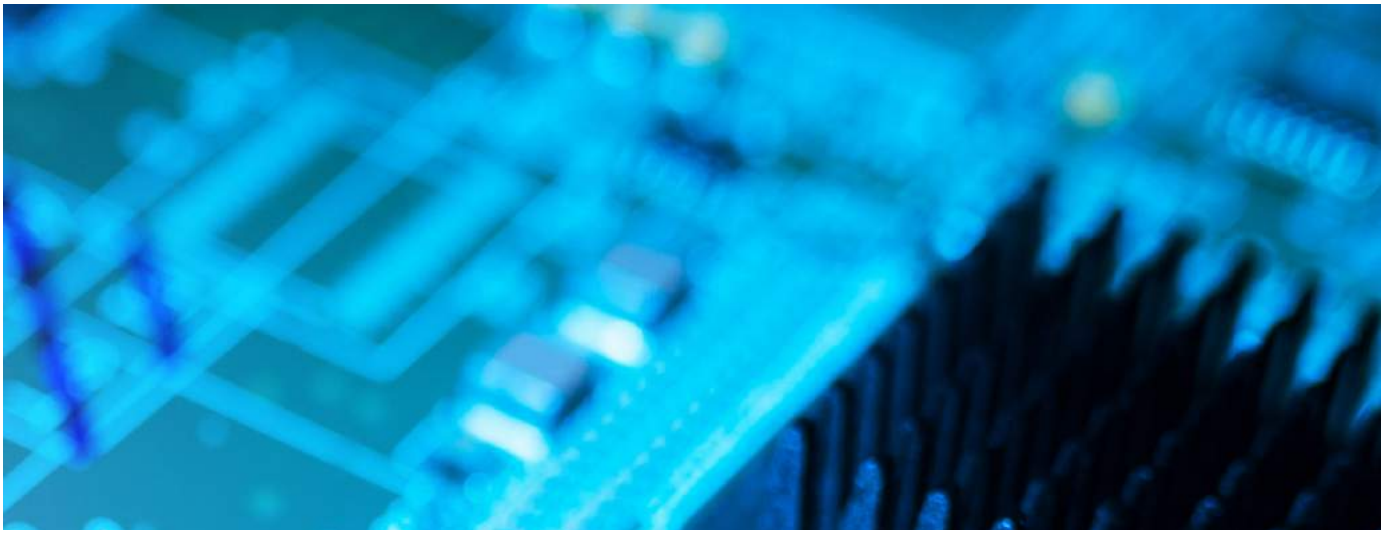


An aerial night photograph of a city, featuring a large, brightly lit roundabout in the lower right quadrant. The surrounding urban landscape is densely packed with buildings and streets, all illuminated by the warm glow of city lights.

# Tomorrow's world

*A revolution begins*





## ***Towards the fluid and inclusive information ecosystem of the future***

PwC has been part of a system providing confidence to a wide array of stakeholders for over 100 years. Today, as technological advances impact the scale, scope and utility of data and information, we believe a new system of information and trust is taking shape around us. This ecosystem will offer great opportunities for both businesses and society to inform their decisions better than ever imagined.

We are part of this evolving ecosystem, which needs to be transparent, dynamic and open. In stating our view and supporting the transition towards the future, we are supporting the evolution of a system that addresses a broader set of needs and which we believe is an important step in pursuing our purpose of 'Building trust in society and solving important problems'.



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## *A fluid, inclusive information system is taking shape*

### **Executive summary**

#### **Powered by technology, fuelled by data, open to all**

Companies today are navigating their businesses through an increasingly complex world of decisions, risks and opportunities, amid technological advances that are unprecedented in their speed and impact. This is enabling their management teams to access data from an expanding array of internal and external sources and synthesise it to develop fresh insight for decision-making. These insights have the potential to be deeper, more comprehensive and detailed than ever before, helping companies to manage their businesses more effectively and respond to stakeholders' interests.

But that's not all that's changing, because a growing proportion of the information that management teams are using is now generated outside the company and beyond their control. And this information is also available to an increasing range of stakeholders – who are starting to draw on it to inform their own decisions and put the company's decisions and behaviour under intensifying scrutiny.

This scrutiny is causing companies to question how they interact with their stakeholders and affect wider society. Underlying this rethink is an increasing demand for greater transparency about who is running a business, their ethics and values, the company's culture, and what drives their decision-making.

At the same time, all organisations know that the sheer pace of technological progress means they themselves need to adapt to take advantage of technology in the future.

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*Advances in technology and the proliferation of data are enabling the creation of new business models and ways of doing business.*

### **A system under strain**

Businesses are using a wider range of data and sharing this information. However, this move towards reporting a wider range of information, combined with the growing availability of company-related data from other sources, is putting today's system of reporting and assurance under strain, pulling it in directions undreamt of when it was first developed over 100 years ago. At the same time, advances in technology and the proliferation of data are enabling the creation of new business models and ways of doing business that were not feasible – or even conceivable – when the system was developed.

In combination, all these developments and the pace of change at which they are happening are driving growth in the demand for information – in turn putting further strain on today's system. A system is needed that addresses these challenges: one that provides management teams with information to manage their businesses more effectively, responsively and responsibly; and one that enables people to access the right information to make their decisions with confidence. That system also needs to adapt quickly to reflect the pace of technological innovation and manage the wealth of information being used to make decisions. And this system must enable companies to be held to account.

### **Towards the new ecosystem**

A solution is starting to emerge. The shifts that technology is driving in data and information are nothing short of revolutionary, triggering – and enabling – radical changes in how organisations are managed and how they report their activities and impacts. These changes include actions and investments by a growing number of organisations – technology companies, investment groups, data aggregators to name a few – fuelling a move towards a more diverse, dynamic and fluid information environment. It is characterised by freer flows of information covering a broader spectrum of data and information types and sources – company and non-company, machine – and human-generated, and financial and non-financial, including operational, market and transactional.

The outcome is to create a new information ecosystem that's far broader and more inclusive than before – one in which the flows of information between companies, people and machines will create new roles in the generation, analysis and consumption of data and information.

