

BROKEN CONNECTION

Why firms reject investments in Connectivity, only to be surprised by disruption later

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WIRED FOR CHANGE

From medical equipment to consumer electronics to energy, established firms across many industries are still struggling to rationalize integrating Connectivity into their products. Simply retrofitting legacy products into a Connected world won't cut it; the incremental business case often doesn't justify the added cost. Connectivity is poised to contribute \$2 trillion to the global GDP by 2030¹.

The challenge is that Connectivity isn't always a source of incremental value - it can be hard to justify adding WiFi, let alone the software effort, if the associated app can't be easily monetized. We will show that while Connectivity isn't always a source of incremental value, it can be a source of transformational value: unlocking new markets, spawning new business models, and creating new product classes. This shift in architecture is reshaping industries, toppling giants, and crowning new leaders. Companies must adapt to Connectivity or risk short-circuiting their potential.

Navigational Challenges at Garmin

With the proliferation of Connected smartphones, Garmin, once a leader in navigational products for vehicles, faced significant disruption. In 2009², Google Maps started offering turn-by-turn navigation on its smartphone app for free, and it quickly became difficult for Garmin to justify the added value of their standalone GPS devices.

However, recognizing the shift towards Connectivity, Garmin pivoted to developing GPS smartwatches and fitness trackers, leveraging their expertise in GPS technology to carve out a new niche in wearable tech. As a result, their stock increased by ~500% over the last 15 years. Garmin recognized that incremental innovation on standalone GPS devices had run its course : an exceptionally difficult realization to make in most companies. By embracing change and venturing into wearable tech, Garmin transformed connectivity challenges into opportunities for growth.

The Connectivity Conundrum

The challenge of adopting Connectivity often positions departments in the firm at odds. No one department can pave the way for Connected products. Some examples TSP has experienced are:

PRICING	How much will consumers pay for Connected locks & security?
MARKETING	How can we segment out which buyers would use the functionality of a Connected refrigerator?
OPERATIONS	Would equipment Connectivity at remote oil and gas terminals lead to uptime for operations, even if we can't intervene every time?
PARTNERS	Should we share app store data with partners, suppliers, aftermarket providers?
WARRANTY	How do we staff the teams to comb through the vast quantities of data produced with returned laptops?
REGULATORY	How will the regulator react to the privacy considerations brought forward by additional Connectivity?

¹McKinsey & Company. (2020, February 20). Connected world: An evolution in connectivity beyond the 5G revolution.

https://blog.google/products/maps/look-back-15-years-mapping-world/

https://www.mckinsey.com/industries/technology-media-and-telecommunications /our-insights/connected-world-an-evolution-in-connectivity-beyond-the-5grevolution

²Reid, E. (2020, February 11). A look back at 15 years of mapping the world. Google.



Where these incremental value questions place a firm in a stalemate, new entrants will almost certainly fill the void. August (smart locks), Ring (video doorbells and home security systems), and Nest (intelligent thermostats) were born out of necessity because Yale, Simpson, and Honey-well dropped the ball.

Nest's entry into the market in 2011 challenged Honeywell's dominance, but it wasn't until 2013 that Honeywell began to offer competitive smart thermostat solutions. By then, Nest had set the standard for what consumers expected in home temperature control and was acquired by Google³. Nest's revenue a decade later was \$3.2B.



Finding the Broken Connection

It is easy to blame "organizational inertia" for why incumbents fail in the face of disruptive technologies. In this paper, we look at adaptive strategies: What are the specific failure modes that prevent firms from seizing the opportunities presented by Connectivity? How does a culture of innovation emerge from rethinking product development and customer engagement? How should companies manage disruption pressures from Connectivity? Ultimately, the Broken Connection is the overlooked gap between technology investment today and industry disruption tomorrow.

THE DISRUPTION DILEMMA : UNDERSTANDING TRANSFORMATIONAL VALUE

Disruption isn't new : America's 1800s ice industry followed the same pattern as today's consumer electronics. In the early passive refrigeration era of iceboxes, ice was harvested from frozen lakes and delivered door-to-door weekly. At its peak, the ice harvesting industry produced 25 million tons annually, with distribution of Boston ice reaching as far as India. The invention of active electric refrigeration in 1894 and subsequent improvements in refrigerant choice represented a potential disruption to the ice harvesting industry. Early refrigeration was considered inferior - unreliable and potentially hazardous - and as such was dismissed by the ice industry. Instead, the ice industry focused on improving the efficiency, mechanization, and quality of their product, as well as combative marketing to note the flaws and risks of refrigeration as inhuman (not employing delivery drivers) and inorganic.

