

Records Management & Blockchain

“Proceed, but with caution”

AUTHORED BY:

ALAN PELZ-SHARPE, ROB BEGLEY & JON BUSHELL

This report provides industry information and analysis regarding the potential use of Distributed Ledger Technologies (DLT) (aka Blockchain) for Records Management. It should be used as an analytical resource for senior executives to leverage when planning Records Management strategies. The report defines the key characteristics of the current market. It also identifies the business opportunities, key players and maps both challenges and opportunities.



Deep Analysis

August 2018



Overview

It's hard to miss the broader hype in the popular press and zeitgeist regarding Blockchain and Distributed Ledger Technologies (DLTs). But despite this, a 2017 survey of Information professionals showed that two thirds of the participants in the survey were not familiar to any significant degree with Blockchain technology¹. That's a problem, as DLT technology will, in the future, have a major impact on Information Management technologies and practices. Traditional methods and processes will be disrupted, transformed and in some cases disintermediated.

The good news is that some records management practitioners and professional bodies are gradually taking interest, and there is an increased focus on Records and Information Management (RIM) in broader Blockchain discussions, though these are often poorly informed. RIM professionals need to embrace and expand their knowledge about this technology - if not for use today, then certainly in the future.

One of the things that seems to be holding back the discussion in Information Management circles is that there are few technical solutions that utilize DLT technology available in the marketplace. However, there are many working prototypes, products and ideas in development. This is, in large part, because investors and start-ups have been more focused on crypto-currencies and projects involving Initial Coin Offerings (ICOs), where there is the potential for quick returns on investment. The crypto-currency focus is beginning to change as the exploration of the potential use of Blockchain in document and record rich environments like Insurance and Supply Chain has grown significantly. We expect this exploration to ramp up considerably in 2019. Even though, as one might expect, there is a high failure rate for Blockchain start-ups. Funding, particularly in the US, continues to flow and as some start-ups fail, many more are arriving to take their place.

The aim of this report then, is to consider how much and how seriously Information Management professionals should be investigating the use of this technology from a records management perspective, and this is where the challenge lies. From our analysis it is clear that Blockchain will have a major impact on Information Management as a whole over the coming years. But Records Management as a sub sector of the Information Management industry will likely move at a slower pace, lessening any sense of urgency to embrace Blockchain and DLTs.

¹ Begley, R. (2017) [Information & Records Management and Blockchain Technology: Understanding its Potential](#). Masters thesis, Northumbria University.



Definitions

Distributed Ledger Technology is an umbrella term used to describe technologies that distribute records or information among all those using it. Comparing a Blockchain to a DLT is like comparing an Apple to a Fruit. An Apple is a Fruit. Similarly, a Blockchain is a DLT.

Many people only know the term Blockchain due to its popularity and that it could be considered as the first generation of DLTs. Blockchain has essentially become a buzzword for all DLTs. This report will consistently use DLT (not “Blockchain technology”) as shorthand to refer to both of the following: 1. Blockchains; 2. Other forms of DLT.

All Distributed Ledger Technologies are by definition distributed, meaning they run on a peer to peer (P2P) network. This means that there are multiple computers acting as both client and servers in the network. Some DLTs run on just a handful of computers in the network; others utilize hundreds or a few thousand.

Management Summary

- Organisations that are looking at DLT as a potential solution to records management issues should exercise caution at the present time. There is currently no shortage of promises and ideas being presented to potential investors in the technology, but complete working systems are currently thin on the ground.
- DLT should not be seen as an alternative to current electronic RIM practices. The most promising DLT projects are building on top of existing RIM practices rather than entirely replacing them.
- Organisations interested in implementing DLT are best to focus on ensuring their current information management procedures are working effectively. However, regardless of current interest in DLT, there will come a time where information professionals have no choice but to use it in some form.
- For now, the technology represents an interesting opportunity for Records and Information Management, but will require careful evaluation and compelling use-cases before organisations consider full scale implementations.

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DLTs for Records Management

When looking at DLT technology from a RIM (Records Information Management) perspective, there are two key principals that underpin the technology that have potential to impact RIM practices.

Immutability

The first element of interest is immutability. Data is stored in the digital ledger in such a way, via the use of public/private keys, digital signatures and cryptographic hashes, that tampering with the data is immediately obvious to users. Once data or transactions are appended and confirmed by consensus across the nodes running the Blockchain, it is close to impossible to change or alter it. This append-only data store, which secures against the deletion or alteration, is a useful data structure for storing audit data.