So, what about trust in the information? These changes are already giving rise to new challenges and increasing demand for confidence in information. The need is being met through a combination of assurance as we know it today and new approaches based on technology, including the use of the increased processing and analytical power to collate and analyse huge volumes of data from multiple sources to corroborate data.

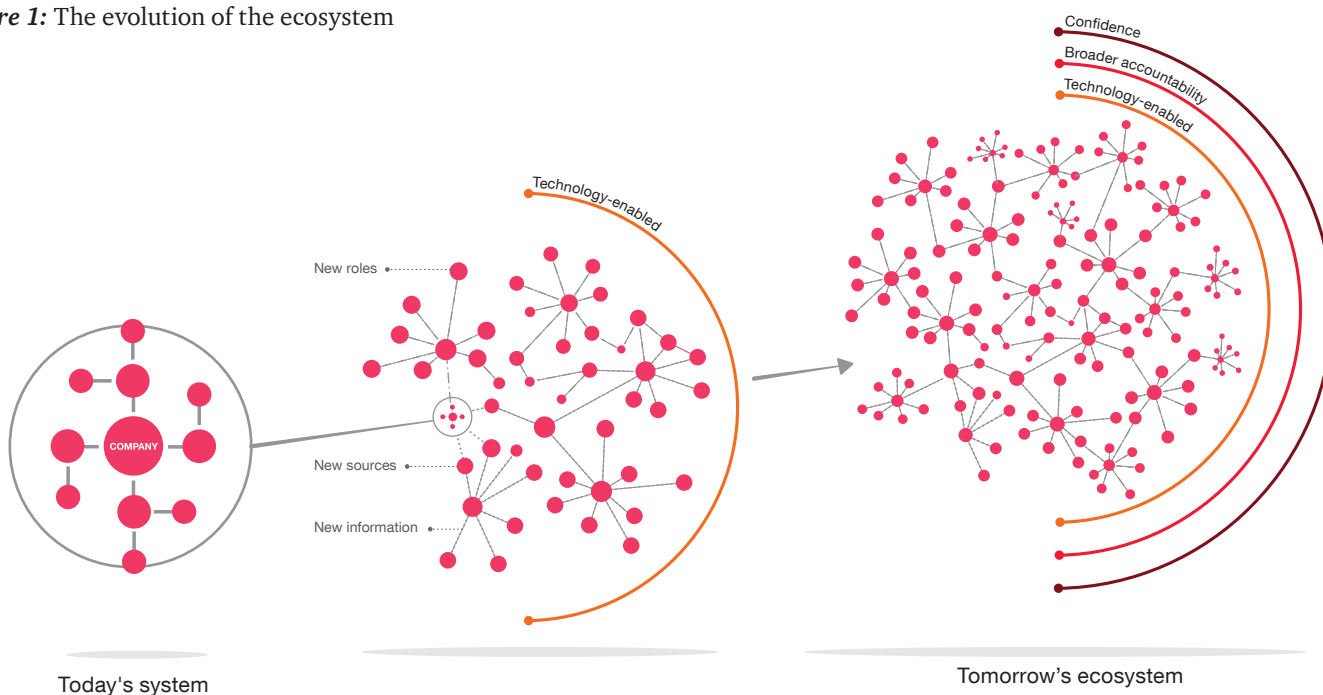
As the new information environment takes shape, the individual elements needed to create an effective ecosystem – technology, roles, data generation, flow and consumption, and confidence in data – will evolve independently. These will all be pulled together by those who are part of the ecosystem. However, there will need to be a change in behaviours to help create the ecosystem of the future.

### Tomorrow's ecosystem

Compared to today's system, tomorrow's world will include more sources and a greater flow of data between a wider range of users and intermediaries such as aggregators and analysts. As technology and stakeholder demands continue to develop, roles in the ecosystem will continue to adapt accordingly. Crucially, those in the system will include not just entities and individuals, but also machines. These will play a vital role in generating data, managing the volume and complexity of data, and – through the use of technologies such as artificial intelligence (AI) and machine learning – making and supporting decisions.

The ecosystem's interconnected components will include elements of today's system of reporting and assurance, some of it optimised by technology (see figure 1). The connectivity across the network of diverse systems will enable decision-making that promotes the interests of the ecosystem as a whole and balances the needs of different participants – not meeting everyone's needs equally, but enabling the impacts of decisions to be considered and understood in a more holistic way. At the same time, the open flow of information will help to potentially identify systemic risks across the ecosystem, helping those with regulatory, policy and economic roles fulfil their responsibilities.

**Figure 1:** The evolution of the ecosystem



### No time to lose

PwC believes the ecosystem we've described is the future of information and trust. While the timeline for it to become established remains unclear, it is already starting to emerge – and its development is set to be accelerated by continued investment and technological breakthroughs.

It is time to take action. Everyone who is part of today's system, and those who want to play a role in tomorrow's ecosystem, must understand how the rapid change will open up opportunities. They should act now to secure their future role and support the development of the ecosystem.

1. Use the data that is becoming available to improve your decision-making. Work with the data providers to improve its quality.

2. Build relationships with those who will help you grow in the new ecosystem.
3. Establish clear communication channels with stakeholders to influence the 'story' in the context of the data being used in the marketplace.
4. Introduce governance and controls, with appropriate change management programme, over use of new data and technology in the organisation and ecosystem.

They should do this as a matter of urgency: early adopters will gain a competitive edge – while laggards will face disruption and a battle to catch up.



## Section 1

### The future ecosystem of information and trust

**A data-rich world is changing how businesses are managed and held to account**

Today's business leaders are facing a world of increasing complexity, intensifying competition, growing scrutiny and pervasive technological change. As they strive to manage their organisations through this shifting environment and adapt to its new realities, they can draw on an ever-expanding pool of data and information, supported by developments in storage, processing, analytics and connectivity. These same advances are enabling today's rapid technological innovation. Management teams know they can only realise the full benefits from this innovation if they change how they use information, make decisions and engage with their stakeholders.

