Insurance 2025:

Highly Integrated Smart Contracts

Overview

In the past five years, three technologies have laid the foundation for remaking entire industries:

1. Advances in IoT technology have burst open the floodgates of real-time data.
2. AI can process this massive amount of new data to identify previously unknown correlations between inputs on risk.
3. Distributed ledger technology has obviated the need to either, (to borrow from a Russian proverb), trust or verify data provided by a third party.

Though use of these technologies in insurance applications is still in early days, it is clear they will have profound impact on the industry. This paper will explore how these three transformative technologies might be woven together to create a single platform, enabling insurers to mitigate claim events, slash operating costs, and improve the customer experience.

Successfully implementing such a platform will require a significant change to the insurance business model. Insurers will expand their role beyond just that of a counterparty to whom risk is transferred and become a critical business partner providing operational, logistical, and business process services to their clients.

Thesis

IoT and sensor data provide granular data in real-time on processes and conditions that were previously detectable only the through post-production Q/A processes or manual checks. Distributed Ledger Technology (DLT) allows the reporting of this data to become immutable. Large amounts of "shenanigan-proof" data can be run through an intelligent rules engine to create smart insurance contracts.

There has already been considerable interest in using DLT and IoT data to create smart contracts to insure objects that are the *sources* of that IoT data. Aigang has a proof of concept application for insuring mobile phone batteries.

The transformative opportunity lies in putting data from *disparate* sources onto the blockchain and running that data through linked applications. Such a platform will permit the creation of sophisticated integrated smart insurance contracts to cover complex risks and processes.

Insurers will replace multiple policies (with often over-lapping and/or gapped coverage) with a single, closed-form risk mitigation and claim adjudication solution.

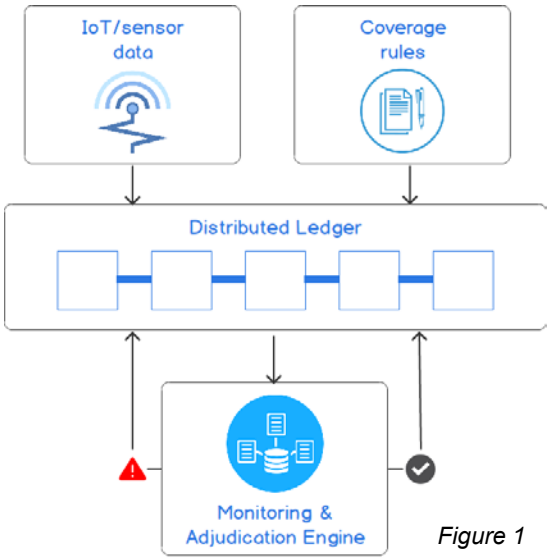

Figure 1

For ease of reference, this paper will refer to these agreements between insurer and insured as Highly Integrated Smart Contracts (HISCs).

HISCs holistic approach to risk identification and mitigation allows insurers to become integral partners to their clients by offering a comprehensive solution that extends beyond risk transfer. Prevention of loss events will reduce costs and eliminate distractions, freeing insurers' clients to focus on their core businesses. The HISC platform will also allow insurers to help clients optimize their operations, resulting in increased efficiency, improved margins, and greater operational certainty.

Let's look at a use case to see how this might work in practice.

Use Case: Semiconductors

Our use case will look at an application where sensors are already extensively used and tolerances are very tight: semiconductor fabrication.

Platform Overview

Figure 2 is a high level illustration of the HISC platform components shared by an insurer and a foundry, and some key points of interface and data exchange.

1. Senor data related to the manufacturing and testing process as well as dynamic data on the physical and IT infrastructure of the facility is collected and sent to the blockchain.
2. Static data elements that factor into evaluating risk and potential liability – including licensing requirements, certifications, and equipment specifications - are also sent to the blockchain.

3. The dynamic and static data is used in conjunction with the foundry's internal limits, terms and specifications contracted with customers, and regulatory requirements to form the rules of the HISC.
4. The engine evaluates all the data against the HISC rules and sends alerts when limits are approaching or breached, and similarly confirms when inputs and outputs conform to rules of the HISC. The AI layer of the engine would learn over time how the inputs impact one another in ways not previously recognized so that tolerances might be tweaked interventions can occur ever earlier, further minimizing both risk and waste.

