

The forces of transformation

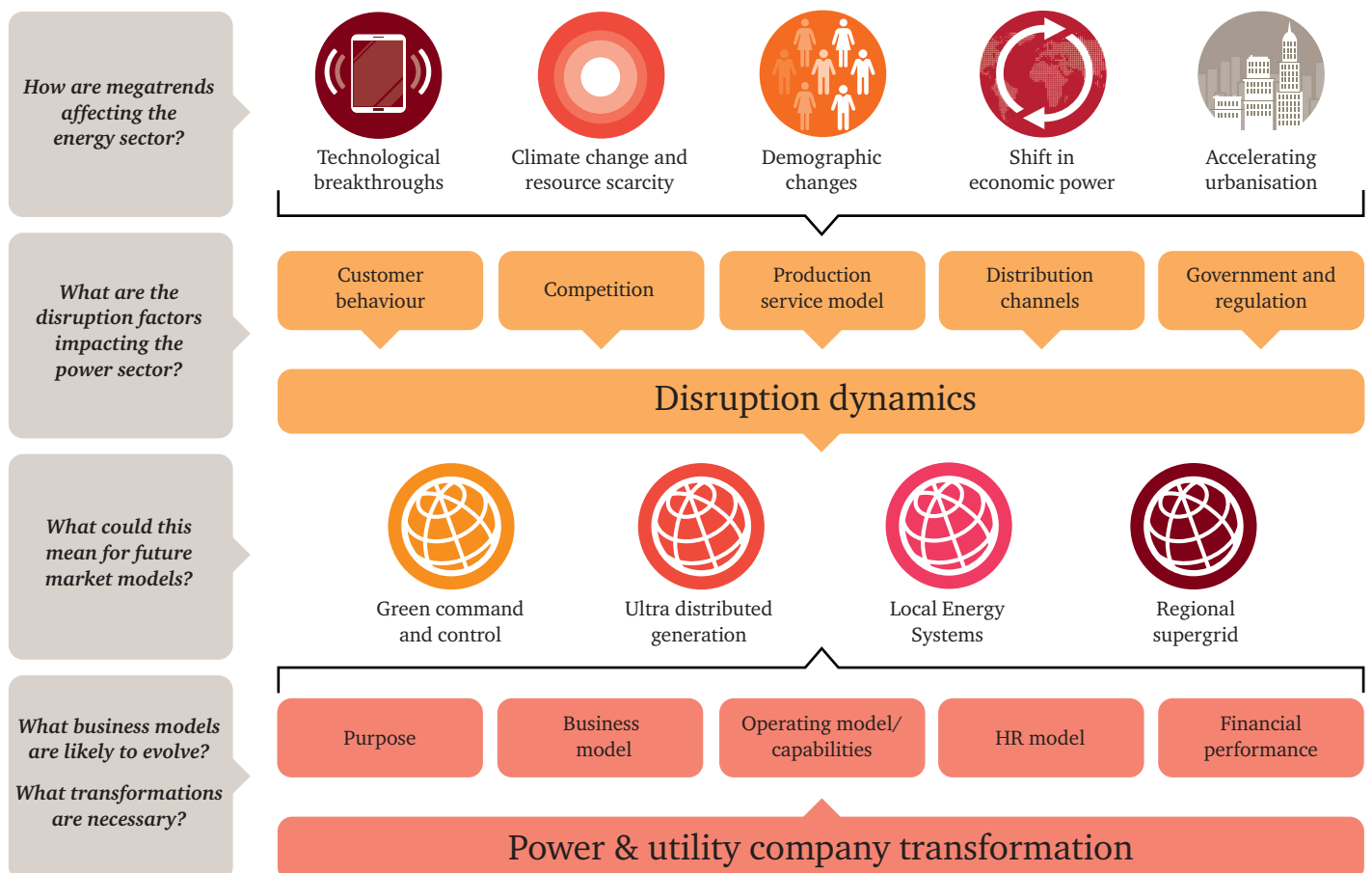
Energy transformation is being driven by five global megatrends interacting with and amplified by a set of shifts taking place within the power sector. The five megatrends – technological breakthroughs; climate change and resource scarcity; demographic and social change; a shift in global economic power and rapid urbanisation – are challenges for all businesses.

