Financial Stability Institute

FSI Insights
on policy implementation
No 47
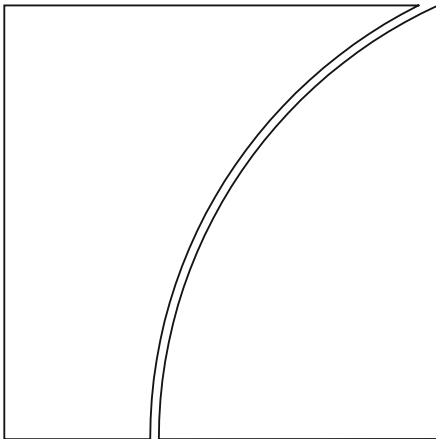
Suptech in insurance supervision

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BANK FOR INTERNATIONAL SETTLEMENTS

This Insights is written jointly by staff members of the Financial Stability Institute (FSI) of the Bank for International Settlements (BIS), the Secretariat of the Access to Insurance Initiative (A2ii) and the Secretariat of the International Association of Insurance Supervisors (IAIS). Insights papers aim to contribute to international discussions on a range of contemporary regulatory and supervisory policy issues and implementation challenges faced by financial sector authorities. The views expressed in them are solely those of the authors and do not necessarily reflect those of the A2ii, BIS, IAIS or the Basel-based committees.

Authorised by the Chair of the FSI, Fernando Restoy, the Chair of the IAIS Executive Committee, Vicky Saporta, and the Chair of the A2ii Governing Council, Peter Braumüller.

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Executive summary

The International Association of Insurance Supervisors (IAIS) has acknowledged the importance of digital innovation and, specifically, the role of suptech in the "new normal". In this paper, suptech refers to the use of innovative technologies by insurance supervisors to support their work. There is a need to improve understanding of the potential of suptech to aid insurance supervision. Interactions with insurance supervisors also show that there is strong interest in sharing specific solutions, experiences, practices and lessons learned on the use of suptech.

 This paper aims to contribute to filling this gap by citing concrete examples of how suptech tools are used by 22 insurance supervisors, from both prudential and conduct perspectives. The paper provides an overview of suptech use by insurance supervisors based on reported use cases. It provides examples of suptech tools that are being assessed, developed or used by insurance supervisors for various activities – from data collection to data analytics. It explores how these suptech tools are identified, developed and used; how effectiveness is measured; how such tools were used during the pandemic; and other suptech tools that insurance supervisors are interested in having or developing. In doing so, the hope is that the paper will provide a valuable resource to insurance supervisors to better understand suptech based on the experiences of their peers. Such understanding can pave the way for a more informed approach in undertaking any suptech work.

 The 38 suptech tools covered in the paper are classified according to their intended use – whether for prudential or conduct supervision, or both. Half of the tools may be used for both prudential and conduct supervision. The remaining half of the tools are almost equally divided between those used for conduct supervision and those used for prudential supervision. Almost all of the tools are already being used in actual supervisory processes or are in the process of being fully developed to go live. Only a very small proportion of the tools are in the proof of concept or prototype stage. Most of these tools were, or are, being developed internally or jointly with external parties.

 Suptech tools for prudential supervision of the insurance sector are similar as those used by banking supervisors. These include automated dashboards that show key risk indicators, eg for credit, market and liquidity risks, as well as tools that allow for early detection of financial distress. Moreover, machine learning techniques are also used for network analysis and in tools that are used either to provide an independent view or to improve on existing risk scoring frameworks. In general, prudential tools aim to achieve pre-emptive engagement with supervised firms by allowing for more frequent and prompter monitoring.

 Most of the reported conduct tools, on the other hand, are specific to the insurance sector. While most tools aim to improve the compliance assessment of insurance distribution-related activities, one was developed to support authorities' classification of consumer complaints. Some are suptech analytics tools that involve the use of natural language processing (NLP) to analyse data provided to customers in pre-contractual and contractual documentation by insurers and intermediaries. There are a few data collection tools: a couple gather information from insurers' websites and social media platforms

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to identify mis-selling practices, while others facilitate compliance assessments of the interactions between insurers/intermediaries and customers during sales calls.