Against this challenging background, management teams' access to more insightful and diverse information is enabling them to make better decisions about managing their businesses – for example, by understanding markets in real time and innovating continually around products and services. Similarly, a business's various stakeholders – investors, employees, customers, suppliers, regulators and more – have more data on which to base decisions about the company. Those decisions depend on having confidence in the data and the underlying systems, processes and controls.

#### **Improved decision-making using a wider range of data<sup>1</sup>**

*"We are seeing an increased demand for analytics services from the companies that have narrowed their focus on specific uses, such as risk management. The advantages that these companies are realising – increased higher-quality input into decision-making processes from a variety of internal and external, structured and unstructured data."*

Shaheen Dil, Protiviti



1 Source: Financier Worldwide

### A new system will be needed in the technology and data enabled world

The current system for creating and reporting a company's financial results was originally designed over 100 years ago, to report on the performance of capital-intensive infrastructure projects and manufacturing activities. Since then, it has evolved to account for changes in markets, economies and business models, while continuing to fulfil an important role by providing trusted information to the capital markets.

It remains an essentially company-centric model where companies are the owners and primary sources of data about themselves – primarily financial information for shareholders – and they control its flow, using frameworks established by accounting standard setters and securities regulators.

Now, with the pace of change picking up, ever more data being generated and consumed, new ways of doing business emerging, and more and more people wanting insight into the information driving decisions, the strains on today's model are starting to show.

Companies are responding by using a much broader set of information to manage their businesses and measure and report performance. However, much of the expanded information set generated by companies – and all the data from external sources – falls outside the scope of today's regulated system of financial reporting and assurance. Although there are a number of standards and frameworks for companies to report this information, few are widely adopted. Similarly, although there are approaches for providing confidence in some of this information, such as assurance, much of it lacks any form of validation today.

To relieve the pressure, we need a system that addresses these challenges: one that can handle the pace of technology-driven change and provide management with information to manage their businesses more effectively, responsively and responsibly, while also enabling stakeholders to access the right information to make decisions with confidence. And one that is more responsive to participants' and societies' needs – including the need to identify broader systemic risks in a timely manner.

Armed with this wealth of data, society is putting companies under increasing scrutiny – holding them to account for their actions, questioning the role of business as a whole in society, and asking how individual companies affect and interact with their stakeholders. Those same stakeholders want to understand more about the strategy and culture of a company, who is managing it, their ethics and values, and what drives their decision-making. These questions are coming not only from those with a financial interest, but from others seeking information about issues ranging from executive remuneration to tax contributions, and from environmental footprint to workers' contracts and conditions.

So the situation is clear: there is more information available, companies are making increasing use of it, others are gaining more access to it, technology is making it increasingly usable, and new forms of confidence are required. Management teams also know they need to implement profound changes in their businesses if they're to position them to take advantage of further technological change in the future. Can a solution come about that reconciles all these developments while also meeting the resulting needs? In our view, the answer is yes. And it's already starting to take shape.

### Companies are using big data and analytics

*“Data analytics based modelling can recognise when there is a high probability that a part is going to break. A machine may be within its operational parameters but the coupling of two or three indicators – one type of vibration along with a particular type of stress or environmental condition – suggests that it could break earlier than you might expect. Analysing the past allows you to predict future behaviour.”*

Bill Ruh, GE, Chief Digital Officer

### Powered by technology, fuelled by data, open to all

What we see emerging from today's combination of headlong technological change, the increased utility and ubiquity of data and information, and changing behaviours is a network of systems – a new ecosystem of information and trust. This will be powered by technology and fuelled by the proliferation of data and information flowing across it. The ecosystem will be capable of adapting to future developments in technology, managing multiple sources and types of data and information, accommodating existing and new ways of providing confidence, and fostering more balanced decision-making across all those in the ecosystem. The result is to benefit the ecosystem as a whole.

Those in the ecosystem will include a large, diverse and networked range of entities, including multiple sources and users of data, new and old, human and machine. The relative importance and influence of roles within the ecosystem will change over time, with technology creating and destroying roles, and data and information becoming increasingly important and valuable relative to money and other capital.

Entire business models will be built around data, focused on undertaking activities like measurement, aggregation, analysis and decision-making. We'll also see further development of secondary markets for data and information, with participants competing on analytics, price, timeliness, quality and relevance. The data value chain will become more sophisticated, with value being added to data as it is shared or traded from its point of origin via intermediaries – the likes of aggregators, analysts and algorithm-based decision makers – to end users.

The system of networks will work together to develop the ecosystem. It will enable users to decide how they want to consume the data or information, including the scope, format, timeliness and frequency. Where there is a need for structure and comparability in data across users, connectivity across the network will enable the dynamic development of protocols for presenting information in ways users want. For example, investors or analysts could create a format and structure for data that is shared and developed Wikipedia-style,<sup>3</sup> with data providers or aggregators then sourcing data to feed this structure – enabling the standard to develop according to users' evolving needs.

#### Four key benefits of the new information ecosystem

- Improved decision-making in companies through a broader mix of data inputs and greater use of technology
- Greater transparency in the ecosystem – open to all participants
- More confidence throughout the ecosystem, enabled by technology-based mechanisms
- Stronger insight into the performance of the whole ecosystem – together with deeper insight into opportunities, and earlier warning of crises and potential systemic risks

### Acting for the common good of the ecosystem

*The electric vehicle maker Tesla has made a commitment to allow others to use its technology IP to support a sustainable future for transport. This policy is “intended to encourage the advancement of a common, rapidly-evolving platform for electric vehicles, thereby benefiting Tesla, other companies making electric vehicles, and the world.”*

### The importance of data relative to other capital

*“Data is the new oil.”*

Shivon Zilis, Bloomberg Beta partner<sup>2</sup>



<sup>2</sup> <http://fortune.com/2016/07/11/data-oil-brainstorm-tech/>

<sup>3</sup> “The ultimate purpose of Wikipedia’s community is to create and improve articles to distribute them freely.” How Wikipedia Works and How You Can Be Part of It, Phoebe Ayers, Charles Matthews and Ben Yates (2008) p.6



## As technological innovation continues, the ecosystem will adapt and evolve

The role of technology in the ecosystem will be both pivotal and pervasive, as ongoing innovation both drives and enables change in who is part of it, what they do and how they do it. Machines connected via the internet of things (IoT) will be increasingly important sources of data, and AI and machine learning will manage the volumes and complexities of data to make decisions, learn how to make better decisions, and – perhaps most importantly – enable better decision-making by humans. Technologies such as natural language processing (NLP) will enable more information to be extracted from data. Others, such as blockchain, will potentially reduce risks and costs – and, in doing so, enable business innovations such as globally distributed share offerings. However, with technology continuing to advance rapidly, many potential impacts on data generation, processing and consumption are yet to be seen.

