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Supercharge me

The power of network effects

Francois de Bruin

It takes Aviva Investors

Introduction

Network effects can boost a company's growth and build durability – when combined with other strengths, argues Francois de Bruin.

World history shows the power of network effects to transform societies, spread knowledge and spur innovation. There are lessons here for companies. Firms can create a sustainable competitive advantage by leveraging networks to enable economies of scale, innovation and competitive moats.

Human networks began with the invention of language and cooperation. "We discovered that, by working as communities, we achieve much more per individual than we would working individually or in small bands," says Geoffrey West, distinguished professor at the Santa Fe Institute and author of Scale: *The Universal Laws of Life and Death in Organisms, Cities and Companies.*[1]

From there, the discovery of agriculture allowed humans to become sedentary, form cities, build trade and, crucially, exchange ideas. In his book *The Square and the Tower*, an account of networks and hierarchies, historian Niall Ferguson contended: "Social networks have always been much more important in history than most historians […] have allowed."

In 14th-century Europe, trade networks allowed the spread of the bubonic plague that killed half the population but, combined with the rise of international banking networks, also led in the 15th century to the advent of the Renaissance man, defined by Ferguson as "a polymath engaged simultaneously in finance, trade, politics, art and philosophy", and to the Iberian age of exploration that allowed Europeans to build networks spanning the globe.

"As so often in history, new technologies propelled these new networks into being, while at the same time the networks accelerated the pace of innovation," wrote Ferguson.

He explained trade "was one of two networks that transformed the early modern world," the other being Johannes Gutenberg's invention of the movable-type printing press. Gutenberg's technology created an entirely new economic sector and "helped unleash the huge religious and political disruption we know as the Reformation, as well as to pave the way for the Scientific Revolution, the Enlightenment and much else that was antithetical to the Reformation's original intent".

> *"New technologies propelled these new networks into being"*
>
> **Niall Ferguson**

What this led to, at times through bloody wars and revolutions, was "a large-scale reallocation of resources from religious to secular activities" in Protestant states, but also a huge increase in urban growth, both of which spurred economic dynamism and wealth creation.[2]

This era saw European economies diverge from the rest of the world, gaining an advantage that would last for centuries.

In this article, we look at what makes network effects so powerful, the challenges for companies in establishing and maintaining networks, and what investors should look out for when considering network companies.

1. Why network effects are so powerful

Network effects occur in cases where the more customers a company has, the higher the value of its products and services for each customer. Managed well, this can create a powerful competitive moat and give a company strong pricing power, as the value to customers grows exponentially with each new customer joining the network.

Network effects are most associated with the technology sector but can be found across various industries. They can also be direct, where users get value out of each other, or indirect, where user groups get value out of each other.

Credit card companies are a great example of indirect network effects: the more people want to pay by card, the more valuable it is for a business to accept these payments; the more businesses accept card payments, the more valuable it is for customers to have a card.

The types of networks include freeform networks, where customers and suppliers both have open access, as in the payment card example; service networks that enable interactions between groups, such as consumer credit scoring agencies; referral networks, where benchmarks, direct or indirect, run as a golden thread between industry participants; and captive networks like discount clubs, where client benefits are growth enablers that also create high switching costs (see "*Five principles for performance persistence*").[3]