Trust

The second key element is trust. By distributing stored data across multiple peer-to-peer nodes hosted by different individuals or organisations, participants can trust that any attempt to tamper with data on a node will be prevented by the consensus maintained across the rest of the network. DLTs transfer the burden of trust from institutions and organisations, who may have a vested interest in not acting in a trustworthy manner, to a technological solution which is not controlled by the interests of one single entity.

Immutability + Trust

Members of the public are becoming more aware of their rights in relation to their personal data, and less trusting of organisations in general that are using that data. The auditable nature of Blockchain and DLT technologies could provide the means to better hold governments and companies to account. It will also help with the long-term integrity of digital documents stored within public archives.

The Process of Building Trust with DLTs

DLTs can be used in two key ways to improve trust in recordkeeping and information management:

Firstly, cryptographic hashes of records in a repository (the DLT can also store data if required) can be stored onto a DLT such as a Blockchain. This process uses complex algorithms to generate a unique hash, a string of numbers and letters, for any digital file. This process is irreversible therefore every time you hash the same document, the resulting hash will be the same, but you can never turn a hash back into the original document it came from. In other words, by time stamping a hash of each record onto a Blockchain, you can always compare the stored hash with the current hash of any record; if the hash differs then you have proof that the record has been altered in some way, because the record on the Blockchain is immutable.

Second, there is an audit trail stored on the DLT along with the hash. When a record is accessed or altered the activity, will be logged in the DLT, and a "keyless signature" will be returned and stored next to the record. These signatures serve as an electronic timestamp that

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show if any changes (no matter how minor) were made – all such changes are registered, verified and immutable on the DLT/Blockchain.

When to Consider Using a DLT?

If you or your organization is looking at the potential to use Blockchain to improve or overhaul your current records management operations, we suggest you study the following simple, yet effective, evaluation method.

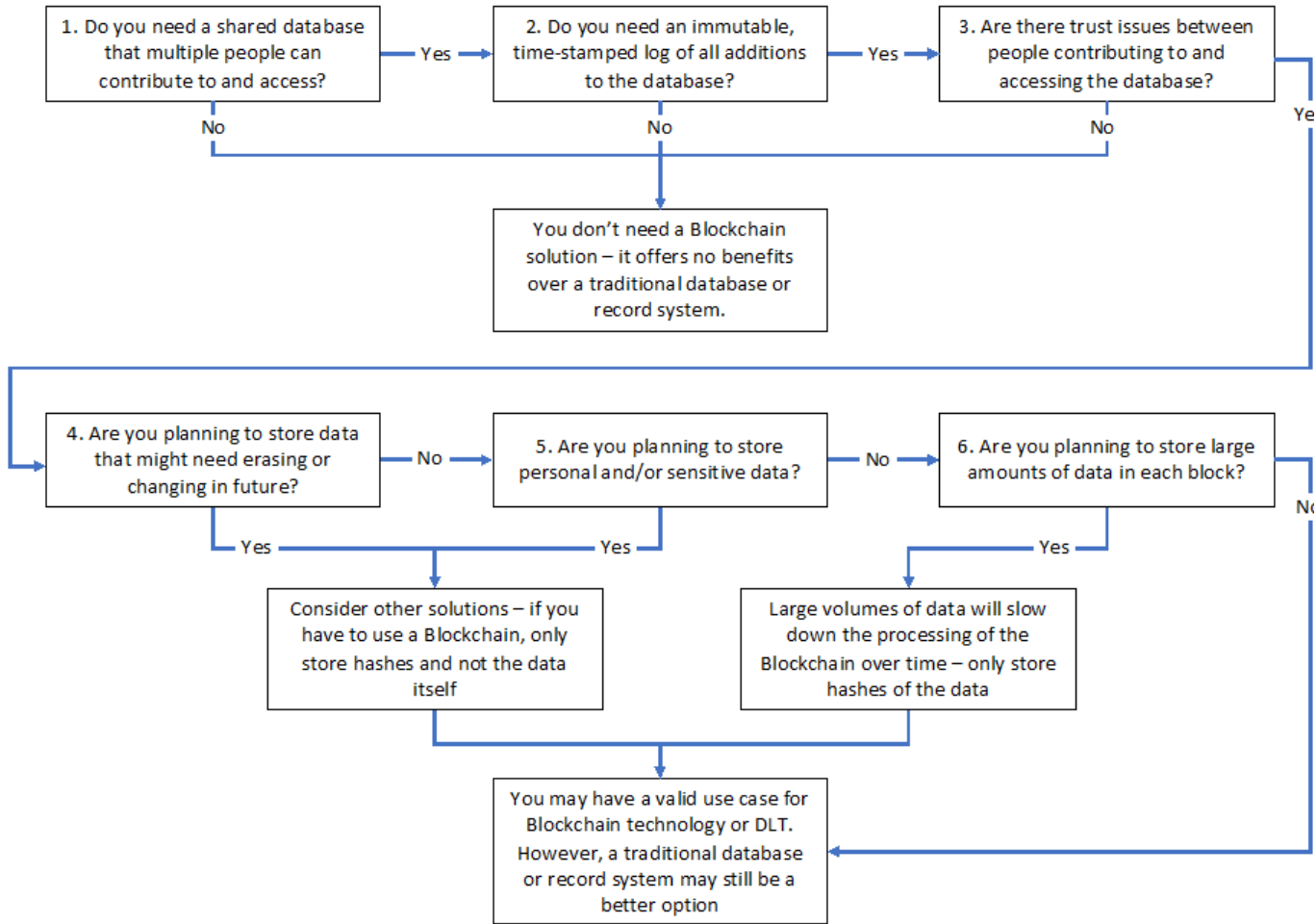
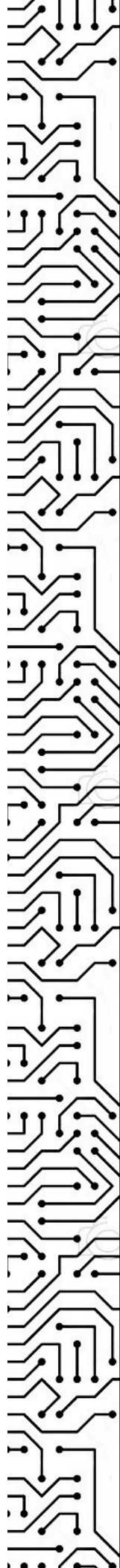


