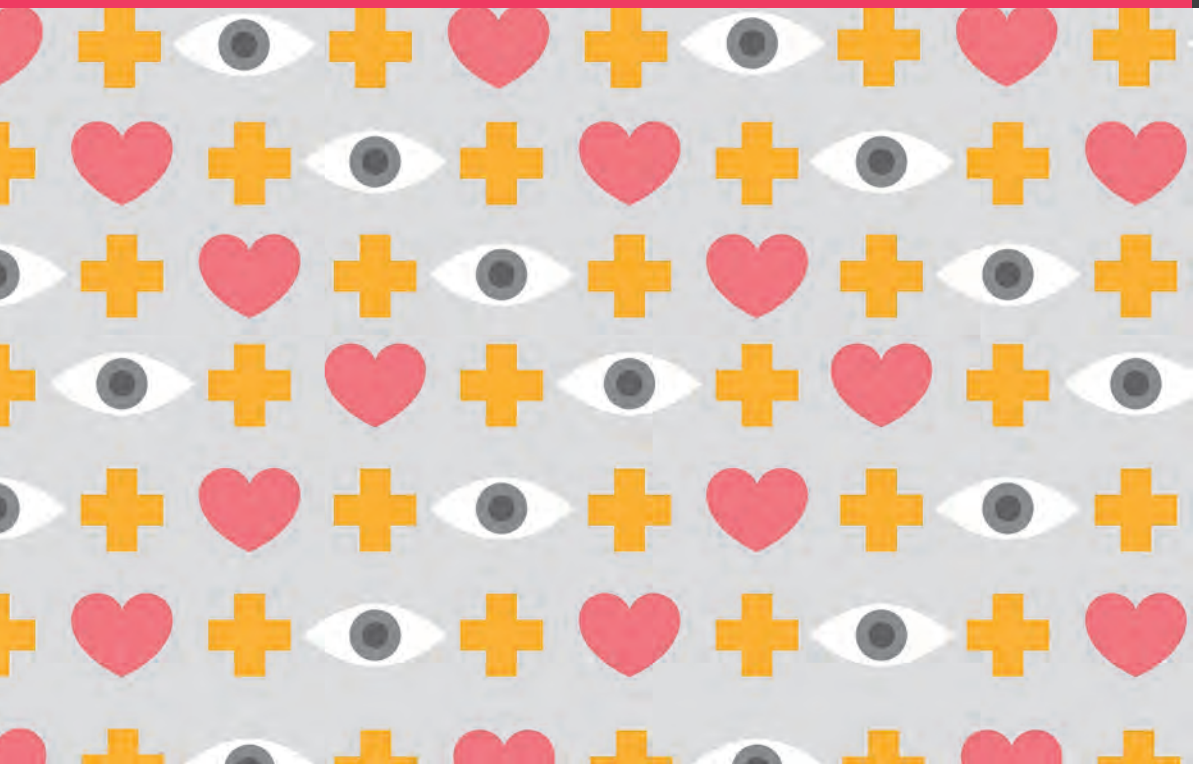
Revamping India's health insurance sector with blockchain and smart contracts

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pwc

FICCI VIRTUAL HEALTH INSURANCE CONFERENCE 2020
India's Largest Virtual Health Insurance Conference

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Message from FICCI and PwC

Globally, there is increasing acceptance of blockchain technology by insurers as well as the healthcare industry. It is expected that the use of blockchain for healthcare data exchange will contribute the largest market share in the near future. Moreover, by 2025, the healthcare industry would be able to save more than USD 100 billion per year in costs related to data breach, information technology (IT), operations and support functions as well as insurance frauds.[1]

In health insurance, blockchain has the potential to solve the most widespread challenges related to interoperability and non-standardisation of healthcare information that has created data silos in the industry. Along with the benefits of universalisation of health data stored, access to the entire medical history of a patient and reduction in the administrative efforts to handle patient data, the distributed ledger and smart contract features of blockchain will bring in transparency in contract execution and management, provide a secure system of records and bring in automatic and near real-time settlement for claims.

Blockchain will also enable continuous surveillance and digital auditing, making all the stakeholders – healthcare providers, drug manufacturers and insurance companies – accountable for their actions. This can help boost the trust between insurers and policyholders, providers and patients, as well as the healthcare industry at large.

1 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6517629/

Insurers partnering with blockchain-linked businesses are already seeing impressive innovations in many developed healthcare systems. In India, while the private health insurance industry has been witnessing robust growth, with gross direct premium income underwritten by health insurance companies growing at 15% year-on-year to INR 449 billion for 2018-19,[2] the country is facing huge challenges in expanding the coverage owing to its massive 1.34 billion population and soaring healthcare needs.

Now, with the increasing role of the government in provisioning for health insurance through Ayushman Bharat, innovations related to blockchain have the potential to converge the efforts and information between the government, hospitals, pharmaceutical companies, medical device manufacturers and insurance providers. This will lead to better care for the patient and reduced costs for the system, and would be a significant leap towards attaining universal health coverage.

FICCI and PwC foresee the possibility that blockchain technology will transform India's health insurance industry, creating a value chain that is more secure, efficient, cost-effective and consumer-friendly. However, in order to reap the benefits of blockchain and maximise its usability, it is crucial that there is maximum participation in the network.

To implement the prototype, FICCI's Health Insurance Committee formed a task force in 2019. Members of the task force have contributed to the development of this knowledge paper which analyses the potential of blockchain technology in adding value, specifically to health insurance claims. It is expected that blockchain will help eliminate the inefficiencies by automating claim processes and payment methods, streamlining business processes as well as reducing operational complexities and transaction costs.

The task force is currently working on a trial on health claims workflow and will launch a pilot in other areas of the health insurance industry to explore and deliver a desired blockchain prototype.

FICCI is thankful to the members of the task force on blockchain for their enormous contribution and to our Health Insurance Committee for their support and guidance on the research and development of this paper.