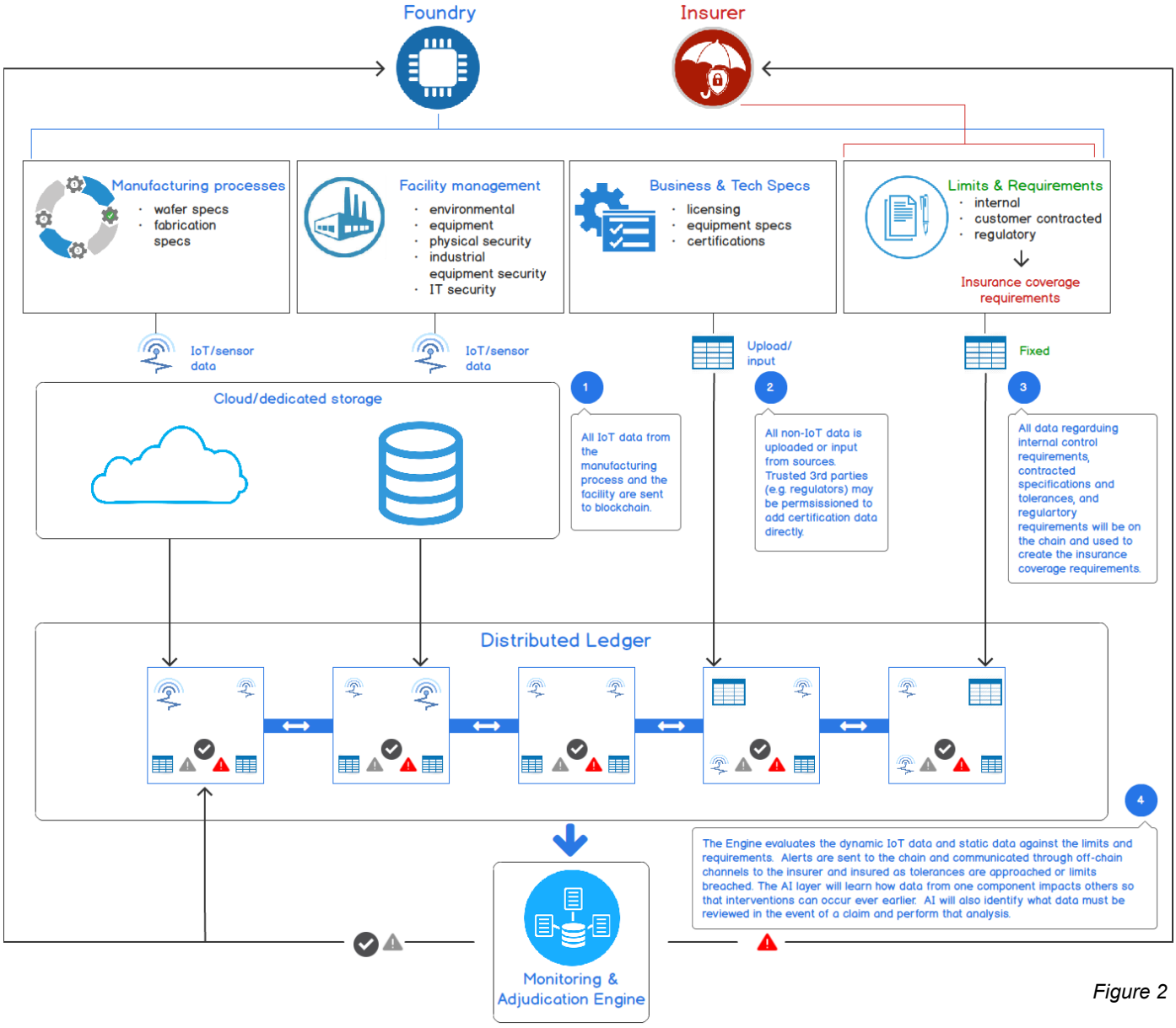

Figure 2

Platform in action

Let's look at two scenarios to see how the HISC platform would work in practice. The first will look at risk mitigation, the second at claim adjudication.

