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Deutsche Bank: Pursuing Blockchain Opportunities (A)

On a sunny Friday evening late spring 2014, Rhomaios Ram, Global Head of Product Management of Deutsche Bank's Global Transaction Banking (GTB) division, left his office to meet his old friend and colleague Paul Maley, Head of Debt Market Structure, Global Markets (GM) at Deutsche Bank, for dinner in the young and trendy neighbourhood of Shoreditch in London's East side. On his way, he realised that he did not have any money on him, so he decided to stop at an ATM and was surprised to see a Bitcoin ATM at the Old Shoreditch Station Café.

Seeing the Bitcoin ATM reminded Ram of several conversations he had in past months on the subject of Bitcoin. As he stepped into the restaurant to meet Maley, the focus of conversations turned to Bitcoin and the impact disruptive technologies could have on financial services and beyond. Maley recalled: "We started talking about the fact that we'd had this shared interest in Bitcoin, and more importantly blockchain, the technology upon which Bitcoin was built. Within a few minutes, we both agreed that this technology would be more disruptive than Bitcoin itself and its impact on banking could be huge."

Ram added: "Our conversation got me thinking about blockchain and its potential application to Transaction Banking as well as financial services in general. Somehow it felt to me that blockchain was having a moment—like the moment Malcolm Gladwell dubbed the 'Tipping Point': that magical moment when an idea or trend crosses a threshold, tips and spreads like wildfire."[1]

Blockchain, a foundational technology upon which Bitcoin operates, is a database technology that creates an auditable distributed ledger of transactions recorded digitally among a broad network of users.[2] When used with Bitcoin, the blockchain record can only be updated by consensus of the majority of the participants in a network, and once entered, entries cannot be erased.

[1]Gladwell, Malcolm (2001): "The Tipping Point: How Little Things Can Make a Big Difference."

[2]See this video for a description of blockchain: https://www.youtube.com/watch?v=r43LhSUUGTQ.

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Ram was intrigued by this concept, which allowed people who didn't know each other to securely conduct business without having previously established any form of bi-lateral contract and without using a trusted, central intermediary to facilitate the transaction. "I never actually paid for anything in Bitcoin and Bitcoin itself remains a curiosity not a business topic for me. But it was so obvious that the blockchain technology could be a game changer which could revolutionize transactions in banking and beyond."

Edward Budd, Chief Digital Officer at Deutsche Bank's Global Transaction Bank added: "In 2014, it did not require much research to see the potential applications for blockchain technology. Just think about what this could mean for banking? Take commercial payments for example. Cross-border payments tend to be expensive to process, so blockchain or other new forms of digital currencies could potentially provide an entirely new payments infrastructure. Or take the securities space, if we were to have these more sophisticated technologies, could we trade financial derivatives outside of the current financial markets and let private parties buy and sell securities on blockchain networks? What would that mean for the global markets? Would you still need an exchange to trade on?"

What Maley, Ram and Budd already realized back in 2014, was the potential of blockchain technologies to disrupt how secure transactions could be conducted on public networks and they all acknowledged that as a bank they would need to address the topic to make sure they could leverage its potential. The question however was how? Budd recalled: "We could see the potential for blockchain throughout the financial services industry. However, we were well aware that exploiting the potential of the technology would be a step-by-step process, not an overnight revolution."

Background

In 2016, Deutsche Bank AG was a financial services company with operations in over 70 countries and $1.7 trillion in assets under management. Deutsche Bank provided commercial and investment banking, retail banking, transaction banking and asset and wealth management products and services to corporations, governments, institutional investors, small and medium-sized businesses, and private individuals.

Like most of its competitors, in 2014, the Germany-based bank was facing tremendous global change, not only because of the increased regulatory demands after the financial crisis, but also due to changing client demands relating to new technology trends and the resulting need to update banking infrastructures and systems. At the time, Deutsche Bank was following a mixed IT and digital strategy of outsourcing commodity banking infrastructure, taking control over critical software by bringing it back in-house, while courting start-ups and facilitating ideas in an open innovation fashion.[3]

In early 2015, Deutsche Bank announced the initial outline of its "Strategy 2020," in which the bank committed to become a more digital bank.[4] Across all four of its lines of business (Global Markets, Global Transaction Banking, Asset Wealth Management and Private Wealth & Commercial Clients) Deutsche Bank planned to substantially invest in digital technologies, spending €1 billion by 2020 to capture new revenue opportunities.