Accelerating rates of growth

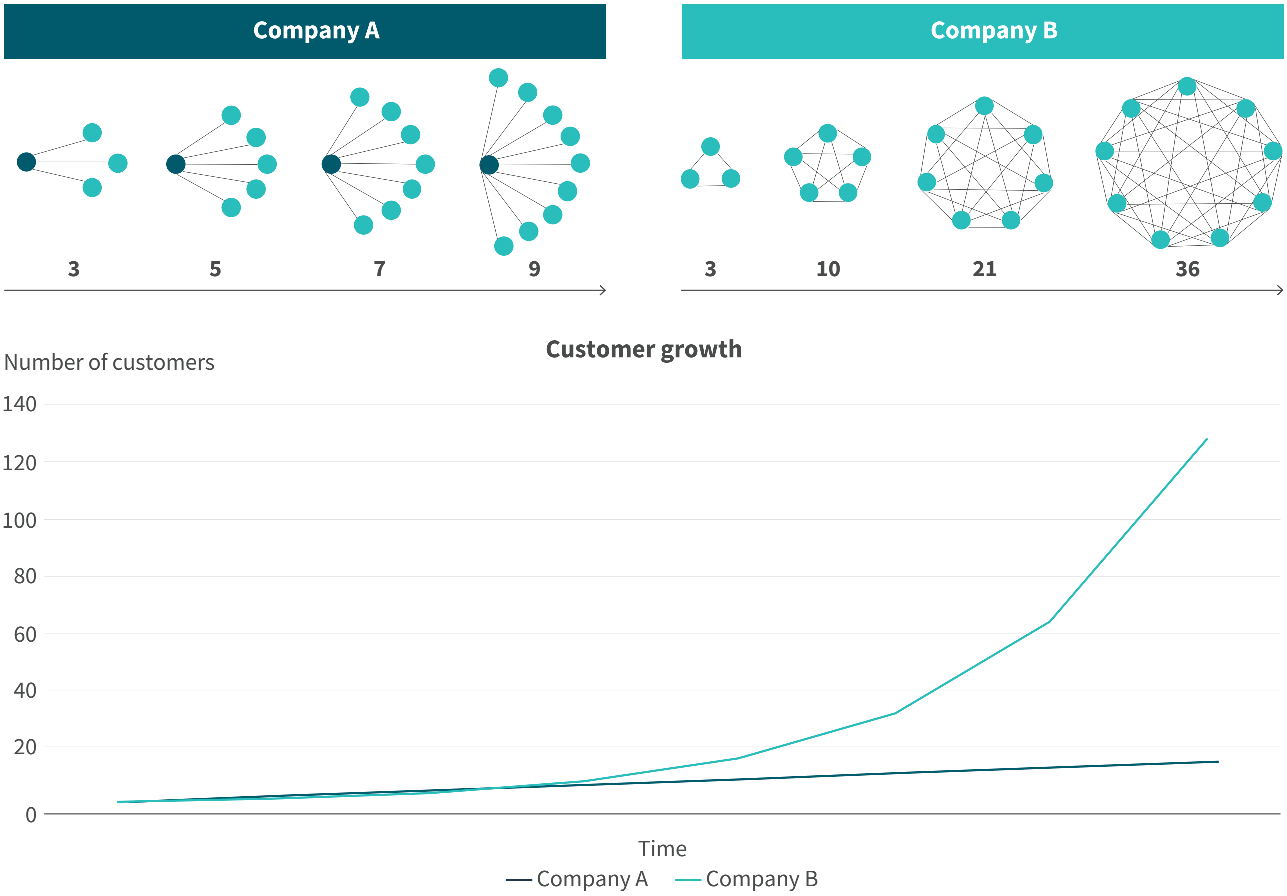
West's research has shown company growth sits at the cusp between that of organisms, which is sub-linear, and cities, which is super-linear. "The difference between sales and expenses, which is the driver of growth, eventually scales approximately linearly. This is good news because, mathematically, linear scaling leads to exponential growth and this is what all companies strive for," he wrote.[4]

But not all companies are created equal; while some businesses exhibit accelerating rates of growth, others exhibit diminishing rates. Thanks to Metcalfe's law, network-based companies can achieve the former. This law states "the value of a network is proportional to the square of the number of connected users. As the physical cost of the network grows linearly, its value grows exponentially".[5] While it originally applied to telecommunications, the principle can be extended to other types of networks.

While some businesses exhibit accelerating rates of growth, others exhibit diminishing rates

In Figure 1, Company A has a diminishing growth rate. It grows in a linear fashion, whereby adding a customer results in the sale of one additional item. In contrast, Company B benefits from accelerating rates of growth. When a new customer is added to its network, the company benefits from the additional user and from the interactions between all users within the network. As the number of interactions grows much faster than the number of users, it accelerates Company B's growth.

Figure 1. **Networks can accelerate company growth rates**



Note: For illustrative purposes only.
Source: Aviva investors, June 2023.

Entrenching products and customers

However, networks are mostly inegalitarian and success breeds success – a node with many connections will get more connections, while one with few connections will remain isolated. Similarly, a network company with many users will tend to attract many more.

