REGTECH- A NECESSARY TOOL TO KEEP UP WITH COMPLIANCE AND REGULATORY CHANGES?

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Abstract: The discussion about the need for regulation got fuelled after the latest 2008 Global Financial Crisis, with many demanding stricter policies to avoid history from repeating itself. These voices have been partly answered, as a plethora of new policies, regulations and standards has been implemented since then. Drafted under good intentions, these new rules have also shown to have detrimental consequences. Exclusion of potential customers and high barriers of entry are only the side-effects of the rapidly rising costs of compliance that the large set of new regulations have brought upon businesses. RegTechs, a new category of innovations that were before classified as part of FinTech, are tools of the future for complying with regulations. This article describes the past, current and future developments of RegTechs, present some real-life cases of current RegTech companies, and discusses their place in a world of ever-changing rules and policies.

Keywords: RegTech, FinTech, regulation, compliance, Global Financial Crisis, internal auditing, accounting, tax regulation, GDPR, reporting

Introduction

Since the Global Financial Crisis 2008 the financial regulations and regulatory changes have increased to almost unmanageable heights. According to Thomson Reuters (2019) a regulatory alert is issued every 7 minutes. The cost of compliance after the crisis has increased by 60 % (Deloitte 2017a) for retail and corporate banks, and the pressure to obtain regulatory effectiveness and compliance, is very high. Today 15-20 % of the total business costs consist of costs for compliance, risk and governance (Thomson Reuters, 2017). It's not just the large amounts of regulations that have become overwhelming but also the complexity of them. (Deloitte, 2017a). Basel III, GDPR, PSD2, MiFID II, BCBS 239 are just some of the new regulations, which have emerged after the crisis. Regulatory changes are poised to increase in the near future, due to the ongoing technological development of the financial sector. Hence, the rapid development of the financial industry combined with growth of the regulatory and compliance burden, creates a demand for new solutions. Technology is affecting the financial industry and how companies operate, by creating new solutions, increasing effectivity and bringing change to how we comply and deal with regulations (Thomson Reuters, 2017). Are RegTechs the answer to the problem and if, what kind of solutions do they offer?

Regulatory Technology or RegTech are technological solutions for compliance and regulation, to improve regulatory processes. It has been present already from the late 1960's, but in a different form than after the Global Financial Crisis. (Arner, Barberis and Buckley, 2017b). Today RegTech has spread all over, and new solutions are frequently presented. It has

been recognized as a sector with a lot of potential. By 2020 Regtechs are going to represent 34 % of all regulatory spending (KPMG, 2018). Despite all possibilities the sector offers, there are a lot of challenges to be addressed, like for instance operational risk especially in handling risk data and a regulatory environment that doesn't suit the technological environment we have today (Baxter, 2018; Arner et.al 2017a; 2017b; Kavassalis, 2018).

In this article we look at RegTechs and how they can be a solution for the compliance and regulatory burden, especially in the field of accounting, internal auditing and tax regulation. We try to give a broad overview of the subject, present practical solutions, and look at the potential opportunities and threats. Specifically we examine hands on company solutions offering auditing-, tax regulation- and GDPR compliance solutions. Further we present on-going research and discuss the criticism that surrounds the subject. Existing research so far has mainly focused on the financial sector and look at RegTechs from a legal perspective. (Arner et.al 2017b; Kavuri and Milne, 2018; Micheler and Whaleys, 2018) Furthermore, existing research has also investigated the potential of RegTechs and what needs to change in order to reach the full potential (Arner et.al. 2017b: Yang and Li 2018; Baxter 2018; Kassavallis 2018). This will provide value to practitioners, professionals, researchers and students that are new to the subject, and give them an overview, general knowledge and practical implications.

RegTech- what is it and where does it come from?

Regulatory Technology or RegTech are technological solutions, mainly using information technology for compliance and regulation, to improve regulatory processes. RegTechs aim to help with new and old regulations and manual reporting. Further they deal with risk assessment and management, identity management and control, transaction monitoring, data structuring and fraud prevention like anti money-laundering. (Deloitte 2017; Arner, barberis and Buckley 2017a; 2017b; Yang and Li 2018). When dealing with different regulations the core data, processes and governance are similar, which pinpoints the largest possible benefit of RegTech, namely working in a multi-regulatory environment avoiding duplication of work and increasing efficiency. (Nicoletti, 2017, p.205). However, the sector isn't really there yet, today most of the RegTech companies focus on specific regulatory challenges, offering solutions for manual reporting and compliance (Arner et.al, 2017a; Deloitte, 2017b).