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[3] Penny Crosman, "Deutsche Bank Tech Chief Overhauls 145-Year-Old Global Giant," *American Banker*, May 4, 2015, http://www.americanbanker.com/news/bank-technology/deutsche-bank-tech-chief-overhauls-145-year-old-global-giant-1074140-1.html.

[4] "Deutsche Bank announces next phase of strategy," Deutsche Bank media release, April 27, 2015, https://www.db.com/newsroom_news/2015/medien/deutsche-bank-announces-next-phase-of-strategy-en-10974.htm.

These opportunities included: facilitating customer interactions through remote advisory channels; realizing platform efficiencies through automated or digitized processes; increasing process efficiencies through the potential adoption of emerging technology.

One such disruptive technology being considered was blockchain, a technology that created an auditable distributed ledger of transactions that were automatically recorded digitally as a broad network of users conducted business, for example, buying or selling physical products, or services, or agreeing to provide future products or services for an agreed upon price.

Each computer connected to a network, also called a node, enabled a user to connect to the network with a unique identity, which was maintained in the blockchain database. As transactions between users took place, data was stored in a series of blocks, each of which contained the details of the individual transactions. The blocks were electronically chained together and advanced security features ensured that the blocks remained permanently locked—hence the term blockchain.

Probably the most well-known blockchain application was Bitcoin—a form of digital currency that was not tied to any country or government regulatory body. The Bitcoin blockchain had no central authority; instead it was a shared record of transactions controlled by the user network itself. This meant that there was no need for an intermediary to process, validate and authenticate transactions. By recording and storing the data in this specific way, transactions become auditable, immutable (e.g., unable to be changed) and simultaneously accessible for a vast network of users.

Blockchain networks can be either "permissioned" (private) or "permissionless" (public) (see **Exhibit 1**). Permissioned networks segment information processing among only those nodes that have permission to participate in the chain. Permissionless networks required all nodes to perform all computations for all transactions and thus were considered less efficient.

Examples of Early Blockchain Testing: Smart Contracts

An early use of blockchain technologies was for smart contracts (see **Exhibit 2**). A smart contract, also known as a crypto-contract, was a computer program that directly controlled and triggered the transfer of digital currencies or assets between parties under certain conditions. A smart contract not only defined the rules and penalties around an agreement in the same way that a traditional contract did, but it also automatically enforced the contractual agreements by taking in information as input (e.g. a digitized term sheet), assigning value to that input through the rules set out in the contract, and executing the actions required by those contractual clauses—for example, determining whether an asset should go to one party in an agreement or be returned to the other party from whom the asset originated. Storing these contracts on the blockchain created a decentralized ledger, which enabled enforcement.

Smart contracts were complex and their potential went beyond the simple transfer of assets, to enable execution of a wide range transactions, from legal processes to insurance premiums to crowdfunding agreements to trading of financial derivatives. Many believed that blockchain-enabled smart contracts had the potential to disintermediate legal and financial intermediaries by simplifying and automating routine and repetitive transactions and ensuring compliance among multiple parties to a transaction. In 2016, with the increased testing of blockchain technologies smart contracts were growing in popularity, often built on top of digital currencies to trigger payments.

Raising Blockchain Awareness at Deutsche Bank

Soon after their initial conversation, Maley and Ram decided Deutsche Bank needed to take action on blockchain. Ram said: "We decided that this was something that Deutsche Bank as a group needed to investigate in a more targeted, structured way."

Ram recalled: "We decided that if we were going to further investigate the potential of blockchain, we had to generate awareness and also find out if other areas in the Bank were already exploring potential uses of the technology. During the summer months we posted a series of blogs on our internal social media platform, myDB, explaining blockchain and discussing future scenarios of how blockchain could be used and how the technology could fundamentally change the banking ecosystem. This generated a fair amount of interest from other people within Deutsche Bank, from all different levels and in various units throughout the bank and around the world."

Maley added: "By the end of that summer, Ram and I co-hosted a Distributed Ledger Workshop, with people primarily from Global Markets and from Global Transaction Banking in attendance. The attendees became our internal community of enthusiasts. I called them enthusiasts, because back then there was no official structure or process in place for how to approach this new technology and drive it forward."