Most of the reported tools that may be used for both prudential and conduct supervision deal with data collection-related processes. Data collection-related processes refer to data reporting, validation, consolidation and visualisation. There are also a few suptech analytics tools that may be used for both prudential and conduct supervision. These typically involve the use of NLP, for example, to analyse narrative reports from insurers to identify potential prudential issues or to comb through social media posts for possible conduct-related issues. NLP may also be used to aid in writing supervisory letters to insurers. In addition, respondents have reported tools for outlier and novelty detection and for pattern recognition, which may be used on both prudential- and conduct-related data.

Insurance supervisors raised some novel challenges, in addition to familiar ones such as lack of resources, issues with data, internal processes etc. In particular, insurance supervisors highlighted challenges related to the identification of the suptech tools that they need. These may be due to evolving regulatory requirements that suptech tools are meant to process, and lack of understanding of available technologies and their limitations. Also, insurance supervisors specifically emphasised the need for the right skills and expertise for following up on the findings of the tools. This is where experienced supervisors are relevant, and it highlights the important role that supervisory judgment continues to play.

Insurance supervisors in emerging market and developing economies (EMDEs) are facing the same challenges but to a greater extent, particularly when it comes to resources. They typically leverage available commercial off-the-shelf (COTS) solutions for suptech. This is due to a lack of in-house expertise and a general lack of resources, which also makes them cautious about which suptech tools to use or develop. They have little to no room to undertake experimentation on their own. Thus, there may be scope for them to partner with external parties, such as academic institutions or technology companies, in conducting suptech experimentation.

Insurance supervisors do not yet have clear key performance indicators (KPIs) or methodologies to measure the effectiveness and efficiency of suptech tools. Effectiveness and efficiency of the tools are typically assessed based on feedback from users. Some aim for more objective metrics, such as time saved in completing a task. Nevertheless, there are certain tools that have clearly been beneficial, particularly during the pandemic. These include tools that enabled insurance supervisors to continue to undertake their supervisory activities despite pandemic-related restrictions.

Despite the challenges, insurance supervisors are continuing to explore suptech tools. Many insurance supervisors specifically aim to develop integrated systems or platforms that contain different applications – from data collection to data analytics – and cover the entire supervisory process. Investment in these technologies requires corresponding digital and data expertise. Accordingly, fostering a culture of innovation based on data-driven decision-making, openness to experimentation and challenging "legacy thinking" is required within financial authorities. Capacity building programmes can help in this regard. Acquiring new talent and increasing the data and technical literacy of existing staff through training programmes will not only develop necessary expertise but will also contribute to a more innovative culture.

Section 1 – Introduction

1.   **Supervisory technology (suptech) is the use of innovative technologies by financial authorities to support their work.** Suptech is the result of digital innovation in the financial system resulting from the emergence of advanced technologies, such as big data, artificial intelligence (AI) / machine learning (ML) and other new technologies. The Financial Stability Institute (FSI) has issued several reports on the suptech practices and experiences of financial authorities around the world.[2] While most of these reports cover a range of financial authorities – banking supervisors, insurance supervisors, securities markets supervisors, anti-money laundering (AML) and combating the financing of terrorism (CFT) authorities – many of the use cases highlighted in these reports focused on banking supervision. This is the case, for example, with the most recent report on the use of suptech for prudential supervision, which included insurance supervision use cases in the overall sample but discussed use cases from a banking supervision perspective.

2.   **The International Association of Insurance Supervisors (IAIS) has acknowledged the importance of digital innovation and, specifically, the role of suptech in the "new normal".**[3] Hence, there is a need to improve understanding of the potential of suptech to aid insurance supervision. This was evident, for example, in the responses to a 2021 survey of Asian and African insurance supervisors conducted by the Access to Insurance Initiative (A2ii).[4] When asked to explain what their main issues were, while many pointed to the need for internal expertise and resources, several respondents also highlighted the need to better understand the utility that suptech brings to insurance supervisory processes. In terms of the kind of support needed, several respondents cited the sharing of specific solutions, experiences, practices and lessons learned on the use of suptech by insurance supervisors.