2 SIDBI Microfinance pulse report – June 2019

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1 Executive summary

The health insurance sector in India collected premiums worth INR 516 billion in FY20, accounting for 27%[3] of the total general insurance (non-life) premium collected in India in FY20, which stood at INR 1,893 billion. Health insurance is second only to the automobile insurance[4] segment in terms of premium contribution to the insurance sector in India. However, despite the steady growth over the last 10 years, only approximately 10% of India's population is estimated to be covered under private health insurance (excluding government-sponsored health insurance schemes).[5]

The Indian health insurance ecosystem consists of multiple key stakeholders – insurance companies, beneficiaries, provider hospitals, third-party administrators (TPAs), intermediaries, reinsurers, InsureTechs, start-ups, diagnostics, pharmacies, value-added service providers, government regulators and the government as a purchaser of social insurance schemes. These stakeholders interact through a complex network of interdependent and paper-/data-intensive workflows. However, the interaction amongst different stakeholders is marred by piecemeal flow of information. To improve the interaction process, it is important to develop a trusted blockchain network that would improve execution of processes through multiple nodes in a decentralised manner with auditability, traceability and immutability.

Blockchain and smart contracts could be the ideal way to maintain records and execute transactions through participation of all stakeholders in an accountable way. Blockchain can automatically collect records of agreements such as policy terms, agreed tariffs and relevant information, linkage information and execute using smart contracts based on pre-defined business rules in a transparent, immutable and non-disputable manner. The records will be accessible to all and since they are tamper-proof, the concerns related to data security and privacy would be duly addressed. Blockchain adoption may go a long way in ensuring trust, improving customer experience and thus aiding in the further growth of health insurance penetration.

Globally, blockchain has gained popularity as a solution for health data management and health information exchange. Estonia's adoption of blockchain-based electronic health records (EHRs)[6] is a case in point as it ensures data integrity, mitigates internal data threats, and allows various public and private sector organisations to exchange information in a seamless manner.

Data quality, data standards, protocols and reliability are crucial at the beginning of a blockchain cycle and need to continuously improve for it to be successful.



3 www.irdai.gov.in
4 Ibid.
5 Ibid.
6 https://e-estonia.com/solutions/healthcare/e-health-record/

2 India's health insurance ecosystem and its future

The Indian health insurance ecosystem consists of multiple key stakeholders. The interaction process between these stakeholders is often complicated and involves intense exchange of data. This interaction process between multiple stakeholders can be improved by the adoption of blockchain technology. The stakeholders in India's health insurance ecosystem are:

- Insurance companies
- Beneficiaries
- Provider hospitals
- Third-party administrators
- Intermediaries
- InsurTech companies
- HealthTech companies
- Diagnostics
- Pharmacies
- Value-added service providers
- Reinsurers
- Government regulators
- Government as a purchaser of social insurance schemes

These stakeholders interact through a complex network of interdependent and paper-/data-intensive workflows.

Many stakeholders in the health insurance ecosystem are utilising technology for collaborative purposes but the process is yet to become seamless.

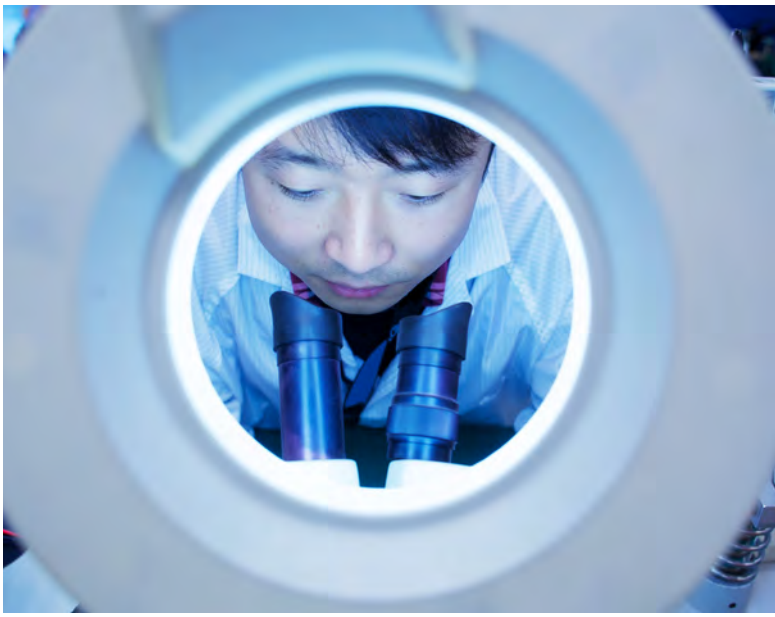
Though technology has helped India's health insurance ecosystem and collaboration amongst multiple stakeholders to optimise complex workflows. As a result, the entire ecosystem transformed from manual to digital for the capture and storage of information such as underwriting records, claim records and medical records.

However, the interaction amongst different stakeholders is marred by piecemeal flow of information. Blockchain can enable seamless exchange of information and improve trust between all stakeholders through participative approach.

The need for auditability, traceability and tamper proof make it imperative to set up a trusted network.

Blockchain and smart contracts in a decentralised distributed ledger could transform the ways heath insurance ecosystem manage records transparently and execute through participative approach of relevant stakeholder acting as a node.

The key parameter for success of blockchain and smart contracts will be its effectiveness in the transparent and participative implementation of complex workflows. It would also depend on resultant cost benefits to insurers, resulting from operational efficiencies, reduced administrative costs and prevention of excess claim amount payments in addition to improved customer servicing.



The future of health insurance in India

- As of FY20, health insurance is the second-largest contributing segment to the Indian general insurance industry, second only to the automobile insurance segment.[7]
- The health and automobile insurance segments jointly contribute more than two-thirds of the value of the general insurance industry in India.[8]
- The health insurance segment has witnessed an increase in its share of gross written premium (GWP) within the general insurance industry, rising from approximately 10% in FY05 to approximately 27% in FY20.[9]
- The ambitious Ayushman Bharat – Pradhan Mantri Jan Aarogya Yojana (PMJAY) scheme launched in September 2018 provides coverage to approximately 40% of the Indian population.[10] Both the government and the private sector are encouraging more people to opt for health insurance in India to gradually increase the extent of nationwide health insurance coverage.
- It is imperative that the interaction between the multiple stakeholders is efficient and accessible electronically in an immutable and transparent manner while addressing all concerns related to data security and privacy.