Figure 1- Do you need a Blockchain? (Public or Permissioned Blockchains only)

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1. Do you need a shared database that multiple people can contribute to and access?
 - The strength of Blockchain lies in its decentralised nature to enable consensus across multiple interested parties.
 - If the intention is to run the Blockchain as a single node for a single entity (for example a single department), you may be better off using traditional database technology, or a private tamper-evident ledger.
 2. Do you need an immutable, time-stamped log of all additions or changes to the database?
 - If not, then don't implement a Blockchain, because the immutable audit log of all additions to the database is a key component of the technology.
 - Using a private tamper-evident ledger can provide this benefit without investing in a decentralised, consensus driven Blockchain system.
 3. Are there trust issues between people contributing to and accessing the database?
 - Blockchain enables trust by decentralising control of the database. It's not managed by one entity, rather the entire user base manages additions and changes by consensus.
 - Putting trust in the technology, rather than people, comes at a cost though, as it makes things harder to change or amend.
 4. Are you planning to store data that might need erasing or changing in future?
 - Retention and disposal of data is an important consideration, given that you cannot erase or change data on the Blockchain itself.
 - A better solution is to store such data in a traditional database and only store hashes on the Blockchain. A hash no longer has any meaning once you've deleted the record from your system.
 5. Are you planning to store personal and/or sensitive data?
 - Storing this information in a shared or public Blockchain is a risk. (as in 4 above – if you are to implement a Blockchain then consider only storing hashes)
 - It could lead to a data breach, where a poorly written smart contract or previously unknown exploit allows access to the encrypted data.
 - It could also cause data protection compliance issues, particularly where relying on consent or where the 'Right to Erasure' is invoked.
 6. Are you planning to store large amounts of data in each block?
 - Larger Blockchains require more computing power to process.
 - Storing large amounts of data in every block is likely to increase times required to compute and access data stored on the Blockchain.
 - It's also worth noting though that most well planned and implemented Blockchains do not store large volumes of data.

