How can new tools and technology such as artificial intelligence encourage new ways to communicate in the world of prudential regulation?

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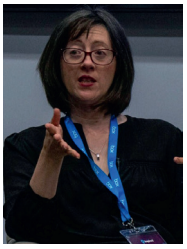

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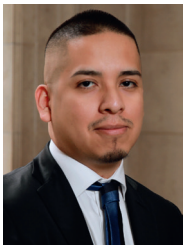

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Abstract This paper sets out how emerging technologies, such as artificial intelligence (AI), can enhance the supervisory efficiency of a modern regulator. The growth and complexity of data present both an opportunity and challenge for global regulators within the data-driven financial services landscape. The need to communicate and use data presents a skills evolution and optimisation for regulation and society. This paper includes a case study on how introducing an AI search and analysis tool has provided the Prudential Regulation Authority (PRA) at the Bank of England with a vast array of new and exciting insights.

KEYWORDS: artificial intelligence, digital skills, supervision, communication

INTRODUCTION

There are forces shaping the economy as the Bank of England noted in the Future of Finance report.[1] These forces are unearthing a new economy that is driven by changes in technology, demographics and the environment. 'Technology is changing how we work, spend and live. It has major implications for the UK's economy and, in turn, finance. Consumers are increasingly shopping online. Platforms connect businesses to consumers across the country and overseas. This is generating vast quantities of data that can be used to improve services, but this data also raises numerous hazards of misuse and abuse of privacy. We increasingly collaborate through the sharing economy. And the freelance and gig economy are growing in importance. Technology is enabling us to be ever more closely connected to the rest of the world through global trade and communications. New business models are disrupting industries — and allowing an unbundling of business models with profound consequences. Automation, including machine learning (ML), is taking on more tasks'.[2,3] The rise of new business models within financial services has seen competition for retail and SME consumers evolve on a regular basis, such as banking as a service firms 11:FS, 10x. The new entrants are leveraging the advancing technology, seemingly unlimited data growth levels and consumers' desire to communicate in new ways.

Technology is changing how we work, spend and live. The global levels of connectivity have led to historic changes to personal communication such as smart mobile phones, SMS, text-based search, social media, video collaboration, virtual reality, AI insights and, in the future, the metaverse. The evolution of personal channels through which to communicate is fast and also enabling a thirst for insight at the tips of our fingers.

This thirst for easy and efficient insights in our personal lives has also been reflected in workplaces. The workplace channels of communication and connectivity, however, have not matched the pace of change, and a continued high dependence on e-mail, written documents and spreadsheets has continued in a manual way. This high dependence is being challenged by advanced technologies and a more tech-enabled workforce.

The Bank of England, Prudential Regulation Authority (PRA), has seen the opportunity to utilise technology to find, analyse and visualise information in an ever-growing unstructured world becoming more urgent and important in the last few years. The PRA has started to explore how the use of AI can enable new ways to communicate across the organisation and in the longer term a more flexible, focused, dynamic and insightful workplace. For example, these new advances in technology have presented the PRA with

the opportunity to introduce AI tools such as cognitive search and a new digital skills framework to meet the changing financial services era. New technologies present benefits for individuals and the workplace, with new modern skills and a more efficient way to use data for insight-led activities. In addition, the introduction of emerging technologies is crucial in the evolution of the workforce as the digital era continues at pace.

TRADITIONAL COMMUNICATION AT HOME AND WORK

Communicating at home has evolved from a dependence on landlines to a significant drop in voice calls owing to the rise in video and text. The volume of letters we post is decreasing, but parcels we receive are increasing. At work, our way of communicating has evolved from feather quills to mainframes, to desktop and now integrated devices. The concept of communicating at home and work has traditionally focused on the telephone and the written word. These traditional forms of communication, however, have morphed and continue to morph into many forms of transmissions, which are faster and more efficient.

Current situation at home

Consumers' engagement with financial services products in new ways, often via smart devices, demonstrates that the relationship between technology and consumers is also changing in many ways at home as well as work. Over the last few years individuals at home have started to use tools driven by technologies such as Alexa, Google, DuckDuckGo as part of daily life, often without realising they are enabled by AI. For example 'text to voice' technologies such as Alexa use automatic speech recognition and more to instantly answer a question or play your favourite song. The insatiable need for instant deliveries, music and information has propelled AI to become more personalised and insightful in a short space of time.

