CHAPTER 3

Blockchain and Industry Use Cases

This chapter introduces some interesting use cases in a myriad of different industries. For some of you, the reason might be obvious. When you start a discussion about the blockchain technology, many people like to say that they still haven’t seen a working implementation in an industry, except for cryptocurrencies. Well, here we leave the theoretical path and show cases that are actually in use today. While there is still work to be done on the blockchain technology, this hasn’t stopped industry leaders from implementing the technology and changing the way they work.

Blockchain and Finance

With its very nature set in finance, blockchain technology can offer various solutions in the world of finance to improve existing markets or help create entirely new ones, depending on the use case and the creativity of those willing to investigate the opportunities. However you look at it, distributed data storages can help facilitate how data is provided in real-time to all parties that wish to participate in the market. This way there can no longer be a
discussion about who has access to market data in a fair manner. Marketplaces could be created where assets are traded over the blockchain platform, just as crowdfunding solutions that allow for smaller projects and companies to find funding. Assets can be transferred in a way that is transparent to all participants, easily verifiable, and cost-effective. Clearing and settlement processes can be fully automated and logged when using smart contracts.

For the regulators, trade surveillance should no longer prove to be an issue, with clear and immutable logs of each transaction. Money transfers can happen without the interference of third parties that claim their share of the transaction. Interbank payments could happen smoothly without time being lost and data could once again be shared with interoperable systems. Financial inclusions could be achieved for those that have no access to financial services and are left in the cold by the current institutions. By allowing these individuals to partake in these processes, we could provide them with better lives and ways of living. Foreign exchange, just as any other form of payment system, could happen over distributed ledgers, improving the current legacy systems that are in place and again eliminating the third parties that take their share.

Entire loan markets could be facilitated over blockchain platforms. People who currently have no access to loans and are left to the sharks that profit from their misery could find a sustainable solution by using microloans or new types of contracts that are built to their needs. The letter of credit is also a classic bank product for business partners all over the world to work and trade with each other. Again, blockchain technology could help to optimize and automate existing processes and reduce costs. There have also been talks, startups, and applications that focus on the creation of derivatives, margin calls, CDS, swaps, and stocks. The possibilities are endless, depending on how you look at current processes or what you can imagine for new products.

The Finance Department

It might be interesting to take a look at the finance department and spot the opportunities within the confines of this department. As always, every project impacts other departments and the company as a whole. However, you can easily see that when you start projects within that same finance department, you can use them as a center of innovation, which in turn can change the entire organization. By the very nature of the technology, this could even include the supply chain, the suppliers, and the customers.

ERP

So, why would you consider integrating your ERP system with blockchain technology? This might result in several advantages. As the Enterprise Resource Planning system is used to manage accounting, procurement, project
management, and supply chain, data accuracy is of key importance. It is used to centralize all business data, which allows deeper control over the business operations and the decision making. However, data accuracy cannot be assured, human errors can be made when creating bookings, and the master data might be wrong, all which lead to mistakes in reporting, payments, and so on.\(^1\)

The blockchain, which offers an immutable ledger and promotes transparency, can be an interesting option when you think about data and ERP systems. It could improve auditability as well, as all transactions are locked in a blockchain so that no changes can be made at a later point in time. This naturally also increases the security of the data being stored on the ERP, but on top of that, the mechanism of private keys ensures that only certain people can access the system. Smart contracts could add extra functionalities and automate intercompany transfers, order handling, procurement requests, and payments. This in turn could speed up the processes that are currently often done manually or by partial automation. All of this could lead to reduced costs due to both process optimization and the reduction of intermediaries in the process.

One supporter of such integration between ERP and blockchain is SAP.\(^2\) SAP seems to have several ideas when it comes to the blockchain technology and their ERP system. One of those is manufacturers, as various types of information can be logged and shared within the same ledger. By giving access to major stakeholders, specifications about machinery and product manufacturing can be retraced. With SAP Leonardo, SAP cloud platform, and SAP HANA, the possibility to use Hyperledger Fabric or multichain allows for blockchain integration within current ERP environments.\(^3\) Another initiative of SAP focuses on the pharmaceutical supply chain, where the “SAP information collaboration hub for life sciences” is used in the battle against counterfeit drugs. Other examples where SAP is exploring such possibilities are tires, tech, and shipping.

Another company that has explored the possibilities is IBM, with its Oracle Enterprise applications team, which works on solutions that integrate blockchain with the Oracle ERP cloud.\(^4\) They see opportunities for manufacturers (details for each component of a product shared among the stakeholders), finance (transactional data from multiple financial systems can be collected in one environment, which eases the audit trail and compliance to company policies), law (shared repositories of legal documents), and food services (real-time follow-up on the food supply chain).

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\(^1\)https://medium.com/@eoscostarica/why-integrating-erp-systems-into-blockchain-is-a-great-idea-e384b298a4a8
\(^2\)https://blogs.sap.com/2018/03/20/how-erp-is-incorporating-blockchain-technology/
\(^3\)www.sap-press.com/introducing-blockchain-with-sap-leonardo_4843/
\(^4\)www.ibm.com/blogs/insights-on-business/oracle-consulting/reinvent-erp-processes-blockchain/
CRM

CRM (Customer Relationship Management) systems are used to improve the customer relationship of enterprises. Even though not directly related to the finance department, they allow companies to increase customer retention and follow up on opportunities. On top of that, it also allows for automation of certain tasks, closer control over processes, and the clear value of statistics and reporting, which allows for improvement opportunities within the enterprise.

Salesforce understood the possibilities of the blockchain technology and integrated it in their Customer 360 platform. They offer the blockchain technology to capture activities that have taken place on the platform and deliver this data to specific workflows, which allow for automation and standardization. When data can be provided in such a fashion, it allows for data analysis, uses data for chatbots, and of course creates an audit trail. The underlying distributed ledger technology can also provide the data to other applications and apps or even to other partners in the business network of the enterprise.

Other Systems

As the blockchain technology becomes a feature in more and more CRM and ERP systems, it can be integrated with other financial and asset management systems without the enterprise having to worry about major changes when one of the applications releases a new update. Once it’s integrated, it will have a major impact on how companies are currently working. Processes and workflows can be further automated, data can be standardized and shared among applications as well as with all partners in the business network. This in turn will lead to better business relationships, as necessary data can be shared and changes will be clearly exposed with audit trails.

These data stores can in that sense also be used for new projects, such as better forecasting of sales and the supply chain, increasing the compliance of the overall process, improving the accounts payable and accounts receivable processes, and reducing costs.

Invoicing

Another major aspect is dealing with invoices. Many solutions attempt to deal with accounts payable and accounts receivable. Several blockchain startups have created solutions for existing problems in this area. Distributed Ledger

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<sup>5</sup> www.salesforce.com/products/platform/products/blockchain/

<sup>6</sup> www.computerworld.com/article/3438838/gartner-blockchain-will-be-nothing-more-than-an-add-on-for-erp-crm-software.html
Invoice systems that focus on invoice discounting have entered the marketplace to create more efficiency.\(^7\)

One solution is Populous World, which focuses on invoice financing.\(^8\) With invoice financing, cash that is locked up in outstanding sales invoices is unlocked because buyers can buy the invoices at a discounted rate. Both invoice factoring and invoice discounting are offered on top of their platform, where they claim to be able to open up finances much faster than other partners, while companies retain up to 95% of their invoice value. One of the key items they like to show is that there are no fees for invoice buying, there are high returns, and the market becomes more globalized. With the use of blockchain, they open the market on a global scale while at the same time introducing transparency and security. Also, third parties and financial institutions are removed from the process in the finance system.

A second example is Prontapay, which aims at using smart contracts to help businesses more efficiently get paid with lower transaction fees while using a stable, fast, and secure invoicing system.\(^9\) Because invoices are sent over a blockchain platform, the smart contracts make sure that the “legal coding” creates a binding agreement between the buyer and seller.

When you take the previous example, you can easily see that the data used to create the legal contract code can be used to feed it directly to ERP-systems so that the entire invoice cycle can be automated while keeping a clear audit trail.

Data Dashboarding

One final example is the Anaplan platform (but one could easily say the same for other dashboard or planning software). Blockchain technology can provide data in a similar way as Anaplan takes data from accounting systems today. Distributed ledgers can provide more data if it is in a shared environment, in a standard format, and includes a clear change log. This allows forecasting to become even more streamlined and compliant with the new regulatory reforms established by IFRS and other solvency frameworks.\(^10\)

Qlik has started to look into how data linked to the blockchain technology can be visualized in an effective manner. Whether it’s the connections between pieces of data, time series data, or data at scale, Qlik can offer a solution so that you can create deeper insights into your blockchain networks.