"Imagine a platform where I share my DNA and use it to look for unknown relatives," says Catherine Tucker, distinguished professor of management science at MIT Sloan School of Management and research associate at the National Bureau of Economic Research. "In that case, because people do not know who they want to reach out to and have few ways of coordinating, and because network effects are global, they might lead to entrenchment."

In this example, the more people share their DNA on the platform, the greater the value for new users looking for relatives. One way to breed this success is to entrench network effects with analytics, decisioning tools and other services. This allows network companies to know their customers, which enables two powerful levers: identifying the most influential users (nodes) and being able to connect the right products to the right customers

One way to breed this success is to entrench network effects with analytics, decisioning tools and other services

Ferguson explained three factors give a node influence in a network: degree centrality (the number of their relationships); closeness centrality (the average number of "steps" it takes for them to reach all other nodes); and betweenness centrality (the likelihood of them being a bridge between other nodes). "In their different ways, individuals in social networks with high degree centrality, betweenness centrality or closeness centrality act as 'hubs'," he wrote.

For a network to adopt a new idea or product (for it to go viral), gatekeepers also play a key role by deciding whether to pass information to their part of the network. "A complex cultural contagion […] first needs to attain a critical mass of early adopters with high degree centrality," explained Ferguson.[6]

Companies able to identify and leverage the influence of hubs and gatekeepers can grow and strengthen their networks much more efficiently.

Having the technological tools in place to offer customers the right products can also create a large competitive advantage that is hard for others to replicate. In a 2019 *Harvard Business Review* article, authors Feng Zhu and Marco Iansiti gave the example of Amazon's recommendation system, which became more accurate the more customers used the site. The system "amplified the impact of the company's scale by continually learning about consumers' preferences," they wrote.[7]

> *"What's different today is razor and blade could be in completely different industries"*
>
> **Sunil Gupta**
> Professor of Business Administration, Harvard University

"The question is whether I am able to use machine learning and other automated tools sufficiently well to reflect different tastes in the way I personalise recommendations or suggestions to allow the platform itself to still obtain scale," says Tucker.

Sunil Gupta, professor of business administration at Harvard University, agrees that, in today's world, competitive advantage comes from connecting products and connecting customers. "Razor and blade have been around forever," he adds, referring to a business strategy whereby a company offers complementary products or services, some of which are provided at a lower price to attract customers. "What's different today is razor and blade could be in completely different industries."

He explains traditional razor-and-blade strategies considered adjacencies, like a car dealer choosing to offer car financing. Thanks to digitisation and big data, companies can now redefine their business to expand into vastly different areas.

"Many companies, and Amazon is a prime example, now say traditional industry boundaries are not the way to define their business," he says. "They define their business around their customers and capabilities. Customers want different things, so they follow the customer and see what their capabilities can provide."

Decentralisation enables innovation

This also gives network companies another advantage: by continually expanding into new areas and decentralising their businesses, they can keep innovating.

According to West, one of the main reasons companies eventually die is that they become more rigid and hierarchical as they grow, losing their ability to adapt and innovate. In contrast, social networks in cities ensure continuous exchanges and idea creation, which leads to open-ended growth and explains why cities don't die.

It is hard to reproduce this dynamic in a company, but having a network structure and connecting with other networks is a powerful way to preserve that innovation and flexibility.

Ferguson identified what he called "weak ties" between clusters, or even between networks, as a key to the exchange and diffusion of ideas that spurs innovation, "a vital bridge between disparate clusters that would otherwise not be connected at all".

And while a resilient network will tend to resist change, he wrote, "it is when a social network and its patterns are transposed from one context and refunctioned in another that innovation and even invention can occur".

Companies that ensure their networks remain open to leverage weak ties, but also those that transpose their models into other areas, can benefit from these effects to remain innovative over time.

Companies that ensure their networks remain open to leverage weak ties can benefit from these effects

A key distinction for network companies when it comes to innovation is scale. Where competitors might innovate at the edge, the strategy often shifts from competition to collaboration as challengers aim to leverage the scale of incumbents, further entrenching the market-leading position. Buy-now-pay-later is a good example. Firms such as Affirm innovated by offering credit-based payment solutionsAlthough PayPal eventually launched its own "Pay-in-4" solution, offering Affirm through its digital wallet allowed the company to keep pace with the innovation customers demand. It also benefitted Affirm by giving it access to PayPal's scaled network of consumers and merchants. This created a rare win-win dynamic in the innovation/competition dog fight.