7 www.irdai.gov.in
8 Ibid.
9 Ibid.
10 www.pmjay.gov.in

3 What is blockchain and who controls it?

What is blockchain?

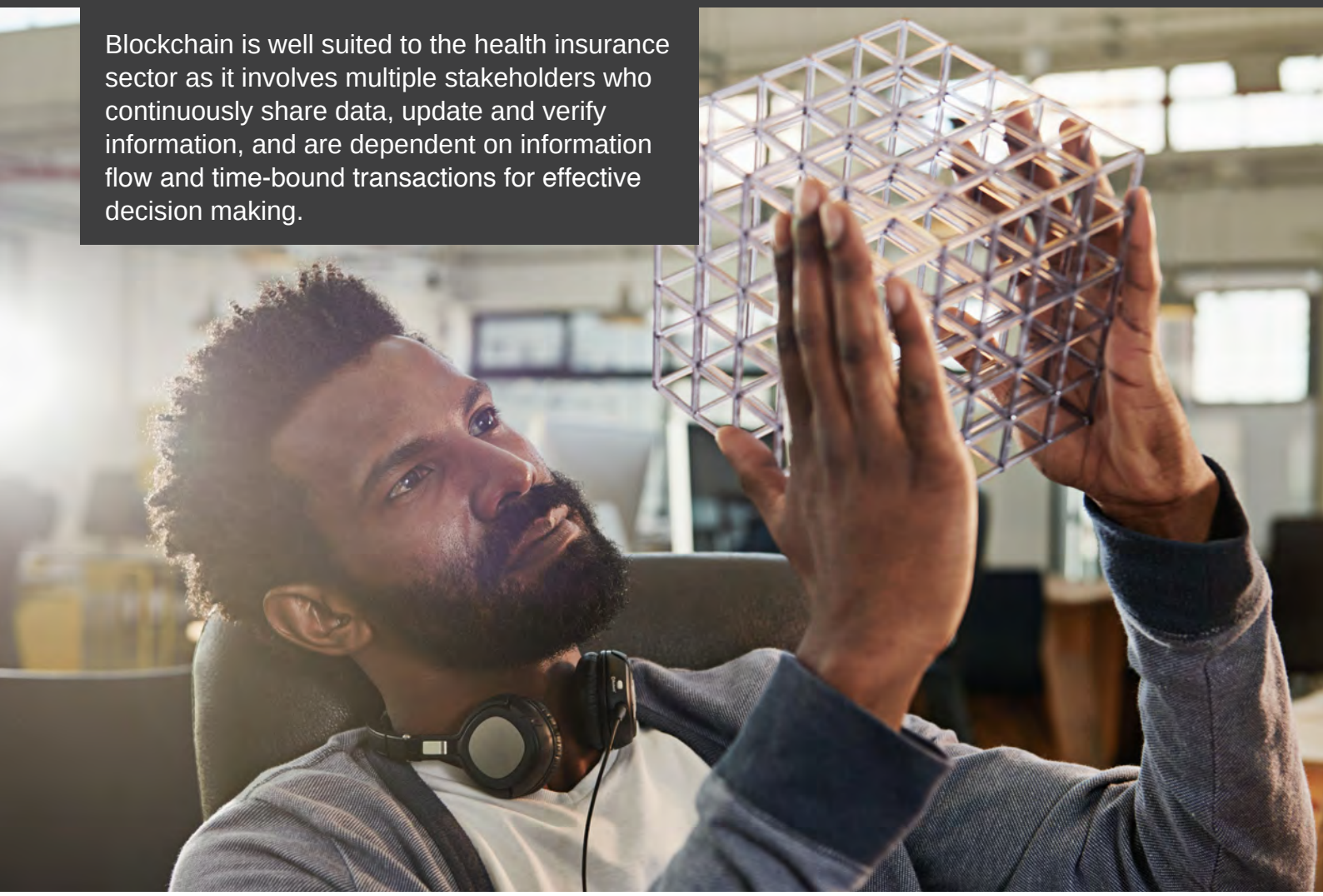
Blockchain is a single, distributed, immutable, write-only ledger of transactions that is updated when multiple, decentralised actors achieve consensus on the validity of new entries by participants.

Blockchain as a technology

Decentralised distributed digital ledger

- Transactions are recorded across many different nodes.
- Records of events are validated and accepted by users based on a consensus.
- Information once entered cannot be altered or deleted, thus making it immutable.

Blockchain is well suited to the health insurance sector as it involves multiple stakeholders who continuously share data, update and verify information, and are dependent on information flow and time-bound transactions for effective decision making.



Who controls a blockchain?

Public blockchain

Fully distributed where anyone can become a part of the network, make transactions and can participate in transaction verification process.

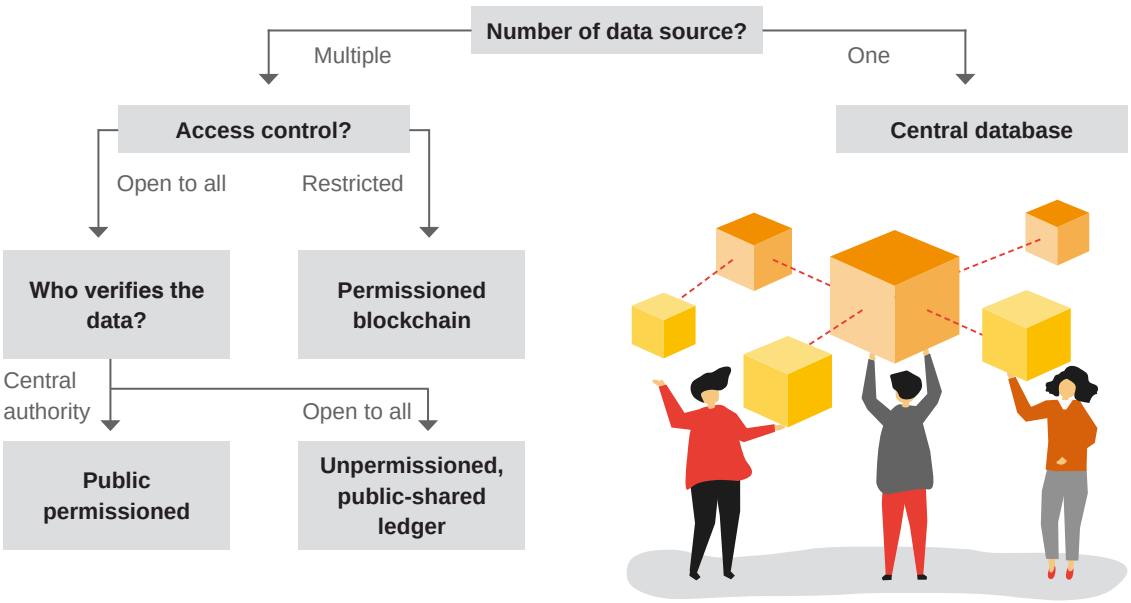
Permissioned blockchain

Decentralised system where special participants are given privileged rights in the system. Not everyone can enter information into the database.