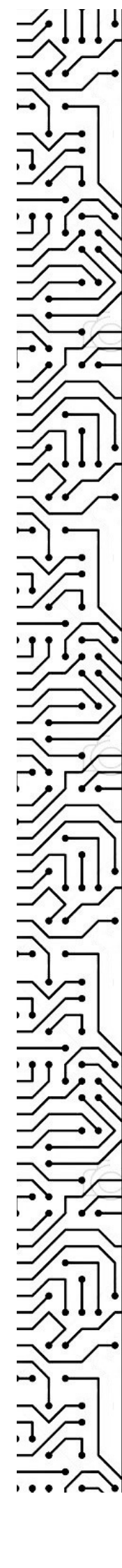
¹ Article 17 of the GDPR

Current use cases to compliment RIM for Blockchain

Organization	Industry	Use
City State of Dubai	Government	Dubai has launched a major Blockchain strategy to build a secure digital platform to run all city transactions. The goal is to dramatically reduce the cost and human complexity of document processing in everything from visa applications to bill payments and license renewals.
OpenLaw & Integra Ledger	Legal	Both OpenLaw & IntegraLedger provide Blockchain driven systems that allow lawyers to automatically generate legal agreements and embed smart contracts that can then be executed on a Blockchain.
IBM (On behalf of Delaware State)	Government	Blockchain-based business filing system which offers more efficient and accurate records with which to transact business and meet state and federal regulations. Delaware has over 1 million corporations registered in the state and generating over \$1B a year in filing related fees. The plan is to utilize Blockchain to eliminate human error in transactions as well as reducing the cost and risk of legal filings by providing an immutable record system.
Bank of America	Banking	Bank of America, one of the world's largest banks has already filed over 50 Blockchain related patents with more planned. The focus here though is not crypto-currency but securing and reinventing their internal ledger and records system. Hence they are using Blockchain to securely record and authenticate personal and business data, ensuring only authorized parties can access it. Further, the system will keep a detailed and indisputable log of everyone who accesses the data.

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Intel	Tech	Intel has filed a patent to radically change the way that digital rights are managed utilizing Blockchain. To quote from the patent application <i>“Blockchain technology is used to document and verify attributes of digital content that are relevant to copyright protection. Such attributes may include, for instance, an identifier for the author of the content, a timestamp to indicated when the content was crated, and a measurement that can subsequently be used to detect copying or modification of the content”</i>
MedRec	Healthcare	MedRec is an initiative out of the Massachusetts Institute of Technology (MIT). It is designed to leverage Blockchain to manage patient records throughout their lifetime as patients (and their data) movement between healthcare providers. The management of Electronic Healthcare Records (HER) are a major area of concern in the US, due to frequent loss, inaccurate data and unauthorized access to the records.
Archangel/TNA	Government	Archangel is an initiative from Surrey University and the National Archives in the UK to improve the accuracy, accessibility and long term viability of archival records for its citizens. It also attempts to tackle the shifting issue of trust, moving it away from trust in the institution holding the records to a shared technological trust mechanism.
Estonia	Government	Estonia is at the forefront of leveraging Blockchain for government work. One key initiative is i-Voting a Blockchain electoral management system. This will replace the existing e-Voting system and will be more secure and run at a lower cost. This initiative ties in with other Estonian Blockchain projects including residency management.

Figure 2 - Current RIM Applicable Use Cases



Adding Smart Contracts to the DLT mix:

In simply providing an immutable distributed database there is the potential for major change in RIM practices. But many DLT systems go much further than this and leverage what are commonly called ‘smart contracts’ that add the ability to automate processes and transactions that would otherwise require human intervention.

A smart contract (also known as a crypto-contract) is a computer program, which under pre-ordained conditions, directly controls the transfer of assets between parties. Similar to the way that a traditional contract works, a smart contract not only defines the rules and penalties related to an agreement, but it can also automatically enforce those obligations.

An example of this in use in a RIM environment would be an automated deletion policy assigned to run periodically (weekly/monthly) to clear unwanted legacy documents on disabled shared drives. Such an activity on the surface may appear simple, but as information management professionals know is driven by adherence to strict and often complex rules, regulations and categorizations.

It is in the design of smart contracts that experienced information management professionals will bring a great deal of value. All information management work is essentially driven by a series of rules and workflows defining what should happen, to what, and how. Smart contracts will automate much of this work and bring speed and efficiencies to currently inefficient manual activities.

However, it is also important to remember that a Smart Contract is just as immutable as the data you store in DLT. Bugs or errors in the structure of Smart Contracts can cause serious issues that are hard to undo. They have significant potential but also carry risks, and their use should be carefully evaluated.

Trusted information, immutable data along with automated and audited process activities underpin the technical capabilities for future records and information management.



Advice for RIM Professionals

DLTs are immutable, meaning they cannot be changed. Therefore, the quality of the data in the records management system needs to be accurate, while much of that data today is not. DLTs actually increase the onus on good internal records management in the first place, not lessen it.

An example of this is MedRec² which is a platform being developed by the Massachusetts Institute of Technology (MIT). It was designed to help patients access their medical records held by care organisations in the US. But it can only operate effectively if records are originally stored in a fashion that compliments searching and retrievability and relies heavily on health organisations having good record keeping systems in place. In practice, many organizations do not have good quality record keeping systems in place. Ensuring that they are in place will be the first step toward implementing a DLT-driven system.

The second step will be to look beyond the existing RIM system and address the broader lifecycle of content. In traditional RIM practices often a record is only managed from the point that it become inactive. In most future systems the content will need to be managed holistically throughout its lifecycle from creation to destruction. This new approach fundamentally challenges many traditional RIM methodologies.