3.   **This paper aims to fill this gap by citing concrete examples of how suptech tools are used for insurance supervision, both from prudential and conduct perspectives.** The paper identifies several suptech solutions that are being assessed, developed or used by insurance supervisors for various activities – from data collection to data analytics. It explores how these suptech tools are identified, developed and used; and how effectiveness is measured. In doing so, the hope is that the paper will provide a valuable resource to insurance supervisors to better understand suptech based on the experiences of their peers. Such understanding can pave the way for a more informed approach in undertaking any suptech work.

4.   **The paper is based on responses from 22 insurance supervisors across the world to two complementary surveys.** The paper is largely based on responses to the suptech-related questions in the IAIS fintech survey of members conducted between May and June 2022, and follow-up questions to selected authorities on their specific tools. To obtain additional perspectives from insurance supervisors in emerging market and developing economies (EMDEs), the paper also considered responses to a shorter survey sent by A2ii to a few relevant supervisors.[5] The rest of the paper is organised as follows: Section 2 describes some of the suptech tools in detail; Section 3 discusses the experience of insurance supervisors in developing and using these tools; and Section 4 concludes.

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[2]   Broeders and Prenio (2018), Coelho et al (2019), di Castri et al (2019), Crisanto et al (2020) and Beerman et al (2021).

[3]   Badat et al (2021).

[4]   A2ii (2021).

[5]   See Annex for a list of survey respondents.

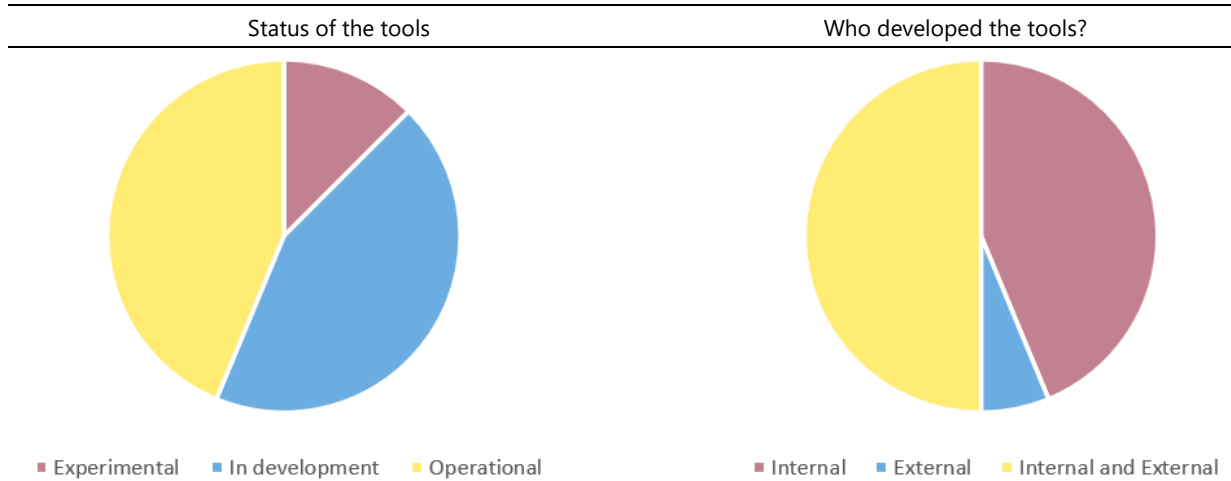# Section 2 – Suptech tools for insurance supervision

5.   **This paper discusses findings based on analysis of 38 suptech tools for insurance supervision**. Survey respondents reported a total of 48 tools. However, closer examination showed that 10 of the tools are either not intended for use in insurance supervision (eg strictly for monitoring lending institutions or asset management institutions); are used for supervision of other sectors but with an unrealised potential use in insurance; or are intended to make the business processes of insurers more efficient. These 10 tools were therefore removed from the sample.