But in the power sector their impact is made all the greater by a number of simultaneous disruptions, involving customer behaviour, competition, the production service model, distribution channels, government policy and regulation. The extent and nature of these disruptions vary from market to market. But in many markets, their intensity is making their impact transformational rather than incremental.

Some of the changes arise from the megatrends – for example the regulatory encouragement of renewables in response to climate change concerns – while others heighten the impact of particular megatrends – for example the potential for rapid urbanisation to accelerate the roll-out of distributed energy and micro-grids.

Together these megatrends and the changes taking place in and around the sector have profound implications for the strategies and future role of companies all along the power utility value chain. They are combining to have a disruptive impact which will lead to the development of new market models and require companies to pursue new business models (see figure 1).

Figure 1: PwC energy transformation framework



Global forces – five megatrends impact power

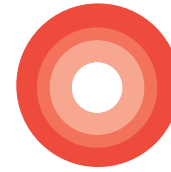


Technological breakthroughs

Technological innovation is at the heart of the shifts that are occurring in the power sector. Advances are happening in many parts of the sector – for example, in large-scale technologies such as offshore wind and high-voltage DC transmission, in distributed and smaller-scale customer-based energy systems and on the load side. Power is being transformed from a top-down centralised system to one that is much more interactive but also decentralised and fragmented. Elements of the old centralised system are becoming stranded and there’s a need to find an alternative investment model that recognises technological advances.

In many jurisdictions, renewable power is replacing or has the potential to replace fossil fuel generation. Smart grids are delivering the potential for greater interactivity with customers. And the scope for even more transformative technological breakthroughs is being taken more and more seriously all the time. A breakthrough in the cost and practicality of battery storage technology could be a quantum leap enabler, opening up the possibility of off-grid customer self-sufficiency when used in combination with ‘own generation’. ‘Power to gas’ is also a potential transformative technology. All bring opportunities for incumbent power companies but many also have the effect of eating away at a utility company’s traditional revenues and undermining the traditional utility business model.

Other technologies, notably the combination of the internet, mobile devices, data analytics and cloud computing with smart grids and smart metering, present opportunities for utility companies to get closer to the customer, play an enhanced ‘energy partner’ role and exploit data opportunities. Analytics capabilities, which today are generally of a low to moderate standard within utilities, will need to be a core strength in the future if companies are to fend off competition from new entrants who already have these capabilities at the heart of their business.



Climate change and resource scarcity

The energy sector is on the frontline of concerns about climate change. The sector as a whole accounts for more than two-thirds of global greenhouse-gas emissions¹ with just over 40% of this stemming from power generation. Resource scarcity or availability, and the associated geopolitics and economics of gas, oil and coal supply, are key factors shaping power market policy.

A growing emphasis on renewables is a response to both climate change and security of supply concerns. In the US alone, over 30% of new electricity generation capacity added in 2010–2013 involved solar and wind power, up from less than 2% in 2000–2003.² Solar photovoltaic (PV) is now present on more than 1.2 million Australian homes and producing over 3.3GW per annum.³ In Germany, renewables accounted for 24% of gross electricity consumption in 2013⁴, placing the country slightly above the growth trajectory needed to reach its 2025 target of 40 to 45%.

Energy efficiency has also risen up the policy and customer agenda. Together, renewable technologies, energy saving and a different customer outlook are leading to a transformation of the electricity environment. They are causing the value chain to shift, away from large conventional power plants towards local power generation, and a greater focus on distributed energy and demand management.

Transformation is also very relevant to developing countries, many of which face the triple challenge of being unable to meet existing demand for electricity while also facing huge demand growth and the need to extend access to those who don’t have electricity. The need for good demand management is already very familiar in countries such as South Africa where managed outages and demand restrictions are commonplace. Technological advances will enhance this response as well as present the opportunity for expansion of power in ways that may leapfrog the traditional grid evolution route.



Demographic changes

Within the next minute the global population will rise by 145. By 2025, we'll have added another billion people to reach about eight billion. Explosive population growth in some areas set against declines in others makes for very different power market growth potential in different parts of the world. Africa's population is projected to double by 2050 while Europe's is expected to shrink.