Example 1: Risk mitigation

In a process as complex as semiconductor fabrication, there may be thousands of data points, but we will look at just one to get a sense as to how the platform might be used.

For the semiconductor to function properly, suppose each wafer must have a thickness of 525 millimeters with a tolerance of +/- 20 micrometers. However for one of the foundry's customers, the manufacturer of implantable medical devices, a wafer more than 535 millimeters causes excess heat buildup and interferes with other critical components. The foundry has agreed to a tighter tolerance: +10/-20 micrometers.

Figure 3, illustrates the process for reporting the data on wafer thickness, evaluating the data against the rules, and ordering and logging required actions.

1. Sensor data on thickness is sent to the blockchain and evaluated by the engine
2. The engine confirms that Chips 1-4 are within tolerance and sends that confirmation to the ledger. The engine determines Chip 5 is approaching the tolerance limit. (*At this point, in optimized systems, relevant equipment would be re-calibrated before an out-of-tolerance wafer is even created*.) Chip 6 is flagged as out of tolerance and is ordered destroyed. If Chip 6 completed the fabrication process and was shipped to the customer. A defective product may result. (*The terms of the HISC may be such that product liability and other claims resulting from shipping that chip would not be covered.*)
3. Chip 6 is destroyed and a record of its destruction is sent to the blockchain.