Nick Doddy, Managing Director of the Group Technology & Operations (GTO) Strategy and Innovation team, was among these blockchain enthusiasts. He recalled: "If you were on the periphery looking in, people were very interested because the project felt very innovative. In addition, it didn't threaten individuals and groups internally since the technology was not being targeted at anyone's current way of working. But we were also relying upon almost a volunteer community to help identify how this technology might influence the future of banking. Through Rhom's personality and persistence we engaged a critical mass of interested colleagues which allowed us to move the idea forward."

Maley added: "The most important enabler came when we identified the right people in the organization who could take this forward and position it with the right people in the right functions—even without a formal structure in place. People were willing to do this, because blockchain was intellectually and entrepreneurially challenging, and because lots of people wanted to know what was happening on the cutting edge. It was surprising to see the level of commitment people had and how passionately they felt about being allowed to work with this exciting new technology."

This initial group of blockchain enthusiasts soon realized, however, that different parts of the organization would need to be included in the initiative, not only to reduce resistance, but also to increase the diversity of perspectives and expertise that would be required to move potential projects forward. Doddy recalled: "We recognized that there were parts of the organization that needed to be brought into this new community. Legal needed to be involved as their view and concerns on the subject needed to be considered. The same applied to the data analytics team."

Doddy continued: "If we had introduced this idea too quickly into the organization, then we would have run the risk of facing lots of resistance. But, by end of the spring 2015, it became important to connect with those who would be needed to move projects forward. Believe me it's very hard to get someone's focus on something that might be happening in 3 years time, when they're dealing with today's issues. Planning 3 to 4 years ahead is an unusual approach in banking as we tend to work in yearly cycles. So you have to be very persistent to get the right people involved early on."

Launching Deutsche Bank Labs—a Driver and Facilitator for Innovation

Although Ram, Maley and Doddy had assembled a strong community of blockchain enthusiasts, they felt that it was time to move their blockchain activities to the next level. In April 2015 they agreed that an official organizational structure was needed to focus their activities (see **Exhibit 3**).

Ram recalled: "Given the interest we had experienced and all the initial work we had put in, we decided that it was time to get some funding to run some initial projects. I had access to Henry Ritchotte, who was the Bank's Chief Operating Officer at that time, and he was open to the idea and wanted to learn more about it. Maley and I went to see him and eventually persuaded him that even if the bank hadn't allocated a budget for this, there should be some dedicated funding to help us develop this idea further, and the money got granted." (See **Exhibit 4** for proposal.)

Having eventually acquired both funding and support from the bank's Chief Operating Officer, Maley and Ram began to look for a location where they could begin implementing blockchain projects. Around the same time, Deutsche Bank had just set up Deutsche Bank Labs, with offices in London, Berlin, and Silicon Valley.

The head of the Deutsche Bank Lab in London, Jon Pearson, who had just re-joined Deutsche Bank after two years as the co-founder of an external innovation lab, described the role of the Deutsche Bank Labs as follows: "Deutsche Bank Labs provides a platform for innovation that supports the Bank in the adoption of emerging technologies to enhance its products, services and processes. We partner with technology start-ups and established technology firms, facilitating rapid experimentation."

Budd added: "Deutsche Bank Labs fulfilled a crucial role in this initiative. Among other things, the Labs could provide us with updates on emergent themes from the innovation ecosystem and more importantly with views on how these emerging themes could be applied to advance the strategy of the Bank. The Deutsche Bank Labs were an important tool that we could use to investigate where and how blockchain might impact our business model and how it could be leveraged."

The Deutsche Bank Labs used a multidisciplinary approach to ensure a diversity of business knowledge and experience, while supporting development teams in their work to develop and refine the business case. This collaborative innovation culture facilitated the exchange of ideas. As Maley explained: "Because the Labs worked on projects that were experimental or at the Proof of Concept stage and therefore before something would be implemented commercially, people didn't mind collaborating and openly sharing information since they didn't see it as threatening their current business."

From Business Case to Experimentation

Having conducted a number of internal workshops, facilitated by the Deutsche Bank Labs, the Bank started to examine how Blockchain could impact their business model (Discovery phase). Initial discussions focused on how this new disruptive technology could impact the securities, payments, and trade finance space.

Blockchain was seen as a way to keep track of payments, transactions and trades involving bonds, equities, or loans—transactions that traditionally required the involvement of banks, traders, exchanges, clearing houses and other intermediaries. Where these transactions often took days to clear, blockchain's Distributed Ledger Technology (DLT) offered the potential of shortening the time to minutes and doing so without the use of physical intermediaries.