6.   **The majority of the suptech tools for insurance supervision are either operational or in development.** Almost all of the tools are already being used in actual supervisory processes (ie operational) or are in the process of being fully developed to go live (ie in development). Only a very small proportion of the tools are in the proof of concept or prototype stage (ie experimental) (Graph 1, left-hand panel).

7.   **Most of these tools were or are being developed internally or with the help of external parties**. Half are tools which were jointly developed by internal units and external parties. Tools resulting from work undertaken solely by internal units account for slightly fewer than half. Meanwhile, those completed solely by external parties make up fewer than 10% of the tools (Graph 1, right-hand panel). Internal units that have developed or are developing suptech tools include those responsible for supervision, data science and analytics, research, IT, data, risk management and innovation. A few insurance supervisory authorities also have dedicated suptech units. External parties include technology vendors, consulting firms, academia and individual AI and ML consultants.

Suptech tools for insurance supervision   Graph 1

| Status of the tools | Who developed the tools? |

■ Experimental ■ In development ■ Operational   ■ Internal ■ External ■ Internal and External

Source: IAIS member survey (2022).

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8.   **These tools can be classified according to their intended uses**. For example, they can be classified based on whether they are – or are intended to be – for prudential supervision, conduct supervision or both. Using this classification, half of the tools may be used both for prudential and conduct supervision. The remaining half of the tools are almost equally divided between those used for conduct supervision and those used for prudential supervision (Graph 2). The discussion in the rest of this Section follows this classification.
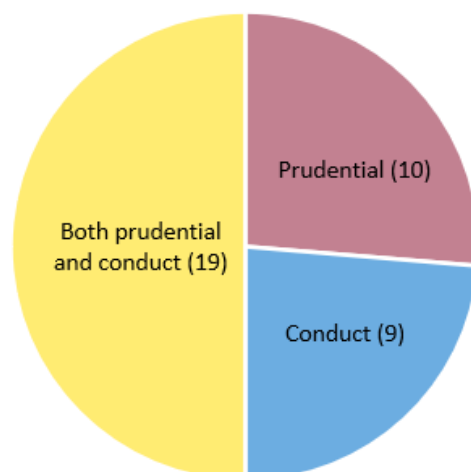
Source: IAIS member survey (2022).

Prudential supervision

9.   **Reported prudential tools are similar to the ones used for banking supervision.**[6] These include automated dashboards that show key risk indicators, eg for credit, market and liquidity risks, as well as tools that allow for early detection of financial distress. Moreover, machine learning techniques are also used for network analysis and in tools that are used either to provide an independent view or to improve on existing risk scoring frameworks. In general, prudential tools aim to achieve pre-emptive engagement with supervised firms by allowing for more frequent and prompter monitoring. The subsequent paragraphs discuss how some of these tools are used specifically for insurance supervision.

10.   **The Monetary Authority of Singapore (MAS) is developing a network analysis tool to analyse interconnectedness between insurers and reinsurers.** The tool will use graph visualisation as well as pattern recognition algorithms. It will aim to identify interconnectedness in terms of risk transfers and exposures between insurers and reinsurers. As such, it will also identify concentration risks within the insurance industry. For example, several insurers may cede risks to the same reinsurer. If the reinsurer fails, this will impact cedent insurers. The tool will be able to identify which insurers and reinsurers are interconnected through these activities. Moreover, it will be able to assess the systemic importance of reinsurers and can inform the design of scenarios for industry-wide stress testing exercises. The tool's analysis will be able to focus on a specific line of business and the type of reinsurer, as well as different cession or recoverable ratios.