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\(^7\) [www.frontiersin.org/articles/10.3389/fbloc.2019.00013/full](www.frontiersin.org/articles/10.3389/fbloc.2019.00013/full)

\(^8\) [https://populous.world/](https://populous.world/)

\(^9\) [www.kickico.com/hi/campaigns/59764/prontapay-invoice-solutions-for-the-blockchain-era](www.kickico.com/hi/campaigns/59764/prontapay-invoice-solutions-for-the-blockchain-era)

\(^10\) [www.anaplan.com/blog/analyzing-planning-blockchain-data/](www.anaplan.com/blog/analyzing-planning-blockchain-data/)
The process of checking data quality and data transformations can be largely automated. By creating a trusted data store with a clear compliance network surrounding it, the lives of data scientists, reporting professionals, and regulatory experts can be easier, and further investigations become possible. This can allow for further optimization of the organization as a whole.

**Assurance and Auditing**

A classic part of the business process is the audit and assurance process. They are key in making sure that reports have a foundation in reality. If there are certain assumptions made, the auditors have to make sure that they hold up. They have to ask questions relating to missing funds or inconsistencies, and so on. With the distributed ledger as an immutable representation of data, this could have a clear impact on how audits are being performed. Transactions that have taken place can easily be verified on such ledgers without a shadow of a doubt. As in all the other industry scopes we have seen so far, you should understand that there is a major opportunity for automation. The existence, accuracy, and completeness of information can all be locked in the ledger and be checked with smart contracts.

Of course, as we have already stated several times, one shouldn’t trust blockchain technology blindly. As with any new technology, there are possibilities for fraud and hacking. Not all vulnerabilities are clear yet and, as with any digital technology, there is an arms race between those that wish to defend and those that wish to attack.

In this sense, it is of major concern that necessary safety measures have been taken (automated and otherwise), that regular audits take place, and that pentests are performed so that the ledger remains secure. Other risks come out of the type of blockchain technology you are using. As there are many different kinds out there, they each have advantages and disadvantages. Sometimes transactions are irreversible, counterparties are hidden, transaction amounts can disappear, private keys can never be recovered, and so on. This means that, as always, you shouldn’t look at distributed ledgers as a magical solution. Risks are inherent in any technology and you have to understand what the capabilities are to find the right use case. An example is the blockchain-based tool launched by Armanino. \(^1\) Traditional techniques are still necessary to gain the final report, but intermediary audits can be automated.

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\(^1\) [www2.deloitte.com/mt/en/pages/audit/articles/mt-blockchain-a-game-changer-for-audit.html](http://www2.deloitte.com/mt/en/pages/audit/articles/mt-blockchain-a-game-changer-for-audit.html)

\(^2\) [www.coindesk.com/accounting-firms-blockchain-tool-claims-to-perform-a-30-second-audit](http://www.coindesk.com/accounting-firms-blockchain-tool-claims-to-perform-a-30-second-audit)
Accountancy

In line with auditing, blockchain technology could have a major impact on accountancy. As the technology itself is often described as a distributed ledger, the connection is clear. The technology finds its roots in transactions, ownership, and a ledger of financial information. Accounting platforms with an underlying blockchain-like distributed ledger technology could change the future of the industry. For this to function, there is a clear need for standards and regulations. If we could achieve this, the need for reconciliation and conflict management could be reduced to the bare minimum.13 Blockchain would also increase the transparency of financial information and could have a major impact on the timeliness of transactions. Fraud could, in a similar sense, be reduced. “Cooking the books” is much harder when you are dealing with immutable transactions and multiple participants who need to verify and confirm these transactions. Also, classic “human error: could easily be detected and filtered out of the ledgers, as the other participants could recognize and reject it.

One organization promoting the possible opportunities in tax, accountancy, and auditing is the Accounting Blockchain Coalition. It has many partners working together to achieve this goal.14

Insurance

An industry that isn’t famous for fast innovation in its way of working is the insurance industry.15 However, the initial interest in blockchain technology came from the financial sector, so the insurers were naturally pushed to look into the technology and possible innovation opportunities as well. This industry has to deal with many challenges, such as the stringent and often complex compliance and legal frameworks in which they operate. There is the limited growth that is achievable in the mature markets, the interest rates as they are in many countries, fraudulent claims that need to be processed and investigated, third-party payment transactions that must be verified, data that needs to be processed, and the administrative burden resting on many of these companies. We can also add the pressure to come up with new products to deal with the challenges of the modern world, new compensation modes depending on the scheme that is being put in place, and so on. Finally, we also have to look into the security of the data being processed, as this is a concern for any major industry dealing with personal data. In a broader aspect, data is

13www.icaew.com/technical/technology/blockchain/blockchain-articles/blockchain-and-the-accounting-perspective
14https://accountingblockchain.net/
15www.idginsiderpro.com/article/3301163/how-blockchain-is-disrupting-the-insurance-industry-for-the-better.html
also necessary for the reserve calculations based on their current contracts. This is of key importance in the insurance space, when exposures must be rebalanced considering certain risks in their portfolios. When you look at all these points, you can see why the industry is facing many challenges.

Blockchain might not be a magical answer, but it could be one of the tools that brings insurance companies into the modern age. A first obvious case is that of fraud prevention. This affects the business and the final consumer, simply because insurance companies need to deal with fraud and that affects the bottom line. With blockchain platforms, there could be more coordination between the insurers on the market. At this time, each insurer is performing analysis on the data they have, so they might filter out suspicious claims or activity. If insurers could work together and share data that is essential to filter out fraud cases (as insurance fraud can often be turned from company to company), the cost might be shared between all the participants while the success rate increases.

This is, of course, strongly linked to data and this is the second place where it might really help the insurance industry. It could help both with the quality of the data as with data management. Currently, a lot of insurers are struggling to deal with the vast amounts of data they have to process while they want to provide better services to their clients. Blockchain technology might also help to improve the current data management systems for the better.

Other opportunities can be found in the underlying payment systems and claims processing, as a lot can be done via automated smart contracts. This, in combination with machine learning models, could help filter out the suspicious cases, while those that are considered “normal” could be processed smoothly without any extra cost for the insurance company itself. This would lead to a better customer experience as they can immediately validate their claims. At the same it could reduce the overhead and administrative costs that insurers deal with.

In the same vein, there is a final important possibility, which focuses on product development and offerings to prospective clients. Effective data management of a blockchain platform could enhance actuarial models as they are in use today, which in turn can help develop new contract terms, better suited for the client.

As you might imagine, a lot of startups have jumped at the opportunity to fill the gap when it comes to the insurance industry and blockchain technology. An interesting example is Estua-re, which is a platform launched by Legal and

16https://medium.com/datadriveninvestor/blockchain-can-revolutionise-the-insurance-industry-896555e0a7d5
17www.dataversity.net/blockchain-in-the-insurance-industry-what-to-expect-in-the-future/#
General Reinsurance Plc. The reinsurance platform is used for pension risk transfer execution and can handle pricing, claims, financial reporting, and collateral.

A second example is Everledger. Everledger offers several solutions, but one of them is focused on the insurance industry. They want to increase transparency and allow for automation, trust, and increased accuracy. The solution also helps with fraud identification.

Other startups in the insurance space include Etherisc, which focuses on process improvement solutions and cuts down on processing fees and claim-processing times. Guardtime is a developer that goes much broader than insurance alone, but has developed a maritime insurance platform with Maersk. FidentiaX a marketplace for tradable insurance policies. Of course, there are many more out there and others in development, but this gives you a good idea of how development is going and where we might see new solutions in the future. No industry remains untouched and we will see major changes in the years to come when we look at the insurance industry.

Real Estate

Real estate (and certainly commercial real estate) is another market that might change due to the influence of blockchain technology in the coming years. Many transactions that now require the interference of one or more third parties could possibly be automated by using smart contracts on top of a blockchain platform. Think of any transaction that leads to the purchase or sale of a property, leasing contracts, and financing and management transactions.

Where do we commonly find the biggest issues with the existing real estate industry? First of all, it is not open to everyone. It shouldn’t be too hard to understand that the most important barrier are the funds necessary to acquire real estate. This has always been a very high barrier but it is not the only one. Most countries have very stringent rules when it comes to real estate and how one can acquire it: identification, credit score, financing, notary services, cash requirements, accreditation, proof of income, access to sponsors, and so on.

