

Applying Precedents Thinking to the Intractable Problem of Transaction Costs in Healthcare

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Abstract

What is the message?

Precedents Thinking — applying past solutions to solve similar problems in a different industry setting — can be applied to what has been the intractable challenge of reducing \$265 billion in annual administrative waste in U.S. healthcare. The Precedents Thinking methodology: 1) frames the problem statement and its key elements, 2) searches for prior innovations, “precedents”, that are relevant to one or more of the problem’s key elements, and 3) combines the precedents into the best possible workable solution to the problem. As a result of their findings, the authors propose standardized, modularized digital contracts and the construction of a uniform digital transaction platform.

What is the evidence?

The authors identified 82 firms or markets that have successfully addressed challenges of this magnitude, focused on a subset of 26 innovations, and developed a proposal for contract standardization and payment infrastructure development that could address

transaction costs in healthcare.

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Introduction

Administrative costs represent a considerable burden in the U.S. healthcare market.^{1,2,3,5,6,7,8,9,10,11,12,13} Administrative costs account for nearly one quarter of the \$4.8 trillion spent on healthcare services.¹⁴ Among OECD countries, the United States spends nearly ten times the average on healthcare administrative functions per capita.¹⁵ Estimates suggest that we can readily eliminate at least \$265 billion annually in spending from reducing this administrative burden.^{1,2}

While the burden of administrative costs in the U.S. healthcare system has been well recognized, developing solutions to this challenge has proved vexing. Efforts to understand why these administrative costs are so high highlight the complexity of the market (317,987 different health plans, 599,204 codes for products or services, and 57 billion negotiated prices¹²). Other efforts have described the high billing and insurance-related costs resulting from the architectural complexity of the contracting process, the complexity of the health plan contracts with providers, and compliance costs.¹³ Moreover, much of the administrative effort in healthcare is based on digitized analog processes, with requirements for phone calls, faxes, and transmission of paper (or PDF) documents. Other challenges include the lack of a regulatory body overseeing the market. The academic and policy literature assessing the problem of

healthcare administrative costs suggests little opportunity to change given the lack of a catalyst for improvement, no market forces demanding change, and no oversight mechanisms holding the market accountable for improving this situation.

However, an alternative perspective is to consider that this is not an intractable problem. There are many markets which have faced daunting challenges such as we have described for the healthcare market and have seen significant change.

How firms and markets change is an exciting area of research in the business literature. The challenge is to ascertain an underlying strategy for reproducible and predictable innovation processes. If such an approach can be articulated, it would offer a new way to address seemingly intractable issues such as the administrative cost issue in the U.S. healthcare market.

Precedents Thinking is one of the newest advances in this field of research.⁴ It builds from the observation that all innovative solutions are creative combinations of prior innovations, “precedents”, found in different businesses and markets that faced similar challenges. If we can find the best precedents, then we can increase our chances of developing an innovative, workable solution to the problem at hand. One barrier to large-scale innovation, or addressing intractable problems, is that it is hard to generate the investment required (money, time and effort, or policy interest in a crowded legislative/regulatory space) to tackle daunting issues such as administrative costs at the required scale. The Precedents Thinking methodology offers innovators a set of proven solutions across firms and markets. One theory is that by limiting innovation to proven solutions, we may have de-risked the problem sufficiently to attract investment required to tackle the problem.

In this paper, we apply Precedents Thinking to the problem of administrative costs in U.S. healthcare.

Methods

Precedents Thinking is a method where past solutions to similar problems are used in new situations to come up with innovative ideas. We applied the Precedents Thinking methodology to the issue of U.S. healthcare administrative spending. Precedents Thinking methodology has three distinct steps: 1) framing the problem statement and its key elements, 2) searching for

prior innovations, “precedents”, that are relevant to one or more of the problem’s key elements, and 3) combining the precedents into the best possible workable solution to the problem.

1. Problem Statement and Deconstructions

The problem statement and deconstructions identify the core elements of the problem to highlight generalized features that could be used in the precedents search process. The problem statement and its key elements known as “deconstructions”, were developed through a workshop using a modified Delphi consensus process featuring expert facilitation. Participants were research team members and selected outside advisors, including the two developers of the Precedents Thinking methodology (see appendix exhibit a1). Participants were provided prereading materials that included explanations and examples of the Precedents Thinking methodology.

The group divided into two breakout sessions. Each breakout group was charged with narrowing the problem statement and defining its elements, the “deconstructions”. The workshop resumed as a whole to refine the two problem statements and deconstructions of each group into a workshop consensus statement and deconstructions. The problem statement and deconstructions continued to be refined over the course of the effort, but, for readability, only the final version is reported in the results section below.

2. Precedent Generation and Selection

Based on the workshop consensus problem statement and deconstructions, the research team began a search for precedents. The goal of this step was to develop an exhaustive list of firms or markets that had successfully implemented solutions to the problem statement within and outside of the healthcare market. Precedents were included if they were: 1) highly relevant to at least one problem deconstruction, 2) had strong evidence of success beyond luck, and 3) were more detailed than a common best practice. The precedent generation process included brainstorming among workshop participants, interviews with a broader group of industry experts and steering committee members, and a final step of using ChatGPT with a prompt of the problem statement alone and with each of its deconstructions until the output was hallucinatory or nonsensical.¹⁶

Each precedent was systematically described with background, insights, and outcomes.

Precedents were classified by industry, governance (public, private, public-private) and primary mode of change (digitization, centralization, standardization).

An initial item reduction step was taken by the research team to arrive at a shorter list of priority precedents based on impact, feasibility, trust building capacity, and applicability to the problem statement. Impact was assessed via capacity to simplify the system and reduce complexity of processes; feasibility was assessed by governance structure (i.e., private, public-private, public) and primary mode of change (centralization, standardization, digitization). Building trust across stakeholders was a binary categorization that held the same weight as the other categorizations. To determine applicability to the problem statement, we used a graphical approach to item summarization where precedent summaries were applied to the problem statement and deconstructions in 2x2 matrixes where each dimension was the level to which the precedent solved each deconstruction. The precedents were then ranked by impact, feasibility, and trust and selected to include a variety of industries and unique insights around the theory of change. A subset of 26 high-priority precedents emerged.

The 26 high-priority precedents were summarized into written briefs including background, key insights, business model, ownership, and impact on heterogeneity, complexity, trust, cost, user experience, productivity, and profitability.

3. Creative Combinations

The final step was to refine the precedents into an actionable set of solutions from the 26 high-priority precedents. This step allowed for the aggregation of precedents into composite solutions applicable to the healthcare market.

Each working group member was assigned to create at least two creative combinations of two to three precedents that solve the problem statement through at least one of its deconstructions. The full team then met and summarized the individual responses into a final summary consensus solution for the healthcare market. The group reviewed the creative combinations generated by each participant and used breakout groups to further refine the individual assignments into consensus sets of precedents and creative combinations to address the problem statement and deconstructions. The breakout groups' solutions were then compared against each other and combined into a final set of precedents and creative combinations for each deconstruction of the problem statement.