These AI technologies are widely used, but in this paper the focus on their use as means of communication and the level of trust is an important interlinkage. The case study set out in this paper focuses on how technology can assist people in communicating, in both home and work. Search engines have been instrumental in the use of AI in the home and the growing reliance on these means the way we communicate and the trust in the answer are almost instant and complete acceptance.

Current situation typical workplace

Trust and data monetisation is an area of economic growth that consumers of data will see and businesses will benefit from. Gartner[4] defines data monetisation as 'the process of using data to obtain quantifiable economic benefit'. Internal or indirect methods include using data to make measurable business performance improvements and inform decisions. The ability to use data and analytics for insights and economic benefit is wide ranging, and therefore how and what we communicate is important at home and at work.

The communication channels and levels of trust in AI at the office are different from how they are at home with our smartphones, devices and smart televisions. The advance of technologies in the office has not evolved at such a pace as in our home lives. While communications tools such as Teams, Zoom and Slack have been revolutionary, especially in the pandemic, the dependence on traditional desktop tools (spreadsheets, documents, e-mail) such as Microsoft Office remains strong. Although, Microsoft Office has evolved considerably since the original launch in 1990 (The Windows Club),[5] with Microsoft 365 using AI power apps to collaborate in a more modern way (Microsoft),[6] the user skill needs to evolve too. The way we communicate at work is

changing, and the need to engage in more flexible, open, dynamic ways means there are growing demands to use and collaborate in new ways as the way of working becomes more global, interconnected and insight driven.

Communicating in the modern era

The rise of fast internet, social media and smart devices and the thirst for real-time knowledge are creating a constant need to communicate. Communicating at home now is often thought of as a transaction of a message, with a chatbot, e-mail, messages, videos and more. In the office, communicating is often undertaken in a meeting, which is often now virtual and includes a side bar of chat messages. The vast array of communication methods has also prompted the question of trust in the method and the information. This trust question of the information is an area the PRA is exploring with research on data ethics.

Communicating also means using data to explain, persuade, analyse and verify an idea, action or process. Data underpins office life, and the new way to communicate is using data to the advantage of the individual. The use of emerging technologies, such as artificial intelligence (AI), to communicate with others at work in an informed and succinct manner is a challenge that organisations need to address. Enabling individuals to use emerging technologies to communicate with other colleagues requires the confident use of emerging technologies and a modern digital skill set.

The rise of ML in financial services

The world is becoming more interconnected in many ways, particularly through individual and consumer behaviour. Within financial services the appetite from consumers and financial services firms is a desire to connect, work, consume and communicate globally. Consumer behaviour is changing with the advancement of technology, allowing consumers to communicate and consume in new and fast ways.

According to the Bank of England, two-thirds of UK financial services firms use ML applications (Bank Underground)[7] in their current technology environment (Figure 1).

This report showed that for financial services firms, the uptake of ML and AI technologies is growing at a fast rate, so it would be prudent to assume, since the paper was written in 2020, that there has been some shift. What is clear, however, is that both banking and insurance sectors make considerable use of ML. In terms of how ML is applied in these firms, the focus is on two important areas, tree-based models and natural language processing (Figure 2). The use of these methods shows a trend towards variables, enabling a decision based on target values.