Possible benefits of RegTechs are lower cost, effective and efficient compliance, accurate information and real time data, flexibility, easy reporting, security and analytics (Hill, 2018). Moreover, they can create business insight and new products and services. RegTechs utilize several upcoming technological advancements, especially with regards to data, like cloud computing, blockchain, machine learning, big data, data mining and analytics just to mention a few (Deloitte 2017b). The selected technological solution is dependent on the problem they are trying to solve, much like fintechs.

Financial technology or FinTech is the use of technology to create new financial solutions (Arner et.al, 2017b). According to Nicoletti (2017) RegTech is a part of Fintech (FinTechs little brother) that deals with regulations. This view is also shared with others like Hill (2018); Baxter (2016): Deloitte (2017b) and Anagnostopoulos (2018). On the other hand, Arner et.al (2017), Nicoletti (2018) and Yang and Li (2018) believe that although RegTech has roots in Fintech it should be considered as an independent sector, because it provides services for different groups not only the financial sector and has other recipients. Fintechs started from the start-up sector and are changing the financial industry with new technological solutions and forcing large financial institutions to change. In contrast RegTechs current aim aren't to change the industry but to help large institutions and others to deal with their regulatory burden and

compliance. (Hill, 2018, p.312). Hence, the FinTech movement is bottom- up and RegTech top-down (Arner et.al 2017b).

RegTech has been categorized in three phases: RegTech 1.0, RegTech 2.0 and RegTech 3.0. (Arner et al. 2017b: KPMG 2018). RegTech 1.0 refers to the time before 2008 beginning already in the late 1960´s, and refers to technological solutions focusing on internal risk-management and monitoring. This initial development was driven by large financial institutions for their own internal processes, governance and control. The second stage: RegTech 2.0 is where we are today, sparked by The Global Financial Crisis and the regulatory burden and increased costs and complexity that followed. These technological solutions are mainly driven by financial market participants and regulators to address the problems of compliance, reporting and processes. In this phase more data is available and the environment is being more and more digitized, offering possibilities for new regulatory technological solutions. The last phase RegTech 3.0, is predicted to use technology as a tool and rethinking the regulatory environment and framework. Regulators, technology and companies working together and addressing regulation, monitoring and reporting in real time using the same technology and data. In this future phase Know Your Customer (KYC) will develop into Know Your Data (Arner et.al 2017a; 2017b).

Regulations are dependent on the political economy, which operate under constant uncertainty. This uncertainty of what regulators are going to do next create "problems" for companies and makes it hard to deliberate when change occurs and the outlook of it. (Hill, 2018). The financial market, services and institutions are more than ever before formed by the rapid regulatory changes and the new financial environment, which demands a need for regulatory technology to cope with the change (Arner et.al 2017a).

Table 1 Summary of RegTech- what is it and where does it come from? (Soure: Authors)

Definition	Areas	Technology (examples)	Characteristics
Technological solutions, mainly using information technology for compliance and regulation, to improve regulatory processes.	- Risk assessment - Compliance - Reporting - Auditing - Identity management and control - Transaction monitoring - Data screening - Fraud prevention	- Artificial intelligence - Block chain - Cloud computing - Machine learning - Big data - Data mining and analytics The selected technological solution depends on the problem.	- Roots in FinTech but should be seen as an independent sector - Provides services for different regulation intensive industries not only the Financial sector - Started by large institutions to deal with the regulatory burden and compliance - Top-down development
The different phases of RegTech			

RegTech 1.0	RegTech 2.0	RegTech 3.0
- Period from 1960-2008 - Focused mainly on internal risk management and monitoring - Driven by large institutions	- Started after the Global Financial Crisis and is the phase we are in today - Mainly driven by the Financial market - Focused on solutions for compliance, reporting and processes with the new technology available	- The future - Technology as a tool - Rethinking the regulatory environment - All sectors working together - From Know Your Customer to Know Your Data