Data Analysis

We used descriptive statistics to summarize the precedents developed from the precedent generation step of this effort.

Results

Problem Statement and Deconstructions

The final problem statement defined by the workshop was: How to create the standardization and infrastructure that's needed to reduce administrative waste in healthcare? We developed two deconstructions of this problem statement:

Deconstruction 1: How to reduce heterogeneity and complexity of contracts that results in administrative burden

Deconstruction 2: How to create the necessary payment infrastructure to support an efficient healthcare transaction ecosystem

Precedent Generation and Selection

We were able to generate 82 precedents for this stage of the research (see Appendix Exhibit a2). A majority (72%) were drawn from Finance, Healthcare, Public Services, & Technology. In terms of governance, 57% of our precedents were private sector solutions, 22% were public sector solutions, and 21% were developed through public-private partnerships. Regarding mode of change, 49% used standardization as a primary mode of change, 29% used digitization, and 22% used centralization. Finally, 35% of precedents were thought to have improved trust in the market. Descriptive data for all precedents and a subset of 26 high priority precedents are reported in Exhibit 1.

Exhibit 1: Summary characteristics of precedents

Industry	Full precedent list (N=82)		High priority precedent list (N=26)	
Consumer Products	2	(2%)	2	(8%)
E-Commerce	7	(9%)	3	(12%)
Entertainment	4	(5%)	1	(4%)
Finance	18	(22%)	8	(31%)
Food Services	3	(4%)	1	(4%)
Healthcare	10	(12%)	2	(8%)
Logistics	5	(6%)	1	(4%)
Public Services	18	(22%)	3	(12%)
Real Estate	2	(2%)	0	(0%)
Technology	13	(16%)	5	(19%)
Ownership				
Private	47	(57%)	17	(65%)
Public	18	(22%)	3	(12%)
Public-Private	17	(21%)	6	(23%)
Primary form of change				
Centralization	18	(22%)	10	(38%)
Digitization	24	(29%)	5	(19%)
Standardization	40	(49%)	11	(42%)
Trust				
Improved Trust	29	(35%)	14	(54%)
Not Impacting Trust	53	(65%)	12	(46%)

Legend: Full precedent list is the result of the precedent generation exercise. High priority precedent list is the final list of precedents used in the creative combination exercise.

Creative Combinations

The final creative combinations aimed to solve both problem statement deconstructions (contract standardization and payment infrastructure) by applying the learnings from a consensus set of our precedents narrowed in on by our working team. The precedents that informed our core solution were:

- *Modularized machine-readable contracts:*
 - Standardized mortgages
 - Mobile phone standard setting organizations (SSOs)
- *Payment Infrastructure:*
 - Society for Worldwide Interbank Financial Telecommunications (SWIFT)
 - Stripe
 - SMART on FHIR
 - State utility commissions
 - FAA

See Exhibit 2 in the Appendix for the complete summary of relevant precedents.

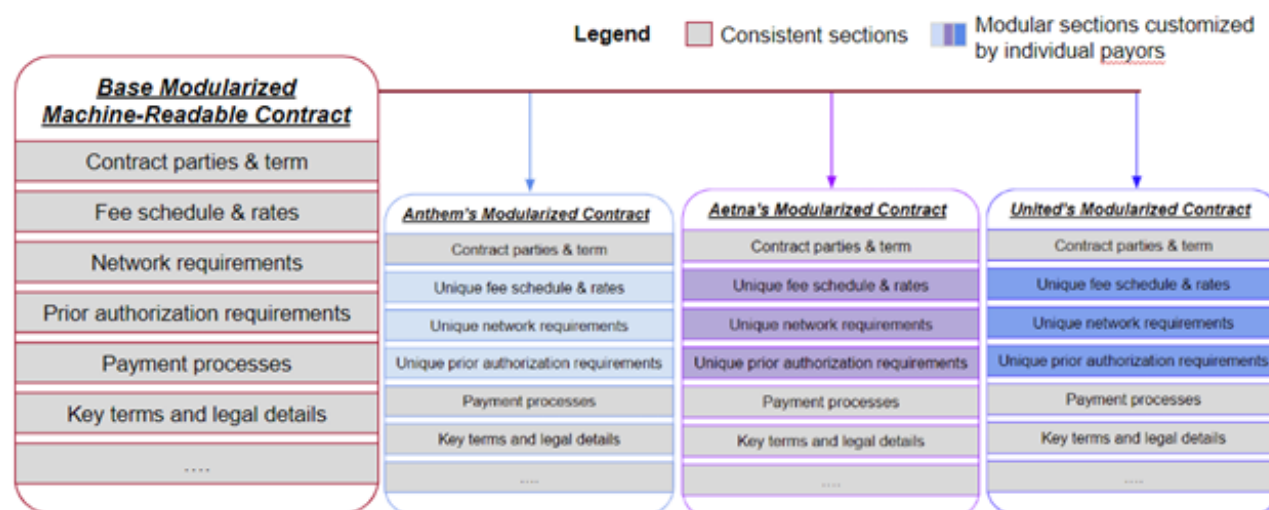
Solution Part 1: Modularized machine-readable contracts

Part one of the solution aims to implement modularized machine-readable contracts in a digital and unified manner. In the current market, each payer (or individual health plan) must negotiate a contract for services with each in-network provider organization. While features of these agreements refer to a similar set of business processes, they do not follow any standardized structure or standard set of fully digital processes.¹² Further, novel features such as value-based payment models are further individualized for payers or plans (often resulting in entirely analog transactions).

Building from our learnings on mortgage standardization, we propose a single, modularized digital contract format. In the early 1970s, Fannie Mae and Freddie Mac standardized to a modular format to improve the mortgage process and to allow syndication of these now standard mortgage products.³ Our working definition of a modularized machine-readable contract is one that is designed to be digitally adjudicated. Such a contract will have a standard

structure and set of contract terms (See illustrative example in Exhibit 3). For example, items that are typically addressed in these agreements include billing processes, payment terms, additional requirements such as prior authorization processes, quality reporting, confidentiality, and regulatory compliance. We have defined these agreements as modularized, not uniform. In other words, agreements could be customizable by health plans under this structure, but customization could not alter the requirement for complete digital adjudication.

Exhibit 3: Modularized Machine-Readable Contracts



Legend: Each insurer could design new contracts, or reproduce the logic, requirements, and processes of each of their current contracts, with the Modularized Machine-Readable Contracts framework. Each care provider could use a single operational and technical framework to interact with every contract from every insurer. Differences between contracts would be captured with standardized categories of inputs and outputs, variables, and functions. To resolve edge cases not captured in the contractual logic, insurers and providers could continue to work as in the current state.