11.   **The French Prudential Supervision and Resolution Authority (ACPR) is experimenting with a tool that aims to improve the detection of "fragile" insurers.** The tool will automate the analysis of technical provisions for non-life insurers and provide visualisations of the results of the analysis. The tool will therefore be able to identify insurers that may not have sufficient assets to satisfy claims arising from issued insurance contracts. Examples of specific analyses the tool is expected to perform include the comparison of prudential and accounting norms by line of business, the analysis of non-life rent liquidation, the actuarial computation of best estimates and the identification of peer groups. In this way, supervisory efforts including on-site supervision can be more targeted towards the most fragile insurers.

12.   **The Swiss Financial Market Supervisory Authority (FINMA) has made a solvency calculation tool available to insurance companies.** This tool is used by around 100 insurance companies to perform

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[6]   See Beerman et al (2021).

the solvency calculation for the Swiss Solvency Test using the standard model. The underlying R package[7] is available on the FINMA website for download. It calculates the capital requirements (or target capital) both as aggregate as well as by component (market risk, credit risk, insurance risk etc). The tool features a user-friendly interface and also provides enough flexibility to allow for adjustments specific to an insurance company.

13.   **The National Association of Insurance Commissioners (NAIC) has recently completed six different comprehensive dashboards to analyse and visualise solvency risks in various areas of an insurer's operations.** Operations covered include bond holdings, equity holdings, premium writings and reinsurance. Business intelligence tools are being used to connect existing regulatory data sources to the dashboards. In these particular cases, the dashboards have been customised to analyse data filed by insurers reporting under each annual statement filing type (ie property/casualty, life and health). Going forward, NAIC plans to develop additional dashboards for use in prudential as well as conduct supervision, and to begin providing standardised data sets and templates for end users to access in building their own customised dashboards and visualisations.

Conduct supervision

14.   **Most of the reported conduct-related tools are specifically for supervision of the insurance sector.**[8] While most tools aim to improve the compliance assessment of insurance distribution-related activities, one was developed to support authorities' classification of consumer complaints. Some are suptech analytics tools that involve the use of natural language processing (NLP) to analyse data provided to customers in pre-contractual and contractual documentation by insurers and intermediaries. There are a few data collection tools: a couple gather information from insurers' websites and social media platforms to identify mis-selling practices, while others facilitate compliance assessments of interactions between insurers/intermediaries and consumers during sales calls. The paragraphs below highlight some of these tools.

15.   **The European Insurance and Occupational Pensions Authority (EIOPA) is developing a tool for collecting and analysing the data that insurers are required to publish for insurance-based investment products.** In Europe, insurers should provide consumers with a standardised pre-contractual document referred to as a key information document (KID) containing essential information about insurance-based investment products (IBIPs).[9] The tool will collect KIDs data across European Union (EU) member states from insurers' websites through web-scraping and robotic process automation techniques, and place them in a central repository. By applying NLP technologies, the tool will support the development of cross-border data-driven supervision of IBIPs in the EU market. The increased data granularity, the ability to aggregate data at multiple levels and the enhanced accessibility of the data could improve transparency for consumers as EIOPA would have a wider range of statistics available for potential inclusion in its reports.

16.   **The Institute for Insurance Supervision (IVASS) is experimenting with a tool that aims to assess the complexity and readability of insurance contracts.** This tool will be used by supervisors to

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[7]   The R package contains code, data and documentation on the model that can be run on the R statistical software.

[8]   Conduct of business supervision refers to the supervision of the fair treatment of customers by insurers and intermediaries, both before a contract is entered into and through to the point at which all obligations under a contract have been satisfied. See Insurance Core Principle 19 in IAIS (2019).