What's clear is that future technological developments – whatever they may be – will open up opportunities for new business models and new products and services. Data will – indeed, already is – playing a growing role in this innovation, and each innovation is in turn generating more data. It's estimated that over 20 billion devices will be connected to the internet by 2020,<sup>5</sup> and that more than 90% of all the data in history has been produced in the past two years.<sup>6</sup> But the data explosion has only just begun.

## More accountable to society

As we've described, the ecosystem will enable business leaders to manage their companies more effectively and with clearer accountability to a broader range of stakeholders. However, for some, the creation of the ecosystem will be a two-edged sword. This is because business leaders not seeking – or not able – to balance the needs of different stakeholders will have nowhere to hide, since people will be able to see how each decision impacts others. This understanding will inform every decision by every organisation or individual – whether about investments, employment, partnerships, purchases or broader societal issues.

## We are already benefiting from open sharing of data

*The New York subway is providing open source data for subway train movements, enabling application developers to create apps that deliver train information to subway users. And three leading German carmakers – BMW, Daimler and Volkswagen – share traffic and hazard data and video via their jointly-owned digital mapping subsidiary HERE, giving drivers early warnings of problems ahead.<sup>4</sup>*

**The need to meet stakeholders' expectations**  
*In PwC's 20th Annual Global CEO Survey,<sup>7</sup> 85% of CEOs said that in a digitised age it was more important to manage their business in a way that accounts for wider stakeholder expectations.*

4 Source: <http://www.reuters.com/article/us-autos-connected-idUSKCN11V0VG>

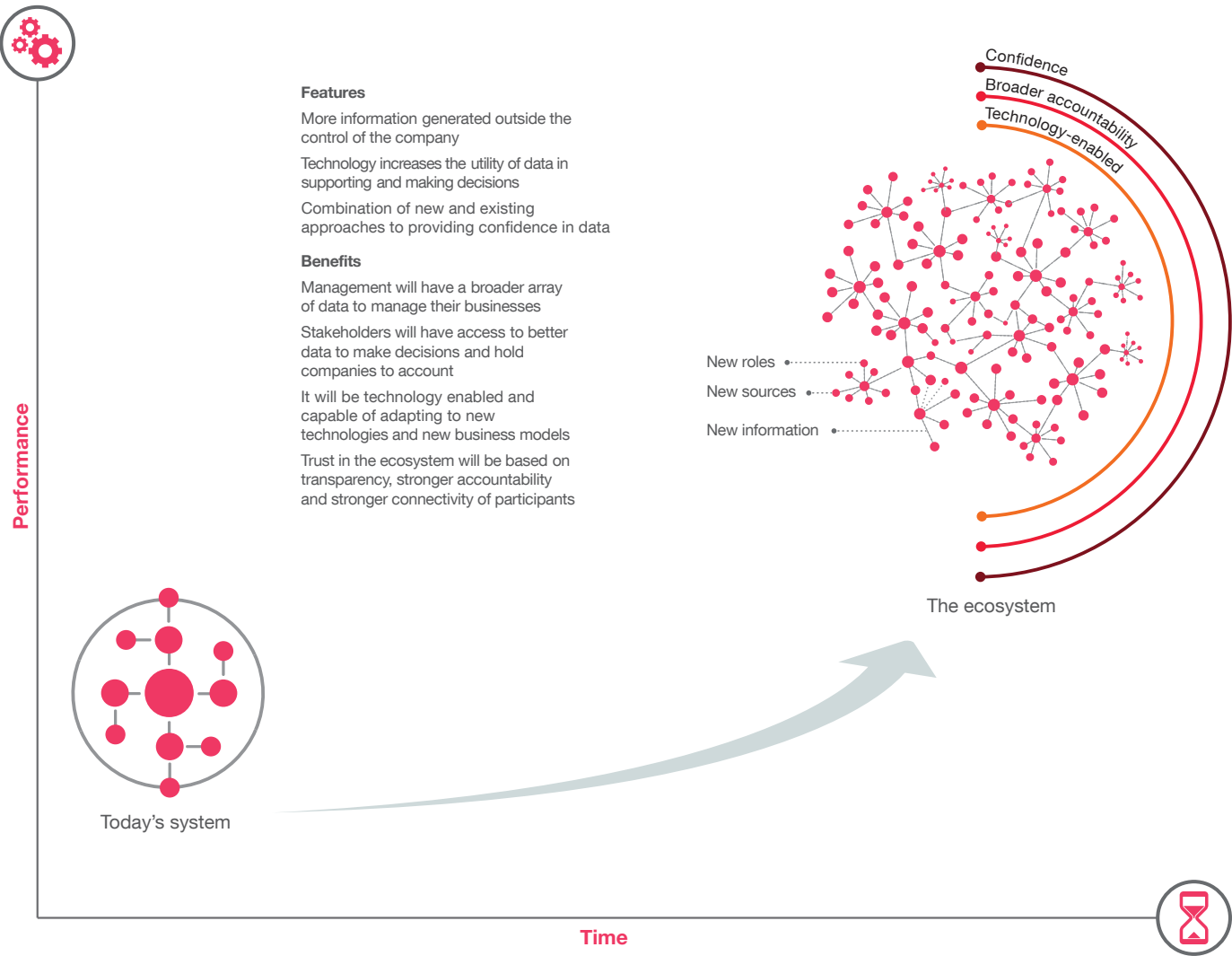
5 Source BI Intelligence 2017

<http://uk.businessinsider.com/the-internet-of-things-2017-report-2017-1?r=US&IR=T>.