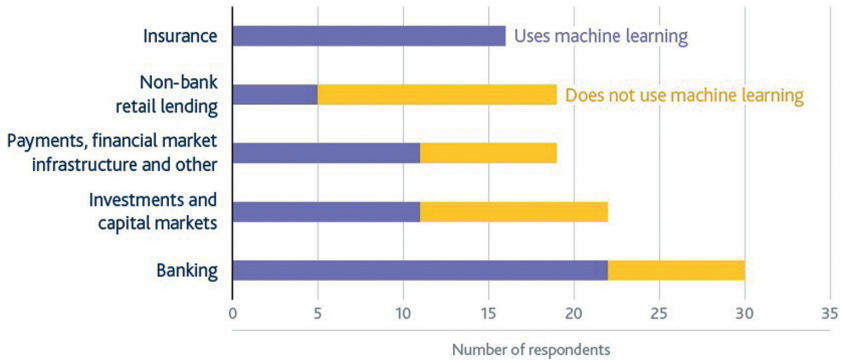

Figure 1 Use of ML applications in UK financial services

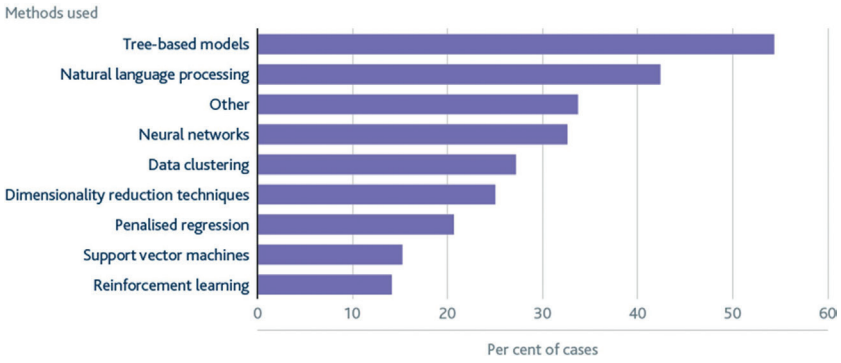

Figure 2 Predictive modelling methods applied in banking and insurance

The rise of predicative modelling gives opportunities for greater accuracy and interpretation for complicated, repeatable and varied problems.

From this report you could assume there is a growth in the use of ML in financial services, which is beneficial for both consumers and organisations. Therefore, the use of ML in prudential regulation is ripe to see how it can be applied and the benefits it can provide.

CASE STUDY OF THE PRA AND DATA

The Future of Finance report[8,9] set out a clear need for the PRA to make the best regulatory use of data and technologies, including AI. This is a significant ambition, so to put it in context, a simple use case is the growing volume of information (such as board packs and risk committee packs) the PRA receives. The Bank of England receives the equivalent of the entire works of Shakespeare twice a week in volume of unstructured information, which is a great opportunity to apply more advanced data science to this data, creating new supervisory insights. It also creates the opportunity to apply ML algorithms to process this type of unstructured information. Using these types of technology can enhance supervision to spend more time making judgments and a more efficient and effective use of time and insights, neatly balancing the use of automation and human capital in a prudential regulatory environment.

The PRA grew its RegTech and Data Innovation division[10] to 'expand the technical support, and data science capability provided to all areas of the PRA, in order to improve our use of data and technology, and enable more research into relevant advanced technologies'. The focus of the data scientists and technologists will also increase our research into relevant advanced technologies. The data scientists use a range of techniques and languages such as R and Python to create new interactive dashboards, Shiny apps and use of public data to give new insights within the organisation.

The specialist division will work with a number of teams, networks and areas focused on supporting the improvement of the PRAs and the Bank's wider data and analytics capability. The division will expand on several work streams already under way: improving data analytics, digital skills, data governance and internal and external engagement on data issues. The PRA's growing focus on the use of its data provides it with opportunities to apply AI to regulate supervisory activities, where analysing unstructured data is an important activity. One large opportunity for the Bank of England and the Financial Conduct Authority is the 'transforming data collection'.[11] This joint initiative with industry aims to understand and address data issues with new and emerging technologies. The programme of work has an exciting opportunity to meet the vision of 'The Bank of England gets the data it needs to fulfil its mission, at the lowest possible cost to industry'.

CASE STUDY OF INSIGHT-DRIVEN AI

In 2018 we identified an overwhelming need for colleagues to be able to find and analyse unstructured information faster and more easily and intuitively. As we set out in the Future of Finance response,[12,13] Supervision receives more than 1 billion rows of data every month, and while this 1 billion is predominately structured, the unstructured data is still vast. The need to be able to consume, analyse and make more judgments in a timely, efficient and effective manner was pivotal to the data-rich life of Supervision.