The growth prize for power companies of serving expanding populations is a big one. For example, Nigeria's population is expected to exceed America's by 2045. But the infrastructure challenge in many countries is immense and not all growth markets are readily open to international expansion. Companies seeking to reposition their geographic footprints towards faster-growth countries will also need to have a clear view on the impact of energy transformation on these countries. The prospect of bypassing the grid and leapfrogging to new local distributed technologies and market models is not unrealistic if the pace of technological advances and cost reductions continues.



Shift in economic power

The focus of global growth has shifted. Looked at historically, we come to realise that western economic strength is a relatively recent phenomenon and the current developments we see are essentially a rebalancing of the global economies.

As fast-growth economies become exporters of capital, talent and innovation, the direction of capital flows is being adjusted in a way that is quite different from the traditional routes from developed-to-emerging and developed-to-developed countries.

We are already seeing significant east-west and east-south investment flows in power markets, involving both financial investors and power sector corporate investors. For example, Chinese state-owned power and utilities companies have been active in their search for suitable international power utility and grid investment opportunities. Europe, South America, Australia and other parts of Asia have all been targets for expansion. Sovereign wealth funds and pension fund investments in the sector have also become multi-directional. The challenge for many power companies is access to scarce capital from this global flow of capital, minimising the risk of stranded investments and seeking innovative ways of securing investment in replacement assets.



Accelerating urbanisation

Over the next two decades, nearly all of the world's net population growth is expected to occur in urban areas, with about 1.4 million people – close to the population of Stockholm – added each week.⁵

By 2050, the urban population will increase by at least 2.5 billion, reaching two-thirds of the global population.⁶ Fast urban expansion presents a major challenge and an opportunity for power utility companies. The speed of urban growth puts a big strain on infrastructure development. In Africa, already large cities such as Lagos, Kinshasa and Cairo are going to become megacities, with more than 15 million people. The population in Nairobi is set to more than double between now and 2025.

Power companies can play a pivotal role in ensuring future cities become 'urban smart' rather than 'urban sprawl'. They have the potential to be lead players at the heart of future city infrastructure but it will require a new mindset and the development of new partnerships. And, of course, the pace and nature of urbanisation in fast-growth and developing economies takes a different form than in the west. In the former, the challenge is very fast growth on top of already stretched or absent infrastructure. In the west, rural urbanisation is a trend alongside big city growth.

Snapshot: Faster technology development, falling costs

The time it takes to go from breakthrough technology to mass-market application is collapsing. In the US, it took the telephone 76 years to reach half the population. The smartphone did it in under ten years.

The price of new technologies is falling equally rapidly. An analysis by UBS predicts shrinking battery and solar costs will make the combination of electric vehicles, solar panels and stationary batteries for excess power a compelling proposition in many markets within the next ten years. It estimates the combination of an electric vehicle + solar + battery should have a payback of 7–11 years, depending on the country-specific economics.⁷ After that, the electricity generated is truly 'free electricity' for the remainder of the lifetime of the equipment.

Falling costs have the potential to introduce a new challenge to the power utility business model. If they translate into actual falls in the price of electricity itself, the industry will have to move away from the default assumption of ever-rising prices, on which many of its deals and investment are based.

Disruption dynamics

The disruption taking hold in the power sector is just the start of an energy transformation. It's not a question of whether the business models pursued in the sector will change but rather what new forms they will take and how rapidly companies will have to alter course. Companies need to be sure they have fully factored into their strategic planning the megatrends and changes discussed in the previous chapter.

The pace of change will be different in each market and each specific situation. The important thing for companies is that they assess their strategy and implement the changes they need to make in time or, even better, ahead of time. Already, of course, many have reset their compasses with a switch in priorities and emphasis. But will this be enough and what more needs to be done?

We see five areas in which disruption is having an impact and where it will be important for companies to assess their strategies:

- customer behaviour
- competition
- the production service model
- distribution channels
- government and regulation.

Together they form the context in which future market and business models will be framed. For each one it is possible to identify developments that are happening now and which, if they accelerate or impact in combination, could intensify disruption dynamics.