Single Sign-Ons (SSOs) are industry or public-private partnerships that bring together competing firms that collectively select and adopt uniform technical standards to ensure compatibility and interoperability among products. This approach has allowed for standardization and innovation that supports the enormous mobile phone market. The SSO process could be used to determine

the final content of the modularized machine-readable contracts, as well as technical supporting details (such as a requirement for SMART on Fast Healthcare Interoperability Resources (FHIR) APIs for digital transactions). The SSO for such a process could build from industry (America's Health Insurance Plans (AHIP), for example) or could be constructed through the Federal government (the U.S. Department of Health and Human Services or the Department of Commerce, for example).

The process of selecting a modularized and machine-readable contract structure would drive innovation in contract design and build engagement from across the industry. In the mobile phone SSO process, each industry partner submits their proposal for mobile phone standards. The best option available is selected by the SSO body and becomes the standard for the industry (for a fixed time, this is an ongoing innovation process). Firms are incentivized to contribute their intellectual property (in the mobile phone market this in in the form of patents) because when one firm's technology is selected, their relevant patents are deemed standard-essential patents ("SEPs"), generating royalty payments from the other firms in the market. Since contract elements may not be patentable, the SSO process may have to develop other compensation schemes to support collective engagement with the process.

Solution Part 2: Uniform Payment Infrastructure

Standardized contracts would enable the construction of a uniform digital transaction platform for the U.S. healthcare market. Such a platform should be seen as critical core infrastructure supporting the market. Currently, each health plan utilizes their own platform to process healthcare claims or relies on a limited set of "clearinghouses" in the market. Given the heterogeneity in transaction processes in the current healthcare market, there is significant underinvestment in this infrastructure (an issue that was highlighted by the recent cyberattack on Change Healthcare¹⁴).

Stripe has built a comprehensive, digital-first backend payment infrastructure that has created a trusted and centralized payment process for vendors across industries with easy access through APIs. Given a standard contract, it is easy to envision the development of a consistent payment processing infrastructure for all payers and providers to use, eliminating the payment inconsistencies that exist in the market today. This infrastructure would house (and implement) the digital contracts to ensure the integrity of the payment process.

SWIFT is a consortium of financial institutions that developed a digital communication system that underlies most banking transactions. The SWIFT network demonstrates that a digital transaction platform can be reliable, secure and robust, even at enormous scale. It is also an example of such a platform emerging out of collective industry action that later expanded to include the Federal Reserve and other central banks as opposed to one created through regulation.

Financing critical infrastructure such as this transaction platform usually follows a pattern of initial investment followed by a self-sustaining financial model (say, by collecting a transaction fee for each payment). In this case, the required transaction fees are likely to be substantially lower than the cost per payment transaction under the current model. Currently, there are no governance mechanisms in the market to support the development of this infrastructure. While the private sector could deploy the capital required for this effort, a purely private transaction platform could be subject to rent-seeking by the platform owner over time, limiting the economic benefits of this initiative. Creating a public or a public benefit corporation to develop and oversee this platform could be a pathway to addressing this challenge. Creating a public oversight mechanism would help to ensure transparency and accountability across the market and possibly avoid rent-seeking. For example, another precedent is how the Federal Aviation Administration (FAA) centralized the infrastructure and agencies needed to support commercial aviation in the U.S. and how state utility commissions regulate public utilities and their profits.

Discussion

The high administrative cost burden of U.S. healthcare is a seemingly intractable problem. These costs result from tremendous complexity in transactions across the diversity of health plans, and the lack of oversight and attention to this issue at the federal and state levels. This is not just an abstract concern about the market. Complexity and administrative challenges are a burden to patients and cost consumers an enormous amount of time by having to negotiate insurance terms and conditions, prior authorization, and appeals processes. These challenges interrupt patients' access to care, resulting in delayed diagnoses and treatment.^{18,19}

The Precedent Thinking methodology described in the business literature suggests one model for developing predictable and scalable innovation. This model requires the identification of a key problem statement, developing and refining a set of firms and markets which have

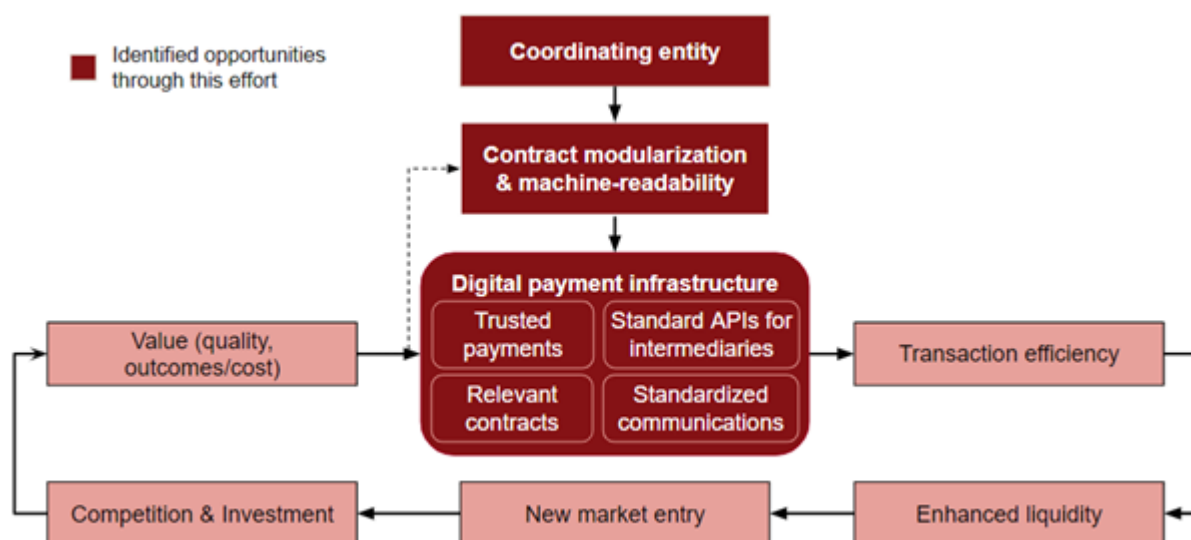
successfully addressed a business challenge similar to the core problem, and then adapting these precedents to a solution for the market of interest.^{20,21} We challenged ourselves to understand how to standardize transactions and create an infrastructure that would be needed to reduce administrative waste in healthcare. We identified 82 firms or markets that have successfully addressed challenges of this magnitude, focused on a subset of 26 of these innovations, and developed a proposal for contract standardization and payment infrastructure development that could address transaction costs in healthcare.

The Precedent Thinking methodology helped us to understand how other firms and industries have successfully addressed challenges of the magnitude faced in the healthcare market. In developing the idea for modularized machine-readable contracts, we identified home mortgages and mobile phone standard setting organizations as key precedents. In developing the idea for a digital transaction infrastructure, we have identified the work of the firm Stripe in financial markets, the SWIFT infrastructure for the banking system, the APIs available through SMART on FHIR, the role of the FAA in the aviation market, and state public utilities commissions. These precedents provide critical insights for solving the administrative cost challenge of the U.S. healthcare market.