TYPICAL STAGES OF DISRUPTION



³Tilley, A. (2014, January 13). Google acquires Nest for \$3.2 billion. Forbes. https://www.forbes.com/sites/aarontilley/2014/01/13/google-acquires-nest-for-3-2 -billion/?sh=5eb16ee06ee2



The ice industry is a classic study in disruption⁴. The ice harvesting business could have framed its mission as "ensuring fresh food" rather than as an ice supply chain. Instead, it positioned the new technology as a rival and quickly lost out to it. The incumbents failed to notice that the rate of improvement of refrigeration technology far exceeded the operational improvements in ice harvesting. Refrigeration added two new dimensions of value : the convenience of not restocking the icebox weekly and year-round reliability.

One of the reasons companies miss out on a disruptive shift is strong organizational biases such as anchoring and loss aversion that skew beliefs about disruption opportunities. Infamously, Kodak developed the world's first digital camera in 1975, but they repeatedly chose to disinvest in the digital photography market so as not to threaten their current portfolio of film-based products. Kodak and many other companies facing disruption do not lack the technological know-how with which to evaluate new technologies. Kodak failed to realize that digital photos and online sharing was the *new market* that represented a new dimension of value (not having to develop pictures), not just a way to expand the printing market.

Disruption can take many forms, and it is often difficult to recognize it using incremental management tactics. New markets are often dismissed because they are initially too small, so the focus stays on winning the existing market. New technologies are dismissed as out of scope because they initially underperform on the existing dimensions of value (such as ice box size in the kitchen and digital photograph resolution). Ironically, these very rational reactions are the reason why firms are surprised by disruption later: disruption always takes place on the new dimension of value.

⁴ Utterback, J. M. (1996). Mastering the Dynamics of Innovation. Harvard Business School Press.





Connecting the Dots

"The advent and power of connection technologies tools that connect people to vast amounts of information and to one another - will make the 21st century all about surprises." -Eric Schmidt, Google

Connectivity has a simple physical definition : whether a device can network with other devices or be addressed on the Internet. However, the customer value to be extracted merits a detailed examination, as it can vary widely. We assert that Connectivity contains two underlying qualities that give rise to its new dimension of value: validation feedback and product ecosystems.

Validation is the feedback on whether the product satisfies the users' needs. Engineers take a best-guess at use cases, but the real validation doesn't occur until the product is out in the wild. Learning from customer use, improving the user experience unknowns, and some-



times creating new products when the product cannot be stretched to fit can be an arduous and tenuous process absent Connectivity.

Connectivity short circuits this feedback cycle. The ability for any device to send or receive information is a channel for continuous improvement, but also for highly personalized performance. Tesla has famously improved its cars' 0–60 time and battery life with simple over-the-air updates. Nest learns your behavioral patterns and adapts heating and cooling profiles to be more efficient. Connected traffic signals deployed in Pittsburgh adapt to traffic patterns, resulting in 40% reduction in vehicle wait times⁵. The validation feedback loop becomes a mechanism for firms to hone in on customer needs.

Products lacking Connectivity face inherent limitations due to their isolated nature. It seems all too obvious to state 24 years after the term "Internet of Things" was coined⁶ and yet, examples of companies struggling with



⁵U.S. Department of Transportation. (2018, October 31). Surtrac for the People: Upgrading Surtrac in Pittsburgh Deployment to Incorporate Pedestrian-Friendly Features.

https://www.transportation.gov/utc/surtrac-people-upgrading-surtrac-pittsburgh-deployment-incorporate-pedestrian-friendly

Connectivity choices abound. Isolated devices are restricted on intelligence and functionality to what can be pre-installed and built into the device itself. For instance, traditional heavy machinery is limited to basic features like process control and safety stops. Without Connectivity, their potential for new dimensions of value such as issue monitoring and real-time project completion status remains untapped.

Connectivity also creates a new layer to the customer experience: the product ecosystem. A system of Connected components emerges with new functionality greater than the sum of its parts. Doorbells transform into home security systems, speakers evolve into voice assistants, and electric vehicles become battery backups for homes. The effect is twofold: the new dimension of value (often involving a SaaS layer) entices customers to buy, and the ecosystem benefits encourage customers to buy again.