Therefore, the complexities and challenges are greater than connecting an existing Records Management system to a DLT. So far we have only looked at Records Management in its traditional form, as a standalone activity that begins once an artefact has been declared a record. As DLTs find their way into Healthcare, Supply Chain and a myriad of other sectors the DLT technology will be used from the creation of an artefact through to its deletion. Take for example the transportation of oil from the well to the pump. DLTs will be used to monitor the entire end to end supply chain from the conditions and quantity of the materials to the shipping and financial documents related to the transaction. Or to give another example, in many instances it is arguable that the moment a contract or invoice is created or received it is automatically a 'record'. In the near future (these are already in development) creation and capture systems will utilize DLTs to create immutable audit trails of artefacts and any related activities.

That will involve a lot of strategic planning, but in our conversations with organizations building DLT-related systems Information & Record Management professionals are rarely involved in current planning exercises.

² [MedRec from the MIT](#)



A word about PII & GDPR Data

Regional regulations such as the European General Data Protection Regulations (GDPR) and The California Consumer Data Privacy Act (CDPA) have far reaching consequences. For example, part of the GDPR ensures that EU citizens can now invoke the 'Right to Erasure'³ and request that companies processing their information to delete it. Information professionals will need to be creative when using Blockchain and DLTs as once records go onto the Blockchain they cannot come off.

The response to the operational challenge of complying with regulations such as GDPR is in theory at least quite straightforward – do not store personal identifiable information (PII) on a Blockchain.

Instead organisations should keep all PII on separate databases and rely on record hashing to leverage the benefits of DLT. These offer a pointer to where your data is actually stored and once the data is deleted (in line with your traditional retention policies) then the hash is useless. By removing data from your traditional database thereby rendering the hash redundant, there is a permanent record on the Blockchain that the record has been destroyed.

DLT and RM 2.0?

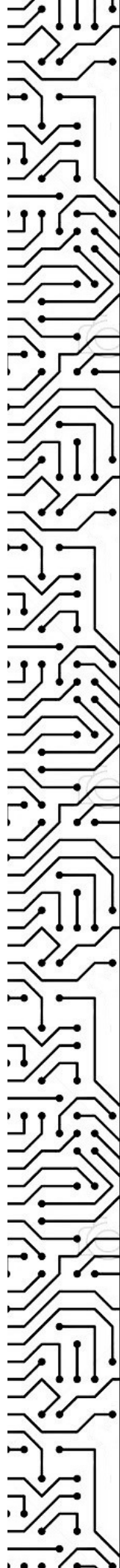
Recent years have seen an explosion in data and content which, from an organisational perspective, is usually spread over multiple systems thus prompting organisations to create and enforce policies and procedures regarding the effective storage and destruction of data. Increasing regional and national regulations for the better management of information (think GDPR in Europe) are also forcing organisations to experiment with new data-centric technologies to extract greater insight and help auto-classify at the point of creation, which increases the need for effective management of metadata.

There is a lot of interest in DLTs as an information management tool that can help organisations to better manage their disparate sources of information across the business. However current implementations of the technology are in fact typically reliant on centralised repositories in order to operate effectively:

- Estonia's ledger is linked to a single, centralised government repository for records.
- MedRec is facilitating the linking of medical records across healthcare providers, but those records need to be stored in each provider's record-keeping system.
- Archangel is ensuring trust in archive material, but that material will be held in an archival digital preservation system to protect the records long-term.

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In order for associated metadata and hashes to be saved onto a DLT, and for the audit history saved in the DLT to be useful, records must be stored in a structured system which can communicate with the ledger. Specifically, it must be able to generate new blocks whenever a change is made to the record itself, send this block out to the DLT nodes to be mined and added to the ledger, and be able to decrypt and read the metadata stored in the DLT using the correct private key.

An alternative to centralising storage of digital records is to ensure that data stored across the organisation is maintained in the same way by staff. A simple example of this in the crypto currency world is a BitCoin wallet. Users have their own wallet – a program that is either installed on their computer, on a USB or removable drive, or accessed via the internet. However, all wallets operate in the same way, by generating blocks containing the details of a single transaction, which can be appended to the Blockchain. The wallet also stores the user’s private key, which allows them to decrypt their previously sent blocks; in other words, their own transaction history.

From an information management perspective, this means staff can store records in different systems; perhaps some in a shared working area (such as SharePoint) and others in a personal storage area (such as OneDrive). The important fact is that each system would need to be compatible with DLT, and therefore the more systems in use the more complex this will be to develop and maintain. It will also require limiting what staff can do with corporate information – audit histories stored in a DLT will be incomplete if staff can save records out of these systems and onto unstructured network or hard drives. If information passes between different storage locations, for example from personal storage to a shared working area, this will also need to be captured on the DLT to ensure unbroken audit trails.