6 Source: IBM <https://www-01.ibm.com/software/data/bigdata/what-is-big-data.html>.

7 Source: <http://www.pwc.com/gx/en/ceo-agenda/ceosurvey/2017/us.html>

Figure 2: The pathway to the ecosystem of information and trust



## New ways will be needed to provide confidence in data

Trust will be central to the effective operation of the ecosystem – and building it will require a balance between two opposing forces. On the one hand, the more open and transparent nature of the ecosystem, and the increased insights it enables, should help to build trust between people and in the ecosystem itself. On the other, the increase in data flows and numbers of organisations, together with the introduction of new technologies, will all create additional issues around which information can be trusted.

A key pillar of trust – both today and in the future – is being confident in the data being used and in the underlying systems, processes and controls. While the ecosystem will have the same broad categories of information that exist today (see figure 3), the volume, type and timeliness of information will increase. What will be markedly different in the ecosystem is how, when, by whom and to whom confidence in data is provided. New technologies, new information flows and new relationships will only add to this need and introduce additional risks (e.g. governance, controls) into the system. For example, some key performance metrics for platform based businesses are currently outside GAAP (see box-out below) and this challenge is growing rapidly with the value of transactions through platforms projected to grow from €28bn today to €570bn in 2025 in Europe alone.<sup>8</sup> These developments will require new approaches to providing confidence alongside more established methods such as independent assurance.

AI, for example, will help to highlight unexpected or outlying data and provide reassurance to users, while machine learning will process data to make better decisions. However, technology will also raise questions about trust. For example, as the use of algorithms grows, people will want confidence in how these work. Is there bias in the formulation? Is it aligned with the values, ethics and expectations of the decision-maker, be it the company or the customer? How reliable is the information feeding the machine learning – and how do we know?

## Platform businesses: A disconnect between management information and external reporting?

*The numbers to watch, change. With platform businesses, the focus shifts away from goods and services and their familiar units of analysis (revenues, profits, inventory), to monitoring and boosting the performance of core interactions, with metrics focused on interaction failure, engagement, match quality and network effects.*

Harvard Business review, Alstynne, Parker, Choudary<sup>9</sup>

## The need to build confidence into algorithms

*“I want...an ethics board [at Microsoft] that says, ‘If we are going to use AI in the context of anything that is doing prediction, that can actually have societal impact...that it doesn’t come with some bias that’s built in.’”*

Satya Nadella, chief executive of Microsoft<sup>10</sup>

<sup>8</sup> <http://www.pwc.co.uk/issues/megatrends/collisions/sharingeconomy/future-of-the-sharing-economy-in-europe-2016.html>

<sup>9</sup> Source: <https://hbr.org/2016/04/pipelines-platforms-and-the-new-rules-of-strategy>.

<sup>10</sup> “Frankenstein fears hang over AI”, Financial Times, 16 February 2017, <https://www.ft.com/content/8e228692-f251-11e6-8758-6876151821a6>



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*PwC's Halo technology allows us to extract and analyse large populations of transactions rather than a sample.*

Furthermore, as the utility and value of different types of data increases, users will want more confidence in this data. For example, the use of AI on people's behavioural profiles could provide insight into the behaviour and effectiveness of teams. Also, today's consumers increasingly want confidence in the information they use to make decisions on products or services. So they will expect data providers – whether the product or service provider itself, or a third-party – to give them confidence in the data that informs their purchasing decisions.

Trust in an organisation and its leaders will be equally as important as it is today, if not more so. If a content aggregator is taking data from tens of thousands of different sources – including machines – it will need to demonstrate how it gets confidence in that data to build and protect its brand. Already, the rise of 'fake news' has seen many media companies take steps to sustain confidence in their reporting, by validating their expanding formal and informal news feeds from sources such as social media.

A further consideration is that the ability to analyse, interpret and visualise huge volumes of data can open up better ways to provide confidence in the data itself. Today, as part of the audit, PwC's Halo technology allows us to extract and analyse large populations of transactions rather than a sample. Compiling multiple sources of data on a single topic can corroborate it or extract valuable insights. Alternatively, having a large volume of data may result in less importance being placed on the reliability of individual data points or sources, and more on the reliability of the data in aggregate. For example, platform-based businesses use compilations of peer reviews and ratings to provide confidence to buyer and seller. And ratings agencies will continue to include an ever broader range and volume of data in their analysis to improve the quality of their assessment.

Alongside these developments, many questions are triggered relating to security, privacy and identity. Maintaining cyber security in a system with more open-source and distributed data ownership presents clear challenges. With so many organisations holding commercially and personally sensitive data, and the potential to derive information from other sources, security and privacy will remain priorities for the efficient operation of, and trust in, the ecosystem.

### **The path is already being laid**

The future system may initially seem like a dot on the horizon but its creation is already well under way, with many of the technology components already in place and accelerating development. We are seeing more data and new types of data becoming available. New companies and new roles in the generation, analysis and consumption of data and information are developing. Businesses, new and old, are embracing the potential of technology and, in many cases, rapidly changing their behaviour in recognition of their accountability to a broader set of stakeholders.

Each of these advances underlines the need for all of us in today's system to act now, both to help create, develop and refine the future ecosystem, and also to position ourselves to play a full role within it. In doing this, we'll not only be building an information environment fit for the digital age – but also laying the foundation for better management decisions and a future of greater transparency and trust.

*“What companies put out in a package is a small part of what we use. Formal reporting isn't all that we look at ... we scrape websites for everything.”*

*Asset manager<sup>11</sup>*

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<sup>11</sup> Source: Tomorrow's world, PwC expert interviews 2017

## Section 2

### How we'll get there – the pathway to tomorrow

There is undoubtedly some way to go before the ecosystem of information and trust becomes established, and although there is no hard and fast timeframe, its development is being accelerated by technology.

Parts of today's company-centric system of reporting and assurance will need to transition from their current state, some of them optimised by technology, to a future in which they operate, as an integral part of the ecosystem. To help navigate this transition, participants must first think hard about how the various developments under way – ranging from new sources of information to broader and more inclusive accountability – will affect them and their role. Then they must respond and adapt to these impacts through concrete investments and actions that will support progress towards the new ecosystem.