Snapshot: Google eyes power opportunity

Addressing a recent PwC roundtable on customer transformation,⁸ Google's Chief Technology Advocate Michael T. Jones described the internet as "machines talking to machines. It can develop in all sorts of ways whether it is components on a 747 or your roof tile sending an SMS saying 'replace me, I'm starting to leak'." Moving on to the world of power, he observed: "All electronic devices will talk about their power needs to an aggregator and you can have an auction for the power for each one. All you need is someone to identify what the rates are."

Google already holds a wholesale power licence in the US. Its January 2014 acquisition of Nest Labs for US\$3.2bn also gives it a position in home automation with ownership of a company that has built a position selling thermostats and smoke alarms for the home. At the time of the acquisition, Tony Fadell, CEO of Nest, said: "Nest will be even better placed to build simple, thoughtful devices that make life easier at home."

Customer behaviour

We're already seeing a gradual erosion of power utility company revenues as distributed energy gains an increasing foothold. Some commentators go so far as to predict that customers will be saying "goodbye to the grid" in the future. In some places, it's already happening. Significant changes in the economics and practicalities of self-generation and storage are needed for such a scenario to occur on any kind of scale.

But even if customers don't literally say goodbye to the grid, power utility companies face the prospect of playing the role of being providers of secondary or back-up power to customers. Instead, they could become part of the change by being more active participants in the self-generation market, providing advice on equipment, metering and using the opportunity to secure more of the home and business services space.

The growth in self-generation can create a reinforcing dynamic. As well as the decline in revenues to decentralised sources, there is the impact of cost pressures on the centralised system which, in turn, reinforces the movement to decentralisation. The reaction of some in the industry has been to press for new regulatory policies to allow for some form of cost recovery in recognition of utilities being left with the fixed cost of the grid but a shrinking revenue base. But as one academic study points out: "In the short run, these steps very well could insulate the utility from solar PV competition but at the same time create substantial medium- and long-term risks, including those of customer backlash, deferral of adaption, and stimulation of enhanced competition."⁹

Both in terms of regulatory relations and customer relations, utility companies need to align their ambitions with those of their customers in a new energy future, ensuring their services are relevant to and cost-effective for as many customer situations as possible.

Competition

Energy transformation is shifting the opportunity for good margins into new parts of the value chain. But lower barriers to entry in these areas of the value chain and the need for new capabilities mean there is the prospect of existing companies being outflanked and outpaced as more nimble and able competitors seize key revenue segments.

New roles for companies come into view. In a distributed energy community with its own micro-grid, players other than power utilities can play an energy management role. This could be for local systems such as transport networks, residential communities or industrial communities.

For example, distributed energy is a key focus both for incumbent power utility companies and for new entrants. It's a big market space, worth tens of billions. It covers a wide spectrum of opportunities, from energy controls and demand management activities that save energy, to local generation, both small-scale and larger-scale, embedded in own use or local networks, through to distributed storage that can shift loads or, ultimately, end grid dependency.

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Engineering and technology companies such as GE, Siemens and Schneider Electric have long been important players as equipment providers in larger-scale segments of the distributed energy market. The growth and extension of distributed energy is likely to blur the boundaries between such companies and the power utility sector, both at the individual customer and community levels.

Demand management services are another key area and, already, we see companies such as Kiwi Power in the UK providing services to industrial and commercial clients, offering demand reduction strategies that they claim might typically see larger businesses reduce their electricity bills by around £100,000.¹⁰

In addition, there is considerable interest from companies seeking to explore the opportunities that come from existing home and online services as well as future smart grid and distributed energy provision. "The battleground over the next five years in electricity will be at the house," David Crane, CEO of NRG Energy, told Bloomberg Businessweek. "When we think of who our competitors or partners will be, it will be the Googles, Comcasts, AT&Ts who are already inside the meter. We aren't worried about the utilities, because they have no clue how to get beyond the meter, to be inside the house."¹¹

“Do power utility companies risk losing out to new entrants from the world of online data and digital technology?”

The production service model

The production service model of centralised generation and grids is being joined by a much more disintermediated and distributed model. New supply sources requiring centralised infrastructure, such as offshore wind, are coming onstream but the danger for utilities is that other assets and infrastructure are left stranded. The centralised infrastructure that has long been a source of strength of the industry can be a source of weakness vulnerable to market, policy or disaster risk. And we're seeing all three of these risks currently playing out in Europe, the US and Japan.