[9]   Regulation 1286/2014/EU of the European Parliament and of the Council of 26 November 2014 and the Commission Delegated Regulation 2017/653 of 8 March 2017, commonly referred to as the PRIIPs Regulation, established a European legal framework to encourage European Union jurisdictions to be more efficient by helping investors to better understand and compare the key features, risk, rewards and costs of different packaged retail and insurance-based investment products (PRIIPs). The regulation aims to achieve this by ensuring that investors have access to a concise, standardised and consumer-friendly information document known as key information document, which must be no longer than three pages.

analyse insurers' compliance with guidelines[10] on the structure and language of insurance contracts/policies. Applying text analysis and NLP will allow supervisors to conduct qualitative and quantitative analysis on a large volume of contracts to assess their compliance with the guidelines, ie to assess their complexity and readability, as well as the level of consistency between contractual and pre-contractual documents. The goal is for the tool to produce an indicator to measure documents' complexity and readability (similar to the Gulpease index). IVASS hopes that outputs from the tool will support its dialogue with insurers, which in turn will hopefully lead to better and easier to read insurance policy documents for customers.

17.   **The French Prudential Supervision and Resolution Authority (ACPR) is developing a tool that automates the transcription of recordings of telephone marketing conversations between insurance agents and customers.** To monitor intermediaries' and insurers' compliance with regulations applicable to the distribution of insurance contracts, supervisors listen to these recordings and transcribe them. To automate this task, ACPR is developing a tool based on open-source pre-trained ML models. All data are saved on a local server and several security measures have been put in place to protect personal information. Should sensitive data be shared during the conversation, there are processes in place to delete it once the monitoring exercise has been completed. The tool might be enhanced in the future by using NLP algorithms to identify the presence of bad commercial practices or the absence of mandatory terms in the transcribed text.

18.   **The Korean Financial Supervisory Service (FSS) has developed a tool to transcribe recordings of insurers' telemarketing activities and to classify them as mis-selling, if appropriate.** It is similar to the ACPR tool but goes further. After transcribing recordings of telephone conversations between insurers' agents and customers, the tool also reviews the text by looking for keywords that should (and should not) be communicated to customers. It then assigns a score that each keyword will earn or lose, and calculates the total score for each recording. The outcome of this analysis is used as input for other supervisory processes. The tool was developed by an external party using a speech-to-text software that the FSS had previously purchased. Supervisory staff were involved in the development of the tool by defining key words and their scores. This tool has introduced efficiencies in the supervision of conduct-related risks and has contributed to more effective consumer protection by encouraging insurers to work harder to prevent mis-selling.

19.   **The FSS also has a tool to detect illegal online advertisements for financial products and services, including insurance.** The tool monitors and collects data on online advertisements from blogs and social media. It then reviews the data to see if they contain key words associated with illegal advertisements. The findings are shared via an online document exchange system with relevant authorities for appropriate action. The tool therefore helps to block many illegal online advertisements and thereby helps to minimise customer harm.

Both prudential and conduct supervision

20.   **Most of the reported tools that may be used for both prudential and conduct supervision deal with data collection-related processes**. Based on the mapping of oversight areas in which suptech applications can be found, first developed in Broeders and Prenio (2018), data collection-related processes refer to data reporting, validation, consolidation and visualisation. There are also a few suptech analytics tools that may be used for both prudential and conduct supervision. These typically involve the use of NLP, for example, to analyse narrative reports from insurers to identify potential prudential issues or to comb through social media posts for possible conduct-related issues. NLP may also be used to aid in

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[10]   The guidelines for the simplification of insurance contracts define a standard structure for insurance contracts which aims to simplify policy language and make it easier for policyholders to understand and exercise their contractual rights. See www.ivass.it/normativa/nazionale/secondaria-ivass/lettere/2018/lm-14-03/index.html?com.dotmarketing.htmlpage.language=3&dotcache=refresh.

writing supervisory letters to insurers.[11] In addition, respondents have reported tools for outlier and novelty detection, and for pattern recognition. These tools may be used on both prudential- and conduct-related data. The paragraphs below highlight some of these tools.

21. **The Taiwan Insurance Guaranty Fund (TIGF), designated by the Financial Supervisory Commission (FSC), maintains a financial and business supervision data repository system.** The system contains structured data, including insurers' financial performance and policy/claim information. These data are reported by insurers and are then uploaded to the repository. The system has an embedded validation function. Data will be accepted only if they pass the validation tests. Otherwise, data are sent back to insurers for correction or explanation. The system therefore helps increase the accuracy of reporting data and prepares them for analyses. Once data are extracted from the system, transformed and loaded to a data mart, business intelligence software is then used to build dashboards for compliance assessment and risk monitoring to facilitate supervisory review.