The bottom line is that the costs and complexity of implementing DLTs increase when introducing multiple and disparate storage systems for records. This is one reason why the current implementations of the technology have all been built on top of well-structured and centralised record storage systems. It is not impossible for DLTs to be complimentary for the management of records, but it creates extra challenges and barriers to implementation.

In the future we will see more use of data analytics for classification purposes, along with advanced machine learning and artificial intelligence to automate manual activities and provide previously inaccessible insights into the stored files and data. The hope is that, in this data-driven future, DLTs will provide a core foundation to deliver accuracy and trust into Record Management practices. However, this will rely on all systems being updated to be compatible with DLTs and will rely on data being stored correctly to facilitate capture onto the ledger.

Organizations will need to think carefully where this technology can be deployed for maximum benefit, given these current constraints.

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Market Overview

Information management technology vendors have been somewhat slow to respond to the growth of interest in Blockchain/DLTs but that is starting to change. Rather than larger established technology vendors, small start-ups such as Sphereon in The Netherlands, AStarLab in Brazil and Recordskeeper in Gibraltar are currently leading the way and have already built systems and implemented them in the real world.

But we do know through our research and advisory work that major firms like Oracle, Microsoft, Xerox, Amazon and IBM are actively exploring the possibilities of DLTs and expect to bring products to the market in the coming year.

Specialist ECM (Enterprise Content Management) vendors like SER, OpenText and Alfresco that have traditionally developed and sold RM technology are also actively exploring a DLT driven Records Management (RM) future. SER in particular is notable here as it released in January 2018 its Doxis4 product, a document collaboration system that is underpinned by Blockchain technology to add extra security capabilities.

But for many organizations in both the public and private sector, buying a new RM system is not going to be the route to take. To put this into market speak, most firms are 'brownfield' buyers that need to augment their existing technology investments, not 'greenfield' buyers that are starting with a clean slate. In other words, most buyers will want (in the short term at least) to augment their existing practices with a DLT system. In these cases, the organisation will often leverage their internal IT skills to develop such a system or employ outside help from a system integrator to do that work. With that approach, there comes both an opportunity and a caution.

As we have already noted, the use of DLT for documents and records is in its infancy and specialized skills are in very short supply but also in high demand – this shortage extends to even the largest and best known system integration and consulting firms. Therefore, you risk becoming a training bed for inexperienced developers to experiment on.

Name	HQ	Blockchain Status
SER	Germany	Product Released
AStar Labs	Brazil	Product Released
Sphereon	The Netherlands	Product Released
RecordsKeeper	Gibraltar	Product Released
Iron Mountain	USA	Prototyping
Fujitsu	Japan	Prototyping
Amazon	USA	Exploring
Alfresco	UK	Exploring
Xerox	USA	Prototyping
Microsoft	USA	Exploring

Figure 3 - Vendors

By default, this also means that for system integrators there is an opportunity to learn the required skills and tap into a growing market need. For organisations that are used to working only with major system integrator or consulting firms, you may want to consider teaming up with a small start-up that actually has the specialist skills. As ultimately, today this is a services-driven rather than product-driven market with most buyers looking to build DLT capabilities into their existing systems rather than go out to the marketplace to acquire a replacement system.

The use of DLTs for RM is going to happen; it's a matter of when, not if, so consider your choice of partner wisely.

The Adoption Cycle

It's clearly early days, but there is growing traction and interest in the use of Blockchain for records management related activities. Currently we see a number of government organisations around the world already exploring the use of Blockchain. Examples here include the likes of company registries deploying Blockchain in Brazil and digital citizen initiatives in Estonia and Dubai. There are also land registry initiatives in a number of African countries, India, Ghana, Sweden, The Netherlands and various US States.

Add to this the multiple industry consortiums in Legal, Supply Chain, Insurance, Banking, Energy and Healthcare that are forging a Blockchain path for their sectors, and we can say that though there is certainly a lot of hype, there is also a lot of real world activity.

Today then, we believe that we are at the innovation stage (*see figure below utilizing the crossing the chasm model*) and that we see a rapid acceleration of exploration and adoption through 2021. The major growth in implementations will come through 2021-23 as organisations move beyond testing and proof of concepts and are deployed in (primarily) supply chain, government and the healthcare sectors.