The PRA undertook a small pilot to assess the challenges of and opportunities associated with further addressing unstructured information for Supervision. A number of use cases identified that there was a clear case for a modern way to find, analyse and share unstructured information across the organisation, as for example, comparing board packs across a time period to look at risks and vulnerabilities using text analysis techniques.

The PRA then proceeded to market with six clear requirements: ability to easily find the information and use synonyms in a Google-like search; intuitive user interface; ability to easily extract information from PDF into Excel; ability to undertake analysis from firm Management Information (MI); ability to use word prevalence and topic modelling; ability to apply filters and drill down. While there were hundreds of other requirements, these six were fundamental to achieving the important success factors.

The PRA formed a procurement team comprising data scientists, change enablers, technologists and Supervision to find the best solution to meet the requirements. In this changing world of data and technology, the PRA looked across established and emerging FinTech providers to meet the requirements. This broader viewpoint encouraged a wider procurement route to enable more nimble, more cutting edge FinTechs to take part in the procurement route. The award was given a Gartner visionary, who provides an AI-driven context intelligence and insights engine.

During the pandemic, the PRA designed and introduced the tool to Supervision within 9 months; an extremely accelerated Agile-led delivery programme led to a short delivery programme. Using the best of modern project management tools and techniques, we were able to work remotely to deliver an AI tool into a secure and complicated infrastructure. The pandemic meant the team never met face to face, so the team worked extra hard to find ways to collaborate and move forward when challenges were presented.

It has been two years since the tool went live and usage remains high, but obvious benefits for Supervision have been clear. The benefits include the ability to instantly find information; personalisation helped colleagues find the information most relevant to the search and their profile. The ability to tailor searches to a topic, such as the term 'capital', or by individual regulated entity, has enhanced data use in supervision. Furthermore, the ability to see trending and related information helped colleagues easily see opportunities to gather further insights. Colleagues have continued to evolve the way they use the tool and new features continue to be introduced to meet a growing demand. For example, the integration of social market monitoring into a feed on a firm provides supervisors with a new way of seeing risks appear.

RISKS, CHALLENGES AND OPPORTUNITIES

Digital skills literacy

One of the challenges most organisations face with the use of AI technologies is user experience and literacy. The financial services landscape is going through a digital revolution, and this is changing the way we regulate firms. The PRA, in

parallel to delivering new insight with RegTech/FinTech technologies, started to consider how it could embrace greater use of technologies and increase the level of digital skills, literacy, across the PRA, and how this would be a significant advantage to the evolution of the PRA role in the financial industry. The exponential rise of data from firms and the ability to analyse and respond to it are a current and growing challenge for supervisors. The skill profile of a PRA person, not that of a data scientist or engineer, therefore enabling a more digitally perceptive skill set through data literacy, is a big opportunity.

The PRA is a data-heavy organisation, which means the insights and activities colleagues gain from the data are important to its success. Like most other organisations, we use technology to help us do our daily tasks; most of these technologies, such as spreadsheets, were developed in the 1970s. New technologies, however, offer the opportunity for greater efficiency and present us with an opportunity to improve supervisory effectiveness. Technologies such as M365 now provide instant collaboration in applications and chat functionalities to workplaces beyond the traditional spreadsheet.

PRA colleagues at all levels should have the necessary tools, analysis, data and digital skills to make most of the information and to integrate these into supervisory processes. This means understanding data ethics, using Tableau and FinTech trends. In 2020 the PRA agreed a digital skills strategy and developed learning frameworks to achieve a vision of a digitally skilled workforce. The strategy and learning frameworks will enable all colleagues to evolve their skills, whether to help them to become coders or to understand how emerging technologies are applied.

Building trust in AI

The PRA has clear objectives, as set out in the 'Banking Approach to Supervision'[14]: '[T]o advance our objectives, our supervisory approach follows three important principles — it is: (i) judgement-based; (ii) forward-looking; and (iii) focused on key risks'. The PRA approach relies significantly on judgment, therefore trust in the technology is important to ensure Supervision judgments continue to be based on clear evidence and analysis.

