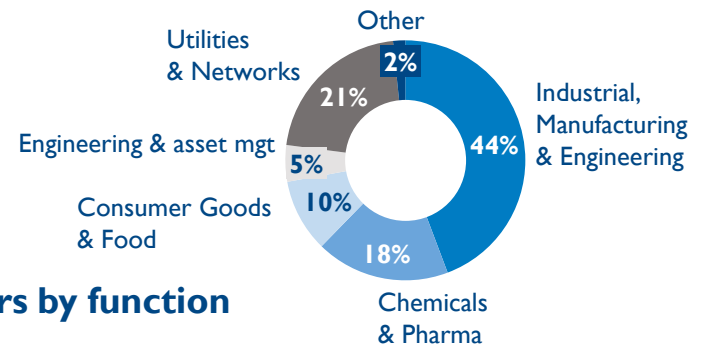
Source: Arthur D. Little

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Together with our knowledge partner DASSAULT SYSTEMES[1] we collected insights and data from a wide variety of sources
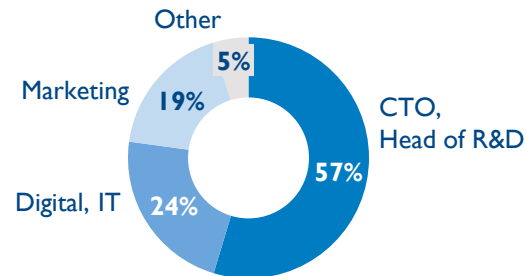
Sources used

- **Interviews** with innovation leaders and digital innovation / AI pioneers (28)

- Responses from >150 senior respondents who participated in our **interactive survey** (see *right-hand panel*)

- **Desk research** (technology and use case identification out of >300 candidate industry and start-up examples)

- **ADL project repository** (dozens of projects related to digital innovation)

Contributors[2]

Contributors by industry

- Utilities & Networks
- Other **2%**
- **21%**
- Engineering & asset mgt **5%**
- Consumer Goods & Food **10%**
- Industrial, Manufacturing & Engineering **44%**
- Chemicals & Pharma **18%**

Contributors by function

- Other **5%**
- Marketing **19%**
- Digital, IT **24%**
- CTO, Head of R&D **57%**

> Our survey design was based on executive interviews with innovation leaders from various industries. The four "archetypes to explore digital innovation" in this report were derived through bottom up statistical methods

Arthur D Little

Arthur D. Little Luxembourg S.A. has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations.

Our consultants have strong practical industry experience combined with excellent knowledge of key trends and dynamics. ADL is present in the most important business centers around the world. We are proud to serve most of the Fortune 1000 companies, in addition to other leading firms and public sector organizations.

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Interested in participating in the survey and receiving a customized report? Please contact:
woerner.heike@adlittle.com

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