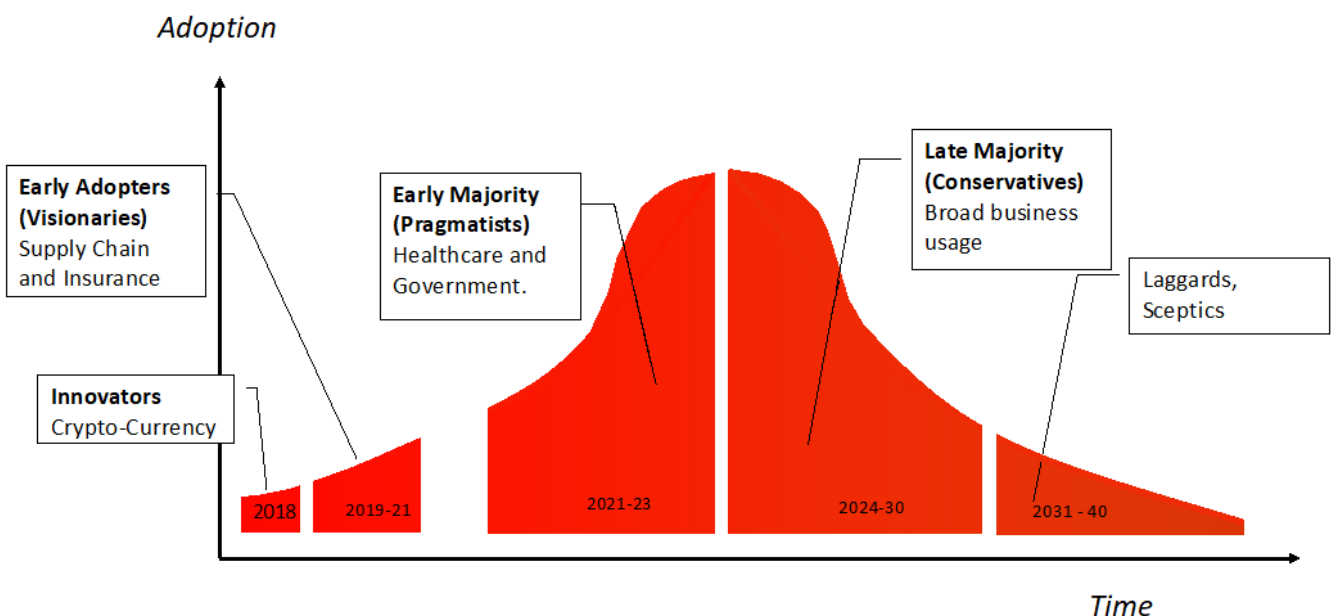


Figure 4 - Crossing the Chasm

From our research activities, we see little evidence or likelihood that specialist records management vendors will see much significant future growth in a Blockchain enabled RIM market. (See figure 5 below)

Though as we do see some ECM vendors already actively exploring their options, hence some will come to market early and have a chance of taking a decent share of the future market. But the clear winners over the next 5 to 10 years will be the cloud storage providers, primarily Microsoft, Amazon and Google who will do so by adding (bundling) DLT functionality into their existing platform services. This melds with a major shift to moving files away from on premises storage systems to the cloud and in many instances essentially building next generation (ECM 2.0) systems on cloud-based platforms such as Amazon AWS. In addition to file management, such platforms also provide database, machine learning and, in the next year or two, Blockchain services. For most major organisations in the public and private sector we expect this move to the cloud to only increase over time and, as the Blockchain capabilities will be a bundled element of the services, to become the dominant slice of the market.

Alongside the cloud service providers are specialist business application vendors like SAP and Oracle that provide back office functionality for running such activities as HR, Finance and Supply Chain are now building optional Blockchain functionality for the records generated and stored in their systems. They will take also take a slice of the market, as this again will simply be provided as a standard part of their services and products.

So all in all, don't expect to see the traditional record and document management technology providers race to address the opportunity of DLTs. Rather expect in the short term to work with developers to leverage DLTs independently and over time expect to see cloud platforms and major business applications to deliver DLT capabilities as standard functionality in their products and services.