Anticompetitive?

Despite the winner-takes-all effect of networks, they are not necessarily anticompetitive.

"It depends on how you define anticompetitive," says Gupta. "Amazon may be big in ecommerce, but it is still small in overall retail, of which e-commerce is still a small portion. But because it strings everything together, it has a comparative advantage compared to many other players."

A company like Amazon works with many other businesses and gives them access to its large customer base – although it also reportedly uses its network in anticompetitive ways, for example to copy and harvest data from other successful businesses using its platform, while boosting its own in-house brands in its search results.[8]

But many successful network companies adopt collaboration over competition because it enables them to leverage weak ties.

"A few years ago, seeing its customer base was a competitive advantage, [Spanish multinational bank] BBVA realised if it invited third parties like fintech companies to plug into its system, it would create network effects," says Gupta. "More partners and products would mean more customers; more customers would bring new suppliers."[9]

In addition, Tucker says network externalities are often local because of users' focus on what matters to them and the personalisation of products and services they receive. That typically renders the general size of a platform unimportant.

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"There are examples of products or services that are global in nature, which is why understanding the fact that network effects are local is so important," she says. "A 2018 paper suggested, for example, that if you compare footwear offered by a large online retailer with footwear from offline retailers, it might look like there is a much larger assortment online. However, this is because offline retailers customise their product assortment to local tastes."[10]

Finally, networks – and other business sectors – almost all have what Ferguson calls "structural holes", which present entrepreneurial opportunities.

"The big companies have a huge advantage because they have a large customer base, a well-recognised brand, a strong balance sheet, good products…," says Gupta. "Start-ups can still disrupt them simply because these large companies have left them an opening; they have taken their eye off the ball in terms of serving customers."

He gives the example of ride-hailing apps, which capitalised on the pain point of customers desperately trying – and often failing – to get a taxi at certain times. "It was not that Uber came and disrupted them; it's just the taxi companies didn't capitalise on it," he says.

2. Challenges to establishing and maintaining network effects

Not all network effects are stable and sustainable. The reality is they require constant attention to grow or be maintained.

Early-stage companies may struggle to grow

Early-stage companies looking to benefit from network effects must often subsidise customers to gain critical mass. When these companies are dependent on turbulent financial markets, it becomes even harder to fund this growth, which reinforces incumbents' position (see "*Theory of reflexivity*").[11]

"Platforms are fundamentally different because you need to create an ecosystem – you might need to use subsidies and you need to create significant market size before it actually takes off," says Gupta.

"Platforms are fundamentally different because you need to create an ecosystem"

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He gives the example of Goldman Sachs's attempt to create Simon, a marketplace to sell its structured notes directly to brokers. Brokers asked for more products to be available on the platform, but while smaller banks agreed to join, large competitors such as JPMorgan Chase created a competing platform instead. Having failed to gain critical mass, Goldman Sachs spun out Simon, which became an industry consortium before eventually being sold to an independent third party.[12]

"Similar platforms were competing for the same customers, so none gained that powerful network effect," says Gupta. "Typically, you can have two or three competing platforms in the same industry, but it's harder to do much more than that. The way to achieve network effects is either through subsidies, radical innovation or a new way to connect, to give people a reason to switch."