In a focused exploration of business precedents, we found that other industries have solved large, seemingly intractable problems like an analog to digital transition. From this effort, we discovered that standardization and digitization have been successfully deployed in several markets, generating key insights that can be applied to the U.S. healthcare market. We identified that large-scale market change does not require initial government initiative (private initiatives have been successful), though government involvement can drive adoption across stakeholder groups.

Another important insight from Precedents Thinking is how solutions such as standardization and digitalization can create positive network effects in a market. Developing modularized, machine-readable contracts and, correspondingly, standardizing a transaction platform, can lead to transaction efficiency, market entry, enhanced liquidity, competition, and value in a manner that can continue to build over time through investments in improved infrastructure and transaction processes (Exhibit 4). For example, it could enable the securitization of insurance contracts to enhance liquidity in the market.

Exhibit 4: Catalyzing a Virtuous Cycle in Healthcare



Legend: Adoption of modularized machine-readable contracts and the unified digital payment infrastructure would enable a virtuous cycle of follow-on impacts across the healthcare market over time. The platform would lower transaction costs thanks to standardized and centralized digital payments. Reducing transaction costs and “friction” associated with the payment infrastructure would ease entry of new firms and products into the market. These new entrants would drive increased competition and investment that would improve the value of the healthcare provided by the system. Clear improvements to value would generate increased investment in the digital payment infrastructure that would allow the virtuous cycle to continue.

Our work is not the only effort to understand the high administrative costs in healthcare. Several authors have identified the high administrative costs in the U.S. healthcare system^{1,2,4,5,6,7,8,9,10,11,12} and some have proposed ideas to help reduce waste.^{2,3,6,9,10,22,23,24,25,26,27} Their work validates the enormous waste in the market and focuses on an overlapping set of potential solutions that can be deployed to address these challenges. However, the path to achieving such solutions remains unclear. Precedents Thinking has allowed us to think deeper about how truly transformative

solutions at scale could be implemented.

One result from this work is a better understanding of the critical role of standardization and infrastructure investment in addressing the high transaction costs in healthcare. Many of the precedents studied that have successfully addressed these challenges come from the finance industry where government structures such as the Federal Reserve Bank have helped to establish, catalyze, coordinate, and regulate different aspects of the financial markets. Obviously, we lack such a coordinating entity in the U.S. healthcare market. Using our formulation of a solution, it would be possible to examine how existing legislative authority can be used to implement our solution, including legislative authority under HIPAA, the Affordable Care Act, and through the Centers for Medicare & Medicaid Services. Additionally, broad executive actions around AI could be leveraged to develop a contractual and payment infrastructure environment for safe AI use. An alternative governance structure could include the role of agencies such as the U.S. Labor Department (through the employer health plan fiduciary obligations) or the Commerce Department. New legislative authority might be required to fully implement the complete set of precedents we have identified in the healthcare market. For example, federal legislation could establish a centralized authority overseeing healthcare payment transactions similar to the federal reserve and state legislation could mandate use of a standard transaction platform by physicians and hospitals licensed within a state when engaging with health plans.

States could also play a key role in addressing high administrative costs because of smaller scale and faster implementation times. Programs like Medicaid, managed at the state level with federal funding, could provide a means of scaling successful standardization efforts.

One challenge for the governance structure is the inherent conflict between standardization and heterogeneity in the market. While it is possible to build technology that can implement enormous complexity in an algorithmically-driven payment process model, the more we enable complexity, the more we risk diluting some of the economic benefit of standardization. Health plans have built their marketing efforts on facilitating health plan customization, even with little economic support for this approach (for example, the Medigap market has 10 health plan structures,²⁸ while the individual insurance (Obamacare) exchange plans have the same benefit structures but differ in cost-sharing provisions²⁹). At the extreme, it's easy to postulate that

there is little economic or market rationale to support the current 317,987 different health plan structures in the new infrastructure, but the degree to which plan customization is a required design element should be a matter of further discussion.

Even with substantial government involvement, industry participation is a prerequisite for the successful adoption of modularized contracts and a digital infrastructure. One possibility is that SSOs provide a platform through which industry partners agree to details such as the degree of plan customization. SSOs could also play a role in making final decisions about digital infrastructure across the industry. Besides SSOs, private entities could collaborate with government on policy options through working committees and nonprofit coalitions. Beyond the initial adoption of new contracts and infrastructure, industry partners could also provide critical insights to guide change management and improvements over time. Incumbent industry leaders unsettled by the potential for a new transaction model that disrupts their core business model might need to be pulled into this effort by government or customers.

Limitations

The strength of the Precedents Thinking method is the robustness of the three steps in the process. While we convened an outstanding research team and steering committee, other efforts to apply the same methodology to this problem could have identified a different set of solutions. Further, while we tried to be exhaustive in developing precedents for discussion, we could have missed key innovations in other markets in the U.S. and globally. Finally, our assumption behind the Precedents Thinking approach is that the solutions can generalize to the healthcare market and scale, and both assumptions are untested.

Conclusion

We applied Precedents Thinking methodology to the challenge of high administrative costs in the U.S. healthcare market. Using business precedents from markets and firms inside and outside of healthcare, we identified contract modularization and the development of a digital payment infrastructure as a solution that can address this challenge at scale. There are remaining questions about the governance model for implementing these solutions and the potential to pilot and scale, but overall, we conclude that high administrative costs need not be an intractable feature of the U.S. healthcare market.