Private blockchain

Only selected individuals can become a node in the network. All the participants will be known to each other and will have rights as per their roles.

How to select a type of blockchain





4 Smart contracts – what are they and their role in health insurance

What is a smart contract?

A smart contract is an agreement that is self-enforced as a code and managed by a blockchain. A smart contract is:



Encoded within a computer programme



Automatically executed upon certain criteria being met



Tamper proof

A smart contract provides the following advantages of:



Reduced contract execution cost



Improved quality and efficiency



Trust-based network

Smart contracts in health insurance

Current payer-centred delivery model

Over the years, a centralised care delivery model using the current framework of existing technologies has been utilised.

Decentralised model

With its unique selling proposition providing a public and verifiable way to embed governance, blockchain is positioned as one of the key emerging technologies.

Blockchain

It has the potential to redesign some of the key processes of the healthcare industry, including health insurance, by making them secure, transparent and efficient through accountable participation by all the key stakeholders.

An integrated decentralised platform that is workflow-driven with pre-set business rules will decrease manual efforts by underwriters on underwriting and by TPAs on claim validation.

Blockchain can automatically collect records of agreements such as policy terms, agreed tariffs and other relevant information sets, link the information together, and act on the data using smart contracts in a transparent, immutable and non-disputable manner.



Use case of blockchain in the health sector

- Globally, blockchain has gained popularity as a solution for health data management and health information exchange. Estonia's adoption of blockchain-based EHRs is a case in point.
- The Estonian National Health Information System has been using blockchain-enabled e-health record solutions and a health information exchange platform. This ensures data integrity, mitigates internal threats to data, and allows various public and private sector organisations to exchange information in a seamless manner.[11]
- Functioning like a centralised, national database, the e-health record retrieves data from various providers, who may be using different systems, and presents it in a standard format via the e-patient portal. Because the e-prescription system draws on data from the national health insurance fund, records of any state medical subsidies that the patient is entitled to also appear.
- Blockchain technology is being used for ensuring the integrity of retrieved electronic medical records as well as system access logs.

11 https://e-estonia.com/solutions/healthcare/e-health-record

Our blockchain solution and experience

Blockchain-based birth registration system

Business problem

A birth registration document is an important piece of information for any citizen. A birth certificate is the basis of other documents which a citizen acquires through his/her lifetime, e.g. school passing certificate, passport, driving licence, etc. The following problems have been identified in a conventional birth registration ecosystem:



Accuracy: If the data in the birth certificate is not accurate then it might have huge repercussions for a citizen.



Verifiability and security: There is no integrated and robust mechanism to verify a birth certificate and secure birth data.



Multiple data sources: Multiple stakeholders are involved and provide information from various sources.

Functional requirement

The client wanted to build a blockchain-based birth registration system without changing the current functional flow. In the current system two kinds of approvals are required:

- Supervisor approval
- Administrative officer (AO) approval

We developed application programming interfaces (APIs) to capture birth registration details when the AO approves the form. The data is pushed in the blockchain and a transaction hash is returned. This hash is used to create a quick response (QR) code which is printed on the form. We are developing a mobile application which will scan the QR code and fetch the data from the backend and tell the user if the certificate is authentic or not.

Business benefits

With the implementation of blockchain technology in the birth registration system, the client could achieve:

- on-the-go and secure archival of digital documents
- tamper proof and sanitised data source
- improved trust and transparency in the system
- effective security with the inherent use of multiple cryptography techniques
- ease of verification of the document.

Blockchain-based death registration system

Business problem

A death registration document is an important piece of information for any citizen. Many benefits from the government for the family of a deceased are directly linked to the issuance of a death certificate. The following problems have been identified in a conventional death registration ecosystem:



Accuracy: If the data in death certificate is not accurate then it might have huge repercussions on the deceased's family members.



Verifiability and security: There is no integrated and robust mechanism to verify death certificate and secure death data.



Multiple data sources: Multiple stakeholders are involved and provide information from various sources.

Functional requirement

The client wanted to build a blockchain-based death registration system without changing the current functional flow. In the current system two kinds of approvals required:

- Supervisor approval
- AO approval

We developed APIs to capture death registration details when the AO approves the form. The data is pushed in the blockchain and a transaction hash is returned. This hash is used to create a QR code which is printed on the certificate. We are developing a mobile application which will scan the QR code and fetch the data from the backend and tell the user if the certificate is authentic or not.

Business benefits

The blockchain solution provides value by improving processes associated with death registration and real transactions. The implementation of this solution resulted in achieving:

- on-the-go and secure archival of digital documents
- tamper proof and sanitised data source
- improved trust and transparency in the system
- effective security with the inherent use of multiple cryptography techniques
- ease of verification of the document.

Blockchain-based solution in project financing for setting up a human centre of excellence

Business problem

The client is highly motivated towards trying innovative and secure ways of storing citizen information and protecting data privacy. In the scope of this engagement, the client wanted to technically support a highly revered social welfare institution to raise funds for setting up a centre of excellence.. To facilitate transparent and secure donations in their pursuit of funds, a blockchain-based crowdfunding application was successfully delivered. The client had the following requirements:

- The new system should enable secure financial transactions for project funding and protect its data privacy.
- The transactions once recorded for funding should not be prone to any alteration by third parties.
- The donors facilitating the project should be able to view all their transactions and feel secure about paying on the portal for funding such projects.
- The desired system would be one which could operate in isolation.