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18 [www.legalandgeneralgroup.com/media-centre/press-releases/legal-general-reinsurance-launches-world-s-first-pension-risk-transfer-prt-blockchain-reinsurance-platform/](http://www.legalandgeneralgroup.com/media-centre/press-releases/legal-general-reinsurance-launches-world-s-first-pension-risk-transfer-prt-blockchain-reinsurance-platform/)
19 [www.everledger.io/](http://www.everledger.io/)
20 [https://etherisc.com/](https://etherisc.com/)
21 [https://guardtime.com/](https://guardtime.com/)
22 [www.fidentiax.com/](http://www.fidentiax.com/)
23 [www2.deloitte.com/us/en/pages/financial-services/articles/blockchain-in-commercial-real-estate.html](http://www2.deloitte.com/us/en/pages/financial-services/articles/blockchain-in-commercial-real-estate.html)
24 [https://blockgeeks.com/guides/blockchain-real-estate/](https://blockgeeks.com/guides/blockchain-real-estate/)
Even in the world of commercial real estate, there are certain requirements we need to deal with. Due diligence processes need to take place to make sure that all legal, operational, and investment implications are clear. Brokers act between investment parties to provide the right information to the right people. The number of third parties you have to rely on seems endless and often this is fixed in law, so there is no way around it. A second issue, closely tied to the first one, is the lack of transparency in the entire process. People who enter the real estate market for the first time often discover, to their dismay, how difficult it is to do everything right. And you have to consider all the middlemen you need to trust to give you the correct information.

With the use of a distributed ledger, you can improve the property search process, expedite pre-lease due diligence, ease cash flow management, and allow for easier and more transparent property title management. Information can and should be free for everyone when considering something as crucial as commercial real estate. The process shouldn’t be unnecessarily difficult considering the investment many families are making when it comes to acquiring real estate. In the same vein, you should be certain that everything is in line with regulation when acquiring property. You want to know if the owner selling the property is really the owner, that the building meets current regulations, that there are no other claims on the property, and so on. This can all be determined using a blockchain-enabled platform that could open up the information to all participants. The lack of transparency also leads to many possibilities for corruption, tax evasion, money laundering, and worse. When looking into reports from Global Financial Integrity, one can see that between China and the U.S. alone, there was a flow of 1 trillion USD between 2002 and 2011 that involved New York real estate.²⁵ In the fight against corruption and financial crime, distributed ledger could lead to more open information sources, discouraging individuals from spending their illicit money on real estate. All of this also creates a strain on the speed of the process, which can easily take months and, in case of international real estate, years.

We mentioned before the high costs associated with acquiring real estate. There is not only the cost of real estate itself to consider, but also the other fees that are linked to acquiring property. Taxes, notary fees, processing fees, transfer fees, exchange fees, broker fees, investment costs, and so on wear down many investors entering the market. By weeding out the middlemen, these costs could also be reduced to the absolute minimum.

Of course, these ideas aren’t new and are well-spread throughout the world, which has led to a number of startups using blockchain technology to change the real estate market. One of these startups is called PropertyClub²⁶ and it wants to increase the transparency in the real estate market and make it easier for people looking for property in NYC.

²⁵https://gfintegrity.org/chinas-corrupt-economic-fugitives-finding-home-us/
²⁶https://propertyclub.nyc/
Another is Managego, which focuses on property owners in the real estate market. It digitizes rent payments, maintenance requests, rental applications, and more. Another startup that has an interesting approach to the real estate market is called Meridio. It wants to make real estate more tradable by making it divisible with equity. This way, ownership of real estate can be shared by many investors and these shares can be traded on top of their platform. At the same time, this reduces transaction costs and lowers the investment minimums necessary to enter the market. Many other startups exist that have an alternative approach to the real estate market, but the key takeaway is that blockchain technology can help improve the current challenges that are faced by market’s participants. Whether you believe in the technology or not, these startups are here to stay and will change the current market processes.

The Legal Industry

The legal industry is a notoriously slow one when it comes to change and innovation. A lot of their practices are almost set in stone when it comes to procedures. However, the pressure of blockchain technology is mounting and startups are trying to revolutionize the landscape so that there might be real change for all participants. Why is there always pressure when it comes to the application of new technologies in the legal sector? Because there is always the question of what the legal consequences are of applying a certain technology. This means that the very application of distributed ledgers might have an impact on the legal outcome of a process. In no other industry is there such a fundamental question when it comes to the application of new technologies. In itself, this leads to legal discussions that can seem endless. In essence, there are changes needed in the very laws themselves for many countries so that blockchain technology can actually be applied. When I say that legal changes are necessary, this means that there is a need for clear regulation, one that is not open to many interpretations. If there is an open interpretation, it should be in the sense that the application of new procedures and technologies are supported.

Another important aspect that we need to consider is the legal industry itself when you enter as an outside participant. All of us come into contact with the legal profession some time in our lives at key moments. Lawyers, notaries, legal clerks and judges, depending on the situation we are facing, help us with many processes such as marriage, divorce, buying a house, and dealing with the passing of a loved one. The procedures are often unclear to participants who aren’t familiar with the legal profession, let alone understanding the stipulations of any decisions they make. On top of that, the costs of legal representation are often quite high. This leads to even more frustration and hesitation to call upon a legal professional in time of need.

27 https://managego.com/
28 www.meridio.co/
Law firms have also witnessed change over the last couple of years. Depending on the branch of law one specializes in, the “classic” family office isn’t what it used to be. Major legal firms are moving in and vying for contracts with corporate clients.29

So where do we actually see the benefits of blockchain technology specifically in the legal world (as one could argue that any form of digitalization could have a major impact on the industry as a whole)? As always, the existence of smart contract functionalities could help to automate requests, legal contracts, and their outcomes. This could give rise to new products that can be offered at a lower cost. By adding descriptions that are clear for any outsider, a complete new market could be created.30 Opening up the market for any person in need, with clear explanations and at a lower cost, could mean a democratization of the legal profession. Transparency would increase as well, as the outcome of legal contracts could be clearly defined in a fixed set. One would no longer be able to disagree about the existence of a contract or the possible outcomes. In this vein, blockchain platforms could help current disputes concerning intellectual property rights by clearly defining who the owner of certain IP is and how the rights can be transferred to another party. This information can be made public so that there can be no dispute and all parties can act in transparency without the need for a third party.

A final obvious point where the legal industry and the blockchain world touch on each other is the technology itself. The existence of ICOs, cryptocurrencies, and open investment mechanisms has opened up an entire new world. Although there have been a lot of new opportunities, as always, there are also people taking advantage of the situation. This has led to cases of clear theft or misinformation to investors. As there is often not yet a clear legal framework for the technology and all its possibilities, lawyers who familiarize themselves with the concept could help shape the world of tomorrow.31 Notable examples relating to smart contracts are the states Arizona and Tennessee in the U.S. which have accepted the digital signature of smart contracts as legally binding.32,33

One of the startups that has jumped to this opportunity is Legal Nodes.34 Surprisingly, it claims to be GDPR compliant, as it includes several legal, organizational, and technical measures to achieve this goal (although they don’t specify what this means). Their platform can be used for legal support, M&A deals, corporate structuring, and legal assistance. Another important

29https://blogs.thomsonreuters.com/legal-uk/2019/11/15/use-of-the-cloud-is-on-the-rise-in-law-firms/
30https://consensys.net/enterprise-ethereum/use-cases/law/
31www.disruptordaily.com/blockchain-use-cases-legal/
32www.coindesk.com/arizona-governor-signs-blockchain-bill-law
33https://publications.tnsosfiles.com/acts/110/pub/pc0591.pdf
34https://legalnodes.org/
advocate of blockchain technology is called Empowered Law\textsuperscript{35} and it strives for public records on blockchain platforms to make them easily accessible. Other clear opportunities lie in notary services, which are essential for almost any society to function. With the advent of new technologies the almost ancient profession could see a complete change in the way of working, user friendliness, and cost. Finally, there is also the possibility of optimizing corporate filings. An example is IBM, which has become Delaware’s future blockchain provider when it comes to their new corporate filing system.\textsuperscript{36} It could lower the cost, increase transparency, and automate processing.