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Appendix

Exhibit 2: Summary of Relevant Precedents

Deconstruction	Precedent	Background	Key insights	Industry	Governance	Primary form of change
1) Modularized machine-readable contracts	Standardized Mortgages	Fannie Mae and Freddie Mac wrote and standardized standardized mortgage contracts in the 1970s	Government-backed private agencies that created mortgage forms divided into key components. 1) Uniform mortgages accepted by every state and 2) those that could not reach consensus called non-conforming.	Real Estate	Public-private	Standardization
	Mobile Standard Setting Operations (SSO)	Information and Telecommunication Industry Standardization efforts apply standards across the entire industry through the work of standard-setting organizations (SSOs) (i.e., a public-private partnership to create, discuss and implement common technical standards across competing firms)	SSOs are self-governed industry associations of competing firms that set industry norms and adapt uniform technical standards to ensure compatibility and interoperability among products. To set a new standard, SSOs typically require a 75% majority to approve the standard. SSOs have a best solution to implement as the common standard across the market driving them to achieve scale while maximizing individual innovation to compete in the creation of better technology. SSO processes are revised and improved through input, through membership of multiple agencies in the SSO and enforcement actions from the DOJ and FTC.	Finance	Public-private	Centralization
	Society for Worldwide Interbank Financial Telecommunication (SWIFT)	Cooperation from many different players to work together to create a financial messaging system that provides improved services to customers and enables smaller banks around the globe	A group of 230 private financial institutions came together to develop a centralized communication system with rules that allowed banks to digitize payment orders. It was a member-owned cooperative institution created by shareholders (1-550 financial institutions in 1973). The world are shareholders. It is a member-owned cooperative institution with full-time employees and CEO. The governance is based on a board of directors. The board members from the member banks from the ECU and central banks of the ECU countries where each nation's usage determines the number of board members that each country is allowed.	Finance	Public-private	Centralization
	Stripe	Reimagined digital payment system by creating a secure, simplified bank connection for developers, and more uniform tool development and reducing complexity in payment processes.	The solution worked because they targeted a specific, primary pain (complexity) and need (payment infrastructure), and offered tailored benefits that existed. By offering simple, well-documented APIs, Stripe made it easier for developers to integrate payment processing into applications making it more convenient for consumers to make purchases and reducing payment processing costs. The president enabled a shared technological base across competing firms via a third party that enabled further innovation and development in an industry with large, one-time recurring payments.	Finance	Private	Standardization
2) Payment Infrastructure	HL7 SMART on FHIR	Influence of government regulation in driving interoperability within healthcare and the development of FHIR standards that the change has created.	With the goal to create a modern standard for exchange, it aimed to overcome the limitations of previous HL7 standards (like version 2 and 3, which were known for being inflexible and cumbersome). FHIR leveraged modern web technologies to enable flexible and lightweight data exchange. The development of FHIR from HL7 required collaboration with various stakeholders, which ensured real-world applicability and industry best practices. HL7 International maintains FHIR, regularly releasing updates and providing guidance to address emerging healthcare challenges.	Technology	Private	Standardization
	State utility commissions	Public utility regulatory activity began to rise in the mid-19th century. States have since created similar commissions to regulate a broader range of public utilities, including electric, gas, and water, to ensure fair rates and reliable service.	Public utilities balance the interests of consumers and utility companies by overseeing operations, approving rate changes, and enforcing policies. They protect customers while ensuring the financial health of utility providers and prevent a cascade of regulation of necessary infrastructure infrastructure.	Public services	Public-private	Centralization
	Federal Aviation Administration (FAA)	Before the FAA was created in 1958, the CAA and CAA and the FAA were separate entities with different responsibilities. The FAA was created to oversee the US established a military system for air navigation and air traffic control and assumed broader authority to regulate aviation health.	The FAA consolidated fragmented regulatory functions of the CAA and the CAA into a single authority, providing a comprehensive and standardized approach to aviation oversight. The FAA has embraced technological advancements, improved safety and security standards, and negotiated service challenges. The FAA has a strong ability to adapt to and address the evolving technological landscape of the aviation industry. The FAA has been actively involved in redesigning the National Airspace System (NAS) to accommodate the growing demand for air travel. This initiative involves modernizing air traffic control, enhancing navigation procedures, and implementing advanced technologies to enhance capacity and reduce delays. The FAA has also expanded its focus on commercial space flights, responding to the rapid growth of drone technology, commercial space travel, and cybersecurity.	Logistics	Public-private	Centralization

Legend: These precedents were used to directly support the final creative combination solutions. Descriptors were developed by the research team and described on the precedent briefs.

Exhibit a1: Workshop Participants and Steering Committee Members**Workshop Participants**

Name	Description
Kenneth Favaro, MBA	Developer of precedents methodology
Stefanos Zenios, PhD	Developer of precedents methodology, Stanford Graduate School of Business
Kevin Schulman, MD	Stanford University Schools of Medicine and Business
David Scheinker, PhD	Stanford School of Medicine
Michael Murray, MS	Former CFO of Blue Shield of California
Meghan Eluhu, MCI	Research team member
Bryan Kozin, MBA	Research team member
Brooke Istvan, MBA	Research team member
Perry Neilsen	Research team member
Walter Winslow, MBA	Research team member

**Steering Committee
Members**

Name	Description
Jacob Asher, MD	Former CMO, multiple health plans
Matt Eyles, MPP	Former CEO, AHIP
Kenneth Favaro, MBA	Developer of precedents thinking methodology, Chief Strategy Officer, BERA Brand Management
Goutham Kandru	Gates Ventures, associate director US healthcare
Robert Kaplan, PhD	Harvard Business School
Ernest Ludy	Former CEO, Medstat
Michael Murray, MS	Former CFO of Blue Shield of California
Kavita Patel, MD, MSHS	Stanford University School of Medicine
Barak Richman, PhD, JD	George Washington School of Law
David Scheinker, PHD	Stanford School of Medicine and Engineering
Kevin Schulman, MD	Stanford Schools of Medicine and Business
Will Shrank, MD	Former CMO, Humana
James Weinstein, MD	SVP Microsoft Healthcare
Stefanos Zenios, PhD	Developer of precedents thinking methodology, Stanford Graduate School of Business

Exhibit a2: Full Precedents List

Precedent	Explanation	Digitization, Standardization, or Centralization?	Public vs private vs partnership?
ATM Machines	ATM Machines allow consumers to withdraw cash from any machine in the country using their debit card	Digitization	Private
ATM Networks	ATM networks allow banks to communicate across regions and contracted networks in order to validate and process ATM requests for an additional fee	Standardization	Private
P&C insurance	Property and casualty insurance to consumers is structured with standard minimum and fault formulas. Individual contract rates are not typically negotiated	Standardization	Private
Medicare PPS	The Medicare BBS determines fixed bundled payments to hospitals based on geographic factors, patient case mix, and DRGs	Standardization	Public
State of MD all-payer rate setting	State (the HSCRC) sets rates for healthcare services that all providers receive from all payers	Standardization	Public
Medicare Advantage Generally	Privately administered Medicare plans reimbursed through capitation at the federal level, allowing private payers to manage the plans locally in whatever way will maximize cost savings	Standardization	Public-Private
NHS standard contracts	All of NHS uses the same contracts (single payer and single provider system makes this easy)	Standardization	Public
Direct contracting employer - provider (i.e., centers of excellence)	Large employers are contracting directly with large providers to get guaranteed rates especially for specific high-cost procedures	Centralization	Private
CMS 1500 form	CMS's attempted common / standard claims form (used for all Medicare FFS and suggested to be used by private payers but it is mostly not used)	Standardization	Public
Uniform Mortgage forms for Fannie Mae/Freddie Mac	In 1971, the two held the first public meeting to begin their efforts to standardize. This proved to be an iterative process with public meetings and community comment periods. There was disagreement over all components so both provided similar standardized mortgage forms and have specific pieces tailored to their guidelines	Standardization	Public-Private