Functional requirement

We had to create a blockchain-based donation management system using the Ethereum blockchain platform to bring about transparency, trust and immutability to the entire process. Following were the functional requirements of the client:

- Creating a pseudonym for every donor, for authentication of payment of every donor after submission of registration form in the designed portal.
- Recording every transaction on the blockchain, after every successful payment made in the portal. This transaction with its timestamp is thereby immutably stored and traceable for the purpose of audit.
- Providing a single, shared view of the transaction to all entities in the system making it more credible and trustworthy.
- Enabling users to view all their transactions and download tax exemption certificate from the portal.

Business benefits

Following are the benefits achieved through the developed application:

- Enhanced security of transactions due to immutable ledger of blockchain
- Cryptographic timestamp-based audit trails
- No central authority to alter data increasing trust in the overall system
- Distributed nodes having same copy of data

Functional and technical strategy for moving land records over blockchain

Business problem

The client wanted to implement land title mutation on a blockchain for enhanced security (tamper proof and resilient), provenance of land title mutation, increased efficiency and reduced cost of service delivery. The erstwhile land mutation system had the following challenges of:

- less efficient service delivery resulting in need for multiple visits by citizens, paper-based service delivery, inefficient use of government resources
- no history of modification of land records
- physical archives of contracts and files to be managed
- limited information of land records.

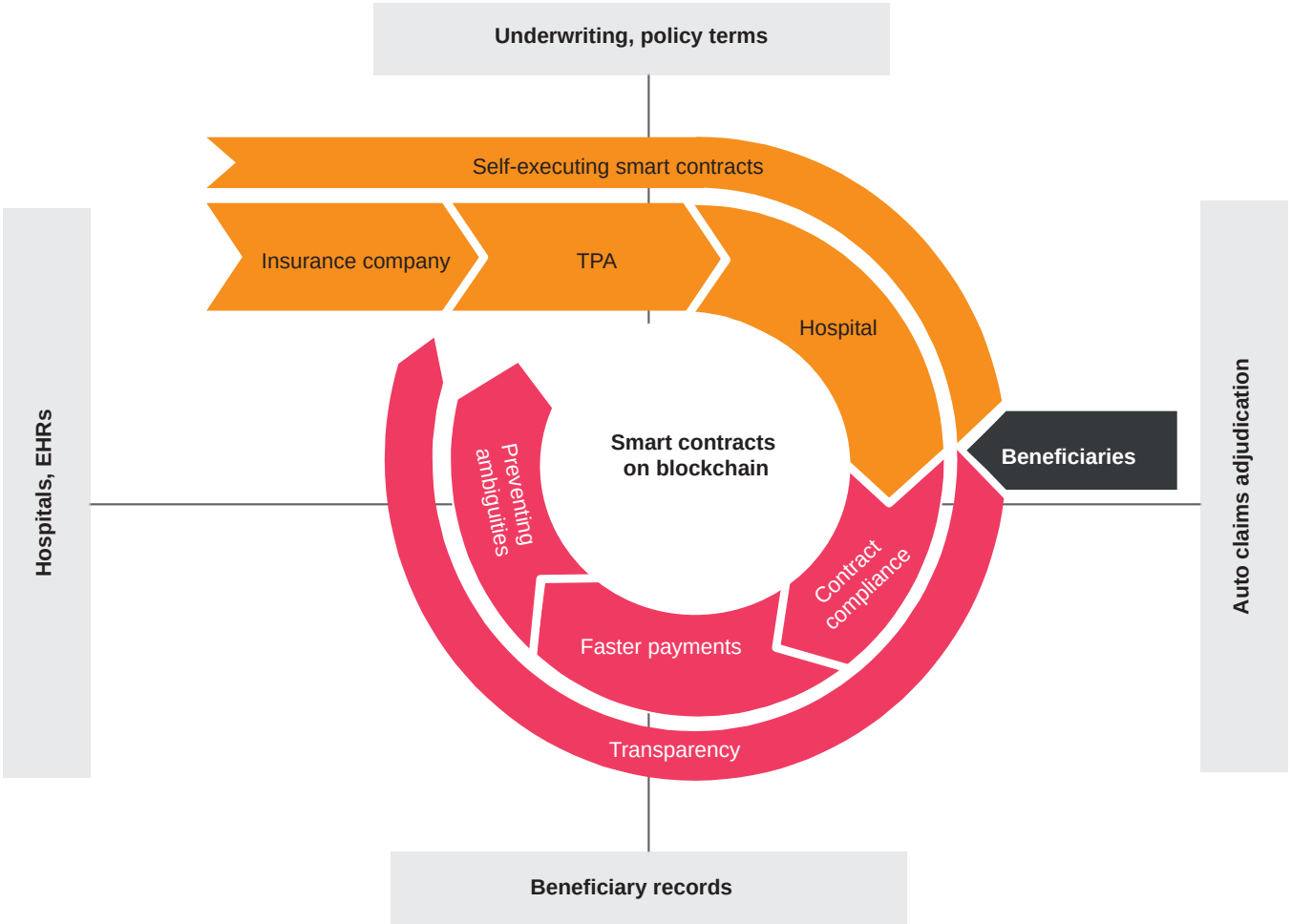
Deliverables:

- Undertake a detailed current state assessment
- Undertake process re-engineering and prepare the to-be of land records on blockchain
- Preparation of technology solution, including architectures, financial reporting standard (FRS), etc.
- Define technical specifications for the system
- Creation of detailed project report (DPR)
- Drafting the request for proposal (RFP) for implementation
- Monitor the implementation of the blockchain initiatives

5 Health insurance management through smart contracts

Smart contracts on blockchain will automate and make contract compliance transparent across the continuum through a distributed, centralised ledger. Thus, it will ensure faster assured payments by preventing disputes that generally arise from ambiguities in payment-related terms and conditions in general contracts.

With the availability of citizen health records, smart contracts will reduce the number of false insurance claims by identifying the submission of repeated fraudulent claims, fake patient identities or false heath records.