Supply Chain

You might not immediately see it, but supply chain offers a clear use case for blockchain technology. It’s not really a specific industry, but is a collection of people, businesses, and different industries that interact when it comes to supply chain. More often than not, it entails an entire network of suppliers, transportation companies, vendors, and customers that interact once or in a more permanent way, and this is irrespective of region. As this is a fundamental element in any industry today, there are many reasons to be critical of the existing processes and procedures. It is often an expensive process, with a lot of delays due to inefficient processes and procedures, being inflexible to change in demand, and based on the more legacy ways of working. Certainly, if we look at new techniques that are revolutionizing entire industries, we often see that these are lacking in current supply chain processes. As customers demand a better experience, more on-demand products and services, flexibility, and quick resolutions to problems, there are major changes to come.

As I have stated multiple times, the blockchain technology isn’t a magical solution that simply fixes all of these problems. But it might be one of the technologies that helps push necessary changes that aren’t happening today. As always a major focus may lie on the cost reduction in current supply chain processes due to inefficiencies. By eliminating third parties and directly working together, costs can be reduced by transparent sharing of information and making sure that several payments between bank accounts don’t need to happen. Smart contracts might be a valuable solution, which can be triggered when a delivery has taken place. Linked to this issue is the collection and sharing of data among the parties involved in the supply chain process.\textsuperscript{37} Data

\textsuperscript{35}\url{https://empoweredlaw.com/}
\textsuperscript{36}\url{https://eu.delawareonline.com/story/news/2018/07/03/state-awards-738-000-single-bid-blostate-awards-738-000-single-bid-blockchain-ckchain-contract-ibm/751001002/}
\textsuperscript{37}\url{https://hackernoon.com/how-blockchain-is-revolutionizing-the-supply-chain-industry-ghw83v0m}
cannot be shared efficiently and integrated among the different partners in a certain supply chain, leading to the loss of valuable information needed to improve the process but also to make sure that no products are lost. Continuing with this trend is the use of EDI (Electronic Data Interchange) systems, which send information in batches to other parties. This information is shared at certain intervals, which leads to issues relating to the change in pricing or when shipments go missing.

For all of these issues, the use of blockchain technology might greatly improve the current supply chain processes. One company that has understood that is Coca-Cola. In collaboration with SAP, they created a blockchain solution in the U.S. for their supply chain. Coke One North America (CONA) works currently with 70 manufacturers on their blockchain solution for the 160,000 bottles that are delivered daily to shops in the U.S. By improving the process, orders can be reduced from processes that take up to months to only a couple of days. Another major company is Walmart. They have teamed up with IBM specifically for their food supply chains. Currently, they track Chinese pork and Mexican mangoes, but one could easily see the potential for the future.

Several platforms have been developed to aid the supply chain industry to make sure that blockchain integration can be performed with ease. Insolar offers the use of private and public blockchains. This provides the most options for possible integration, as it leaves migration to other solutions open. Other startups that focus on supply chain are Skuchain, which aims to improve the security and visibility in the global supply chain process; SyncFab, which focuses on purchase order management; Shipchain, which focuses on freight transport smart contracts; and Origintrail, which offers a data exchange protocol for interconnected supply chains.

**Resources**

In line with what you might expect from supply chain processes, pharmaceutical supply chains and the energy trade, there are also possibilities to optimize the mining and general industry markets. An example is BHP Billiton, which has chosen to use blockchain technology to record the movements of rock and fluid samples to better secure the data that is being generated and reported for the delivery of these minerals.

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38 https://nieuws.btcdirect.eu/blockchain-coca-cola/
39 https://fortune.com/2017/08/22/walmart-blockchain-ibm-food-nestle-unilever-tyson-dole/
40 https://insolar.io/
41 www.supplychain247.com/article/worlds_largestMining_company_to_use_blockchain_for_supply_chain
A second example relates to the diamond market, where precious stones often tend to find origin in conflict areas. The term “blood diamond” isn’t familiar to everyone, and it refers to the fact that these stones are used to fuel conflicts everywhere in the world. They promote child labor, child soldiers, and various war crimes that I am not going to discuss in detail. By using distributed ledgers, we could help verify the origin of these diamonds and precious stones, ensuring that with the purchase of these stones, we do not promote such violence against humanity. The De Beers are responsible for about 30% of the mines, trades, and markets of diamonds, and they have chosen to implement a blockchain solution to help trace stones from their very origins to the customers who buy them.42 By doing this, the platform can become another measure in the fight against these crimes.

One final example in this context is the startup Everledger.43 Everledger has developed several industry applications that focus on diamonds, gemstones, minerals, wines, luxury products, and art. They wish to improve the transparency in these markets, to allow for clear compliance processes and trust between all parties. By creating unique identities, one can no longer doubt where these resources come from.

Risk Management and Cybersecurity

It is certainly worth asking how the risk management and cybersecurity sector could be influenced by the introduction of the blockchain technology. Whether or not you believe in the technology and the possible applications, the fact is that companies are trying new ways of working with distributed ledgers, applications, and platforms. This already means that there will be an impact on risk and security. With the advent of new technologies, new vulnerabilities are introduced and they need to be examined and tested. This calls upon professionals who not only understand the technology and its applications, but also can edit the code to discover how it might be used with malicious intent. Depending on the application, these risks can be linked to operational, credit, or liquidity risk (and in some cases even market risk). Again, understanding the application and the possible risks is critical.

However, there are possible advantages to the technology as well. When we look at data, some of the key characteristics in a compliance/security setting is the availability, confidentiality, and integrity of the data. Distributed ledgers could meet help all three of these requirements, as the integrity can be easily verified by storing hashes. A simple change will lead to a completely different hash so that everyone knows that the integrity of the data has been

42 www.forbes.com/sites/bernardmarr/2018/03/14/how-blockchain-could-end-the-trade-in-blood-diamonds-an-incredible-use-case-everyone-should-read/#35b64c23387d
43 www.everledger.io/industry-applications
compromised. When applied correctly, blockchain platforms could also improve data security and assure that only those participants with the necessary rights can access the data. Finally, availability can be improved, as there will no longer be a single point of failure. Each node has a copy of the data, so that when a node goes down, participants can contact the other available nodes to access the data.

In the field of data compliance, regulations often stipulate that one has to be able to prove that data hasn’t been altered or changed. With immutable records stored on a distributed ledger, this can easily be achieved. Tampering with data can be prevented and even in cases when data changes are possible, immutable logs show who the culprits are.

With an increase in data control and transparency, one could say that client’s oversights could be improved as well. An example is the financial services industry, where the KYC (Know Your Customer) program is a well-known process in which the client needs to be identified. This identification has to pass through several steps. The cost of the entire process is high, and such is the burden on both the financial institutions and the customer. Digitalization could help because smart contracts can automate the steps of the information gathering process, and when there is a conflict, it can automatically alert internal departments or the customer that extra data validation is needed. While the process is still a necessary pain (to protect both the financial services industry and the customers), it could be improved in terms of data integrity, case handling, and testing. Anti-money laundering processes are another viable candidate for optimization via the use of blockchain technology. There are already several startups in the field looking at these processes, such as KYC Chain and Tradle. Customer data could be made available to regulators, including updates on any information in real-time. These processes are of course only part of the broader client onboarding program that is of major importance, which again could become a lot friendlier for future customers.

Another possible candidate is the “proof of process,” where the numbers are checked to see if they really are what they appear to be. By providing step-by-step information and verification of the data, fraud can be prevented in an effective way, thus protecting customers and investors from schemes. Several startups are working on applications, such as Coinfirm and QRC Group.

A third example is the proof of ownership and the chain of custody, which is very important in many industries and processes. By providing immutable records in a transparent way, this information could be used to facilitate many

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44 [www.disruptordaily.com/blockchain-use-cases-compliance/](http://www.disruptordaily.com/blockchain-use-cases-compliance/)
45 [https://kyc-chain.com/](https://kyc-chain.com/)
46 [https://tradle.io/](https://tradle.io/)
47 [www.coinfirm.com/](http://www.coinfirm.com/)
48 [www.qrc.group/](http://www.qrc.group/)
processes that currently are prone to fraud or at least are opaque for any outsider looking in. A company that is looking into this topic is called HyperProof.49

Of course, most of these initiatives look at the qualitative aspect of risk/compliance management, but it shouldn’t be too difficult to understand that quantitative professionals will also feel the influence of the blockchain technology. With better data, better models can be created that reflect the reality in a much more significant way. Include the fact that you can actually link data to automated processing via smart contracts and in some cases even to entire mathematical models, you can see that the process can be optimized and become less prone to human errors.