These characteristics underpin how Connectivity reveals transformational value to the customer. Networked-optimized systems create ultra-personalized efficiency. Connected systems can alter the user interface (from a speaker to an app, for example), creating simplified interactions. Operationally, remote diagnostics, predictive maintenance, and analytics can simply provide greater knowledge and control, allowing the user to make more informed decisions with greater peace of mind.

There are many reasons to Connect, but the most compelling reason is that you might not know what you'll find. The serendipitous discovery of the iPhone's flashlight feature as a capability of the original camera flash hardware exemplifies how Connectivity can reveal unexpected uses. Connected irrigation systems initially automated watering, but ended up enabling precision farming by gathering real-time soil moisture data. The full potential is often unknown; you must build in Connectivity to find out.

⁶ Ashton, K. (2015, March 3). Kevin Ashton Describes 'the Internet of Things'. Smithsonian Magazine.

https://www.smithsonianmag.com/innovation/kevin-ashton-describes-the-internet -of-things-180953749/



CHANGING THE RULES

Much like Garmin's shift to wearable technology, success in the era of Connectivity requires a radical shift in direction. New dimensions of value upset the status quo. The principles that once secured a firm's position may no longer apply. Moreover, not all disruption opportunities bear fruit, creating conflict over differing visions across departments. To win, firms must transform how they play the game, for the rules have changed.



Clay Christensen's (who coined the term Innovator's Dilemma) key lesson from 25 years of study was that managers must create a new organizational space if they want to build new capabilities and new products that will be disruptive to the existing business. There must be distinct boundaries; firms fail when the new team is forced to compete for resources within the mainstream organization as it will often be accorded lowest priority. For example, Seagate and Quantum missed the transition to new disk drives because their existing, larger disk drives competed for the same resources⁷. Their incremental-centric management decisions always ceded priority to the existing product lines.

For established players, the challenge is one of reinventing themselves to allow at least a part of the business to behave as if it were an entrepreneurial startup – and of holding back the conservative forces of the mainstream organization to let this happen. Organizational approaches include:

CREATE	a new organizational structure within the corporate boundaries in which new processes can be developed. Example: Meta's Reality Labs.
SPIN OUT	an independent organization from the existing organization to develop the new processes and values that are required to solve the new problem. Example: Alphabet's spinoff of Waymo.
ACQUIRE	an organization whose processes and values closely match the requirements of the new task, but operate it separately. Example: Amazon and Ring.

Which option is right for Connectivity depends on the firm's financial situation, appetite for risk, market dynamics, and technical muscle. While there isn't a simple playbook, there are several failure modes to avoid.

FAILURE MODES

Despite well-meaning intentions, many firms have experienced archetypal failure modes when attempting to cultivate an innovative environment. Three common failure modes are the Center of Excellence, a search for incremental value, and the Hybrid Trap.

Center of Excellence

A common pitfall is to establish a Center of Excellence (CoE). For example, if an oil and gas company were to

⁷Christensen, C. M. (1997). The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Harvard Business School Press.



identify modular solar-powered sensors and Connectivity radios as an opportunity, they might consider making a CoE on sensor packaging. Envisioned as a specialized unit tasked with developing a subsystem or technology, CoEs often encounter mixed messages on whether they own decision rights, or whether they provide advice. TSP has seen CoEs fail frequently when the parent organization refuses to give enough responsibility – and therefore take enough risk – to the CoE. The result is a gradual descoping of the CoE, entangling them in the parent company's processes and necessitating significant coordination between two very different organizations.

Incremental Value

The contrast between Boeing and SpaceX highlights a critical failure mode: the pursuit of incremental value rather than transformative innovation. Boeing, despite its century-long legacy and vast resources, focuses on refining its established successes in legacy launch vehicles and bespoke defense satellites. By comparison, SpaceX has disrupted space launch and satellite communications. This 22-year-old company has captured a 50% market share by embracing agility, tolerating the right kinds of failures, and betting the house on transformative projects. Boeing's reluctance to adopt such an approach has constrained it to enhancing existing technologies with underwhelming effect. Consider Boeing's CST-100 Starliner vs. SpaceX's Crew Dragon: both were developed under the same NASA contract. SpaceX undercut Boeing by half (\$2.6B vs. \$4.2B), and Crew Dragon has flown 8 operational astronaut missions while Starliner has yet to pass the flight test phase due to years of delay.