Underwriting through smart contracts

Beneficiary	Fills up the proposal form and submits it, along with relevant documents on information related to medical history to the insurance company.
Insurance company	• Assesses proposal form using artificial intelligence • An underwriter/technology solution approves the proposal with/without loading of premium • Formulates necessary terms and conditions
Beneficiary	• Deposits the premium amount • Receives policy documents and related information, including a hospital network list

- Smart contracts will allow proposal forms, medical history, declarations, unique policy terms and conditions including limits/sub-limits to be stored electronically for every type of policy having its own specific requirement.
- Smart contracts capture the information in an immutable way, making it accessible to relevant stakeholders and preventing any disputes arising from concealing of information or false information in a more efficient and faster way.
- The policy terms and list of members can be used for auto-execution of claims.

Claims processing through smart contracts

Beneficiary	Begins the claim process post-discharge by submitting relevant documents like the claim form, medical bills and reports.
Insurance company	• Authorisation of a claim by the processing doctor • Processing and recommendation of a claim by the processing doctor • Approval of claim by the claim approver • Transfer of approved claim amount to the hospital/nursing home/medical care facility in question
Beneficiary	• Receipt of claim amount • Receipt of claim information, including deductions (if any) • Requests for reconsideration, if any • Reconciliation

- Smart contracts on blockchain ensure that the same set of health records can be accessed by all stakeholders through seamless integration of information exchange.
- Smart contracts can also store unique and agreed-upon package prices for each hospital, which are accessible to relevant stakeholders and auto-execute based on rules.

How can smart contracts be successful?

01

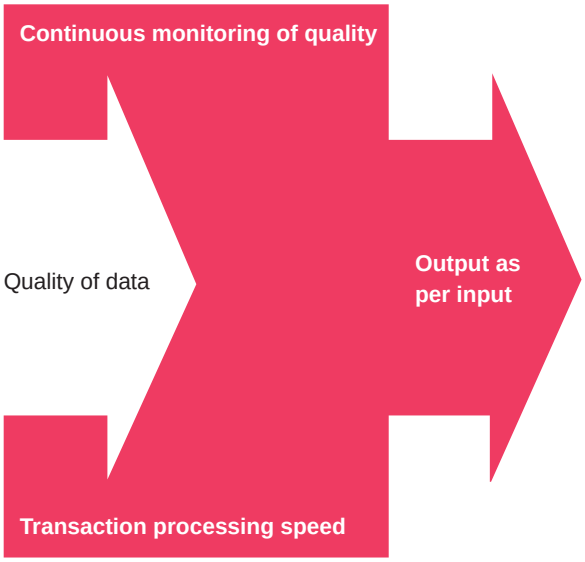
The data stored on a blockchain is not inherently trustworthy, so information needs to be recorded accurately in the first place. The computing phrase ‘garbage in, garbage out’ holds true in a blockchain system of record, just as with a centralised database.

02

Data quality, data standards, protocols and reliability are crucial when data begins to be stored in a blockchain system and needs to be continuously improved. Otherwise, the blockchain may lose its effectiveness and eventually die out.

03

Since the volume of claims and the number of transactions will be huge, how the infra or blockchain maintenance cost and speed will behave as the data keeps growing is a commonly asked question. With new powerful computing technologies and innovations, transaction processing speed is anticipated to be efficient.





Track and trace with blockchain

Journey across the health insurance value chain using blockchain and smart contracts

Policy sale (insurer and customer)

Sale of policy to the customer on basis of:

- policy as a 'smart contract'
- customised pricing offered to the customer (based on medical history/ behavioural traits/wearables, etc.)
- clearly explained policy terms
- loading charges, policy exclusions
- benefits entitlement, payout limits.

Underwriting (insurer)

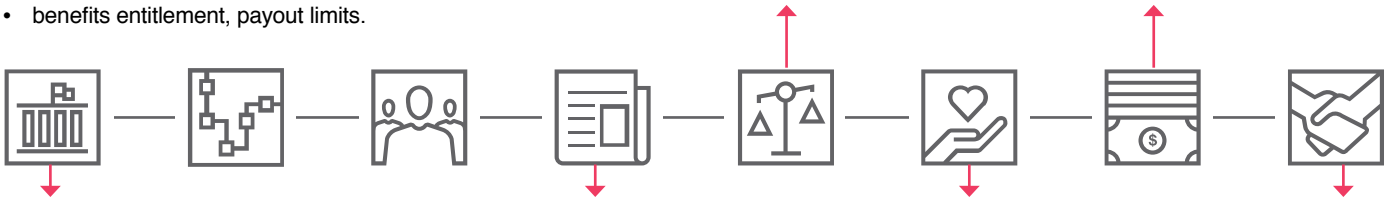
Swift and automated process which includes:

- rule-based underwriting with immutable and approved guidelines
- mapping customer data to policy conditions in real time and offering customised pricing.

Underwriting (insurer)

Cashless payout settlement based on:

- smart contract driven settlement through auto e-invoicing generation
- - customer treatment and agreed tariffs.



Insurer-hospital agreement

The insurer and the hospital agree on an arrangement provided they have in place:

- a tariff agreement
- a packages agreement
- the International Classification of Diseases (ICD) coding system
- a contract validity.

E-health records (insurer)

Accessing the customer's digital identity using:

- KYC details
- demographic and medical history details
- nominee information
- payout bank details.

Claims (customer and provider)

Fast and efficient claims by accessing customer-related information through blockchain, using:

- automated customer authentication
- customer entitlement verification
- updated customer records.

Reinsurance (insurer and reinsurer)

Treaties and claims in accordance with:

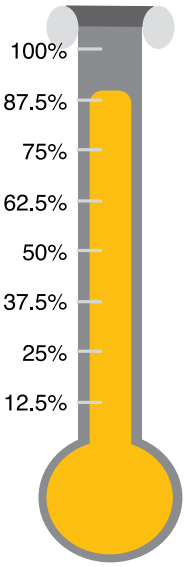
- registering various treaties with different reinsurers (smart contract)
- automation of straightforward claims triggered by smart reinsurance contracts.



6 Fraud detection and agent rating using blockchain

Fraud in health insurance

Insurance companies lose 8.5% of their revenue to fraud



Types of fraud:

Fiction: Incident/illness never happened – phantom policy.

Overstatement: Also known as exaggeration i.e. the total bill was overestimated either by the third-party service provider or the customer.