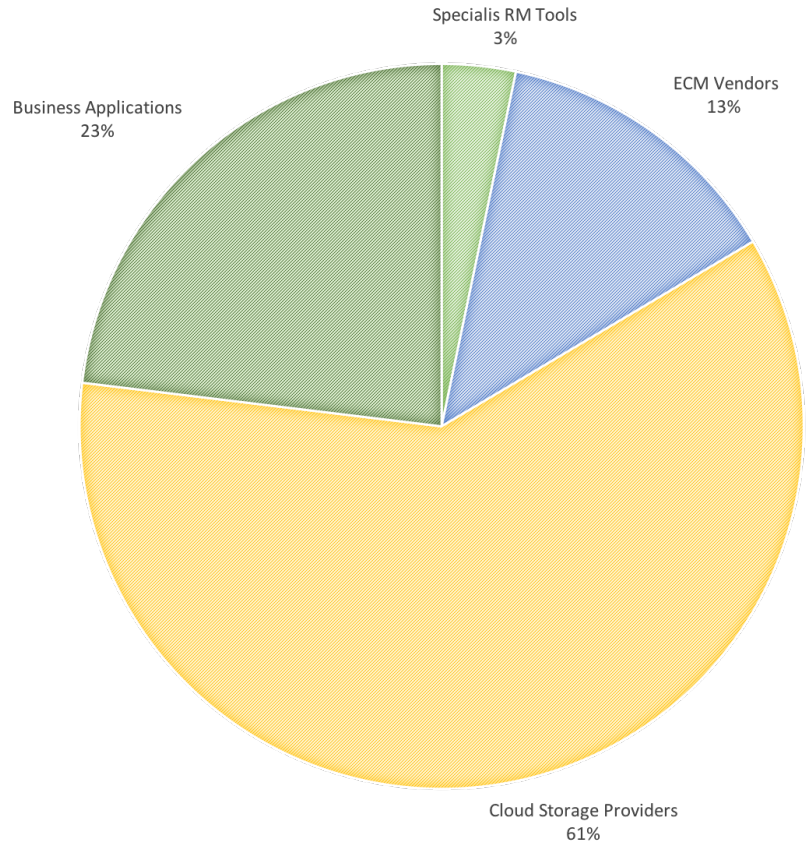


Figure 5 – Estimated DLT for RIM Market Share by 2025



Our Advice

- Organisations that are looking at DLT as a potential solution to records management issues should exercise caution at the present time. There is currently no shortage of promises and ideas being presented to potential investors in the technology, but complete working systems are currently thin on the ground. The most promising RIM projects that have incorporated DLT at this moment in time are still in development or proof of concept phases.
- DLT should also not be seen as an alternative to current electronic RIM practices. Again, the most promising DLT projects are all building on top of existing RIM practices rather than entirely replacing them. Fundamentally, DLT is unlikely to offer any tangible benefits if the underlying data is poorly managed. A government would be unable to implement an audit ledger in the same way as Estonia, for example, without first ensuring all government departments were storing citizens' personal data in a single, central repository.
- For this reason, organisations interested in implementing DLT might be best to focus on ensuring their current information management procedures are working effectively. By improving working practices in this area now, organisations can ensure they are best-placed to implement this technology when it has developed and matured in the future. However, it should be noted that, regardless of current interest in DLT, there may come a time where information professionals have no choice but to use it in some form.
- Public demand is worth considering too, DLT has been seen as one means by which corporate and government control over personal data is limited, by relying on a distributed network to keep them honest. Looking further into the future, there are concepts around the use of DLTs as a new form of identity management online. Would your organisation trust DLTs using Smart Contracts to validate the identity of your customers, or in the example of Europe, of someone making a subject access request?
- It's also important to recognise that DLT is an evolving technology. As protocols evolve and develop we may see much more compelling technologies and use-cases - in the future, it may be too good not to use. For now, the technology represents an interesting opportunity for Records and Information Management, but will require careful evaluation and compelling use-cases before organisations consider implementation.

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About the authors:

Alan Pelz-Sharpe

Alan has over 25 years of experience in the IT industry, working with a wide variety of end-user organizations like FedEx, The Mayo Clinic & Allstate and vendors from Oracle and IBM to start-ups around the world.

Rob Begley

Rob has worked in Information and Records Management (IRM) for nearly 10 years in both the public and private sectors. He recently completed a Post Graduate Master's Degree in Information and Records Management at Northumbria University where his dissertation focused on the current level of knowledge on, and potential impact of, Blockchain technology on IRM.

Jon Bushell

Jon has worked in information management and information technology roles over the last 10 years, and completed an MA in Archives and Records Management at University College London in 2013. He is interested in the opportunities and risks that new technologies bring to the management of records and born-digital archives, both in the present and the future.

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About Deep Analysis



Deep Analysis

Deep Analysis is an advisory firm that helps organizations understand and address the challenges of innovative and disruptive technologies in the enterprise software marketplace.

Led by Alan Pelz-Sharpe, the firm focuses on Information Management and the business application of Cloud, Artificial Intelligence, and Blockchain.

Deep Analysis works with technology vendors to improve their understanding and provide actionable guidance on current and future market opportunities.

Yet, unlike traditional analyst firms, Deep Analysis takes a buyer-centric approach to its research. Understanding real-world buyer and market needs versus the 'echo chamber' of the technology industry.

Boston & Bangalore

Website: www.Deep-Analysis.net

Contact: info@deep-analysis.net

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