Budd recalled: "Everyone in the financial service industry immediately could see that blockchain technology could potentially address many of the unsolved inefficiencies in processing financial transactions but how to securely capture these efficiencies had yet to be worked out. As a result, the initial focus for us was to identify a business case and business model for using and delivering these automated DLT transactions in the future. In retail banking, the focus of investigations was on crypto-currencies and digital wallets; for us in the trading unit, the focus was on developing the business case for post-trade and securities settlement, payments, and other forms of trade finance transactions."

As they explored potential business cases for using DLT technology, the team identified that the most promising area of application appeared to be in securities settlement and clearing. Ram explained: "The cross-divisional workshops facilitated by the Deutsche Bank Lab in London allowed us to agree on areas in which blockchain testing would make the most sense. The area with the most significant business case appeared to be the securities space—with smart contracts identified as key to unlocking DLT's efficiency potential in this area. A corporate bond was selected as it represented a security complex enough to test beyond cash, without being too niche. Furthermore, the corporate bond processing lifecycle enabled us to test the smart contract's self-executing potential. This was not only relevant for testing the technology but also for testing the business model in a field relevant for Global Transaction Banking and Global Markets alike."

Maley pointed out: "What we needed was a simulation to be able to test our existing platform against a prospective environment using the new technology. We looked at use cases where the complexity and the level of digitization and transaction volumes in the existing business were reasonably low. Furthermore, we chose an application area where we could limit the involvement of external ecosystem partners, like clearing houses, exchanges, trade reporting etc."

To validate the technical feasibility, the blockchain team decided to experiment by issuing an imaginary corporate bond as a "smart bond" processed through secure blockchain transactions, which allowed them to test the feasibility of processing the transaction using a smart contract. There were three hypotheses they wished to test:

1. Can the transfer of a financial asset that is not a digital currency from one owner to another be securely and efficiently executed and recorded on blockchain without the use of an intermediary?
2. Can the steps it takes to execute this blockchain-enabled transaction be legally maintained in computer code as a smart contract, so that in case of a legal dispute the smart contract could "decide" without interference of an intermediary who is the "rightful" owner of the asset?
3. Can a smart contract be programmed to execute future financial asset transfers?

The team believed that "how" they tested these hypotheses was as important for the discovery process as the results of the experiment. They also believed that these experiments would help them to understand how to rapidly identify and exploit new value opportunities for both their business and their clients. The overall goal of the experiments was to decide if Deutsche Bank should continue to invest in future applications of using blockchain to transform the process of securities clearing and settlement by defining the impact of blockchain-enabled securities transactions on Deutsche Bank's business model.

The aim was not to create the final platform, but merely to provide a vehicle for starting that process. To test their hypotheses, the Bank used the Deutsche Bank Lab in London to set up the Proof-of-Concept (POC). They used an agile process (see **Exhibit 6**) to explore and evaluate the practical and technical challenges of executing a corporate bond smart contract using blockchain.

Modelling the Corporate Bond Lifecycle

The blockchain team decided to map the existing corporate bond lifecycle to understand and document where blockchain and smart contracts could support and enhance the corporate bond value chain. This would also help them educate IT developers about the structure and behavior of corporate bonds. In addition, they also needed to understand the beliefs of the end users involved in the corporate bond transaction and how these beliefs would impact technology adoption and advocacy.

In addition, they examined sample bond term sheets to gather the requirements for eventually writing a smart contract template. Pearson recalled: "If you look at what it would take to develop a corporate bond smart contract, you've got to innovate throughout the entire value chain. It's not just the infrastructure. We needed to agree on the terms of the contract and then we needed to create digital representations of those terms. Finally, we needed to understand how to write a digital contract that, in the future, could execute autonomously and without the intervention of an intermediary."

Budd continued: "There is significant upfront effort required to structure and capture all elements of the lifecycle of a corporate bond in a legally sound manner. Taking business processing logic from back office systems and converting them into legally binding clauses written in code is not 'easy', yet this is one of the key requirements of unlocking the efficiency potential of blockchain's distributed ledger technology and how information can be captured and recorded."