In Europe, the changing economics of generation brought about by a combination of the rise of renewables, the collapse in the carbon market and cheaper international coal prices has left much gas generation out of the market. Even modern plants, completed as recently as 2013, have had to be temporarily mothballed and many others have been taken out of the market more permanently. In total, over the course of 2012–13 ten major EU utilities announced the mothballing or closure of over 22GW of combined cycle gas turbine (CCGT) capacity in response to persistently low or negative clean spark spreads, of which 8.8GW was either built or acquired within the last ten years.¹²

Disaster risk led to all of Japan's nuclear reactors being gradually taken offline after the 2011 Fukushima disaster and they remained offline three years later. Across the world in Germany, the reaction to Fukushima was to begin to phase out nuclear power altogether. Official policy in Japan is to bring plants back into operation, with the first restart expected to be announced in late 2014, as and when the atomic regulator deems new stricter safety standards are being complied with. But opinion polls have consistently shown that a majority of Japanese are opposed to restarting reactors and nuclear assets are unlikely to regain the same role in Japan's energy system as they had before Fukushima.

In the US, one can draw a direct line from environmental policy to the stranded asset risk faced by many of the country's coal generation plants. Coal-fired power plants are subject to the Mercury and Air Toxics Standards (MATS), which require significant reductions in emissions of mercury, acid gases, and toxic metals. The standards are scheduled to take effect in 2015 and 2016, with generators needing to install costly pollution-control equipment if they want to keep their coal plants running. The US Energy Information Administration expects about 60GW of coal generation to shut down between 2012 and 2018 – a reduction of about a fifth.¹³ A further threat to coal comes in the form of the proposed Clean Power Plan, which will require carbon emission from the power sector to be cut by 30% nationwide below 2005 levels by 2030.

These developments highlight the risk of over-reliance on a concentrated centralised power generation asset mix. The wrong type of asset mix can leave companies vulnerable to rapid transformation, arising from market or policy forces or the forces of events, in the case of nuclear. Such forces provide a wake-up call which is likely to accelerate the move to alternative power systems.

Distribution channels

In a digital-based smart energy era, the expectation is that the main distribution channel will be online and the energy retailing prize will hinge on innovative digital platforms to secure the energy automation, own generation and energy efficiency customer space.

Already, many companies are shifting their positioning to cluster energy management offerings around a central energy efficiency and energy saving proposition and using new channels such as social media to engage with customers. But do power utility companies risk losing out to new entrants from the world of online data and digital technology?

A risk for energy companies is that their distribution channel to end customers becomes disintermediated in ways that are not dissimilar to what has happened to incumbent publishers and booksellers with the advent of Amazon. Not only is the channel to market for incumbents dominated by the new platform but the actual demand for product is eroded as the platform acts as an aggregator for self-publishing and second-hand sales. And, of course, the offering is now much wider than just books, with the combination of a trusted brand and sheer presence providing a marketplace joining consumers to a wide range of product providers.

Smart grids, micro-grids, local generation and local storage all create opportunities to engage customers in new ways. Increasingly, we are seeing interest in the power sector from companies in the online, digital and data management world who are looking at media and entertainment, home automation, energy saving and data aggregation opportunities. In a grid-connected but distributed power system there are roles for intermediaries who can match supply and demand rather than meet demand itself.

A key consideration for incumbent power utilities is if their brands are perceived as being part of the past that is being broken away from rather than the future for customers. An energy saving or demand management proposition may be perceived as more credible coming from a new entrant rather than an incumbent, so use of the brand needs to be carefully considered.

Another important challenge for companies arises from the need to be expert at managing data in a smart home, smart city and smart company environment. As well as data from smart devices and the grid, additional layers of information about demographics, behaviour, customer characteristics and other factors will often be required to best exploit the data opportunity. Many power utility companies already use sophisticated data analytics for customer segmentation purposes which can be built on and supplemented by enhanced analytics, big data from social media and learning from other industries.

Government and regulation

Energy is by its nature a key economic and political issue. More than in many other sectors, firms in the power sector depend on the political context for their licence to operate and public trust in their activities is a big factor.

The cost of power is an important element in household budgets as well as business and industrial competitiveness. The availability of power is a 'make or break' matter for everyone. And its infrastructure is the centre of often controversial planning debates.