When we consider the advantages of the blockchain technology to cybersecurity, we can also consider several points. One is the possibility to prevent access fraud by creating identities on a distributed ledger platform. Currently, the Central Authorities (CAs) in the Public Key Infrastructure (PKI) model can do this.50 People tend to use passwords, which are generally easy to guess or hack. This leads to persistent security issues for many companies. In a sense, using a centralized database, this creates a target for hackers if they wish to steal information. One could argue that a decentralized PKI is more secure when it comes to storing such information. Another possibility in the field of cybersecurity is the use of blockchain platforms for DNS servers, thereby making the network more resilient against DDoS attacks, which are aimed at bringing down the centralized part of a DNS service. Take away this centralized part, and you can hope to take away the power of the attacker.

Energy Markets

Without a doubt, a very interesting use case for the blockchain technology are the energy markets. By using these new techniques, one can obtain a more sustainable market that more efficiently uses resources and ensures that everyone has access to this market. High costs for what is seen as a basic utility is still an issue today and a distributed ledger platform could lower costs and be beneficial for the producers, distributers, and customers.51 According to some reports, the blockchain in energy markets could grow to 3 billion USD by 2025.52

49 https://hyperproof.io/
50 https://blog.capterra.com/benefits-of-blockchain-cybersecurity/
51 https://consensys.net/enterprise-ethereum/use-cases/energy-and-sustainability/
52 www.smart-energy.com/industry-sectors/energy-grid-management/blockchain-in-energy-market-to-reach-3-billion-by-2025/
We could see the use of distributed ledger platforms popping up for P2P energy trading and decentralized marketplaces, which make sure that energy as a scarce resource is used most efficiently in a price-effective way. As the sector is already accustomed to innovation, with solar energy, electric vehicles, smart meters, and more coming in the future, the blockchain technology could become an integral part of this change. In the sense of sustainability and resources coming from acceptable sources, tracking these sources could help adapt the market as it exists today.

However, “classic” energy sectors stand to gain as well. The petroleum and gas trades have many actors, and as with any supply chain, cost reduction, trade optimization, and transparency can be achieved via blockchain platforms. It is also a heavily regulated market with sanctions on several countries that produce these products. To ensure that petroleum or gas is not coming from a sanctioned area, distributed ledger technology could provide immutable proof of where the resources came from. Reporting about energy data and how it’s being used could also be improved. An example is the Chilean government, which is using a blockchain technology to store and report energy data.

With the energy market being a global market, cross-border engagement could be improved in regions such as the EU. It could help to share information across state borders, allow for commodity trading in a cost-effective way, creating real-time data repositories and more. By moving renewable energy to the global market, such as the classic energy resources, it could help change the world as a whole for the better.

The Banking Industry

We have already stated it several times—the birth of blockchain technology took place at the time of the banking crisis in 2008. It was meant as a protest and as a possible solution to work completely around the financial industry as a whole. It is only natural that those same banks have shown a very deep interest in the technology and its possible applications. This also means that this industry has seen the most use cases so far and as such can share the most experience in both success and failure.

There is still a lot of enthusiasm in the industry for new and future applications, but they have learned from their past mistakes and will not simply jump to any new ventures without considering the possible risks or other implementations. Key issues that troubled banks in the past have been the difficulty of scaling solutions for larger commercial adoption without clogging up the entire network, which would lead to customer frustration and eventually customers fleeing the platform. There have also been issues with the ongoing regulatory uncertainty that surrounds the blockchain technology, which makes further investments in related projects risky.
The most difficult aspect, as always, has been to bring several parties together to work on a platform. For competitors to work together, a very good understanding of the reasons why this could be beneficial for all is important. This is not always easy. If we take as an example the banking industry in Belgium and the open banking regulation, the smaller competitors worked together to deliver a compliant and similar open API platform, which makes it easier for third parties to work together. The bigger players, on the other hand, each chose their own path, which eventually made it more expensive for third parties to integrate with all of them. This was in sharp contrast to the Scandinavian region, where, even across borders, the majority of the banking scene was able to implement a similar platform. These lessons of the past teach us that it is easier to work with the smaller players (perhaps they have more to win from enhanced customer services and reduced costs) as well as a cultural aspect where certain countries have banks that work together with one another more readily for the benefit of all.

Leading banks all over the world have been working together to figure out how this technology could optimize their current way of working. One exciting field is money transfers for remittances. Sending money abroad has always been a pain. They are not only expensive but often prove to be cumbersome. Blockchain technology could ease this cost.

Other processes that might be improved by using blockchain technology is that of anti-money laundering and the “know your customer” processes, where fraud can be reduced. Identity can be verified, the process can easily be audited, and the validity of documents can be ensured via distributed ledgers. These processes are often a pain for customers, but when a shared platform could be created, the customer could decide which financial institutions get access to the information. This would mean that the customer would have to go through the entire process only once, after which all his financial institutions would have access to the same info. Updating the information could require the same streamlined process, reducing the impact on the customer.

Financial inclusion has also been an important argument for the creation of financial services over blockchain platforms. Low prices because of automation on top of the platform allow for a broader client base. At the same time, everything necessary for the client can easily be performed via a smartphone. This might still prove to be a barrier, but it is a less harsh one than a personal computer. Digital IDs linked to your smartphone can be used, where otherwise identifying a customer might prove to be next to impossible.

All over the world, new projects are being launched and tested to improve the money and credit markets. The promise that blockchain made the financial industry over night has proven to be a lie. Still, there is a lot of potential that remains untapped and that can be used to revolutionize the industry as a whole. While we might have landed at a moment of “blockchain fatigue” in
the financial industry, similar to the AI winters of the past where AI was no longer popular, I remain confident that this technology will come back and further improve the banking industry.

**Financial Instruments**

We mentioned a bit earlier that the blockchain world has also seen a rise in new financial products. We do need to state immediately that the local financial authority has the power to determine what a legal financial instrument is in a certain country. For some countries, these definitions are quite broad, while others have tried to keep cryptospace as far as possible from customers to protect them from possible losses.

In Germany, for example, the legal definition has been adopted as follows since March 2, 2020: “Digital representation of a value that has not been issued or guaranteed by any central bank or public body and is not necessarily linked to a currency specified by law and that does not have the legal status of a currency or money, but is accepted as a medium of exchange by natural or legal persons and can be transmitted, stored, and traded electronically.”

This provides a very broad base to possible instruments but also imposes stark requirements when considering the supervisory programs and compliance needed to ensure that the right investments are recommended for the right customer, so that risk-averse customers don’t end up with risky investments.

It is this same, often uncertain, regulatory environment that has proven to be a barrier for further innovation. This is a double-edged sword, as new instruments could help those without access to regular financial services to finance their lives and increase profits. On the other hand, widening the door to instruments that are often not well understood can lead to higher risks (as both the banking crisis of 2008 and the cryptocrash of 2018 have shown us).

When working together, regulatory instances from all over the world could come to similar terms, thereby reducing the regulatory uncertainty and creating a stable ground for new financial instruments. Later in this book you will read an entire section on cryptocurrency regulation, which really shows the difference in interpretation when it comes to cryptocurrencies.

It’s interesting to know that there are now also investment funds focusing on cryptocurrencies. Lending instruments, put and call options, and automated contracts have all been introduced.

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53 [https://bitcoinist.com/crypto-now-officially-seen-as-financial-instruments-in-germany/]
Outside of the Finance World

Even though the blockchain technology will be forever linked to finance and the financial industry for many people, this doesn’t mean that there aren’t opportunities or possibilities outside of the blockchain technology. One could take a look at many different industries or departments, but the following sections list just a few so that you have an idea of how people are using distributed ledgers in new and innovative ways.

The Media

An important sector in which the blockchain technology might prove its worth is the world of media and news. We have seen several examples in the last couple of years where fake news affected the behavior of people in harmful ways. These are often directed attempts to discredit certain political parties or individuals. They have also been used to direct political decisions and attack the reputation of major companies. A more recent example of fake news and its negative influence on the world is that of the Coronavirus. Online, several conspiracy theories spread. One stated that the government was responsible for the spread of the Coronavirus, so that tags could be vaccinated into people and tracked via 5G. Another stated that 5G suppresses the immune system and yet another stated that the Coronavirus spread certain radio waves themselves, which it uses to communicate to one another. This led to people in the UK, the Netherlands, and other countries to set fire to the 5G masts. This example shows how dangerous fake news can be and that combating these techniques should be a priority of everyone.