We believe an optimised form of the data generated by the company today will ultimately become an integral part of the new ecosystem. This includes today's financial results and elements such as the accounting standards, regulations and the financial statement audit. Accounting standards setters and regulators are working to keep their rules relevant by adapting them to cope with new ways of doing business and increasing complexity. And the accounting profession is investing in refining the financial statement audit, for example, by embracing technology to enhance quality and using data visualisation to provide greater insights.



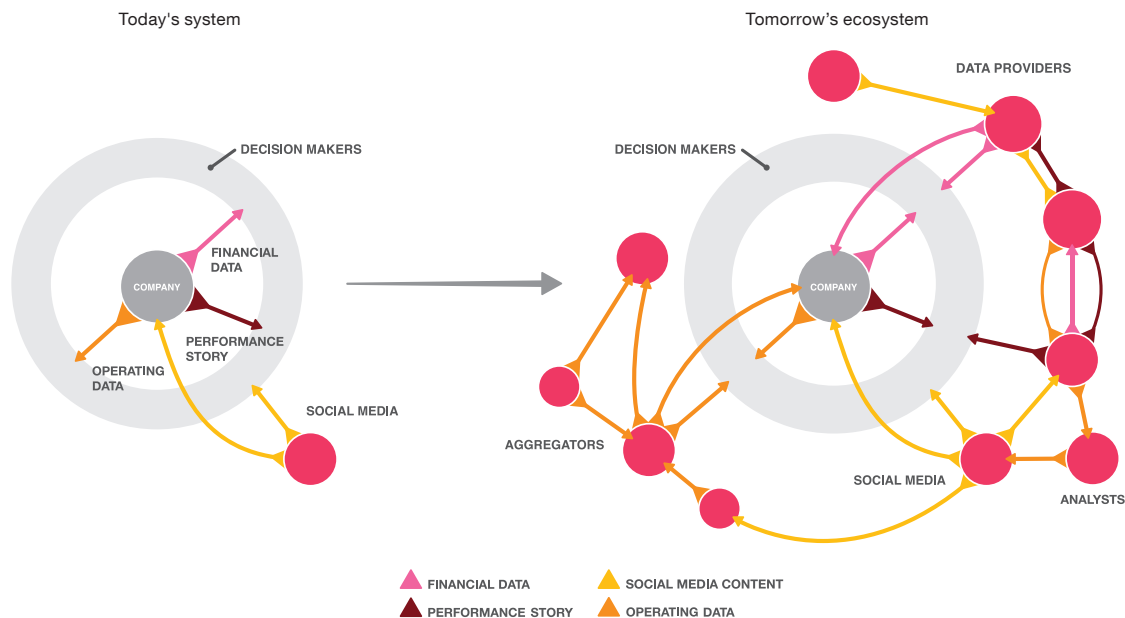
*The deeper insight available from blending financial data with more complete and robust non-financial data is one of the key benefits of the ecosystem.*

Going forward, financial data will continue to play an important role in the ecosystem for many of the same reasons that make it important today. The data, systems, processes and controls that make up the financial results, and the rigour that goes into developing them, underpin many other data sources used for decision-making, and are a big part of what makes that other data useful. While today's financial statements are historical, they can corroborate other information about the business.

Indeed, the use of audited financial data provided by the company may even expand. Financial data consumers will be able to choose how often, in what format and for what time period the data is consumed. Creators or users of algorithms will need reliable data to be calibrated: could assured financial data play that role? This will also impact on those involved in today's financial data. Standard setters who are currently focused on company-generated data might broaden their scope to cover other information used in decision-making.

The company-generated data in the ecosystem will be enhanced by externally-generated data (figure 3). For example, sales figures from multiple retailers will provide real-time insight which can be synthesised with other data to provide forward-looking sales forecasts.

**Figure 3:** Today's company generated data will be supplemented by data from multiple sources





Similarly, today's financial performance story will need to be expanded using data and insights generated by others. Increasingly, data on operational performance and impacts – information that is currently less mature than financial data, and controlled by the company within its internal systems – will be generated or measured externally to the company. Frameworks for this information will be developed dynamically through best practice, and confidence in it could be provided – like today's assurance – through independent third-parties and new technologically-enabled approaches. The deeper insight available from blending financial data with more complete and robust non-financial data is one of the key benefits of the ecosystem.

### **Behavioural change will be key – but various factors could influence the pace of progress**

It's not yet clear when the new ecosystem will become fully established and when it will deliver additional value in terms of cost, efficiency, insight, quality, reliability and utility. But what is clear is that, alongside investment, adjusting to a data and technology-driven ecosystem will demand major behavioural change – not only by businesses, but also by government, investors, individuals, and society as a whole.

In the coming years, investment in refining elements of today's system and integrating them into a new system will accelerate, as people experiment with new technologies, access and use new information and develop new business models. The early adopters will gain a competitive edge by making more informed decisions, perhaps focusing initially on niche opportunities before going mainstream. There are already signs of this happening, with some investment firms differentiating themselves through the quality of their data analytics.

New behaviours will be needed in relation to governance, risk management and rewards. But how will people react to more open and transparent information that exposes failings? Will they accept varying levels of confidence in data by trading this off against its timeliness, scope or other attributes? And how open will they be to wider sources of data? The answers to such questions – and the pace and extent of the resulting behavioural change – may determine when the ecosystem will become established.

### **Behavioural change can't be done in isolation**

*“In a world in which companies are providing more information more quickly, what will determine an acceptable level of validation from a market perspective? Is it acceptable that I provide my best view of the available information? How much variability will people accept? For example, I might take a 50,000ft view of trends on a five-year basis, but will stakeholders be willing to accept significant adjustments? If society is willing to accept this, the market doesn't react severely to these things and investors don't file lawsuits, then companies may be more willing to share this information in the future.”*

Corporate executive<sup>12</sup>

### The focus now should be on building the future ecosystem

Unless we change behaviours to support the development of the ecosystem, we risk undermining the relevance and credibility of today's system, by trying to stretch it into areas it was never designed to cover.