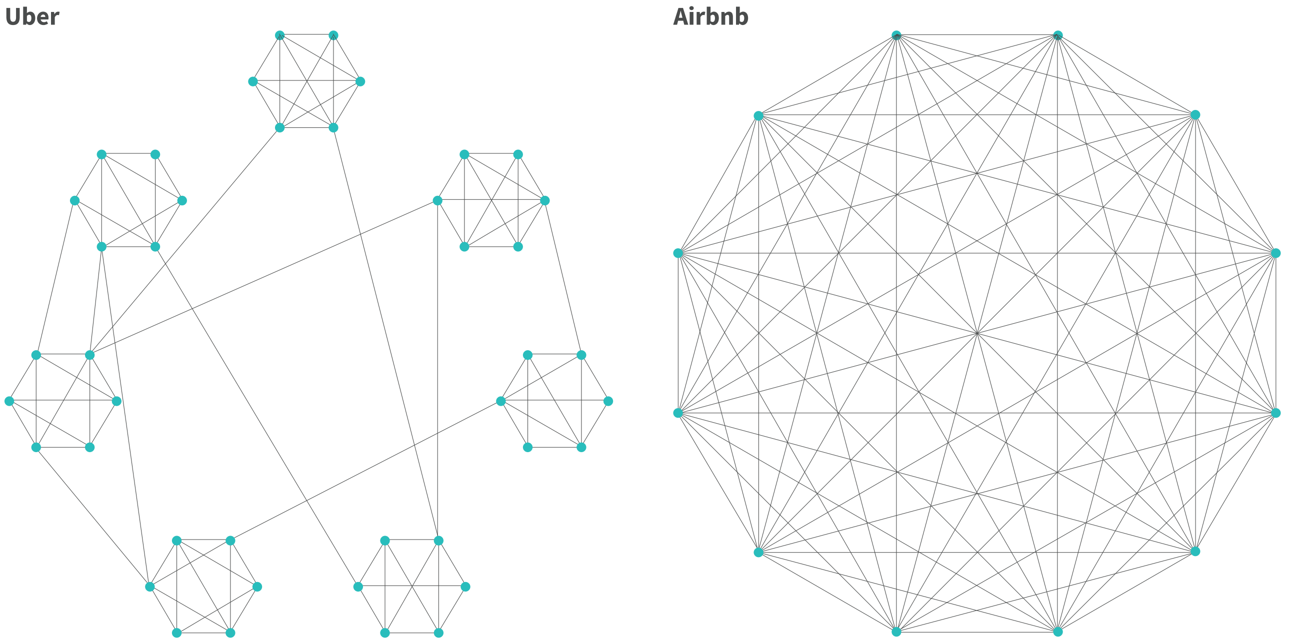
Clustering

Even among established companies, the strength and durability of network effects varies depending on firms' business models. Clustering – the idea network effects are small and localised, either geographically or in product verticals – is one of the primary reasons network companies fail.

In their research, Zhu and Iansiti compared Uber with Airbnb. A high number of Uber vehicles available in New York offers no benefit to a customer in London, which makes it hard for Uber to globalise its network effects. On the other hand, Airbnb customers care about the number of hosts in a variety of cities and countries they plan to visit.

“The network, more or less, is one large cluster. Any real challenger to Airbnb would have to enter the market on a global scale – building brand awareness around the world to attract critical masses of travellers and hosts. So breaking into Airbnb’s market becomes much more costly,” they wrote.[13]

Figure 2. **Uber versus Airbnb networks**



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Source: Harvard Business Review, 2019.[14]

However, it is possible to strengthen a clustered network by building global clusters on top of local ones, by offering a more diverse set of products and services that will appeal to customers beyond their immediate cluster or build bridges between clusters. Zhu and Iansiti cited Facebook’s social games as an example, as they create new connections between strangers that make the network more integrated.

“Both Facebook and WeChat, a popular social-networking app in China, have been enhancing their networks by getting popular brands and celebrities […] to create public accounts and post and interact with users,” they added.[15]

Multi-homing and disintermediation

Another key reason networks fail is when the benefits they offer are too weak to retain customers. Where possible, customers will either use several platforms or entirely forego them once they have connected to a supplier.

Gupta gives an example of disintermediation where a company connected dog owners with dog sitters; once a dog owner had found a dog sitter they liked, there was no need for them to use the platform a second time.

However, for multi-homing as for disintermediation, he says this is nothing new. The basic principles to minimise switching to the competition remain the same: creating strong network effects, providing complementary services and creating loyalty programmes.

> The basic principles to minimise switching to the competition remain the same

“Why do you fly more with one airline than others, even though they offer the same route at roughly the same price and convenience? Simply because you get miles and a higher status through the airline’s loyalty programme and that is valuable to you,” he says.