Current development and potential future

The players on the RegTech market offers solutions for the financial industry but not only, they also focus on other regulation intensive industries and solutions, like for example personal data and the GDPR regulation (Hill, 2018). Most of the companies are still in the start-up phase and the main part of them are at the most three years old. Even though the biggest potential of RegTech, is combining several areas and problems into one (Arner et.al 2017b) the companies at this stage mainly focus one a specific problem. (Deloitte 2017b). It isn't just the new companies that are forming RegTech, as stated above everything started from in-house development and this is still present today. Companies try to find their own solutions or companies cooperate with, to not be left behind (Thomson Reuters, 2018).

Deloitte (2019) has collected a group of RegTech companies on the market right now, they include a total of 289 companies, with the biggest group being in compliance, followed by identity management & control, risk management, regulatory reporting and transaction monitoring. The geographical distribution is relatively wide, but the most part of the companies can be found in Europe (Deloitte, 2017b; 2019). Currently the RegTech sector is fast growing and it's estimated to make up for 34 % of all regulatory spending 2020 (KPMG 2018). 2017 Deloitte (2017b) had only listed 80 RegTech companies, which show the same pattern of growth.

To be able to see the actual development amongst companies, we have looked at Thomson Reuters survey report (2019), which included 400 financial service firms. According to the survey, 21 % of the companies think that RegTech most likely impact the compliance at their company followed by on-boarding and KYC. 2017 the answers were completely different, with the main impact being interpretation an impact of regulations and implementation of regulatory changes. A total of 22% of the companies 2017 were developing inside RegTech solutions compared to only 6 % in 2018, and the same pattern can be found in the use of external sources, with 26 % in 2017 and 13 % in 2018. This is an interesting pattern, because intuitively looking at the regulatory environment and the development of the market, it would be expected to have had increased. Although, the companies using a mix and max strategy for RegTech solutions increased from 2017 to 2018 with 7 %. Another interesting remark from the survey was that the companies that reported to have i implemented a RegTech solution decreased with 21 %. On the contrary the ones that hadn't yet implemented any solution but considered to do so increased by 18 % during the same period. Thomson Reuters (2019; 2018) offers an explanation to the interesting results. In order for a new RegTech system to really work many parts need to be in place, otherwise the risk becomes too high. When developing and going into these new solutions not only the compliance and risk functions need to be addressed but also

maintain good outcomes for the customers. (Thomson Reuters 2018; 2019) It could be that we need time, research, development and testing to ensure that all parts are in place, before we are at a point were companies really can embrace all that RegTechs have to offer.

Data and information, is the key in technology driven regulation. The tools for effective data collection and monitoring, need to be in place in order to get the full potential of RegTechs. (Baxter, 2018; Arner et.al 2017a; 2017b; Deloitte 2017b). The traditional regulatory environment especially financial regulations does not match the current financial market and players, and is in need of change to support the technological development to deal with risk and compliance (Yang and Li, 2018). Baxter (2016) recognizes the same pattern that the financial regulations needs to be thought through in order to work together and achieve better regulatory environment with effective compliance, transparency, efficiency and fairness. (Baxter, 2018). Arner et.al (2017a), believe that RegTechs in the future will be able to offer almost real-time applicable regulatory tools, which identify and deal with risk and at the same time offer efficient compliance. Despite all potential companies when dealing with RegTech solutions are going to face operational risk especially in handling risk data (Kavassalis, 2018).

The current and future challenge for companies when it comes to RegTech is to find solutions that create value and work in the long-run. It is important for the industry to realize what change and solutions RegTech may bring to the table, so that they can grow and develop together and not separately. Investing in these solutions are also important to stay in the game, the big chance is coming and it's important to realize it and act before it's too late. (Deloitte, 2017b).