Blockchain platforms can offer traceability, transparency, and security when it comes to news articles. It could not only help to verify the source of certain articles, but also allow participants to flag articles as fake news, hence forcing out those that would abuse the (decentralized) network and prove the value of the information that is being spread. The New York Times Company is testing the blockchain technology to combat fake news and misinformation. The proof of concept they currently have stores metadata of photos and videos such as data, place of the image, person who took the shot, how it was edited, and how it was eventually published. Another company using distributed ledgers to fight fake news is Orange. You might not immediately imagine a telecoms operator focusing on fake news, but as a major operator in the communication process, they have seen and understood that they play a

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54 [www.leewayhertz.com/blockchain-fake-news/](http://www.leewayhertz.com/blockchain-fake-news/)
55 [www.coindesk.com/new-york-times-confirms-its-using-blockchain-to-combat-fake-news](http://www.coindesk.com/new-york-times-confirms-its-using-blockchain-to-combat-fake-news)
major role in spreading fake news. Orange worked together with the startup called Block Expert to create the application called safe.press.

The safe.press application allows you to check the source of an article, so that you can verify if the article you are reading is reliable. One could still try to defraud the source, but this is very interesting step in the move to secure information. It is not the only one of its kind, so it will be interesting to see how these applications evolve over time. Again, you shouldn’t be blind to the possible downsides of this technology. If a country controls the Internet use of its citizens and controls all the sources of news, it would in fact control all information its citizens are receiving through the majority of its sources.

The possibilities of the blockchain technology within media are of course broader. We are currently experiencing the rise (and fall) of multiple platforms that allow anyone with a computer and an Internet connection to participate in the media sector. This doesn’t take away that there are still major players that actually control the market. This leads to uneven compensation for the actual creators of content. With blockchain-based platforms, all creators can receive direct compensation for the use of their content and property. This can also be used to track the authorized viewers, usage of content, transfer of ownership, and smart contracts that can manage the entire process, end to end. This effectively eliminates the need to work with third parties that are often not compensating the creators as they should be.

There are many startups that have seen these opportunities and entered the media industry with specific solutions. We mentioned earlier in this books startups such as Ujo Team, Opus Foundation, and Stem, which focus on the streaming industry in particular. They offer channels for independent music distribution, freedom for the artists when it comes to compensation, automating royalty payments in general, and allowing for the contact with their fans in open and distributed ways so that none of them can be blocked from content.

Another important topic in the media industry is that of intellectual property rights and certainly how these can be protected in the modern age. Piracy is nothing new and most people are aware of how they can get a free copy of almost anything. The blockchain technology could not only help manage the authorized users who have access to certain content, but could also help manage and timestamp everything. This would effectively prevent any attempts of tampering during any step of the process. Startups such as Mediachain and Monegraph focus on the subject and want to empower the creators.

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56 www.ledgerinsights.com/orange-blockchain-fake-news/
57 https://safe.press/
58 https://hackernoon.com/blockchain-a-new-solution-for-the-media-and-entertainment-industry-f8c83ad3dc07
We should also consider public events that require the purchase of a ticket. Each year there are many attempts to commit fraud in this regard. In this vein, there are also a great many attempts in the sale of pirated merchandising. As we previously mentioned, the blockchain technology can provide an extra layer of authenticity.59

The Health Sector

The health sector might not be the first sector you think of when considering implementations using the blockchain technology.60 The idea of sensitive personal data locked away in some database, which can be accessed by anyone, should make you think. Still, the blockchain technology could have a major impact on how the healthcare industry is functioning today. The industry is not known for fast innovation when it comes to the general functioning of hospitals and the administrative burden that is often part of the patient relationship.61 To this day, it still happens that patients register at different hospitals when they aren’t happy with the diagnosis they receive. The studies are repeated at multiple hospitals but these are often unaware of some research that has happened at other institutions. There are efforts in place to remove these barriers, but it still remains an issue. The major risk here is the patient’s well-being.

So where do we find two major areas of concern? The identification of patients and the blocking of information. There is no universal patient identifier to this day, so that mistaken identity can still happen. Linked to this is the blocking of information, as it can lead to problems in the care for the patient. Information is often not shared between institutions, there are difficulties when data is requested, a long procedures, long waiting times, and so on. Sometimes the patients themselves try to hide information, leading to their own harm. Even though this information should be available to medical professionals and certainly should be shared upon request of the patient, this is often not the case. Another linked issue is that hospitals and other institutions often have limited funds and data security isn’t a priority. This leaves very sensitive data open for possible breaches, where in turn people could become victim of this shared information. A private distributed ledger solution might be the solution to these now common problems.62

When we use such a platform, we can create unique identities so that there can no longer be a case of mistaken identity or mismatched patient data. We could actually reduce the number of medical mistakes. In the same vein, medical fraud and abuse could be halted as everything is recorded in a

59 www.entrepreneur.com/article/333856
60 https://blockgeeks.com/guides/blockchain-in-healthcare/
61 www.healtheuropa.eu/blockchain-the-trust-solution-for-healthcare/96840/
62 https://blockgeeks.com/guides/blockchain-in-healthcare/
tamper-free database, making sure that each action taken is there for everyone to see. You could give patients complete control over their data to share with those people and institutions they wish. On the other hand, if a medical practitioner wants to verify that other data exists on the patient, they can do so. Will they immediately get access to the data? Depending on the setup, no. But if they ask the patient for that information and the patient refuses to share the information, the medical practitioner has to take the proper precautions for the sake of the patient. An example is the Opioid epidemic, where patients fake injury, injure themselves, or try to collect drugs at several institutions for the same injury. Only with proper information sharing can patients be protected and can abuse be halted. Patients could also receive rewards via a reward mechanism linked to the blockchain platform, incentivizing them to follow a healthy lifestyle, follow a care plan, or take action to remain healthy.

Another major aspect of the health sector is the pharma industry, which is a major industry. A lot of medicine is sold each day and some of this supply ends up in the wrong hands. There is also the fabrication of other products that aren’t really from the supplier but end up somewhere in the middle of the sales process and put patients in harm’s way. Counterfeit drugs alone cost the pharma industry $200 billion, so you can understand that this is a major issue. The goal is to reduce the impact of these counterfeit drugs in terms of cost and also reduce the major risks many people are subject to because of these drugs.

A blockchain platform could validate the existence of certain drugs when they are being transported. In the same sense a lot of pharmaceuticals are returned by wholesalers for a variety of reasons. Often these drugs aren’t destroyed but instead are resold. Before this second sale can happen, the authenticity of the pharmaceuticals needs to be verified to make sure that they are the same drugs. The EU has the Falsified Medicine Directive, which requires drugs to be serialized/barcoded and uploaded in a centralized database. In the U.S. and other countries, this isn’t the case, so again a blockchain application might have a positive impact on the market. In the same way, one could prevent counterfeit drugs being sold, as these would not verified in the system.

Blockchain could also be used to verify the consent that a patient gives for clinical trials data, as well as the validity of the test outcomes. This not only to verify the outcome of the study but also to make sure that the well-being of the test subject is respected at all times. A startup that focuses on this very topic is called Clinico.

www.hhs.gov/opioids/about-the-epidemic/index.html
https://medium.com/blockchainbistro/top-5-use-cases-of-blockchain-in-pharma-and-healthcare-that-you-should-know-about-77ccdd76369b
www.cliniko.com/
In line with the use case presented before, a distributed ledger platform could help create a universal database, which could give us a clear database with clinical trials on new drugs and medications, follow the production of drugs and medicine, and their distribution all over the world. This means that if all suppliers and vendors could be persuaded to work together in one major system, we would be able to phase out a lot of counterfeit drugs due to the simple fact that the data in the blockchain is tamper free, and processors in the middle cannot simply adapt the data to their liking. With every action being clearly logged, no person could deny involvement in fraud or the production of counterfeit products.

Insurance fraud specifically in the healthcare sector is another concern. An interesting startup that takes a look into this is called ALLIVE.66 Here data can be shared with insurers based on the requests made by the client and this can be linked to a validation by a medical professional. This way, the fraudulent participant must have at least a few accomplices to succeed, and their cooperation is logged away in the blockchain for eternity.67

Other possible advantages include cost reduction due to the administrative burden of many hospitals. Blockchain could also enhance security and controls over healthcare transactions (one would be amazed how confidential data is sometimes processed, but this not only in the healthcare sector), improve general doctor-patient interactions, track medical transactions, and so on.

Again, we should always keep in mind what we are doing with sensitive personal data and not just blindly jump over to new solutions. These considerations determine the future of many patients and, with data protection in mind, we should move forward with a clear vision.

The Public Sector

Within the public sector, several possibilities for the implementation of blockchain and distributed ledger technology have been identified and already been used. A first aspect of the public sector that I want to highlight has to do with pensions.