Originating and Validating Corporate Bond Smart Contracts

To launch the experiment, the blockchain team assembled a small design team, consisting of investment bankers, lawyers, and coders. Two start-ups were identified that could work with the team in Deutsche Labs to simultaneously and independently develop blockchain solutions based on the specifications of the Deutsche Bank blockchain team that would test the hypotheses. Both start-ups collaborated with the internal design team to model, create, and validate a smart contract so that it was ready for execution over a distributed ledger (see **Exhibit 7**).

During the process, they modeled a corporate bond as a smart contract, encoding executable lifecycle event triggers—for example, coupon payment, change of ownership, principal payment, interest payment and maturity. They also defined and agreed upon appropriate smart contract technology. Subsequently, they verified the smart contract over a blockchain, simulating multi-party consensus and asset transfer.

Setting up a Distributed Ledger Environment and Executing Smart Contracts over a Blockchain

The blockchain team set up an agile technical environment to enable continued experimentation. Different distributed technologies and environments were tested to understand their respective complexities and limitations. The blockchain smart corporate bond contracts were also linked to external inputs to test the functionality of lifecycle event triggers within multi-party transactions.

Measuring Success

The blockchain experiments successfully validated the technical feasibility for using blockchain smart contracts to create and execute corporate bonds. But the team had yet to demonstrate the tangible business value of the blockchain corporate bond process on Deutsche Bank's business model. To accomplish this, the experiments would need to be expanded beyond Deutsche Labs, which would require that the team educate business, legal, and technical teams on the practical and technical

challenges on leveraging blockchain. In addition, the potential of blockchain technology to simplify settlement and clearing processes and improve the efficiency of back-office trading processes and infrastructure also needed to be assessed. Finally, the team needed to demonstrate the potential of blockchain to provide transaction transparency and to identify approaches needed to satisfy regulatory requirements and generate regulatory reporting.

The Future of Blockchain at Deutsche Bank

In December 2015, Deutsche Bank's blockchain team concluded that the proposed blockchain-based solution was technically feasible. Before leaving for their seasonal holidays, the team reflected on the process they had used to identify and test the impact of this new technology as they also planned for the commercialization of the first blockchain applications.

But, even as they celebrated the success of the experiments, the true test still lay ahead. Budd said: "While it was promising that our testing of the blockchain technology revealed that trades could be executed using 'smart contracts' and that parties in a trade could theoretically exchange a contract without an intermediary and thereby reduce their clearing and operational risk, the test equally demonstrated the significant upfront effort required to structure and capture all of the elements of a complex, multi-party financial transaction in a legally sound manner."

Significant legal, political, and market obstacles would need to be addressed to commercialize the technology. Pearson outlined the issues that needed to be addressed: "Once you have created a smart contract, who verifies that it will execute as intended? Is it enough to have all participants in a transaction verify that the contract was legally executed? Would risk be equally shared? Our experiments have not yet addressed these issues, and, until a workable solution is in place, we're not going to see enterprise smart contracts in production in the near future."

Budd resumed: "My view is, that there won't be one blockchain that defines all transactions but, instead, we'll probably end up with many types of blockchains. The challenge will be to achieve standards and interoperability between all of them. It is important we carefully consider what standards mean in this context and ensure that we do not 'stifle' innovation before it has truly emerged."

However, Doddy believed that blockchain would eventually be deployed in the real world. "Typically, Deutsche Lab's engagement gets smaller and smaller as we progress from idea to adoption," he explained. "Over time the business areas will get more and more involved in this, to a point where that the business units are responsible for deployment and for managing the new environment. Once they understand that the new technology provides tangible value it's easier, but ensuring commitment and adoption is the hardest part of the innovation process—especially when you are working with new technologies. You can get lots of good ideas and you can do lots of experiments, but unless there's a part of the organization that wants to take responsibility, and unless it shows real value, then you're basically stuck. So engagement with the organization is absolutely critical."

Now that technical feasibility was proven, the team evaluated next steps needed to begin commercializing the technology. What steps could the blockchain team take to begin to prove the tangible business value from the technology? What key questions would need to be answered?