Table 2 Current development and potential future summary (Source: Authors)

Company characteristics	Development	Potential future
- Companies are still in the start-up phase - Main part of the companies are at most 3 years old - Focus on one single problem - In-house development still present - Most companies are in compliance, identity management & control and risk management - Relatively wide geographical distribution but focused on Europe - The sector is fast growing but only a part of the companies already available has the same growth pattern	- The companies that haven't yet implemented any RegTech solution are the most optimistic - The survey show that a mix and match strategy (in-house/external) seems to work the best right now - The results show that it may be harder to implement successful RegTech solutions than initially thought	- Estimated to make up for 34 % of all regulatory spending - Data and information are key factors for technology driven regulation - The traditional regulatory environment does not match the current financial sector and technological development - Potential to offer real-time applicable regulatory tools - Challenge to find solutions that work in the long-run - Important to invest in these solutions to stay in the game

Cases

The aim of the following case-study is to display real-life applications of Regulation Technologies. The selected case companies, display and solve clear and understandable problems. Moreover, these companies offer regulatory compliance solutions for audit and assurance purposes. The first company offers a solution that complies with GDPR and detects unstructured personal information. The second company, uses a software solution, which allows direct determination of tax effects of an investment, without further calculations. The third company, gives an artificial intelligence powered solution for auditing and internal audit. Information about firms and their products have gathered from companies' websites, news articles, magazine articles, and academic papers.

Aigine- GDR compliance

The General Data Protection Regulation GDPR aims to protect personal information of individuals (Burgess, 2019). The new regulation affect companies, and potentially force them to hire additional staff to be able to comply with GDPR accordingly (Burgess, 2019). Burgess (2019), claims that GDPR has already renewed the way firms handle personal data, and personal data issues will and has become a boardroom issue. Aigine offers a solution that might reduce the need for new staff hired for GDPR compliance purposes.

Aigine offers a tool to make complying with the European Data Protection Law GDPR more time efficient. The main change brought by the GDPR, applied to personal data and especially unstructured data sources, which were unregulated in many countries until the new regulation. Whereas from the 25th of May 2018 both structured and unstructured personal data have to be reviewed if it contains personal data or not (Aigine, 2019). Aigine helps in the review process by making it easier to detect personal data in these unstructured documents, like for instance emails and notes in word documents (Lindström, 2018).

Aigine (2019) claim that: "We have invented collaborative cognitive learning, making it possible for you to use our Artificial Intelligence to handle the challenge of unstructured personal data." It means that Aigine's competitive edge is to detect personal data from sources that are unstructured and therefore time-consuming to review entirely manually.

The actual process of using Aigine is divided into four stages, filtering, highlighting, assessing, and documenting. In the filtering stage, Aigine scans all documents in the company and separates documents that contain personal data. After that, documents that contain personal data will be forwarded to the responsible person in the organisation. The responsible person does then manually the actual review. When reviewing documents, Aigine highlights all suspected personal information making the actual review more comfortable and more time efficient. In the assessment stage, Aigine uses artificial intelligence to suggest and to help to determine legal grounds for saving personal information. By doing that Aigine makes it possible to assess documents and legal grounds for saving personal information without legal expertise. In the documentation stage, Aigine documents legal grounds for saving personal information in the document. These four stages are presented on the home page of Aigine (2019).

In Sweden, several municipalities have started together a project to use Aigine to comply with GDPR. Peter Mankesiöld (2018), project leader of municipality association Sambruk, highlights that it is essential that the machine does not decide whether there exist legal grounds for saving personal information or not. As an example, he takes up a license plate number of a car owned by a company. If the car can be attached to an employee, it may be personal information although the firm legally owns the car. According to Mankeskiöld (2018), it is vital that human makes decisions about personal information because human understand better

how different circumstances may affect the decision. Mankeskiöld's (2018) concern is understandable, but at the same time, Aigine have also been criticised about the number of human hours needed when using Aigine (Hedqvist, & Månsson, 2018).

Hedqvist, & Månsson (2018) made a case study of challenges and opportunities an Aigine type of software may include. The research question of the study is "What are the challenges and opportunities with using cognitive computing for mapping personal data in order to help comply with the GDPR?" (Hedqvist, & Månsson, 2018, p.4). Authors identified four opportunities cognitive computing may offer. Authors see as an opportunity that cognitive computing can understand both structured and unstructured data. Likewise, the ability of cognitive computing to learn to identify personal data is seen as an opportunity by authors. They see also continuous learning by cognitive computing as an opportunity because it improves the accuracy over time. Authors argue that all these opportunities may lead to increased efficiency which means cost savings. These opportunities are apparent and may lead to substantial resource savings. The fact that the detecting accuracy of personal information evolves due to Artificial intelligence under time the software is used, may end up to the almost as precise detecting accuracy as a human can do. The challenge is that during the period when Aigine learns to detect the right information the actual compliance may be insufficient. Therefore companies ought to weight the risks that are related to insufficient compliance due to deficient detecting of personal information when taking Aigine in use.