Pensions are one of the major topics when elections are at the door in Europe, but also elsewhere across the globe. One of the reasons is that pensions make up a significant part of the costs that governments are dealing with. That is why we have in Belgium, but also in many other countries, the so-called pillars. The first pillar is what the government provides for you when you retire, the second pillar is what can be saved from your employer, and the third pillar is what you yourself voluntarily set aside.

66https://allive.io/index_en.html
67www.ibm.com/blogs/blockchain/2018/06/first-mover-advantage-innovation-through-blockchain/
The major problem that most countries have with their current pension schemes is that the current working population needs to pay for the retired population. This wasn’t a problem in times with increasing population numbers, but with falling birth rates, this system is facing some tough challenges.

Blockchain to the rescue! If things were only that easy. But some solutions have been put forward to help at least in part with the challenges that we are currently facing. We are going to mention a couple of those solutions here.

What are people currently looking for in a pension scheme? An easy-to-comprehend system that allows participants to understand how they can secure their financial future and invest in a safe way. If possible, it should be easy, low-cost, fraud-free, and easy to understand.

Several players have entered the market just for this purpose: to help people invest in their future in a way they can trust and understand. This, of course, offers in no way a solution for the first two pillars of the system I described, but at least it allows people to have some assurance of what they can set aside for themselves.

A beautiful example is NestEgg, which is a blockchain-based solution in the Netherlands that allows participants to crowd-fund certain sustainable infrastructure. If the crowdfunding is successful, the infrastructure is built and you are a partial owner of said infrastructure. Each product has its own investment policy (NestEgg is linked to AGP, the largest pension fund in the Netherlands), where you can choose to reduce your energy bill or receive the return on your bank account. This way, you can slowly (you can already invest starting from 25 Euro) grow your personal savings and maintain your cost of living. At the same time, you are helping fund the infrastructure of the future.

A second project I want to highlight here is Akropolis. It also focuses on the third pillar and is directed at participants interested in creating their own, personal investment funds. In a decentralized way each participant can choose in which pension products they would like to invest. All transactions are transparent, together with the eventual fund performance. An audit of the fund can happen hassle-free.

Of course, there are many more areas in which we could consider blockchain applications when we look at the public sector. One of those areas is the concept of partnering. Whether you are in the EU or anywhere else in the world, partnerships with the private sector or between other public entities are commonplace. With the use of blockchain platforms you can create more transparency in these initiatives, which can open up opportunities and participation. It can also provide insight into how government funds are spent, how decisions are made, and what the output is of these collaborations.

68https://hackernoon.com/attempting-to-reform-the-global-pension-system-with-blockchain-21e0ab9b51d9
Where these platforms and intergovernmental partnerships now are often opaque to anyone trying to look in from the outside (and often even for the people directly involved), with distributed ledgers, these governance systems can become more transparent. It could also democratize the process when people subject to the partnerships decisions can participate and vote on the projects they want to implement, directly giving power to the citizens who are subject to the decisions being made.69

These platforms could also be used to reduce fraud in the sector and help manage the funds in a clear, transparent, and secure manner. By linking the funds to the blockchain technology, you can also increase compliance by implementing smart contracts that are automatically triggered if the request is compliant and sets in motion regulatory action if it isn’t.70 Other possibilities include the secure storage of government and citizen data, trusted governments, and civil online systems. These applications could reduce the costs of many of the current applications. As it is for any person who has to deal with administrations these days, it is likely to be a hassle. Why? Most of the time, you interact with the government only when you have an issue, so that any process already seems slow and painful to start with. If you consider that a lot of these processes are indeed outdated, you start to understand the frustration that a lot of people feel, even when they only think about having to interact with the government. As the frustration is likely to stay, these applications could reduce these feelings to the bare minimum.

Identity and Voting Applications

When discussing the blockchain technology, identity is quite an important part of it. Traceability and transparency are only effective if identity within the platform can be ensured. Luckily, this can easily be done with distributed ledger applications. As with many things, voting is an integral part of life if you are living in a democracy. There are several risks linked to the voting process, as any person can understand. Fraud and deception are two of those risks. But something more general and what a lot of people might also understand is the simple frustrations that go into the process itself. Getting up early in the morning, or racing from your job to simply stand in line to wait, so that you can cast your vote. You can end up standing in line for hours due to technical difficulties, or all other citizens have the same idea as you and showing up at the last moment.71 Of course there are also other cases where people are prevented from voting by “unknown” agents, places where votes disappear, or

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69  www2.deloitte.com/us/en/insights/industry/public-sector/blockchain-public-sector-applications.html
70  https://consensys.net/enterprise-ethereum/use-cases/government-and-the-public-sector/
71  www.thebalance.com/how-the-blockchain-will-change-how-we-vote-4012008
places where votes seem to change over time. On top of that, it has become clear that the percentage of citizens who still vote is falling (sometimes dramatically) over time.

As early as in 2012, there has been research into the possibility of using the blockchain technology for the voting process, so that it could be both more secure and more reliable for citizens. If you understand the fundamentals of the blockchain technology, it shouldn’t be too hard to see how the technology could improve the entire process. It could lock in votes, prove that every citizen casted their vote only once, and allow voting from people’s homes. The results of the voting process could be processed much quicker than today. This would also mean that public consultations could become a process of daily life, as it could be much easier to get a vote through digital means.

Several startups have jumped at the opportunity to optimize this process and are now offering solutions (or developing solutions) that might one day replace the processes we are so familiar with today. One of these startups is called FollowMyVote. The company believes in using digital and technological solutions (of which the blockchain technology is a major part) to change government elections. It’s used for political party voting, collegiate voting, HOA voting, and proxy voting. It uses the BitShares platform and believes that this is the best way forward to provide reliable applications that have a predictable way of working.

A second startup with a focus on the subject is called BitCongress. They released a whitepaper as early as 2016 in which they proposed their solution. It uses a token-based system where participants can vote based on the number of VOTE tokens they have.

Not everyone is happy with the current progress and the use of the blockchain technology in a voting landscape. There have been several warnings that turning to digital solutions might introduce extra risks in the voting process and possibly even pose a threat to democracy. So far the studies that have been reported weren’t positive about Internet-based voting. There are currently online votes being cast in several processes. One of these examples is the general election process in the U.S., where in 2016 there were already

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72 [www.newscientist.com/article/mg21328476.500-bitcoin-online-currency-gets-new-job-in-web-security/](http://www.newscientist.com/article/mg21328476.500-bitcoin-online-currency-gets-new-job-in-web-security/)

73 [https://followmyvote.com/](https://followmyvote.com/)

74 [www.bitcongress.org/](http://www.bitcongress.org/)

75 [https://themerkle.com/tamper-proof-decentralized-blockchain-voting-with-bitcongress/](https://themerkle.com/tamper-proof-decentralized-blockchain-voting-with-bitcongress/)

76 [www.computerworld.com/article/3430697/why-blockchain-could-be-a-threat-to-democracy.html](http://www.computerworld.com/article/3430697/why-blockchain-could-be-a-threat-to-democracy.html)

77 [www.commoncause.org/page/email-and-internet-voting-the-overlooked-threat-to-election-security/](http://www.commoncause.org/page/email-and-internet-voting-the-overlooked-threat-to-election-security/)
over 100,000 ballots being cast online. Why then is the outcome of the studies currently negative? Is this linked specifically to blockchain? Of course not. Anyone that follows the news in recent years knows and should understand the risk of data and Internet-based applications. Influencing possible voters is one thing, bombarding citizens with fake news is another, but the actual election process? With the results we have seen so far, imagine what would happen if attackers were actually able to get in there. The potential of malware and cybersecurity risks is manifold.

The blockchain technology cannot simply eliminate these risks. So rather than simply saying that we should use distributed ledgers as a base for a new and digital way of voting, distributed ledgers should be only one of several pillars that help us develop an easier and more accurate voting system. General security of the applications, privacy and integrity of the data, and reliable information for the voters are all crucial issues. We shouldn’t lose sight of these key considerations before moving forward, because the possible risks if we fail to provide these might be more devastating than in any other area.

The Game Industry

In 2018 about 138 billion USD was spent on video games, making the games industry one that you should certainly not ignore.78 Even more important is that it is an industry more than willing to dive into innovation and new technologies. Virtual reality, artificial intelligence, and the newest standards in experiencing gaming mean that blockchain can play a role in the story.