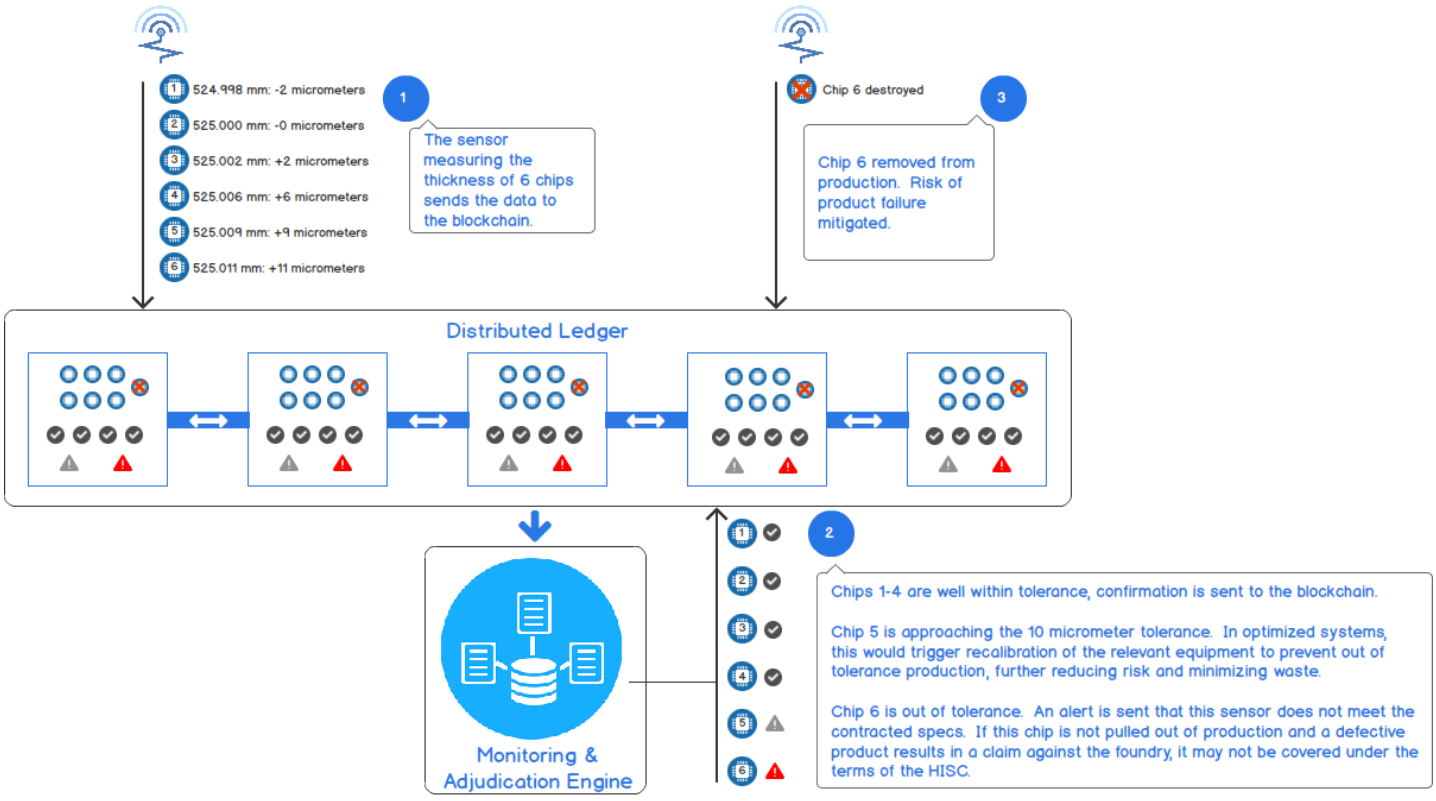

Figure 3

Example 2: Claim adjudication

Arsine is extremely flammable, explosive, and highly toxic chemical used in the semiconductor fabrication process.

After bringing a new machine into the plant with his forklift, Bob accidentally runs his forklift into an arsine storage vessel. There is a small fire that knocks the foundry offline for a week, and 3 employees were injured, including Bob.

Figure 4 illustrates the claim process through the HISC platform.

1. The foundry submits the claims to insurer through the platform.
2. The claim triggers a request for the data related to the coverage requirements.
3. The engine evaluates the claim against the coverage requirements. It looks at Bob's licensing and certification, maintenance records of the forklift, the specs of the storage container, the facility temperature, and the performance of the fire suppression equipment. The engine determines the claim is payable.
4. The insurer pays the foundry's claim, a record of which is sent to the ledger.