Hedqvist, & Månsson (2018) identified four main challenges with using cognitive computing for GDPR compliance purposes. According to authors one of the biggest challenges is that cognitive computing requires human work to learn to detect personal data and to become competent enough. They think that it is also challenging to make accuracy as good as in work made by a human. If the goal is to make accuracy as good as a human is capable, it would require a massive amount of human work to teach cognitive computing to detect the right information (Hedqvist, & Månsson, 2018). Additionally, cognitive computing needs a relatively large quantity of data to be able to learn to detect the right personal data (Hedqvist, & Månsson, 2018).

Based on the criticism of Hedqvist, & Månsson (2018) it seems that the preparation and teaching are vital to begin before the actual use of Aigine. A client company should also have enough data to be able to teach Aigine which is the personal data in the context of the client company. The lack of data could limit the number of potential user companies in a way that companies who do not have stored the data and recently founded companies may not be able to use the Aigine. Potentially, Aigine learns in the future to categorise different contexts using Artificial Intelligence and thereby reduce the amount of training data needed from the client company's side.

Apiax- Tax Product

Apiax is a RegTech company that offers advanced tools for compliance of financial regulations. The goal is to make compliance of regulations lean and efficient (Apiax, 2019). Ralf Huber (2018), Legal Lead and Co-Founder of Apiax, describes the possibilities of the Tax Product as "Financial institutions can finally make use of tax calculations in their advisory processes. This is the missing piece in the puzzle of value-added, personalised investment advice."

The digital Tax Product allows financial advisors to focus more on tax-adjusted returns instead of only focusing on cost-adjusted returns (Shäubli, 2018). According to Huber (2018), the complexity of tax effects have been the issue why financial service providers do not have focused on tax-adjusted returns, but Reg Tech solutions are now capable to handle that complexity and solve the problem. In practice, it means that it will be possible to estimate the

tax effects of an investment directly for example in the meeting of the executive board or an advisory meeting with a client.

Software as Apiax- Tax Product may have a significant impact on the tax advisory industry by making the advisory process much more efficient. Responsibility and credibility issues have to be taken into consideration when a tax advisor is a machine. Andreas Straessle (2018), regulatory engineer of Apiax, says that user can change rules in Apiax to adapt these rules to users desire to take risk. When traditional tax advisors suggest some alternatives, they are often responsible for their suggestions at the reputation level. That type of risk of losing reputation does not exist when interacting with software. Human tax advisors may also tell about tax risks and experiences about similar cases especially when actions are questionable and include a high level of tax risks. Actions that include a substantial amount of tax risk may also be hard to take without knowing previous experiences of other clients. That part of human interaction and its possibilities in tax advising have to be taken into consideration. Apiax type of software may lead to changing demand for tax advisories. The demand for human tax advisors may shift from basic tax issues towards issues that need expertise and experience of difficult and high tax risk transactions. Apiax type of software is going to make tax advisory process much more efficient. However, it may take time until people start to use this type of software and to trust the software's advises.

Mindbridge - AI Auditor

Mindbridge Ai is a company that offers the first and only AI-powered auditing solution in the world (MindBridge, 2018). Mindbridge Ai auditor uses machine learning and AI techniques to make the auditing process more effortless and efficient (MindBridge, 2018). They offer digital solutions for companies in audit and assurance and internal audit purposes. They have customised product also for companies that offer financial services. Following chapters focus on the internal audit as well as audit and assurance.

The big thing of Ai Auditor is that it analyses the whole dataset of transactions of the company and the analysing time is in minutes. By doing so, the auditor does not have to spend the time to think about the right size of data sample for the actual audit review which is the case in the traditional audit process. When all data has analysed the detection of fraud and mistakes is more accurate and credible. Fathi (2018), CEO of MindBridge, writes how artificial intelligence may help the U.K.'s audit system at the time of major corporate scandals. He argues that by reviewing all company data with AI-powered technology leads to a significant increase in audit quality. Fathi (2018) also offers a solution for mistrust in audit "AI is uniquely poised to fix many of the symptoms of mistrust in audit… As AI eliminates human bias from all stages of data analysis, identifying anomalies according to accepted audit standards and going beyond to spot risks that have never been conceived by a human brain, the technology will help firms of all sizes increase their audit quality and risk assurance, while decreasing engagement times."