So it's inevitable that the activities of power utility companies are never far from the centre of the public and political spotlight. Recent and current events in different countries discussed in the earlier section on the production service model highlight the potential for the public and political will to alter the nature of the business.

The political context shapes the utility business model. Changes in that context can dramatically impact utilities. This has always been the case but, in a more dynamic energy transformation context, political and regulatory decisions become even more significant. The different political approaches to energy transformation in different countries are key to explaining why the impact on fossil and nuclear generation has been faster and more dramatic in Europe compared to elsewhere.

A more dynamic environment also elevates the importance of public trust and perception. Energy transformation is extending the scope for the public to vote with their feet, not just by switching suppliers but by reducing dependence on utility companies altogether.

Snapshot: A weakened capital base

In Europe, the erosion of utility company earnings has had an inevitable impact on investment attractiveness. The Economist reported that "in 2008 the top ten European utilities all had credit ratings of A or better. Now (in 2013) only five do."¹⁴ Share prices were similarly hit over the same period.

In the US, the power utility share price story has been much healthier but the association representing US shareholder-owned electric utilities has sounded a warning note about the capital implications of energy transformation: "When customers have the opportunity to reduce their use of a product or find another provider of such service, utility earnings growth is threatened. As this threat to growth becomes more evident, investors will become less attracted to investments in the utility sector. This will be manifested via a higher cost of capital and less capital available to be allocated to the sector."¹⁵

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The need for innovation

Incumbent companies that don't innovate could risk seeing themselves succumbing to the pressure points and being eclipsed in the same way that incumbents like Kodak, Blockbuster video stores and high street booksellers were in other sectors. Certainly, sector transformation could shrink the role of some power utility companies to providers of back-up power.

In our most recent Global Power and Utilities survey, only a minority of our survey participants expect centralised generation and transmission to play the lead role in meeting future demand growth across the main markets of Asia, Europe and North America.¹⁶ Instead, energy transformation will gather pace and we expect that growth will become more innovation-dependent, with success coming to those companies that use innovative technologies, products, services, processes, and business models to gain competitive advantage, to stay ahead of change and create new markets for their products and services. In Africa innovation will be driven in part by the fact that power utilities will not be able to support the increasing demand for electricity supply and businesses will evaluate other solutions, such as looking at different means of co-generation.

Business model innovation is just one element of the innovation required but is likely to be a key part. The difficulty is that business history tells us that the majority of business model innovations are introduced by newcomers and incumbents often find it hard to respond successfully. Incumbent companies sometimes try to hold on to the existing model for too long or fall between two stools as they try to manage two competing business models at the same time – the original business model and the new model.

One way to avoid this trap is to separate out responsibility for developing new business models and value propositions. For example in banking, this is what HSBC did in the UK when it developed its highly successful First Direct telephone, and now internet, banking service in the 1990s. Not only was branding separate from its then 'Midland/HSBC' traditional branch banking brand but the service operated largely independently of the parent company. Another route for separation is by outsourcing to a community of new entrants and smaller firms. The incumbent utility can then nurture these innovations and help scale up the emerging dominant products or services.

Avoiding a capital crunch

As well as innovating, utilities need to make sure that a weakened investment case doesn't close off growth routes. Energy transformation is eroding the capacity of utilities as investors. Some have suffered rating downgrades. Others have had to deleverage, reducing debt relative to cashflow, to maintain credit ratings. These developments, primarily affecting companies in Europe and some in Africa, come at a time when they also face major capital investment challenges to replace ageing infrastructure as well as make energy transformation investments such as smart grids. In parallel, many such utilities need to deploy capital to pursue diversification away from mature, low or flat-growth markets towards fast-growth regions.

Global competition for capital is intense, and all the more so because the capital constraints faced in some markets stand in contrast to other markets. In the US, the challenge for power companies has been to convince investors that peak stock valuations can be maintained, a key part of which will be to demonstrate that they can negotiate the challenges of energy transformation without facing the kind of conditions that have engulfed their European peers. Innovative and alternative approaches to financing are becoming more commonplace in the sector. Partnerships and strategic tie-ups with sovereign wealth funds, insurance and pension funds, already becoming more numerous, are likely to increase in importance.

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