He also gives the example of Apple, which offers FaceTime. If a customer’s connections all use it, that will create a strong incentive for the customer to remain with Apple, even if competitors offer innovative products.

“Complements help in that sense because they provide additional value with minimal cost,” says Gupta. “The best complement is one that provides a lot of value to the customer at the lowest cost to the company. FaceTime doesn’t cost Apple much but provides significant value to the customer and creates staying power.”

Negative effects

Another risk is that, as networks grow, new types of users joining can make the ecosystem less attractive for existing users, making the whole network more fragile. In a 2018 paper, Tucker gave three causes of potential negative effects:[16]

- Congestion, for instance where there are too many products on offer, not enough of which are targeted to the customers, or where too many sellers in a marketplace discourage others from joining.
- A desire for privacy or control, which may lead to a preference for a smaller audience.
- Some users being unattractive to others, like parents on a social networking app putting off their children from using it.

“They typically stem from the fact network effects are often social and it is not necessarily the case that all interactions will therefore be beneficial,” she says. “If a platform operator continues to focus on the idea its job is to make interactions go well (rather than simply maximise interactions), that would be a good starting point.”[17]

3. Investment implications

The strength of network effects can vary between companies – as demonstrated by the importance of clustering – and over time. Despite the initial success of Myspace, users migrated en masse once Facebook gained popularity.

“Network effects do not imply entrenchment and can actually lead to quicker destabilisation of a market leader position,” says Tucker, particularly for virtual networks that don’t depend on hardware.

“Early economic analysis often relates a platform’s competitive advantage to its user base. But Google Plus failed quickly despite a huge installed user base because its features did not provide advantages over existing social networks,” she adds.

The notion the value of a network depends on the number of users is oversimplistic. Strong network effects are necessary, and investors need to understand whether a company’s network is global rather than clustered, and if it is protected from potential disintermediation, multi-homing and negative effects. But to boost growth and build durability, companies need to build in features that strengthen and protect network effects as well.

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Distinguished Professor of Management Science, MIT Sloan School of Management and Research Associate, National Bureau of Economic Research

It might be a trade-off between growth or innovation and high barriers to entry, or the ability to combine multiple competitive advantages like Amazon or Google, where some of the elements are free and open, while others are highly entrenched with high switching costs. Network bridging, which allows platforms to leverage users and data from one network to another – and boost innovation – is another strengthening feature.[18] These can be more simply grouped in two categories: features that build bridges and those that increase switching costs.

Investors need to understand the degree to which a company exhibits these characteristics and can improve upon them to get a realistic picture of its long-term prospects.

Using data to build bridges

"Network effects only protect you if there is a minor innovation or improvement that is not disruptive enough for people to switch. But if there is a major innovation that gives huge value, it can easily drive people to move," says Gupta. "That is the reason Facebook bought WhatsApp; an innovation came and Facebook was worried people would connect with each other through this text messaging system instead of its own platform."

As discussed earlier, customer data can help network companies stay innovative. But it is important for companies to use the data they collect, and use it well. They can then strengthen their brand power and network effects by staying ahead of evolving requirements and identifying structural holes to develop an offering where there is a durable need.

> It is important for companies to use the customer data they collect, and use it well

For example, Equifax has expanded from providing credit scores into Workforce Solutions, which offers employee verification and broader HR compliance management solutions. That gives it staying power with employers and enables it to grow across all industries. Similarly, S&P Global offers indices and ratings, then grows its network thanks to market intelligence.

Zhu and Iansiti also give the example of Chinese outsourcing marketplace ZBJ. When it discovered many new businesses used its services to get help with logo design, it began offering trademark registration – the natural next step in setting up a company. Today, ZBJ is the largest provider of trademark registration in China, with $70 million in annual revenues from that operation alone.[19]

"Industry boundaries are getting blurred and the source of competitive advantage is changing," says Gupta. "The key asset now is customers and data."

He gives another example of how Amazon has innovated using customer data. Thanks to the quality of data and robustness of its forecasting models, Amazon can now offer one-hour delivery in several cities by anticipating demand. Gupta says that, not only is it a huge benefit for customers, but Amazon's forecasts also allow it to move inventory quickly, which has financial benefits.