AI Auditor also offers many possibilities for internal audit. The detection of fraud or internal policy violations is much faster and easier. Even though internal and external audit processes will become more efficient and of better quality, it may not lead to substantial monetary savings. Reason for that is the current price level of AI Auditor service.

The price of AI Auditor Software is from £4200 to £30000 per year (The Digital Marketplace, 2018). The price of one run of audit material or a case file analysis is £4200 (The Digital Marketplace, 2018). In that case, the results are available for analysis a one year. Instead, for unlimited engagements or case files for one year the user have to pay £120 000 per department (The Digital Marketplace, 2018). From the perspective of small and medium-size companies, the total costs of auditing may become too high with the current price level.

Although, the maximum amount per company for unlimited use of AI auditor is £300000. It means that for bigger companies it may lead to savings over the maximum price if Ai Auditor manages to replace human work in for example internal audit process and thus lead to savings in personnel costs.

Table 3 Case summary (Source: authors)

Company	Solution	Benefits	Limitations
Aigine GDPR compliance	Makes it easier and more effective to detect unstructured personal information to comply with GDPR	- Reduces the human contribution - The review can be done without a lawyer	- Companies need to "teach" cognitive computing with their own data - It takes time for a client to get started with the product
Apiax Tax product	Allows to focus on tax adjusted returns internationally without knowing national tax laws and regulations	- Financial institutions can use tax adjusted returns in their advisory process - The price of tax consultancy may fall	- Responsibility issues in case of judicial proceeding
Mindbridge AI-auditor	AI-powered solution for audit and internal audit, which allows the company to analyse their whole dataset in minutes	- The quality of audit increases substantially - Reduces the human contribution	- Relatively high price

Ongoing research

The last financial crisis opened our eyes for the deficiency of the regulation and supervision of the financial system. As we know the amount of regulations financial institutions need to comply with has rapidly expanded in later years. The whole incubation of RegtTech seems to have been carried on by the financial sector and the primal cause has been to keep the costs reasonable (Arner et al. 2017b). The main part of the research on RegTech address the subject from a legal perspective. Moreover, the research is generally associated and discussed together with Fintech. As a consequence of the fact that RegTech is a quite young term the roots of RegTech are said to go back to the 1960´s. RegTech has experienced rapid evolution and today the research in the field is quite initiatory. Nowadays the research considers the later effects of RegTech on your business environment (Butler et al. 2018).

Even if we can find some literature on RegTech the research is for the most part from a law point of view. In their recent working paper by Kavuri & Milne (2019), they state that there is lots of work and research to be done in the area of Fintech and RegTech prior to making it an established academic discipline. The target of the paper is to offer cohesive future research themes based on group meetings with policymakers and academics and a critical assessment of the existing literature. Kavuri & Milne state that there is an opportunity for interdisciplinary approach that include law or other disciplines to analyse the implications of RegTech The

authors also outline seven research gaps existing today that they see as important to make the area of Fintech and RegTech become an established academic discipline. Two of the key areas of research the authors named are closely associated with RegTech; "the relationship between the new financial technologies and financial regulation" and "identity, security, data privacy and their regulation in financial services". The later has according to the authors almost no existing research. It's important to notice that the paper from Kavuri & Milne is written from a more Fintech point of view and there is differing opinion on how much linked Fintech and RegTech actually are.

Packin et al. (2018) wrote an article under the topic *"RegTech, Compliance and Technology Judgement Rule"*. The authors focus on regulatory compliance in the financial industry. The authors revise the supposition that RegTech will be able to improve the regulatory compliance in the financial industry, which they define as the use of technological solutions to facilitate compliance with and monitor regulatory requirements. The authors express concerns against the adoption of RegTech and argue that it's not a panacea for all corporate governance challenges. The article points out some considerable risks and challenges of RegTech solutions such as; high costs, barriers to the adoption and development of RegTech systems, RegTech questionable impact on risk management and corporate procedures of financial companies, the problematic side-effects of no longer having a human directly working with tasks that RegTech does cheaper and faster, and the phenomenon of anti-RegTech. Many of the problems that the authors point out are in connection with the assumption that the human is capable of thinking ethical while a computer only does what it's programmed to do.