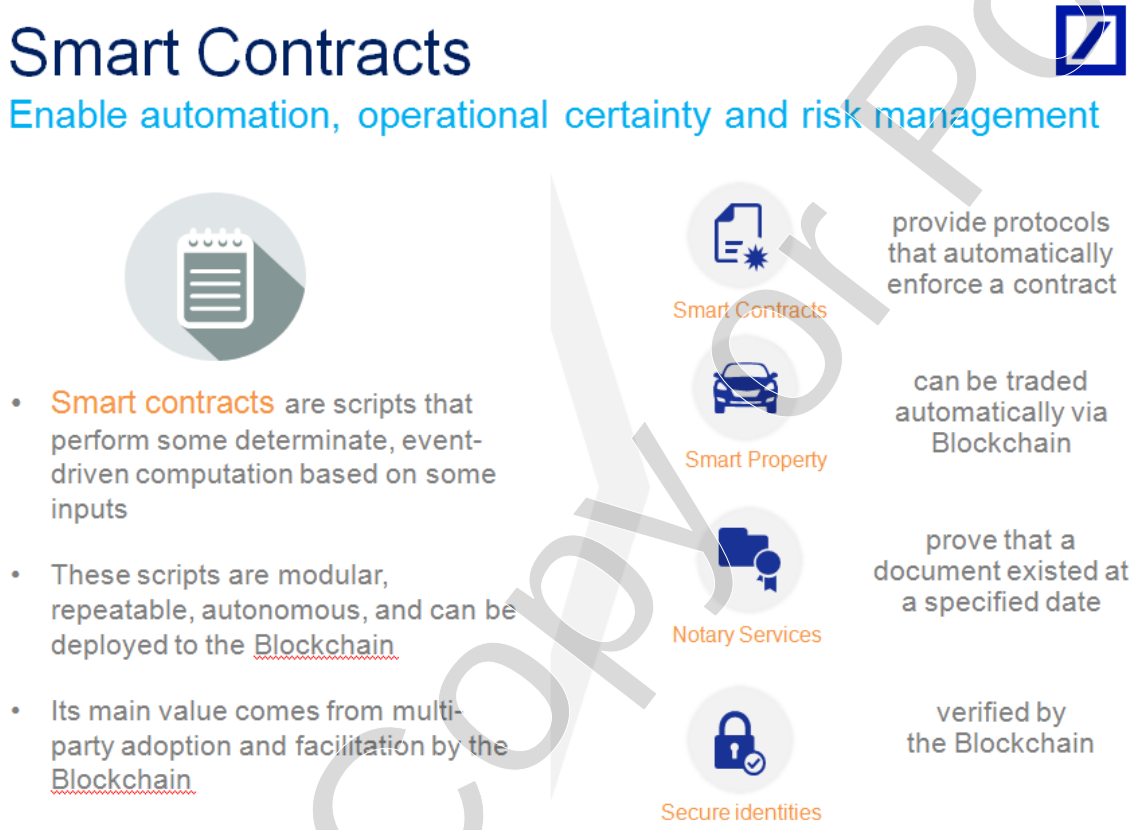
Exhibit 1 Transfer of Value

DB focus

Distinctive Features	Public/ Unpermissioned	Private/ Permissioned
Transactions are …	Public	Private
Participants are …	Anonymous	Known
Permission needed to…		
– carry out transactions?	✗	✓
– validate processes?	✗	✓
– create smart contracts?	✗	✓

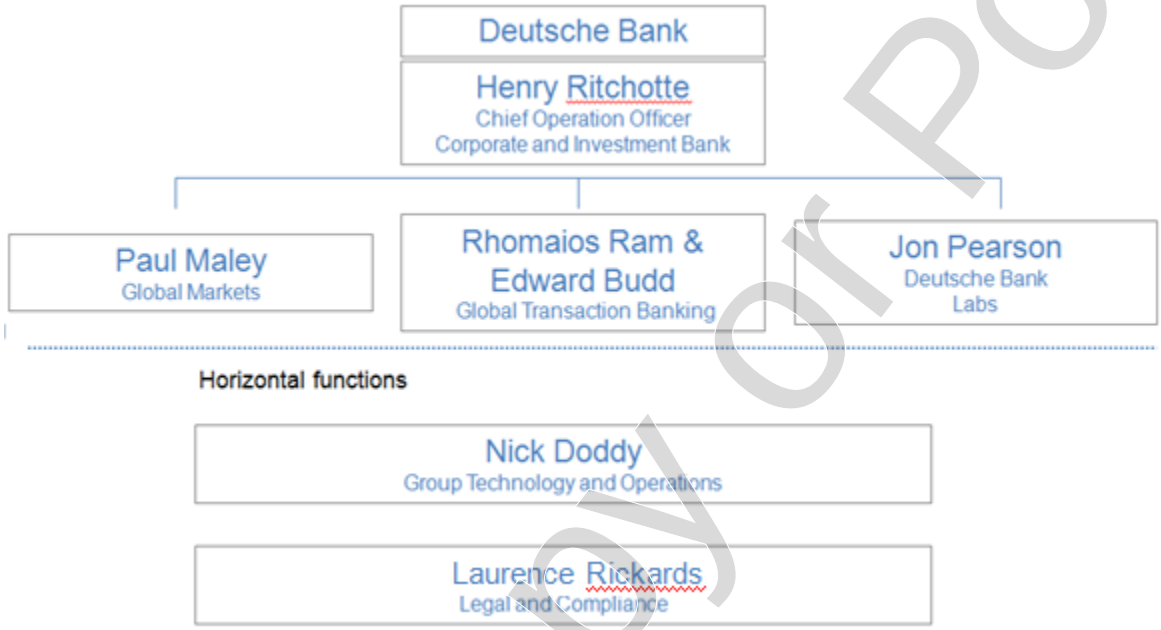
Source: Company documents.