The vast knowledge of prudential regulation to enable financial stability held within the PRA's workforce is within humans. The rise of the machines should enable humans to continue their supervisory judgments, policymaking and decisions in new ways, through a combined human and machine workforce. As the Bank of England[15] set out, the future is not a 'cyborg supervisor' but a human enabled by artificial technologies.

The introduction of more data-centric tools within the PRA and regulated firms requires Supervision to have modern digital skills but also an understanding, and therefore trust, in the insight given by the AI-led tools. The trust comes both from the continued use of the AI tools and from understanding the concept of AI. The PRA embarked on a series of engagement strategies for Supervision to increase its understanding of AI to assist in the journey to confidently use and apply AI to daily activities.

Building insight from research for prudential regulation use of AI

An important part of introducing AI is embedding the capability and capacity within an organisation. Part of the embedding is undertaking research to truly understand the benefits and opportunities of AI. The Bank of England has set out a number of research priorities[16] as research is crucial to what any central bank does. It forms a critical part of the analytical apparatus that guides policymakers' decisions. The Future of Finance research priority

focus for the PRA includes deep learning models, behavioural biases, federated learning and so on. These priorities ensure that the application of AI enhances policy impact, supervision and external collaboration. Deep knowledge of emerging technologies will help how we communicate the importance and applicability of AI.

Research provides opportunities through deep analysis, written word and engagement with a variety of colleagues to take full advantage of emerging technologies. The need for research in the PRA's work and drive to enable AI is important as we explore the opportunities, risks and challenges. The need to acquire a deeper understanding of how the technologies work and the trust in those processes and designs are crucial to the adoption within the PRA.

Opportunities for AI in prudential regulation

As the PRA continues to meet its ambitions to become a 'world class RegTech authority', it has a clear focus of introducing and leveraging emerging technologies and a strong digital skills framework. There are both tangible and intangible benefits from embracing new technologies to improve our efficiency and effectiveness as a regulator and deliver benefits to financial services firms and the real economy.

Two opportunities where the PRA can see AI being instrumental in change are, firstly, in identifying and implementing improvements in the PRA's use of data by 2025, including better tools for peer analysis, and beginning to exploit the benefits of ML and AI for regulation and supervision. For example, a new project under way, early warning indicators, is the ability to compare firm indicators and parameters in a flexible, near real-time manner using AI techniques, which will provide considerable new insight for Supervision.

Secondly, the world of AI is constantly evolving. So while the PRA has a confirmed plan of major RegTech/FinTech change initiatives, we need to continue to undertake a series of proofs of concept to research, explore and enable new opportunities or solutions to meet business challenges. One example of a proof of concept project is integrating multiple data sources for market monitoring using public and private information that leverages AI to personalise the dashboard for the user's risk or specialist area. Another area of exploration is identifying and optimising parts of the authorisations process for new and existing firms, looking to making it more efficient and effective for all parties involved in the process.

As set out in the Financial Stability Board report,[17] there are a wealth of opportunities for Supervision. For example, the De Nederlandsche Bank (DNB) has created a dedicated supervision innovation department to coordinate and accelerate the implementation of its digital strategy, whose purpose is to adopt a more data-driven approach and deploy technology to support the supervisory process, with the ultimate goal of transforming the DNB into a 'smart supervisor'. The European Central Bank (ECB) is developing a supervisory technology platform, called Virtual Lab, which will provide the digital infrastructure for remote collaboration across the Single Supervisory Mechanism (the ECB and the national competent authorities). The ECB's SupTech Virtual Lab will provide a solid foundation to instil an inclusive data-driven and innovation-friendly culture, where advanced users can pursue more complex AI, modelling and programming projects and newcomers are given an intuitive environment to explore, experiment and learn about the use of the technology.

Another notable opportunity is the Federal Reserve Board of Governors' proposal concerning the application of natural language processing (NLP) for continuous monitoring, web searches and COVID-19 monitoring. There are several use cases of SupTech and RegTech across the Federal Reserve System (FRS) that are currently in use as well as in the

development process. While many of the use cases have originated over the last few years, a number of them have recently been repurposed or adapted to enhance the Federal Reserve's supervisory response to the COVID-19 crisis. The most common application of SupTech is ML techniques, and more specifically NLP, to enhance and to create more efficient and effective supervisory processes. The FSB report set out 27 case studies all with significant opportunities, both technology and skills through the adoption of emerging technologies.