OTC derivatives contracts	In 1985, the ISDA and published a list of agreed-upon definitions and terms for contracts, covering a wide range of topics including floating amounts and default and termination provisions. ISDA also published a Master Agreement (MA) template in 1987, with updates in 1992 and 2002.	Standardization	Private
Tax forms	1040 form created in 1917, IRS created in 1953 which audited and ensured up to date standard forms	Standardization	Public
Credit card applications	Credit card applications are not standardized. Different credit cards are allowed to use different components of information to make a decision on approval. However, there are standard elements. For example, all lenders may consider a FICO score and all credit card agreements must include a "Schumer box" which details fees associated with the card as required by the Truth in Lending Act to be presented in a standardized format	Standardization	Private
Walt Disney World Ticketing	Rather than pay for each experience at Disney individually (like FFS), Disney Goers will pay for a general ticket upfront with "special" experiences and perks being paid on an individual basis. Tickets and experiences can be bundled for a few days or seasonally depending on the park goers preference.	Digitization	Private
Search Engines Algorithms	Search engines use a variety of factors and algorithms to predict which searches are most relevant to the user's request; this process has become increasingly sophisticated and sponsor-based as these platforms have developed. However, many firms will "hack" these algorithms by using SEOfavorable components on their websites in order to get higher rankings	Digitization	Private
Life Insurance policies	Purchasers of life insurance are the people being directly insured themselves, no network negotiations	Standardization	Private
Online Gambling	Originating as digitally posted sports books in 1995, private companies took advantage of lax gambling restrictions in Caribbean countries to establish online betting exchanges. CryptoLogic in 1995 allowed monetary transactions over the internet, which allowed the entire betting transaction to occur automatically on client websites. Note: the legality of online betting remains controversial	Digitization	Private

Streaming Services Analytics	Large streaming services need to perform “content validation” in order to determine which content is worth purchasing/financing and what can be cut from their portfolio without losing a large percentage of subscribers	Digitization	Private
TV Residuals Standards/Structure	Residuals are paid to union members for continuously shown media. Residuals are calculated based on a variety of factors, including guild membership, initial payment, time spent, type of production, and foreign vs domestic market	Standardization	Private
TV Residuals Payments (SAG AFTRA)	SAGAFTRA Unions administer and negotiate TV residuals for its members who appear on TV	Centralization	Private
Fast Food Franchising	Brand identity, trademarks, suppliers, and products are licensed to investors for a percentage of revenue in order to establish a local chain	Standardization	Private
Eventbrite	Consolidates contracts with artists and vendors on a centralized platform and derives revenue from a percentage of the ticket sale	Centralization	Private
Residential Lease Agreements	Property managers and landlords use standardize lease agreements	Standardization	Private
Banking clearinghouses	Established between 1750 and 1770 as a place where the clerks of the bankers of the city of London could assemble daily to exchange with one another the cheques drawn upon and bills payable at their respective houses. Meant to reduce the risk of a member firm failing to honor its trade settlement obligations.	Centralization	Public
Digital ACH infrastructure	Computer-based electronic network for processing transactions, usually domestic low value payments, between participating financial institutions, automating the clearinghouse concept developed in the 1700s in London	Digitization	Public-Private
Apple Wallet	Digital passes etc. collected across arious apps, emails, etc. into one central digital wallet	Centralization	Private
Stripe	Stripe’s focus was to make it easier for developers to integrate payment processing into their websites and applications. They gained popularity and expanded its services globally at the forefront of developing and implementing new technologies in the payment space (i.e., simple checkout, support for various payment methods, tools for managing subscriptions and recurring payments)	Standardization	Private

TurboTax	TurboTax has become the premier source for compiling and issuing annual tax payments for both federal and state filings. Consumers can use a tool at no cost to help with filing tax returns	Digitization	Private
CommonApp	CommonApp served to simplify the college application process by enrolling multiple institutions to the same college application questions and formats to make it easier on students and families	Centralization	Private
The Bar exam / association	The Bar serves as a standardized set of requirements for legal professionals to be certified by in order to practice. Standardized nationally and tailored at the individual state level. The bar creates a repository of all certified lawyers	Standardization	Public
Online marketplaces (Indeed, amazon)	Proliferated in the 21st century as a simple way to shop or share data online in standard locations/sites with standardized formats	Centralization	Private
Credit scores & loan preapproval	Credit scores created by centralized providers serve as the measurement for financial services providers. FICO created in 1989, which is the basis for a credit score to determine approvals and preapprovals	Standardization	Private
Student loans / FAFSA	FAFSA is a standardized form by which student loan decisions are made with key data elements that are shared to loan providers	Centralization	Public
Railroad infrastructure (Amtrak)	A combination effort from government subsidized players and private entities enabled passenger rail transportation across the US to grow significantly	Centralization	Public-Private
Spam email (Phishing)	Ever since the first spam email was sent over ARPANET in 1978, email clients have been trying to sort spam email using all sorts of sophisticated algorithms and big data analytics. However, spam emailers have used equally sophisticated systems in order to evade detection which has driven increasing reliance on technological innovation on both sides of the "spam war"	Digitization	Private

Federal Direct Cost Reporting	Within a higher ed institutions, “direct” costs for sponsored projects are individually itemized and tracked per project, even under the same principal investigator. When those costs are reported to the federal government for grant reimbursement, they are concatenated under 8 categories for billing simplification	Standardization	Public
Tech modularization (Hardware – HP printers, Software – Enterprise software offerings)	HP printers are a famous operations case study of modularization in production where HP can easily mass produce a bunch of printers and then just change the charging cable to sell them around the world	Standardization	Private
Quality metrics (state-based efforts to standardize)	Healthcare quality metrics have exploded over the past 2 decades with thousands of different quality metrics providers are required to report to specific payers and regulatory bodies. There have been several states that have taken legislative action to standardize quality metrics and require that health plans use the standardized measures. For example, Minnesota’s 2008, Massachusetts 2010, and Oregon’s 2013 laws direct the development of standard sets of quality measures and mandate healthcare providers report on these measures and health plans do not require other metrics	Standardization	Public-Private
Eliminating upcoding in MA	There is a history of providers and payers “upcoding” in MA to get more money for a more risky population. The federal government reviewed MA codes compared to FFS codes and found a bunch of codes that were higher \$ reimbursement that were overutilized and cut those codes / reduced their payment to be in line with average, etc. where medically appropriate	Standardization	Public
Government contracts / RFPs / RFIs	Government has a standard Request for proposal process for hiring vendors / contractors that allow the government to evaluate on set criteria and also a request for information (RFI) process to solicit input into law making from private sector associations as well as nonprofits and research institutes	Standardization	Public
Class pass / Doordash / Eventbrite	A centralized app and payment that allows a consumer to choose from many options at many providers (e.g., for food, for workout classes)	Centralization	Private
Drinking water standards / wastewater standards	The Federal Water Pollution Control Act of 1948 was the first major U.S. law to address water pollution. Growing public awareness and concern for controlling water pollution led to sweeping amendments in 1972. As amended in 1972, the law became commonly known as the Clean Water Act (CWA).	Standardization	Public