Exhibit 2 Smart Contracts



Source: Company documents.

Exhibit 3 Organizational Structure



Source: Company documents.

Exhibit 4 Proposal Presented to COO

Objectives

Proposal

We intend to develop an agile time boxed Proof of Value (PoV) to validate the potential of crypto-technology by issuing an imaginary Corporate Bond using a Cryptographic 'Smart Contract' over a "Distributed Ledger".

We wish to test three key hypotheses:

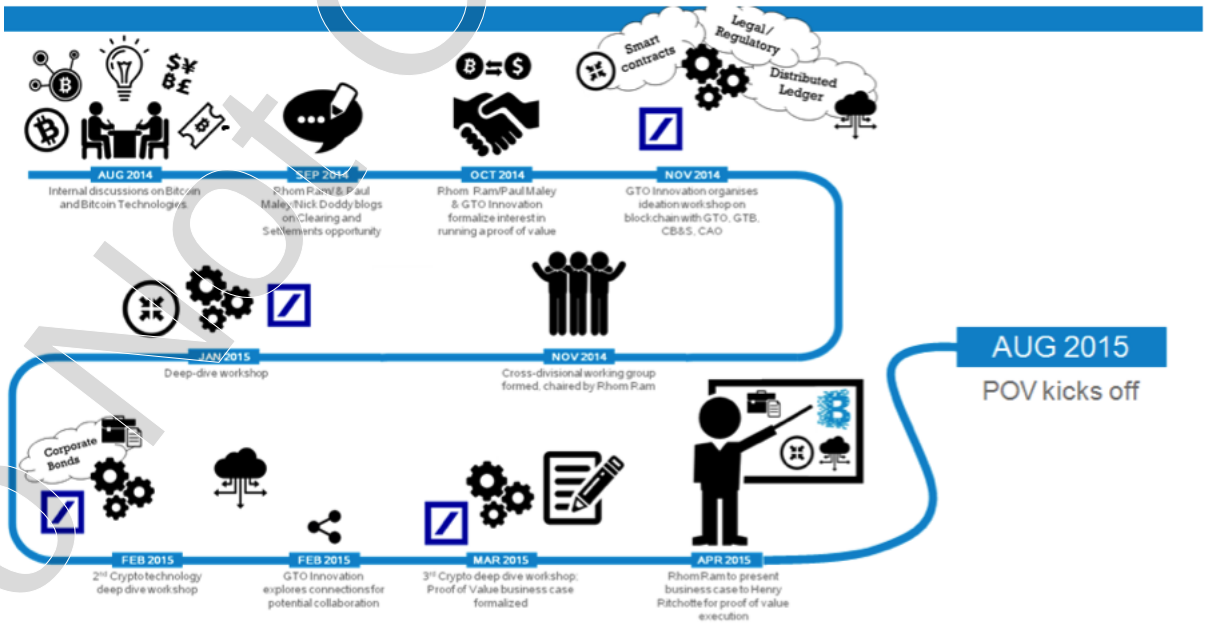
1. Can ownership of a financial asset that is not Crypto-currency be transferred using the distributed ledger concept with certainty and finality?
2. Can that financial asset be legally enshrined in computer code as a Smart Contract, such that any legal dispute could be decided by how the code of the Smart Contract executes on a distributed network?
3. Can a Smart Contract be programmed to execute the lifecycle events of a Financial Asset?