The Hybrid Trap

Incumbents who hedge new technology bets with hybrids of old products often find this approach counterproduc-

tive. The strategy aims to combine the best of both worlds, but typically results in underperformance in both domains. A notable example is BlackBerry's attempt to counter the iPhone with the Blackberry Bold 9900, which combined a touchscreen with a traditional keyboard in response to the first iPhone, but failed to compete effectively with a poor touchscreen and a tiny keyboard. The root cause was that there is no shift in mindset; most companies approach new technology from the perspective of the old one—assessing digital photography on resolution compared to prints, developing EVs purely to reduce emissions, considering disk drive read/write speed for existing computer platforms, etc. In doing so, biases reinforce old behaviors. Hybrid efforts give established companies a false sense of safety.



ORGANIZATIONAL PRINCIPLES FOR FIXING THE BROKEN CONNECTION

Disruptors are frequently smaller organizations that lack the extensive resources of established incumbents but manage to outcompete the giants. To embody the role of a disruptor, firms must adopt a new mentality. In our experience, fostering an entrepreneurial spirit hinges on three defining behaviors:

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Innovation as Learning, not Planning

Clay Christensen's finding was that innovation endeavors "must be plans for learning rather than plans for implementation." The very nature of a disruption event is that no one can predict what will happen, so one must assume preconceived notions are wrong. Instead, work closely with Product Managers to identify underlying customer needs, and flexibly iterate with a "crawl, walk, run" approach.



In the author's experience working with Diligent Robotics (who produced one of Time's 100 Greatest Inventions of 2019), piloting Connected robotics technologies with hospitals allowed the team to narrow in on the true needs of the customer. As the team learned with its customers, features became less about flashy AI-powered gadgets and more about maximizing utility, uptime, and integration with the hospital's workflows. CEO Andrea Thomaz framed the innovation opportunity as a healthcare company that specializes in robotics, not the other way around.

Focusing on being adaptive and on learning in a time of tech and market change implies a willingness to ask : What business are we really in? How would Connectivity enhance our core experience? What adjacent tasks could add a new dimension of value?

Extreme Ownership

To do "more with less," organizations must place significant responsibility on the individual. It is imperative to have a team of highly skilled and effective doers, where each member is entrusted with personal ownership of specific aspects of the product. This approach fosters a robust culture and accrues intellectual capital, enabling the autonomy.

At SpaceX, this is the Responsible Engineer (RE) – one who is CEO of their product. The RE mentality owns the product cradle to grave, taking extreme ownership of the outcomes, and is determined to win at all costs.

Some questions to consider : How do we delineate scope for clear, actionable domains for each team member? How can we cultivate a culture where ownership includes a holistic view of the Connected system? What approaches would balance autonomy with strategic alignment across our Connectivity efforts?

Place Your Bets

Connectivity rewards decision making: firms must place their bets and commit to their endeavors. Innovation teams chasing Connected products and transformational value must control their budgets and set their KPIs separate from the broader organization. The palpable risk of failure drives their innovation and success. Companies can place multiple bets, building pluralism into the decision-making process, but betting is limited : you can't bet on everything. Except for a few giant firms like Apple, most cannot afford to remain passive, hoping to simply acquire the successful outcomes later.

Jeff Bezos discusses the concept of one-way and two-way doors, emphasizing the importance of recognizing which decisions allow for reversibility and which do not. It's



advisable to proceed swiftly through two-way doors (e.g. pricing for the Echo Dot) without transforming them into one-way doors (e.g. permanently integrating proprietary voice recognition hardware into the Echo). When faced with uncertainty, adopt a 'disagree and commit' stance, secure in the knowledge that it's possible to pivot later. Conversely, it's vital to identify one-way doors, as these decisions represent irreversible commitments.

Some questions to consider : How can we balance bets and risks to drive Connectivity breakthroughs? Where does Connectivity break our architectural decisions, and what can we do to hedge the risk? If we knew competitors were working on Connectivity, how would we beat them to market?

Developing the capacity for disruption demands a principled approach to keep the ship aligned. Exploring new ideas at the organization's periphery, managing uncertainty, and fostering a culture of entrepreneurial experimentation all require discipline.

CONNECTING TO INNOVATION

Connectivity unlocks transformational value, yet its impact is diluted when assessed through the lens of incremental gains. It can help monetize customer data, drive operational enhancements, and foster lock-in via ecosystem effects. The allure of Connectivity lies in the unexpected discoveries it enables. To capitalize on this potential, organizations need to sidestep incremental value mindsets and foster environments ripe with entrepreneurial spirit. Only then can they mend the "Broken Connection."

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