22. **The Central Bank of Malaysia (BNM) has a web portal that facilitates regulatory compliance and the processing of regulatory applications.** The portal enables financial institutions to submit regulatory applications, including for appointments of key responsible persons or new products and services, with pre-submission documentation checks. The portal also manages the processing workflow, ensures appropriate governance for approvals and notifies applicants of the outcome of their applications. Additionally, BNM is currently working on enhancing the portal to better support supervisory activities and record the outcomes of supervisory assessments. Anticipated new features include information dashboards and data analytics functionalities, the ability to work offline, and improved governance and audit trail capabilities.

23. **EIOPA is developing a Cooperation Platform to enable the use of an efficient notification system, and the exchange of information for the purposes of updating and maintaining the European register of insurance undertakings.** The platform aims to promote an efficient and traceable exchange of information between home and host national competent authorities (NCAs), thereby addressing inconsistencies identified in national registers maintained by NCAs and the European register maintained by EIOPA. The inconsistencies, which resulted from the current approach, not only put in question the reliability of the national and European registers, they also expose the NCAs and EIOPA to legal and reputational risks. The platform allows for cross-border notifications and provides an interface to automatically update the EIOPA register based on cross-border information exchanged through the platform. NCAs may also follow the same approach and develop an API to use the information exchanged through the platform to automatically update their own registers. On top of the incremental information exchanges, a periodic full submission to the European register will be requested to allow cross-checking of the data received via incremental exchanges, as well as to capture data not exchanged on the platform, ie mainly undertakings with no cross-border activity. For this full submission, NCAs will be required to send information from a home authority perspective only, to allow for the cross-checking of data received from different NCAs and the European register. If there is a discrepancy, the platform will be used to notify all relevant authorities.

24. **EIOPA has implemented outlier and novelty detection as well as pattern recognition tools.** Given the large number of submissions to it, EIOPA is in an ideal position to develop such tools using machine learning and other advanced analytics algorithms. These, in turn, contribute to the development of tools at the national level. For this reason, EIOPA is in close contact with NCAs and has also established an internal code-sharing platform. On this code-sharing platform, EIOPA has shared Python code with NCAs for outlier and novelty detection based on multiple different ML algorithms. EIOPA uses those codes regularly on production data and shares the results with the national supervisors. The applied methods benefit from the large EIOPA database. Unusual datapoints in prudential reporting from European insurers can be identified using machine learning methods (eg based on isolation forest, local outlier factor). Given

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[11] The same tool reported in Beerman et al (2021).

a specific template, the codes identify those insurers (from ~2,500 insurers in Europe) with unusual patterns or structures, compared with similar insurers or compared with the past. As insurers are very heterogenic in size, those comparisons are run on pre-normalised data sets. The results are useful for detecting both data quality issues and business situations relevant to supervisory activity. While this specific use case is on prudential reporting, such models can also be used for conduct-related reporting.

Use of suptech in EMDEs

25.   **There is growing interest in, and use of, suptech in EMDEs.** Insurance supervisors in EMDEs are mostly using suptech solutions for data collection and regulatory reporting. Some are also using suptech for data analytics. While some of these solutions have been developed exclusively for insurance supervisors, most of them are generic solutions offered by technology vendors which have been customised to meet insurance supervisory requirements.

26.   **Supervisors in EMDEs rely on obtaining commercial off-the-shelf (COTS) solutions that are customised to their needs rather than developing solutions internally.** The customisation parameters are based on a review of a supervisors' methodology and processes for supervision, as well as requirements related to legislative changes. For example, in Zambia after the Insurance Act, 2021 was enacted, the Pensions and Insurance Authority (PIA) revisited several of its supervisory tools and has identified new suptech tools that it may need.