Many possibilities can be discovered when one considers this industry. Many games offer in-game purchases, to the frustration of some. Distributed ledgers could offer decentralized exchanges. If you are not familiar with gaming, it might be difficult to understand, but hacking, fraud, and theft are real problems in this virtual world. Considering the amount of money, time, and effort that is spent to gain these assets, they are often seen as valuable as any other tangible asset. The blockchain technology could also offer a proof of ownership, protecting gamers from fraudulent participants. With a distributed ledger, hackers will no longer be able to steal property. Also the progress made by players and conversations can be stored. When certain events take place, there is proof of what happened between the participants, which means admins can provide clear resolutions. This is only a conservative view on how the blockchain technology is affecting the gaming industry.79

78 www.cnbc.com/2018/07/18/video-game-industry-is-booming-with-continued-revenue.html
79 www.forbes.com/sites/darrynpollock/2019/05/06/blockchain-technology-can-give-billion-dollar-gaming-industry-a-decentralized-leg-up/#4d4406866094
With the tendency to create more and more open worlds, massive multiplayer experiences, and unbound rules, the classic setup cannot fully grasp these types of games any longer. Why? Participants come from all over the world to work toward a specific goal and purpose. Centralized control is therefore no longer a positive thing. One wouldn’t want to see discrimination toward any of the players. Striving toward fairness, openness, and inclusivity, distributed ledgers could offer these controls. Several experiments have been performed to see how we could evolve from centralized solutions to decentralized setups, where the players gain more control over the environment they are interacting with.

A notable example is Taurion, which is a sophisticated game of the modern age. The players are in full control of the world around them. At the same time there is a specific mining system in place; experience can be gained, people can trade, fight, and so on. It is a notable example of how gaming experiences can evolve, where players gain more and more control instead of being bound to the rules of the game environment. This could make the experience even more lifelike and engaging.

**Education**

The sector has an important set of challenges such as the openness of the sector. It is a sound principle that everyone should have access to education. The reality is completely different. Sadly, a lot of people to this day do not have equal opportunities and cannot partake in the education system as they should. On top of that, the cost of proper education has been increasing over the years, leading to massive amounts of debt and people not being able to even start the educational track they would like to. Teachers will also tell you that there is a decline in people that are willing to positively participate in classes and in many countries there is simply a shortage of educational professionals.

However, the future isn’t all bleak. There has been an interesting rise in education technology. New technologies, such as virtual reality and artificial intelligence, are easily integrated in the classroom, and there is also a place for the blockchain technology. These solutions aren’t going to solve all the issues that are plaguing the educational industry, but they are changing the way knowledge is shared and might actually bring hope to a currently hard situation. The “edtech” industry will reach about 94 billion USD in 2020, which shows that we should take this industry seriously.

A first way that the blockchain technology plays a major role is by issuing diplomas or certifications. More and more digital courses have become available and (often) at low or reasonable prices. The actual diplomas

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80 | [https://egamers.io/meet-taurion-the-new-crypto-mmo-game-by-xaya/](https://egamers.io/meet-taurion-the-new-crypto-mmo-game-by-xaya/)

81 | [https://soeonline.american.edu/blog/the-future-of-education-technology](https://soeonline.american.edu/blog/the-future-of-education-technology)
themselves could be issued and linked to a blockchain platform. This could have several benefits. First of all, one could never argue that a student didn’t achieve his diploma. Next, the student could easily share his proof with possible employers and would retain full control over his personal data. One would not be able to falsify or lie about a diploma. Sharing information between educational institutions and/or the government would become a lot easier and credits, sponsorships, and results could easily be verified. At the same time, it would offer a safer way of storing this information than is currently available to many universities or schools. Many other industries are plagued by the fact that they have limited resources and cannot afford to spend a lot on cybersecurity or on storing credentials. By using distributed ledgers, they can secure this information much better.

We already touched on the subject several times, but the cost of education is high and seems to be ever increasing. Several initiatives have been created to improve the road toward a valuable degree. One is the development of the MOOC (Massive Open Online Course). There were over 101 million registered users of MOOCs in 2018, which shows that more and more people are turning in this direction for further education. Here, blockchain could not only help store credentials but could use micropayments, smart contracts automating exams, tests, and course delivery, and so on. Potential lies in the way information is shared with students and library services as well. The blockchain technology could help distribute information in a more affordable and socially acceptable manner.

One startup looking into education and distributed ledger technology is Disciplina. It focuses on test preparation and learning.

Human Resources

The human resources or HR function has a broad and important job in any company. Communication between businesses, vendors, people, activities, and processes are all aligned by this department. Currently the newspapers are talking about the “war for talent” in many different sectors being fought by HR and recruitment professionals. One shouldn’t underestimate the pressure a lot of people in the industry are feeling and, as always, we can assume that the blockchain technology could in some part ease the pain.

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82https://hackernoon.com/blockchain-poised-to-disrupt-education-industry-f41d6f415a3f
83www.classcentral.com/report/mooc-stats-2018/
84https://dataconomy.com/2019/01/how-will-blockchain-transform-the-education-system/
85https://disciplina.io/en/
86www.gartner.com/smarterwithgartner/5-ways-blockchain-will-affect-hr/
With the use of smart contracts, imagine that the management of in-house talent and external sourcing could be in part automated. Budget approvals could be linked to strict rules, just as authorizations and reviews are. New hires could be subject to automated testing and training. Corporate policies could be easily shared and digital signing can be verified on a blockchain platform. Background and employment checks could be verified by a simple click.

Employment contracts could in the same way be managed, stored, and shared with employees. Future changes could be managed and tracked over time. Payments and benefits could be fully automated over a blockchain platform without any human intervention, easing the payment process, proving verifiable payments, and leaving a perfect audit trail.

External talent could be contacted, signed, and paid over the same platform. In a world where working at home and teleworking have more and more become the norm in our society, they could more easily be managed. As with many other examples, blockchain could help with fraud prevention, improve the security of personal data, and give proof of existence through verification by the network’s nodes.87

Automotive Industry

The automotive industry has an increased need for connectivity with the rise of connected vehicles, fleets, and autonomous vehicles. With these connected vehicles is the need for an infrastructure that can pick up these signals. The industry is currently researching whether the blockchain technology could serve as a clear infrastructure layer. The current problems lie in the fact that each manufacturer is creating its own competing technologies without a real standard, so these implementations are uncoordinated, incompatible, and wasteful.88 With the implementation of more and more IoT solutions in these cars and trucks, great optimizations can be achieved when we look at fleet management, payment services, infotainment, and other services.

Blockchain could help with the management of vehicles for large enterprises. Again, transparency could be gained and the entire process of managing vehicles and verifying the origin would be simplified in this manner. You could also think about insurance and payment processes, verification of the origin of vehicles, and even KYS (know your supplier) processes, which are necessary to prove that vehicles aren’t stolen and are the responsibility of the seller. In the same vein, we have to be able to verify the repairs that have happened to

87https://medium.com/swlh/hr-digital-transformation-powered-by-blockchain-27d0a5794761
88MetaAnalysis of Methods for Scaling Blockchain Technology for Automotive Uses., Sid Masih.
a vehicle. Can we trust anyone performing these repairs? In what state was the car before these repairs? Is the correct mileage reported or not? All of these questions could be answered by using distributed ledgers.

The Smartphone Industry

You might not immediately think about it, but mobile phones can be changed by using the blockchain technology. Smartphone producers from all over the world have heard the calling of the decentralized web, with one of the biggest players being Samsung. The Galaxy S10 is one example that includes a secure storage system for cryptocurrency private keys. Other players are HTC with the Exodus 1, Sirin labs with Finney, and Electroneum.

As we discussed earlier when we were talking about the technological aspects of the blockchain technology, these platforms allow for decentralized applications. These applications form the basis of web 3.0. The idea is that we once again move away from centralized servers from large corporations and allow peer-to-peer technologies between the smartphones themselves. So what has stopped these applications from becoming mainstream?

Several issues, come to mind, such as scalability and regulatory uncertainty. Another issue is that, to use decentralized applications, you need to be tech savvy. If a company could get around these technical impediments, they could not only allow decentralized applications to become mainstream, but also open up a new world to customers all over the world.

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89. [www2.deloitte.com/cn/en/pages/consumer-business/articles/blockchain-in-the-automotive-industry.html](http://www2.deloitte.com/cn/en/pages/consumer-business/articles/blockchain-in-the-automotive-industry.html)

90. [www.technologyreview.com/s/613051/what-the-hell-is-a-blockchain-phone-and-do-i-need-one/](http://www.technologyreview.com/s/613051/what-the-hell-is-a-blockchain-phone-and-do-i-need-one/)