Another article approaching the theme from a law point of view is Micheler & Whaleys "Regulatory Technology" (2018). The article emphasizes that a learning period will be experienced when we learn about the limitations of technology. Regulated entities may not have knowledge of software development and this will probably be an opportunity for new service providers in the financial market. For the moment there is a small group of companies keeping the leading positions in data analysis and they are probably also interested in having a share of the emerging market. Lastly it's important to remember that technology is neutral, it reflects the preferences of those who develop it.

As a different angle of approach there is Treleaven and Batrinca (2017) which is a discussion contributed by two computer scientists. The authors present the concept of algorithmic regulation modelled on the algorithmic trading paradigm. They also bring up employing technology under development for blockchain distributed ledgers and smart contracts. Lastly the authors state that blockchain smart contract technology will have a more considerable disrupting impact on legal services than Fintech is having on financial services.

Gurung & Perlman (2018) investigate the evolution of RegTech from a global view and especially how central banks in developing countries are contemplating the use of RegTech. The authors present evidence from India, Mexico, Nigeria and the Philippines. Differing from the developed countries the driving force behind RegTech has not been the interest to cut compliance costs. In the developing countries tracks increase the responsibilities of central banks to keep up with new technological developments like DFS and the evolving characteristics of market participants. In the developing countries the new technology has been very useful for improving their existing systems and providing them with new tools to use in supervision. The authors see RegTech as a possible tool for the central banks to achieve financial stability, safety, integrity and inclusion objectives. There are also possible challenges for the central banks connected to the implementation of RegTech products. The financial, social and political situations in the developing countries can pose unique and distinct challenges for the central banks in the process of implementing RegTech.

Panisi & Perrone (2018) lead off by stating that RegTech does reduce information asymmetries and the costs related to them. RegTech allows financial institutions to comply

with regulation and regulatory authorities to improve their possibilities to deterrence. Most important the authors also present important RegTech perils of the financial system mentioning risks related to the vulnerability of technology and automation biases that harm the personal responsibility and decision-making effectiveness. Further RegTech increase imbalance in resource allocation between the financial institutions and supervisory authorities. Considering the issues mentioned above the authors' state that the most effective cure is investing in the "human factor" by re-establishing the balance between technology and humans. It's important to contain the perils RegTech for the good of the financial system by subjecting the supervisory processes to reliable safeguards against technological problems and preserving human judgement and personal responsibility in decision-making

Challenges with RegTech adoption

The benefits and possibilities that new technological advancements bring us are almost limitless and certainly beyond our wildest imagination. But we need to tread carefully as we approach the future through new technology. For all their benefits, with new innovations and opportunities comes also new threats and perils. This is especially true for regulatory technology. If we start to replace the human regulator with machines, the possible repercussions for technological failures can be severe.

Algorithms and machines are neither malevolent nor benevolent. They are almost like traditional tools that needs our hands to be of purpose, but they don't need our continuous presence and effort to function. Instead, we can tell them what to do and they will obediently do our bidding. Only thing is that they don't understand our language, we need to translate it in order for them to understand us. This translation is challenging, as the subjective understanding of rules and risks are codified into rule-bound controls that are believed to satisfy regulatory mandates (Bamberger 2010).

The complex and intricate nuances of the real world is hard to fit into the binary mind of the computer. In the words of Friedmann & Nissebaum, programming often requires to "quantify the qualitative, discretize the continuous, or formalize the informal". To do this properly and in a way free from bias is a challenging task, even with the best of intentions.

The weaknesses of regulatory technology are not only limited to the algorithms and the code itself. RegTechs rely on the data fed to them. While humans certainly make mistakes by leaning on insufficient data and false premises, we possess an ability to understand the nature of the information we use for our decisions and have the chance to be critical towards it. But for the machine, the data we feed it is all there is. A computer can't understand that the data it's working with is faulty, even in cases when it would be obvious to us humans. This might change in the future as we get closer to achieving general artificial intelligence, but for now the responsibility of providing the algorithms with correct data falls on our shoulders (Goertzel and Pennachin, 2007).