Global scan of regulators using AI

A recent Bank for International Settlements paper[18] noted that while regulators use AI, they should set out guidance on accountability, transparency, fairness and ethics. This is an important issue as the growth of AI becomes more prevalent in both industry and regulations, and therefore decision making. As the PRA noted, the future is not where machines make decisions solely but a combined strength. And for regulators, this combined strength could be the future of 'cyborg supervisors'![19]

The combined strength of machines and regulators will become a substantial advantage as technology and financial services evolve and merge. How regulators use technology to understand the market developments and continue to preserve financial stability is an important evolution of the regulatory landscape. The Financial Stability Board[20] undertook a survey of regulators with data, innovation, RegTech and SupTech strategies. In Figure 3 the countries in dark grey have one or more of these strategies in place.

These strategies have been driven by demand and supply to enable regulators to optimise the benefit of emerging technologies. The drivers, shown in Figure 4, for introducing and applying emerging technologies to regulatory activities include enhanced surveillance and compliance, increased complexity and volume of regulations and more insightful and forward-looking policies.

The important supply drivers (Figure 5) are perhaps more global normal drivers, such as the availability of methods, tools, skills, data and costs. The appetite for adoption of new technologies continues at pace, but the benefits and challenges need to be fully understood and realised before introducing

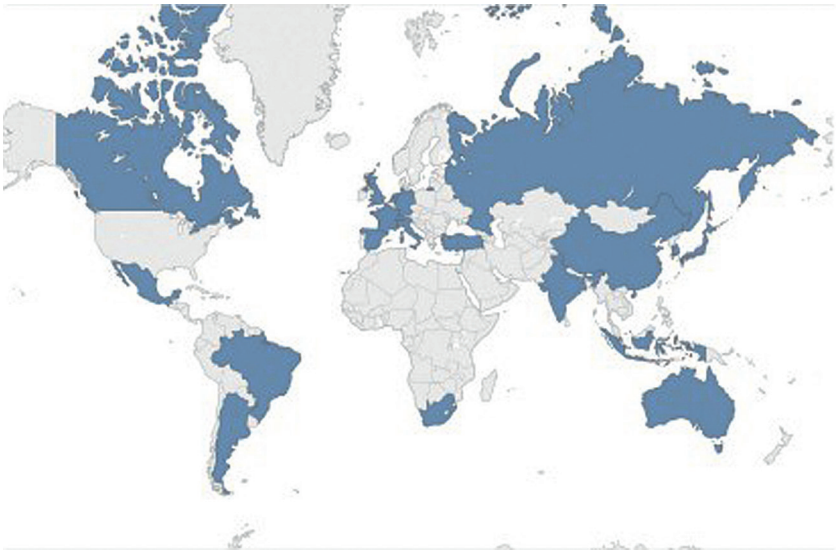

Figure 3 FSB recent view of regulators progress with data, RegTech, SupTech and innovation strategies
Source: FSB survey