We recognise that many factors could accelerate or slow down the creation of the ecosystem. For example, progress could be accelerated by a technology breakthrough that leads to a company demonstrating competitive advantage in being part of the ecosystem, including gains in efficiency, data confidence or trust. More negatively, a failure or crisis in today's system of reporting and assurance could have a similar accelerating effect towards the new model.

Conversely, progress could be slowed down by a lack of leadership or market investment, cybersecurity breaches that deter the sharing of information, or vested interests in today's system putting a brake on innovation because of a fear of excessive regulatory constraints or loss of revenue. More generally, the conflicting interests of different participants could impede the free flow of information. But despite such risks, we believe the direction of travel is clear: towards the creation of the new ecosystem.

### Industry systems are starting to be disrupted

*Antony Jenkins, former CEO of Barclays and now CEO of FinTech start-up 10X, spoke in January 2017 about how "banking was approaching a moment where technology can disrupt the existing providers within the industry, effectively hollowing out the economics of the incumbents".*

*He envisages the transformation of the financial services industry happening in three overlapping phases.*

- **First phase – now and over the next three to five years:**  
*Thousands of FinTech start-ups are launched and attract capital in areas like small business and student lending, foreign exchange and peer-to-peer lending. The incumbents respond by setting up accelerator and incubator programmes and establishing FinTech partnerships, but are hampered by their legacy and cultural resistance to change.*
- **Second phase – now and over the next 10 years:**  
*Some FinTechs gain traction and take customers from the traditional banks by delivering a better customer experience. The incumbents struggle, losing revenue to FinTechs and implementing further job cuts and branch closures. Banks fragment, leaving behind a 'zombie core'.*
- **Third phase – starting in 2022 and lasting 15 years:**  
*New technologies such as AI and distributed ledger potentially eliminate banks' intermediation role, not just in payments but also in saving, lending and capital raising. However, incumbent banks will not disappear entirely – unless they completely ignore the implications of technology changes.<sup>13</sup>*

*"Change can't be driven with standard setting – but standards should acknowledge and permit progress"*

Standard setter<sup>14</sup>

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13 Source: "Is banking approaching an 'Uber moment'?" by Michelle Perry, CA Today, 27 January 2017

14 Source: Tomorrow's world, PwC expert interviews 2017

## Section 3

### How the ecosystem will change what we do

As the ecosystem evolves, new roles will be created, many will change and some will disappear completely. Today's systems are designed for people to make decisions based on information from machines; now machines are increasingly able to make their own decisions or assist in the decision-making process. Such shifts mean everyone will need to consider their roles and position within tomorrow's world.





## Management

Management teams will continue to see more information about their business coming from external sources and so beyond their control – information that is being used by others to make decisions about their business. This heightens the importance of telling their 'story' directly to the market, to provide more context and data for decision-makers. A fundamental consideration will be how they balance their responses to the demands of different stakeholders in line with their strategy and culture. Management will also play a new role in pooling data with other participants to help identify and respond to systemic risks in the ecosystem.

## People

For employees, the continuing introduction of new technologies will result in a move away from tasks that can be automated towards more specialised tasks. This will shift the mix of roles in most organisations, with the ecosystem requiring more statisticians, data scientists and IT specialists as well as subject matter experts, to interpret the output – plus new technology roles yet to emerge. Workers will be able to make better career decisions using new applications such as career and skill matching using ecosystem data. Workers will also have the data to benchmark the ethics of a current or potential employer against their own, and new work models such as crowd-sourcing project teams may become widespread.

## Machines

Machines will play a greater role in the generation, processing and use of data and information. They will be the source of huge amounts of new data: drones, sensors, satellite imagery and numerous domestic devices will all be connected in the ecosystem. Process automation will continue to expand, using past and live data to manage processes in real-time, such as in autonomous vehicles. More generally, machines will make more and more of the decisions, in all aspects of our life, that we currently make ourselves. Use of technologies such as blockchain in validating data or physical flows could make intermediary roles redundant, such as banks' role in financial transactions.

## Technology increases the importance of telling the story

*"One of the things technology does is provide information to people very quickly and very democratically. There is no longer any place to hide. Businesses have to be able to deal with the fact that managers might know as much as the people they've got working for them. It's become harder for companies to selectively evolve a story so people need to be engaged earlier with fuller disclosure and be prepared for people to check and cross-check them, and fill gaps in information with their own perceptions."*

Investor<sup>15</sup>

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<sup>15</sup> Source: <https://www.pwc.com/gx/en/ceo-agenda/ceosurvey/2017/gx/deep-dives/2017-global-investor-survey.html>

*The role of the auditor is already changing, and we foresee a continuing shift away from human effort towards technology.*

### Data intermediaries and aggregators

The need to make sense of the sheer volume of data flowing across the ecosystem points to a significant increase in the role of aggregator, analyser and interpreter. We are already seeing companies take on these roles, with investment firms aggregating multiple data sets from multiple data sources to analyse for investment decisions. We are also seeing more companies offering content aggregation platforms (e.g. InfoNgen) to manage data overload, by aggregating relevant and reliable information sources and structuring them in more easily-usable formats.

*“The skills needed in investment teams have changed – it’s one part traditional skills (financial, engineering etc.) and two parts technology, computer science.”*