"The cash conversion cycle – the amount of working capital needed to run a business – depends on three things: accounts payable, accounts receivable and days of inventory," he explains. "The average cash conversion cycle for a US retailer is 30 days. Amazon's is a negative number."[20]

The temptation is for companies to think they need to get into a room and innovate. But network companies understand they have to get out of their own offices and into their customers', letting customer challenges dictate where innovation is required. Some focus on facilitating the growth of the industry they serve, thereby enabling their own continued expansion. Healthcare is a great example. IQVIA is a major global contract research outsource provider and the result of the 2016 merger between two leaders in contract research outsourcing (outsourced clinical trials) and orchestrated customer engagement (what the pharmaceuticals industry calls its customer relationship management).

Network companies let customer challenges dictate where innovation is required

The combination of those activities has resulted in a powerful competitive advantage. Clinical trials are supplemented with real-time, real-world tech and can provide full-cycle analytics, from clinical trial results to sales numbers. This has led to 40 per cent faster site identification, a 30 per cent improvement in patient enrolment rates and 25 per cent reduction in clinical monitoring costs. As a result, not only does IQVIA help pharma companies run trials more efficiently, it has won 70 per cent of RFPs since 2017 against incumbent VEEV (and more than 80 per cent with Big Pharma companies). Its moat is substantial: IQVIA has visibility on 85 per cent of pharma drugs globally.[21]

Reinforcing switching costs

In addition, companies can strengthen networks by raising switching costs, directly or indirectly through added client benefits. The stronger the benefit, the higher the pain for customers who leave, which can deter them even if a competitor develops a better offering (barring radical innovations, as discussed above).

"In some sense, all platforms try and figure out ways to make their platform attractive enough to stop users multihoming," says Tucker. "That is why we see loyalty programmes and points, and why we see gamification, for example."

A captive network like Costco is a good example. Customers pay for membership to benefit from wholesale prices. The fee immediately creates switching costs, while reinforcing the incentive for customers to shop at Costco and make the most of their membership, driving revenues for the firm.

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Amazon follows a similar logic with its Prime membership, as fees create switching costs and bring in revenue. "Research shows Prime members shop three to four times more than other customers and, perhaps most interestingly, are far less price-sensitive than non-members," says Gupta.

Amazon has gone a step further by adding streaming services to Prime, not to make money from video, but as a powerful way to attract and retain members.

"When Amazon started Prime in the US, it cost $79 per year and the only benefit was two-day free shipping," says Gupta. "Customers could easily calculate how many shipments they might expect to order in a year and whether it was worth the price. Then Amazon gave them something which made it impossible to do the math: unique content through Amazon Prime movies.

"That is what creates the stickiness and sells more products on the ecommerce platform," he adds. "In fact, Jeff Bezos publicly said every time Amazon won a Golden Globe, it sold more shoes."[22]

In a more prosaic way, by their very nature, freeform networks can see clients' switching costs rise as they grow. For instance, the more customers use a payment system like Visa or PayPal, the more difficult it is for a business to stop accepting those payment methods without losing customers.

An age-old concept still shaping the future

As shown by the success of Big Tech, network effects can be extremely powerful, online and offline, but not all networks are created equal. Discerning investors will look for companies with global rather than clustered networks, with a lower risk of negative effects, which reinforce their network effects by smart use of data to build bridges, innovation and high switching costs.

Firms with these characteristics are part of a long tradition. While technology might have supercharged the power of network effects, the principles underpinning them have been identified in the workings of societies and economies through the centuries. Networks have been the fulcrum of human progress since the intellectual ferment of the Renaissance – and could yet provide a competitive edge for investors as we hurtle towards the AI-powered future.

Network effects can be extremely powerful, online and offline, but not all networks are created equal

Figure 3. **Companies with strong network effects**

Characteristic	What we look for	Where we find it
Collaborate	Partnership mindset with existing competitors and new entrants	Visa PayPal
Community	Customers and merchants collectively promote the network	Alphabet Adobe
Empower	Acts as facilitator empowering the growth of the industry	IQVIA ThermoFisher Scientific
Scale	Economies of scale shared with customers	CostCo Amazon
Exponential	Scale of the network creates new opportunities	FICO Equifax

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Source: Aviva Investors, June 2023.

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