FAA / air traffic control regulations	There was some regulation from the 1930's to the 1950's with the FAA creation taking place in 1958 to ensure safety and things were initially fragmented. The FAA consolidated and became part of DOT in 1967 to ensure a coordinated transportation system.	Centralization	Public-Private
GAAP / Capitalization standards	The SEC was created after the crash of 1929 with the first mention of GAAP in 1936. The goal was to achieve conformity with proper accounting, full disclosure and comparability.	Standardization	Public
Car emissions standards	Congress passed the landmark Clean Air Act in 1970, which gave the newly formed EPA the legal authority to regulate pollution from cars and other forms of transportation.	Standardization	Public
Gas octane levels	Combination of private marketing in the 1960's to standardize offerings to consumers and the Clean Air Act from the EPA phasing out lead gasoline.	Standardization	Public-Private
W2 vs. 1099 / employee vs. contractor distinction	The 1099 tax form has been around since 1917. Labor laws in the 1930's and additional regulation in the 1970's was passed focused on contractor vs. employee distinction with separate forms	Standardization	Public
Fishing (Fish and Wildlife) as technology increased	As early as 1871, Spencer Fullerton Baird, Assistant Secretary of the Smithsonian Institution flagged depletion and created the National Marine Fisheries Service (NMFS). Various regulation pre-dated the formation of the NOAA but then NMFS was consolidated under NOAA which was more focused on conservation and established regulations and quotas that reduced overfishing	Centralization	Public
AI in finance / open banking rule	CFPB issued RFI on AI in 2021; 2022 issued notice highlighting discrimination in models; June 2022, the American Data Privacy Protection Act (ADPPA); also in 2022 Biden issued AI Bill of Rights, which set out provisions to give consumers more control over and protection of their data	Standardization	Public-Private
Voting machines (Analog to digital transition)	Ballots were originally paper and have been converted to digital in many places. Mail-in voting is still analog but counted by machines. This is an example of a hybrid system	Digitization	Public-Private
Shopify	Collation and tracking of online purchases. Helped centralize online shopping and shipping information for consumers	Standardization	Private
Blockchain identity verification (Truework)	Traditionally, identity and employment verification were extremely tedious for processes like mortgages. Truework created a digital verification of information and maintenance of that information for future use	Digitization	Private
Online air tickets	Tickets used to be purchased at counters in airports and travel agencies then moved online and centralized by Google flights	Digitization	Private

DocuSign	Example of digitizing an analog process of signing documents but doing so in secure and trusted environment	Digitization	Private
RFID in Retail Inventory Management	Example of multiple stakeholders coming together in the private sector to develop the technology in a lab at MIT and then commercialize it for digital tracking and tagging of inventory and shipped goods that can be interoperable	Digitization	Private
Online retail return	As shopping moved digital, so did returns. Amazon is a great example of simplification for the user on top of this digital process (you can just walk into a UPS store with whatever item you want to return and scan a QR code, don't even have to box anything up).	Digitization	Private
DSCSA for drug tracking	Enacted in 2013 to focus on transparency and tracking of drugs through the supply chain. It improved safety, visibility, tracking and availability data	Standardization	Public
Digital fast food menu boards and OS (e.g., Toast)	Analog process made digital. There was also standardization and cataloging of items. Tedious process with tons of combinations became streamlined through an easy to update digital platform.	Digitization	Private
HTML/early internet architecture	The first internet was invented by Tim Berners-Lee, a physicist at the European Laboratory for Particle Physics (CERN), who wanted to share research ideas freely with his collaborators in other countries. This was the first rendition of "hypertext" which later became HTML, the language of coding internet websites. HTML was further developed and legitimized by the Internet Engineering Task Force, led by other scientists and engineers trying to standardize HTML to maximize its benefit to the academic community. This is an example of private standards slowly incorporated by larger working groups until it established as the global standard	Standardization	Public-Private
Lean Manufacturing	Lean manufacturing is a production method that tries to eliminate waste by limiting excess production and inventory to match total demand and focus on quality control and efficiency at individual steps in the manufacturing process	Standardization	Private
Automated passport control	Automated border entry for travelers meeting entry requirements improves user experience and reduces manual bureaucratic steps	Digitization	Public-Private
Usage-based Billing for Utilities	Automated billing and payments options offered by utility companies that can be set up directly with customer bank accounts or credit cards. This improves efficiency, likelihood of utilities getting paid and hassle for users	Standardization	Public-Private
Accounts Receivable Securitization	Been in place since the 1980s, but low penetration vs. mortgages. Reliable and cost efficient funding through accounts receivable securitization + receivables insurance can reduce credit performance uncertainty, mitigate catastrophic risk and enhance cash flow	Centralization	Private
Digital Identity Verification (e.g., face scans)	Fast form of secure identity verification (i.e., hard to copy a whole face). There are systems sharing information used in more and more locations like airports to expedite security processes.	Digitization	Private

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ICT Cellphone	TIA has a history of encouraging disclosure of IP to ensure standards to accelerate interoperable / connected development	Centralization	Private
Tesla (DTC marketing)	Tesla eliminated the dealer as a secondary margin taker to increase their ability to make their cars more affordable	Standardization	Private
Tesla (supply chain innovation)	Unlike traditional automakers, Tesla vertically integrated several aspects of its supply chain, including manufacturing key components like batteries and electric motors in-house	Standardization	Private
Enterprise resource planning systems in manufacturing	Enterprise Resource Planning (ERP) systems in manufacturing emerged in the 1990s as a response to the need for integrated solutions that could manage various business processes, from production and inventory to finance and human resources. ERP systems aimed to eliminate data silos and enhance overall operational efficiency. ERP systems revolutionized manufacturing by providing a unified platform for managing and analyzing business processes. They streamlined operations, improved communication between departments, and enhanced decision-making through real-time data insights.	Digitization	Private
Two-factor authentication	Two-Factor Authentication (2FA) has its roots in the information technology and cybersecurity domains. The concept gained prominence as a response to the vulnerabilities associated with traditional username and password systems. The idea is to add an additional layer of security by requiring users to provide a second form of identification beyond just a password. It has enhanced cybersecurity by adding an extra layer of protection against unauthorized access. By requiring users to provide a second form of identification, such as a temporary code from a mobile device, 2FA has reduced the risk of data breaches, identity theft, and unauthorized system access.	Digitization	Private
SWIFT (Society for Worldwide Interbank Financial Telecommunications)	Global provider of secure financial messaging services. It facilitates standardized communication and transactions b/w financial institutions worldwide and streamlines financial processes (e.g. fund transfers, payment instructions, etc.). It was started by a group of private banks who recognized the need for a standard messaging service and then grew to include government central banks	Centralization	Public-Private
Contactless fare payments (MTA in NYC, BART in SF, etc.)	Public transportation systems allow for contactless cards/mobile payment apps enabling better customer experience	Digitization	Public-Private
Freelance Platforms (Upwork, Fiverr, etc.)	Marketplaces for businesses to find and hire independent professionals for temporary jobs or projects based on select criteria (skills, experience, location, etc.) secures transactions and ensures payment and quality work	Centralization	Private
Hotel express checkout	Hotels allowing guests to skip traditional checkout process and receive an electronic invoice instead to improve user experience and reduce work for the hotel	Digitization	Private
Minor software updates	Software companies conduct automatic updates for minor software releases (e.g. iOS updates). This streamlines the software maintenance process without requiring explicit prior authorizations for security updates or bug fixes	Digitization	Private
Common Course Registrations	Direct enrollment for classes that don't require prior authorization to reduce burden for schools and students	Digitization	Private
Peoplesoft / HR software	Simplified authorization processes for routine time off requests and low-risk HR processes	Digitization	Private
Renewal of government licenses	Government implemented automatic renewal processes for licenses with straightforward renewal criteria (e.g. driver's licenses, business licenses, hunting/fishing licenses, etc.), reducing burden for both the government and users	Standardization	Public
Napster	User created content from centralized data (i.e., playlists from central repository of songs)	Centralization	Private
HL7 FHIR	Industry created interoperability standards that enable easy data exchange and developer consensus	Standardization	Private
Roth IRA	Innovation on the 401K that offers tax advantages	Standardization	Public-Private
State utility commissions	Regulation to ensure fair rates, reliable service, and compliance with standards. They balance the interests of consumers and utility companies by overseeing operations, approving rate changes, and enforcing policies.	Centralization	Public-private