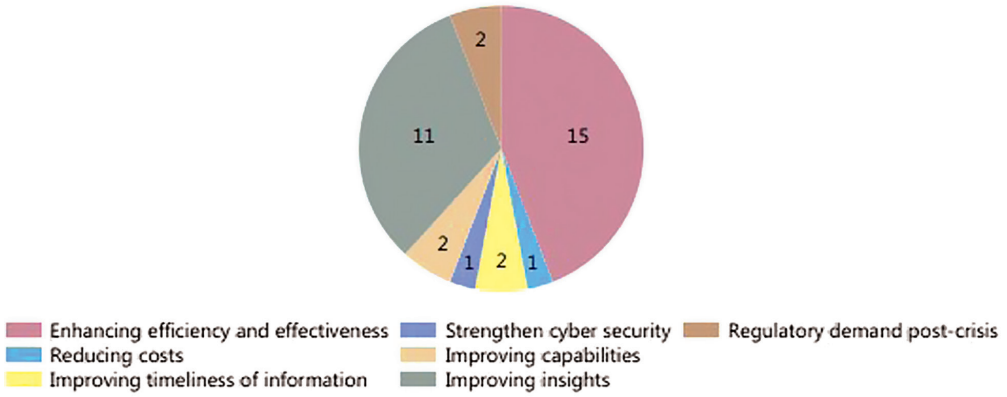

Figure 4 Drivers for regulatory innovation

Source: FSB survey

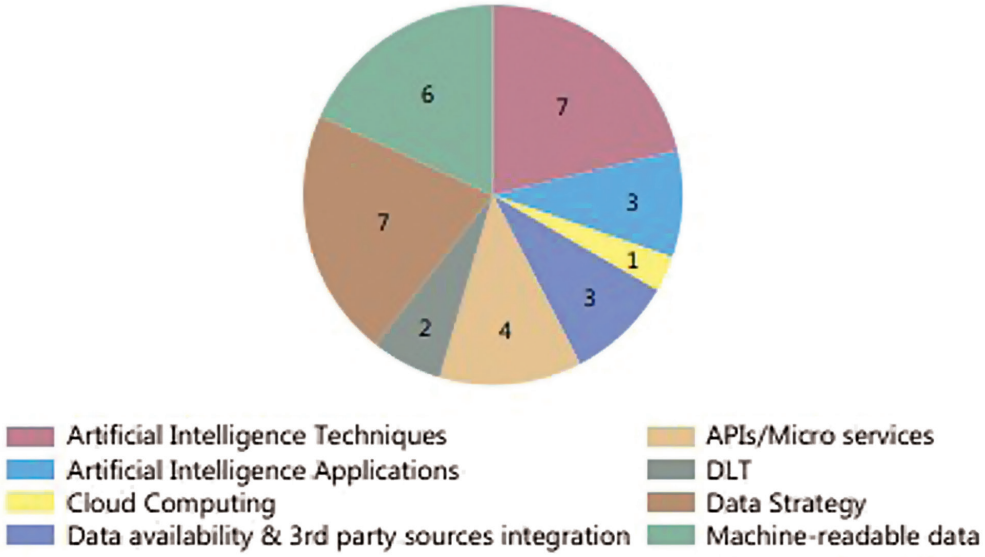

Figure 5 Supply drivers for adoption of new techologies

Source: FSB survey

these technologies. The technologies can enable a vast amount of benefits, but at the same time the culture, skills, communication and decision making need to be fully ready.

The readiness is important as using these tools will alter the way regulators communicate both internally and externally. Regulators need to ensure they have the right level of technical, data science, skills as well as the digital skills to fully realise the benefits and address challenges of introducing these technologies. The ability to alter an organisational culture to a fully digital mode is a significant investment over many years.

The Financial Stability Board[21] identify that the ECB has created a digital strategy for the organisation that builds and fosters a digital culture, an essential element for the evolution to a digital era. The PRA also has a digital skills strategy that encourages digital thinking, use of new technologies but also

innovation. Innovation with technologies and supervisory insight will be critical to the step change to meet the digital era.

Furthermore the World Bank[22] noted that staff are the greatest contributor to the success of new technology adoption. Investment in both people and technologies is important to ensure the data and technologies help identify, assess and mitigate supervisory risks and culture. Although the end goal is not to be a tech leader but a modern regulator, the effort and transformation to use data to drive supervision for the future is considerable.

CONCLUSION

Regardless of the pace of change, change is inevitable. Unlike other programmes of work, technology enables faster development. The culture of the workplace has changed with the introduction of more insightful technologies and also with the recent pandemic. The need to develop a digital workforce that evolves at pace is evident.

In prudential regulation the growth of AI to empower a future regulatory mindset and consumer/creator of data is a necessity. The volume of data for prudential regulation continues to grow in volume and complexity. The opportunities for AI to enable humans and machines to work together for financial stability are vast. The ability of humans and machines to communicate in a transparent, seamless and insightful manner will continue to drive the adoption of AI into the busy office life. The case study of the PRA and its new AI search and analysis engine shows how ambitious and forward looking a financial prudential regulator needs to be to meet this digital era.

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