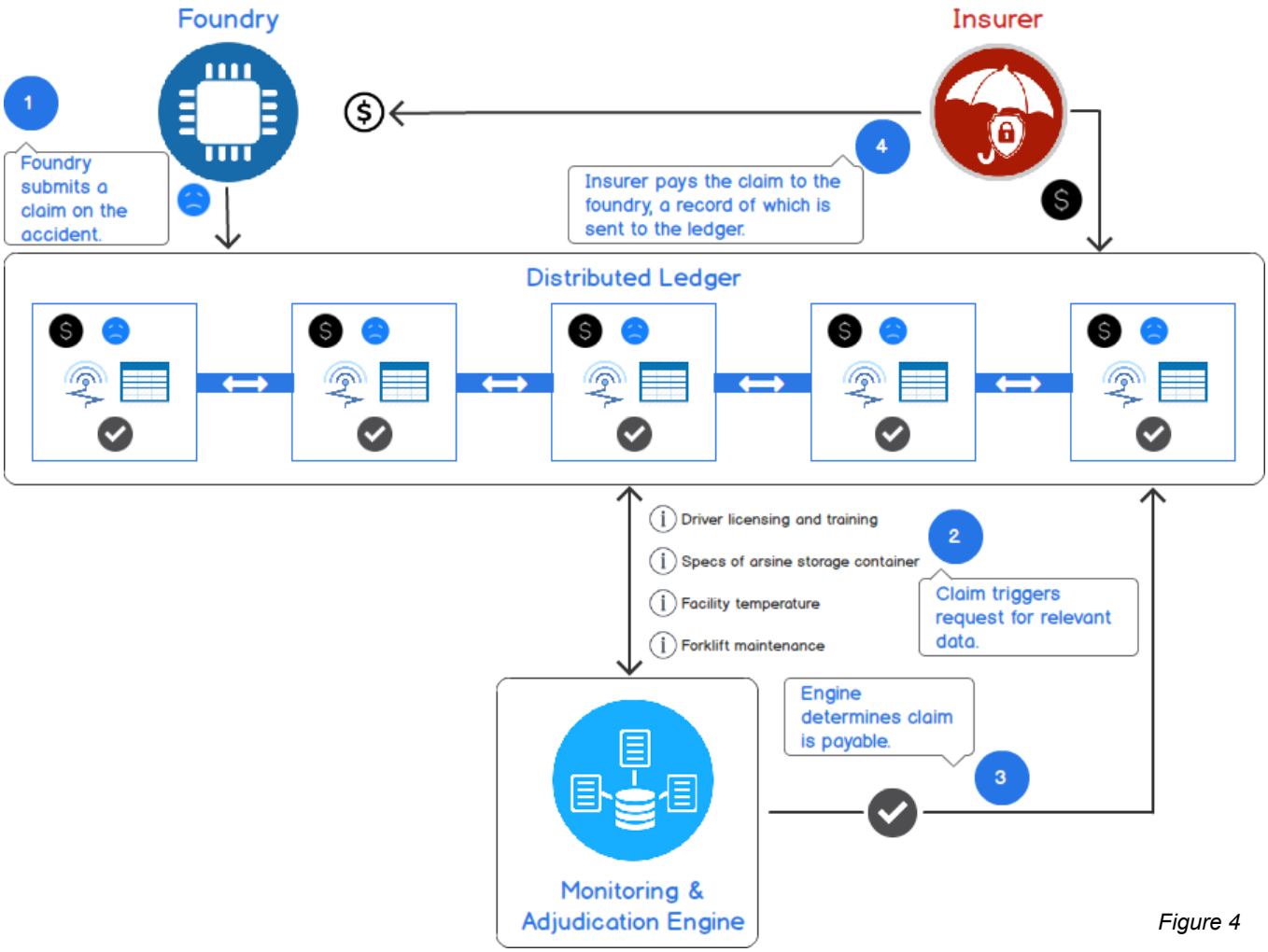

Figure 4

HISC Benefits

These two hypothetical examples provide a sense of how these technologies will benefit insurers. Exactly how these benefits are realized will vary, but the benefit themes will be the prevention of loss events, reduction of operating costs, increase in efficiency, and the evolution of the insurer to an integrated services provider.

Below is an overview of the primary benefits we can anticipate from the HISC platform.

Fewer loss events

The HISC platform is designed with the express purpose of reducing loss events, which of course increases margins[1]. The impact of loss events often extends far beyond the cost of the claim. The box on the right unpacks the potential impact introduced in Example 1 to illustrate how loss events become amplified to more fully appreciate the value of avoiding them.

Chip 6: How losses are amplified

Chip 6 was a working chip, but outside of the contracted specs with foundry's customer. If it were shipped, their customer's medical device product would become defective. The worst outcome, of course, is a patient's health could be compromised. We'll limit our review to the commercial impacts – in the absence of the HISC and the platform – to the medical device company, foundry, and insurer:

- The medical device company would suffer significant reputational damage. They would trace the failure to the foundry's faulty chip and terminate their contract.
- If the device caused harm, the medical device company and foundry would both be sued and potentially subject to regulatory action. The associated ancillary costs and distraction would likely be significant.
- The insurer would have product liability and potential D&O exposure.
- There would likely be litigation between the insurer and the foundry regarding the claims and the business relationship would end.

Lower operating costs for insurers

As even complex claims are auto-adjudicated, many of the costs associated with the claim process – investigation, audit, legal, sign-offs, and disbursement – can be eliminated, significantly increasing margins.

Lower costs and greater efficiencies for their clients

An optimized platform will let stakeholders know a problem is coming before it arrives. Alerts like approaching tolerance thresholds allows recalibrations to be made before they breached, reducing waste and increasing margins.

Over time, the AI layer will provide new insights, enabling the engine to identify previously unknown correlations between inputs. For example, the engine may be determine if two particular specs both reach 90% of tolerance, failure is likely for a certain application. This insight will decrease returns and associated costs and increase customer satisfaction.

[1] Over time, this margin will erode as it is competed away. However, as claim volume shifts downward, more permanent savings will be realized through lower reserve and capital costs.

Increased customer satisfaction and higher retention

A less-than-smooth claim experience leads customers to move their business. HISCs provide friction-free claim payment, increasing customer loyalty.

Customized coverage

HISCs allow insurers to create customized coverage, fully capturing the insurance spend, while clients are protected from coverage gaps without paying for products or features they don't need.

New revenue opportunities for insurers

As insurers move beyond risk transfer and into other services, there will be new revenue opportunities for insurers. There are three broad opportunities in ascending order of complexity:

1. The massive amounts of data and insights from companies across their books can be sold to customers and service providers in benchmarking reports and industry studies.
2. Insurers will be well positioned to provide operations and business process consulting services to their insurance clients.
3. Over time, small to mid-sized companies in certain industries may find it attractive to outsource manufacturing logistics management to insurers, akin to UPS's move into supply chain logistics and management, and Amazon's into retail order fulfillment and cloud services.