Exhibit a3: Summary of 26 Precedent Briefs

Precedent Matrix

Digitization
Standardization
Centralization

Problem statement: How do we improve the quality of the patient experience and lower costs of care by creating billing-related administrative efficiencies between payers and providers and payers and members?

Who reduced complexity of process (e.g., number of steps)?	RFID in retail: How existing tech was adopted to track components end to end	Toast: How they improved efficiency and experience via uniform infrastructure	Stripe: How they built a backend payment infrastructure allowing apps to connect to banks	Digital software updates: How smaller updates are pushed continuously online	Napster: How they centralized data and let consumers customize	Tesla: How they sold cars DTC and standardized the supply chain across car models	AR Securitization: How parties pooled risk to improve capital efficiency and payment mechanics	Early Internet: How computer networks for academics became consumer standards	CMS prior auth rule: How CMS incentivized ePA adoption through MIPs	
Who reduced heterogeneity of components of a system?	Common app: How they centralized basic components of applications to be sent to all schools	SWIFT: How banks came together to create a common messaging service enabling digital / automated money transfer	Credit scores: How they streamlined a process with reliable uniform third-party data	Online marketplaces: How they consolidated online shopping into large platforms?	GAAP: How the FASB set standards for how all companies report finances	ATMs: How banks contract with large networks and fintech for consumer driven convenience	FAA: How consolidating agencies enhanced aviation regulation and safety measures	TV Residuals: How production co's contract and administer residual payments	OTC Derivative Contracts: How the private sector created a standard contract	Mobile phone SSOs: How a public-private partnership enabled functional innovation
Who built trust between stakeholders with conflicting incentives?	Standardized mortgages in the 1970s: How Fannie and Freddie pushed for standard contracts with uniform and non-uniform portions		2008 Financial Crisis Mortgage Regulation: How Dodd-Frank increased oversight over the financial sector and set standards for consumer verification		Centralized counterparty clearing: How gov't mandate expanded what transactions were run through CCPs, private regulated clearinghouses		Two-factor authentication: How it digitized a high-risk, complex process to enable higher security online	Fiverr: How they centralized offerings and increased credibility of freelance workers		

Exhibit a4: Example of 2 Pager Precedent Briefs

Precedent Overview – Mobile phone standardization through SSOs

Background

- Phone technology has become progressively more complex and demands more capabilities from hardware components designed and built by different manufacturers requiring standardization across the industry.
- Information and Telecommunication (ICT) standardization efforts have transcended individual firm-level supplier relationships to apply standards across the entire industry through the work of standard-setting organizations (SSOs)
- SSOs are self-governed industry associations of competing firms that collectively select and adopt uniform technical standards to ensure compatibility and interoperability among products
- To set a new standard, SSOs typically require members to disclose their intellectual property that may be related to the prospective standard. The SSO then determines the best solution to implement as the common standard across the market allowing them to achieve scale while incentivizing individual innovators to compete in the creation of better technology
- SSO processes are continually revised and improved with government input, through membership of multiple agencies as well as commentary and enforcement actions from the DOJ and FTC.
- SSOs have evolved since the late 19th with a focus on reaching economies of scale by reducing heterogeneity where appropriate

Key Insights

- In setting technology standards, government agencies serve many different facilitation and oversight roles for the SSOs.
- Government can provide technical expertise, ensure transparency and fairness in the standard setting process, and provide enforcement if the market is not functioning correctly.
- Standardization in this market led to a unique system of rewarding and sharing innovation across the industry

Business Model

B2B

B2C

B2B2C

Ownership

Public

Private

Public-Private

Application to Healthcare – Mobile phone standardization through SSOs

Outcomes

- **Heterogeneity:** Reduced
- **Complexity:** No impact
- **Trust:** No change
- **Cost:** Decreased given a highly reduced complexity and heterogeneity
- **Experience:** Improved for innovators and mobile developers
- **Productivity:** Drastically increased as a result of the more straightforward innovation process
- **Profitability:** Increased as a result of the reduced effort and focus on net new processes each innovation cycle

Application to Healthcare

- A public-private partnerships model could potentially be health insurers competing to offer up proprietary standards for core functions such as prior authorization or value-based payment processes for industry-wide adoption
- Multiple different agencies could be involved in streamlining healthcare financing, including creating a healthcare SSO
 - Potential leaders include CMS or the Assistant Secretary for Planning and Evaluation (ASPE) in HHS to manage healthcare entities, Departments of Commerce or Labor to manage new technologies or employee risk pools, and the FTC and DOJ to ensure that this process complies with the antitrust laws.

"I am trying to create a list of examples where industries have innovated to improve nonstandard administrative processes to streamline a set of services and remove costs. I want to focus on administrative spend reduction in particular with target reductions in contract complexity, billing process complexity, and documentation & regulation standards as examples. I don't want to focus on applications to patient care. I want to apply a set of takeaways from these other industry examples to healthcare to try to figure out how to remedy the rising healthcare costs in the US. Please provide examples with a title of the precedent, a quick summary of the history/definition of the change, the industry it was relevant to, the impact to that industry, and the potential application to healthcare. Please provide 25 examples."

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