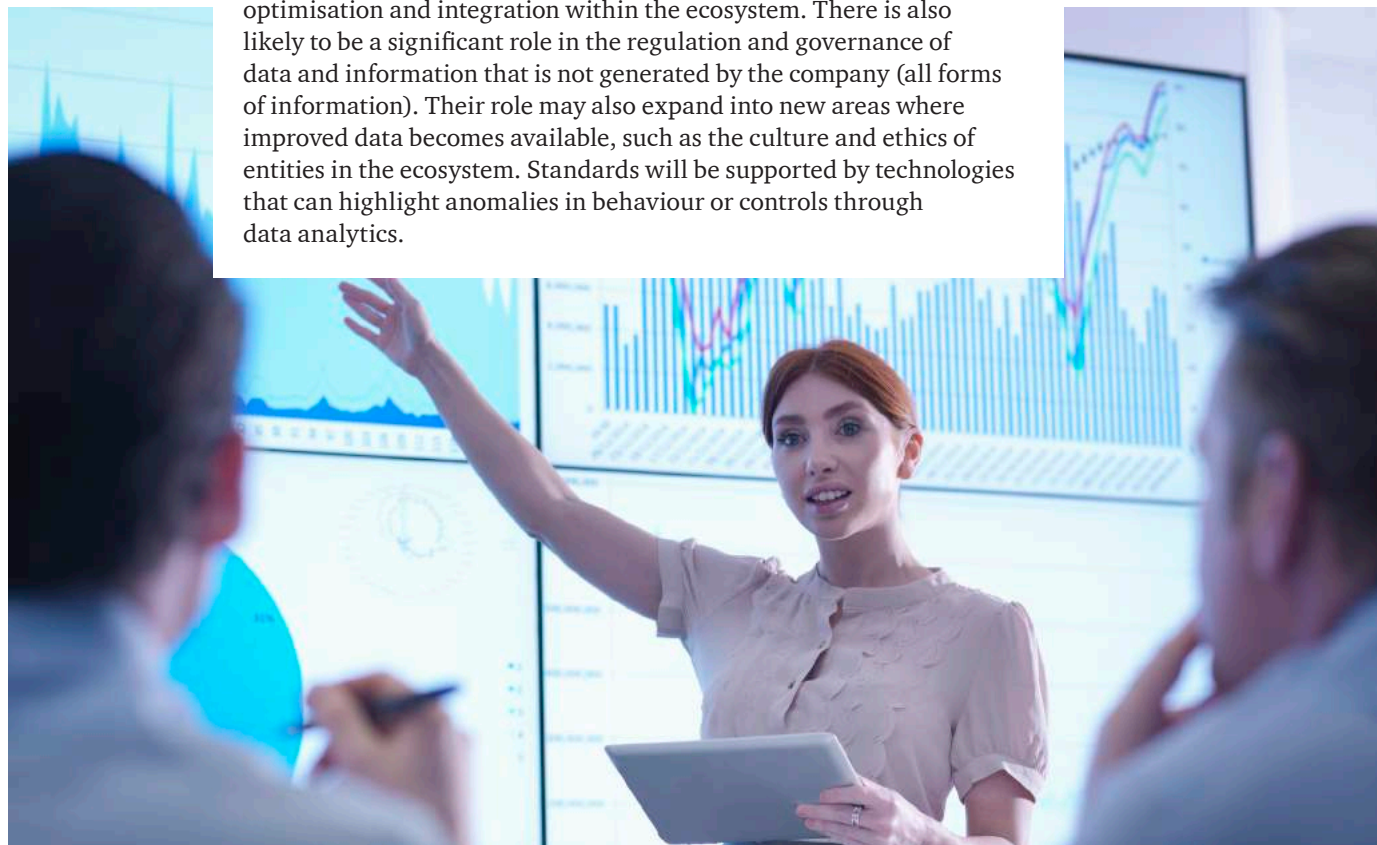
Asset manager<sup>16</sup>

### Providers of confidence

Confidence in data and information will be provided through a mix of humans, technology and data analytics (e.g. correlation, collaboration). New and expanded sources of information will create new roles for confidence providers, and today’s providers will need to invest in new approaches to meet demand. The role of the auditor is already changing, and we foresee a continuing shift away from human effort towards technology. That said, judgement will remain an important element in the audit and other forms of assurance, and will increasingly be informed and supported by AI and machine learning. This is a key function in the new system in providing a stable, effective and reliable ecosystem.

### Regulators and standard setters

The role of regulators and standard setters will also change. With the regulated financial results, they will play a role in fostering optimisation and integration within the ecosystem. There is also likely to be a significant role in the regulation and governance of data and information that is not generated by the company (all forms of information). Their role may also expand into new areas where improved data becomes available, such as the culture and ethics of entities in the ecosystem. Standards will be supported by technologies that can highlight anomalies in behaviour or controls through data analytics.



16 Source: Tomorrow's world, PwC expert interviews 2017

## Section 4

### Preparing for the new world

All those involved in today's system of financial reporting and new entrants have an opportunity to lead the development of the ecosystem of information and trust. As we've described, parts of today's system will remain relevant as the new system develops, and can play an important role in it. To do this, today's system needs to be optimised to work effectively in the developing ecosystem.

Currently, many investments are being made in developing individual aspects of the ecosystem, and there will be a growing need for collaboration to realise synergies. As well as working together to support progress, all participants in today's system will need to consider how technology may improve or replace aspects of their role, or provide opportunities to develop new roles in the ecosystem.



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*It's time to act  
– and join the  
information  
revolution.*

### **Key actions for management**

Management teams are aware of the opportunities and threats created by technology and the need to adopt new technologies, invest resources in cyber security and recruit and develop new skills development. We believe the evolution of the ecosystem presents further opportunities and challenges that require action in three key areas:

#### **1. Network of systems**

- Establish and/or strengthen relationships with participants who will have influence over – and be impacted by – the organisation's activities in the ecosystem. Create an engagement framework that will enable collaboration with multiple stakeholders.
- Consider who in the ecosystem the business might want to partner with, to add value both to itself and to the ecosystem.

#### **2. Distributed ownership of data**

- Understand the nature and sources of data available that can be used in managing the business and may be used by others to make decisions that impact the business and stakeholders. Work with the providers of this data to improve its quality.
- Establish clear communication channels with stakeholders, enabling management to control the 'story' in the context of the data being used in the marketplace.
- Implement tight governance and controls over use of information within the organisation covering areas such as quality, timeliness, reliability, etc.

#### **3. Technology-driven decisions**

- Consider how to equip stakeholders with the right information or tools (e.g. algorithms, apps) to use data more effectively in making decisions about the business.

In PwC's view, the emergence of the new ecosystem of information and trust is the logical next step in the evolution of today's increasingly data-rich business environment. While its implications are profound, so are the opportunities it creates for those who understand and embrace its potential. It's time to act – and join the information revolution.



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