False fitment: Falsification of claim for uncovered incidents.

The best way to counter fraudulent service providers is by naming, shaming and blacklisting.

Gaps

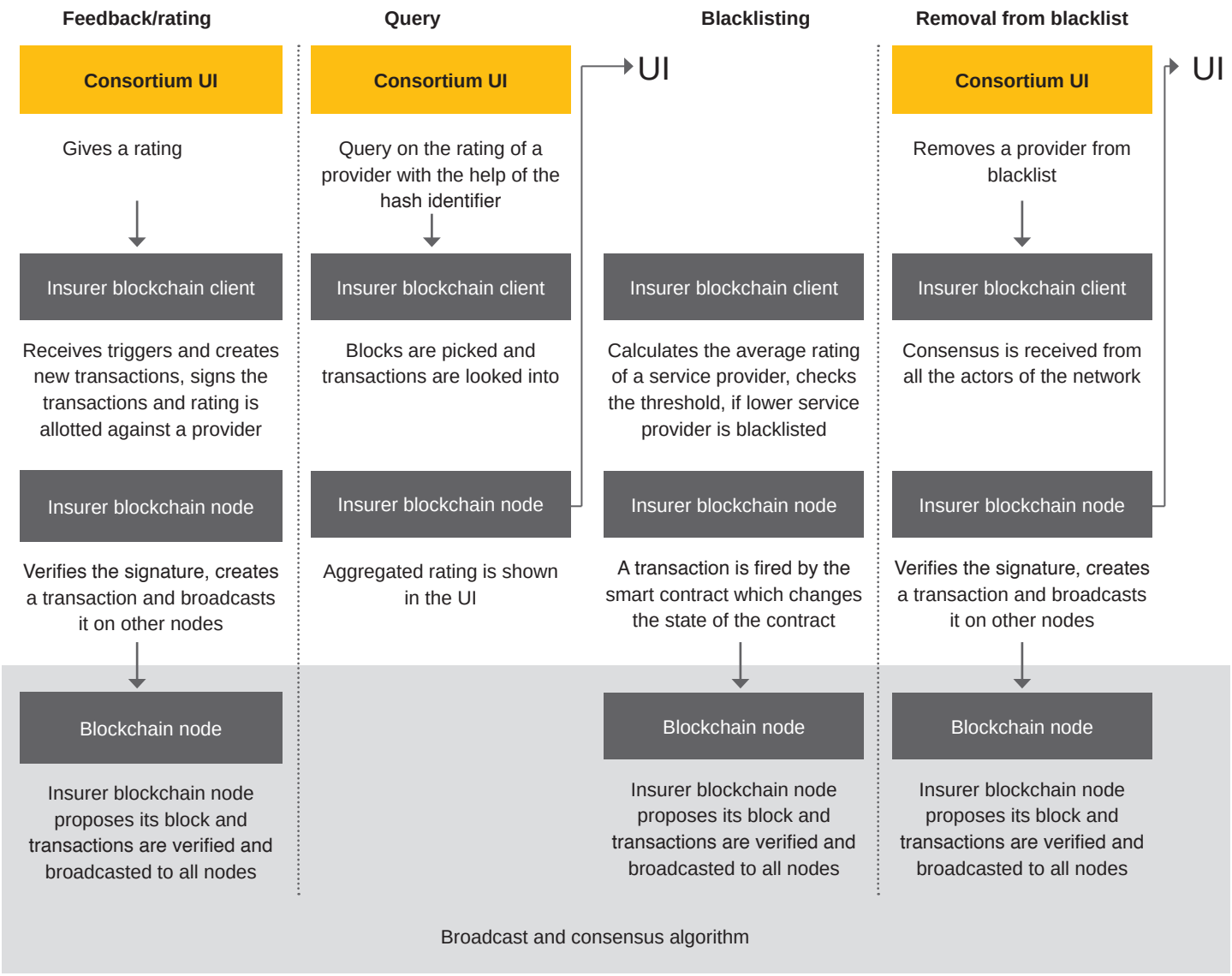
- Maintaining an insurance company's own database to record the blacklisted service provider is an overhead to cost and effort.
- Since data is maintained in silos, it is not visible to other companies.
- Data stored in a central database becomes a single point of failure.

A blockchain-based, common listing of fraudulent entities by collecting the information from all insurers would be an active knowledge repository, benefitting the industry.

Source: Indiaforensic Center of Studies



Fraud in health insurance – solution with blockchain



Source: PwC analysis of data from industry research

Benefits of using blockchain for blacklisting

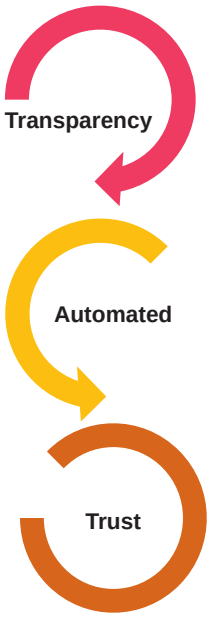
A smart contract is deployed against each service provider which keeps the record of the rating received by all insurers in the network in an immutable ledger which is visible to the entire consortium.

The address of the smart contract is treated as a unique identifier against a particular service provider. The points stored in the contract is used to blacklist the provider by the smart contract.

If the consolidated rating goes below a certain threshold, then the smart contract is discontinued and the provider is blacklisted for business. This information is visible to all the participants of the network.

The rating can be changed and the blacklist tag can be removed only after arriving at a consensus within the network.

Proven value driver



Shared ledger gives a clear picture of the provider's detail to all the peers at any given point

Smart contract based immutable and secure blacklisting mechanism

Increased trust and co-operation amongst participants



Agent rating system



Revenue loss

All of this leads to revenue leakage for the insurer and a poor experience for the insured.

Causes and problems

- Currently there is no integrated mechanism in the insurance sector to track and tag an agent for wrongdoing or fraudulent conduct.
- There is no mechanism available to know an agent's performance and history with his/her previous company.
- There is no mechanism to decide which agent should sell which policy.

The need of the hour is a common database which is immutable and shared with all the participants so that anyone can find the average rating of an agent. This can be achieved with blockchain.