With all these different pitfalls, mistakes are bound to happen as we adopt regulatory technology. But even more so than with faulty data, when a mistake happens, we usually recognize it instantly and start to rectify it, leading to isolated mistakes that can provide a valuable learning experience. Computers and algorithms on the other hand with their blind obedience can't understand when they are wrong. Unless we humans as the monitors can recognize that the machine is mistaken, it will continue its faulty path, allowing for systematic failures and biases. The intricate mechanisms of the code and its processes can be obscure and is beyond understanding for most of us, making detection of these systematic biases harder (Bamberger 2010). If we fail to detect these faults in time and allow for build-up, the consequences can be harsh. This has already been the case in many risk management systems

that were thought to take everything into account, as was the case with the latest 2008 financial crisis or the fall of LTCM in 1998.

Many of the challenges we face in today's embracement of RegTechs will ease as technology and AI improves. But there is one question that is harder to solve and few will be the answers provided for it by technological advancements. When these mistakes happen, who will we blame? Accountability will be a central question as machines start taking over. The answers won't be as straightforward as cases like drunk driving or armed robberies where the (ab) user of a tool is the obvious culprit. Yet we can't allow the algorithms to completely rid us off our responsibilities. Kroll et al. (2016) emphasizes the importance of policy adoption, as the current tools were primarily designed for human decision makers. Collaboration between legislators, auditors, risk-managers and coders is paramount for a successful adoption of regulatory technology. Many are the opportunities provided, but for us to truly grab them, the warnings associated with them should not fall to deaf ears.

Tabell 4 Challenges summary (Source: Authors)

Challenge	Problem	Risks
Accountability	Who is accountable when mistakes are made by the machine	Unnecessary risk taking and indifference due to easy avoidance of responsibility
Translation from rule to code	Rules and laws are originally written for humans rather than computers	Wrong interpretation by the machine leading to faulty output
Automation bias	Machines can't understand when they are wrong and mistakes will be repeated until humans notice	Build-up of mistakes resulting in critical system failures
Binary mind of computers	Context based judgement is challenging to achieve due to on/off machine mind-set	Sub-optimal outcomes due to machine prioritizing wrong parameters

Conclusions & future outlook

To address the present and future situation of RegTechs, we have looked at recent developments in the industry and presented some real-life cases of the companies behind today's regulatory technology. By many standards RegTechs are still a novel phenomenon with major developments still to come. New companies focusing on regulatory technology are popping up left and right. The potential benefits of reducing costs, adding security and lessening the amount of manual and arguably boring work tasks is tempting. Yet the industry is shaped like few others, with the volatile political landscape partly dictating the pace from top-down. As we enter the era of RegTech 3.0 and businesses start to move from knowing their customers to knowing their data, both practical and ethical questions need to be answered. Current research focuses on understanding the long-term effects for the business environment companies operate in (Butler et al. 2018), while future research may have a more data-centric approach (Arner et al. 2017).

Before the technological advances reaches the point where regulatory technology can be applied with minimal effort to a broad network of rules and policies, the regulators need to acknowledge the existence and possibilities of RegTechs when preparing new regulations. This is important not only for the benefit of constructing sound policies, but also to incentivize the development of the RegTechs. Currently most RegTechs tackle specific problems and policies and sudden changes in the rules can quickly erode the long-term value of a new software that took considerable time and effort to develop. The steep price tag of some of the products offered by our case companies is partially a result of the high costs associated with the development of RegTech software. Co-operation and mutual understanding between the authorities and companies will not only protect work from going to waste, but also encourage the creation and innovation of new and better solutions (Kroll et al 2017).

RegTechs were born out of the financial industry with costs as the main driver, but they are already adapting ways beyond just reduced expenditures. The dynamical interaction between policy makers, companies and coders will ultimately decide the future of RegTechs, but with the rising costs of compliance and major advances in fields critical for regulatory technology like big data, blockchain and AI, RegTechs are here to stay. With proper care and sensible decision making, RegTechs can provide a future with more transparency, security, effectiveness and fairness.

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