Additionally:

4. We wish to start the process of adopting modern techniques to innovation at Deutsche Bank
5. Understand how to rapidly identify and exploit new value opportunities for both our business and our clients
6. Establish a technical platform to ensure the ongoing exploration of related crypto opportunities and provide a robust platform for further 3rd party engagement
7. Identify the significant Legal, Political and Market Convention obstacles to overcome
8. Demonstrate viability of this technology to the business

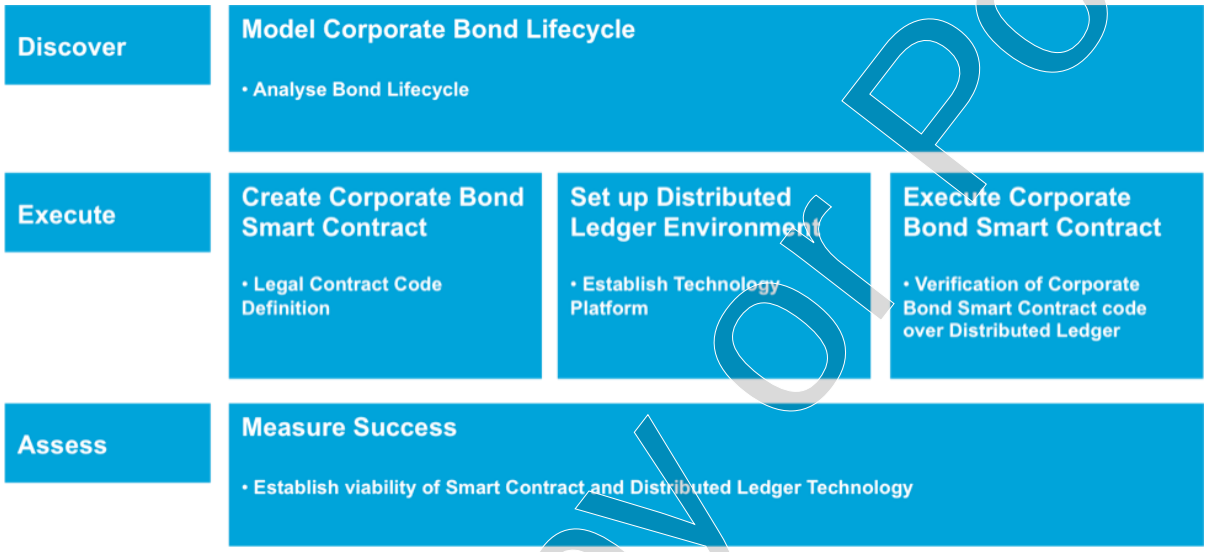
Source: Company documents.

Exhibit 5 Process Overview



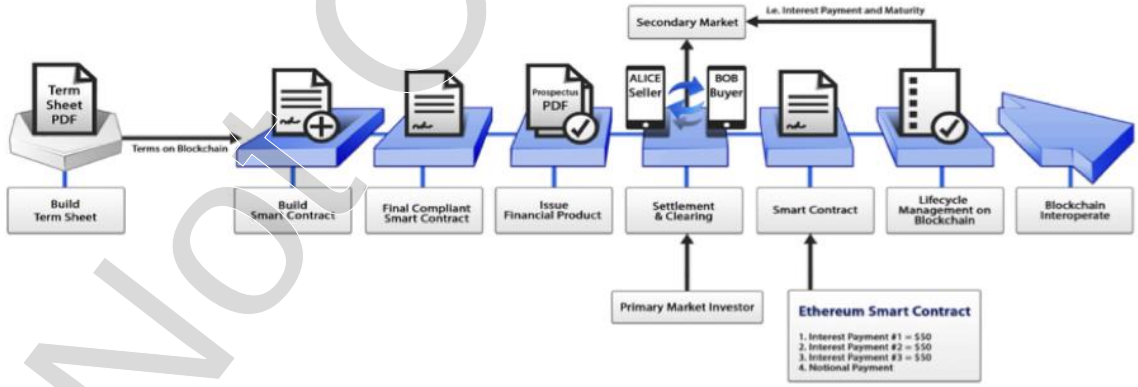
Source: Company documents.

Exhibit 6 Model for Blockchain Experimentation



Source: Company documents.

Exhibit 7 Smart Bond Lifecycle



Source: Company documents.