Source: PwC analysis of data from industry research

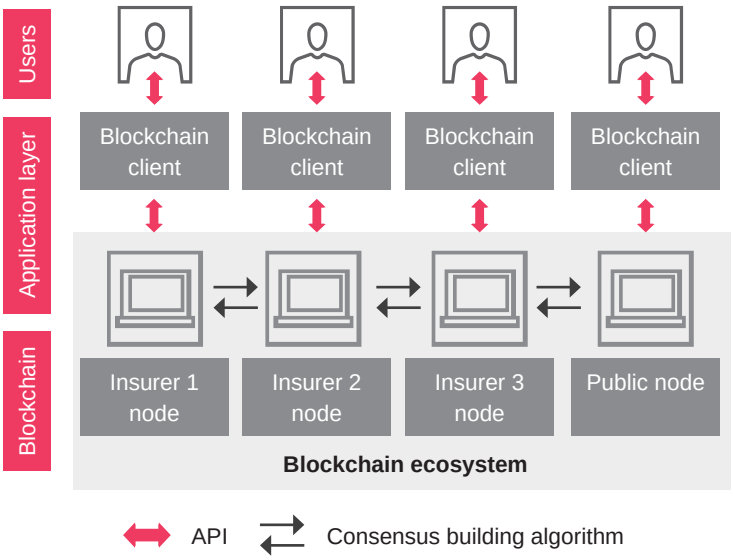


Agent rating system – solution with blockchain

Blockchain enables a distributed, immutable and transparent rating system. The insurer and the customer can give their feedback which is immutable and visible to all. The revenue leakage problem can be tackled in an effective fashion.

All insurance companies will work as nodes in the ecosystem.

All insurance companies will work as nodes in the ecosystem.



Process flow

Agents are registered on a blockchain. An account is created, the hash address of which is treated as a unique identifier.

Customers use their account to rate an agent. Similarly, the insurer also rates its agent.

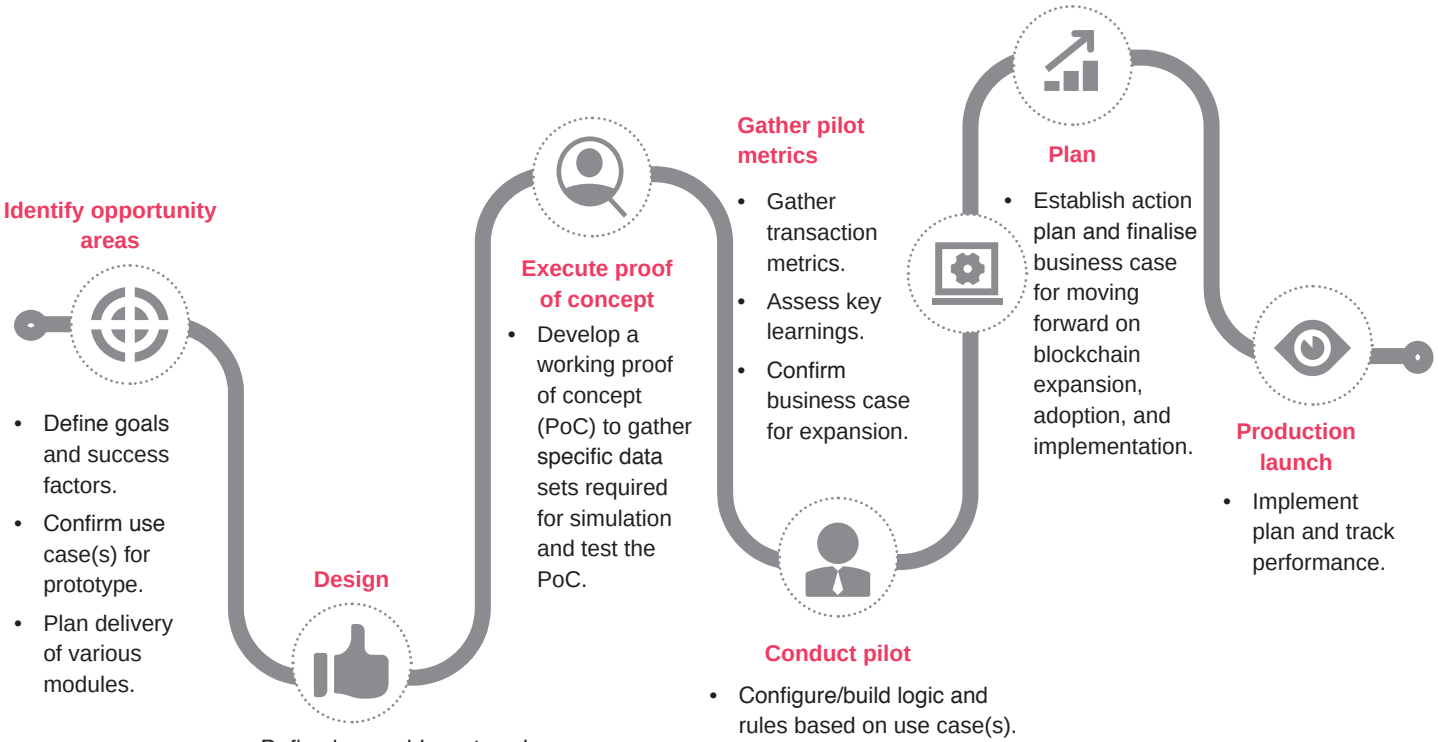
Smart contract is executed and the rating is recorded for an agent.

Whenever an insurer wants to check the rating of the agent, he will provide the address. In turn, a smart contract is executed and the rating is fetched from the blocks.



7 Way forward

Health insurance presents an unprecedented opportunity for integration of growth and technology. The Government of India (GoI) is moving from the role of a provider to a payer through Ayushman Bharat-PMJAY and aims to unify all social health insurance schemes. The National Digital Health Mission (NDHM) has been announced and digitised health records will play an instrumental role towards automation of health insurance, especially in adjudication of claims. The health insurance sector will also see the adoption of blockchain technology and smart contracts through accountable participation of all stakeholders. The key learnings from the implementation of the NDHM framework can be utilised to assess and strengthen the efficacy of blockchain across the health insurance ecosystem.



About FICCI

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