Each of these additional revenue opportunities also has the added benefit of increasing the stickiness of the customer relationship.

Critical Success Factors

There are several non-inconsequential hurdles to be overcome, before HISCs transform commercial and specialty insurance. Below are just five of the critical success factors necessary to implement HISC platform. Included is high-level estimate of the relative technical and implementation challenges of each.

1. Additional IoT data

Some operational and business processes may have dozens of data points to analyze, others thousands. The closer to 100% of the data that is brought on to the blockchain the more effective HISCs will be. IoT data has grown significantly, but total capture rates vary widely. As sensor costs continue to fall rates will continue to increase. *(Technical Challenge: Low to Medium, Implementation Challenge: Low)*

2. Interoperability between different IoT platforms

Like any new technology, adding IoT to operational and business processes will be an iterative process. Within a single company, there are likely to be several different platforms for different processes (e.g. manufacturing processes, data security, equipment monitoring). IoT data from all of these different systems will need to be brought onto the blockchain and incorporated in to rules engines and other applications. *(Technical Challenge: Medium, Implementation Challenge: Medium)*

3. Implementation of DLT standards

Neither HISCs nor the platform can be deployed on a public blockchain, so there must be some DLT standard broadly adopted by the industry. Corda (R3) and Hyperledger (Linux Foundation) are two consortium-led DLT platforms in development. JPMorgan (Quorum, built on Ethereum) and Monax have also created smart contract platforms. Companies are unlikely to support multiple standards, so getting agreement around one (or building a solution that is DLT agnostic) is imperative. *(Technical Challenge: High, Implementation Challenge: Very High)*

4. Intelligent engine development

Putting data on the blockchain is simply readying the inputs. The data must be routed to a (likely) off-chain rules engines that must do more than provide a simple binary outcome. These engines will need to trigger actions, in some cases requiring human intervention, but still reported on the ledger. AI technology currently in broad use today is sufficient for the activities required in HISCs. The data integration, using ETL, data visualization, EDWs etc., will be complex, but can all be accomplished using existing tools. *(Technical Challenge: Low to Medium, Implementation Challenge: Low)*

5. Integration of off-chain processes

Not every required action determined by engine will necessarily be able to be executed on the platform. This may include backup communications between stakeholders, transferring funds, and certain operational actions. These off-chain actions and their results will need to be cleanly brought back on-chain. Early on, there will likely misses on some handoffs, but those challenges will be more due to planning and communication issues than technical shortcomings. *(Technical Challenge: Low, Implementation Challenge: Low)*

Final Thoughts

The HISC platform described in this paper is closer to the end state than it is the next step of how these disruptive technologies will impact P&C insurance. The takeaway is that these (and surely other) technologies are an opportunity for insurers to not only change *how* they do business, but also the very *nature* of their business. They can become more than risk transfer counter-parties and create new revenue streams by offering high-value services, making them indispensible partners to their clients.

Getting there will not be easy. It will necessitate insurers become embedded, to a certain extent, with their clients. Successfully deploying HISCs will require insurers to expand beyond current competencies, and develop expertise in other domains. These will include technology platforms, operations, and logistics generally, as well as more specific subject matter expertise in the industries they serve.

This need to provide more integrated services to their clients may lead to strategic partnerships between insurers and consulting firms, or perhaps acquisitions of one by the other. Exactly how and how soon this unfolds is anyone's guess, but once change begins in earnest, momentum will build quickly and insurers who are ill prepared will find themselves unable to compete.

About the author

Jay DeVivo is the founder of CoFunder, where he is evaluating InsurTech funding and consulting opportunities. He is also interested in helping non-U.S. based startups establish a North American presence in Connecticut.

Jay also leads the Risk Management function for larger reinsurer of variable annuities. Previously he ran a consulting business, working primarily with venture-backed startups helping clients refine their go-to-market strategy, negotiate partnerships, and manage early stage product development. Prior to that, Jay worked in early-stage venture with startups across a variety of industries.