Section 3 – Experience in developing and using suptech tools

27.   **Insurance supervisors identify suptech tools to experiment on or develop through either a top-down or bottom-up approach.** Under the top-down approach, identification of suptech tools may depend on the organisational strategy or function specifically established for that purpose. EIOPA, for example, has published a suptech strategy that covers both prudential and conduct of business supervision.[12] In South Africa, the Prudential Authority has defined a target operating model that is the basis for identifying and prioritising the development of suptech tools. Under the bottom-up approach, identification of suptech tools is done through direct consultation with supervisory staff.[13]

28.   **Insurance supervisors are using innovative channels to solicit ideas from supervisory staff on what suptech tools they need.** The focus is to identify the pain points or the current challenges and needs of frontline supervisors, and to explore potential solutions. Insurance supervisors do this through a number of means, including employee surveys; "innovation feedback portals" or innovation fora in which all supervisors can make suggestions about potential suptech tools; cross-departmental "design thinking workshops"; and dedicated cross-departmental project groups for understanding the needs for suptech tools, their feasibility and design, as well as potential challenges in developing them. ACPR's Innovation Hub, for example, organises calls for ideas (so-called "intrapreneurship" challenges) or holds discussions directly with supervisory units to identify their needs. Depending on the needs, existing tools are either retrofitted or new tools are developed, which involves experimentation by data scientists and supervisors.

29.   **Having frontline supervisors continuously engaged in the innovation process requires the right culture.** Crisanto et al (2020) stress the need to foster a culture of innovation that relies on data-driven decision-making, openness to experimentation and questioning "legacy thinking" within financial authorities. To achieve this, the German Federal Financial Supervisory Authority (BaFin) points to

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[12]   EIOPA (2020). Subsequently, EIOPA developed a suptech programme, which was informed by a survey to supervisors from all NCAs.

[13]   Beerman et al (2021) note that the ultimate users of suptech tools should be the main source of ideas on what tools to develop.

their four pillar approach involving data literacy, data leadership, data governance and data strategy. Data literacy creates conditions for independent use of data by supervisors. Managers can help foster this by showing data leadership, for example, through data-based decision-making. Data governance, on the other hand, can make rules on data use and access as simple as possible while considering data protection requirements. Data strategy, meanwhile, can establish organisational direction and resourcing for all these initiatives.

30.   **Responses pointed out that suptech tools achieve efficiency and effectiveness but in most cases it is not clear how this is measured.** Some insurance supervisors indicated that they are working on developing metrics. For those that provided more specific responses, the metrics tend to be user focused. For example, key performance indicators (KPIs) typically include feedback from users and information about how much usage the tool gets. Efficiency metrics include time saved in doing a task as a result of using a tool. Effectiveness, on the other hand, could be assessed based on how successful a tool is in actually identifying the cases it is meant to detect (eg risky activities). But this assessment tends to be qualitative through feedback from staff using the tool. This seems to confirm that efficiency gains from suptech tools are more easily quantified than effectiveness, as pointed out in Coelho et al (2019).

31.   **Insurance supervisors realised the value of suptech tools even more during the pandemic.** This is especially the case for tools that reduced face-to-face contact. For example, the pandemic situation accelerated the use of digital and contactless collaboration and communication tools.[14] Some supervisory authorities implemented online, remote examinations in response to the closure of offices early in the pandemic. Many authorities relied heavily on the analysis of data submitted by insurers using suptech analytics tools. This included the collection and analysis of new or additional data to effectively implement off-site monitoring in lieu of on-site examinations. Online data submission systems enabled the collection of these data as well as the tracking of data submission by insurers.

Challenges insurance supervisors face when dealing with suptech

32.   **Many insurance supervisors find it challenging to identify the appropriate suptech tools to develop and use.** Respondents cited lack of understanding of available technologies, their maturity, their limitations and/or their costs as contributing to this challenge. Another contributing factor often cited is the evolving regulatory requirements that suptech tools are meant to address or monitor. This is exacerbated by the slow process of implementation from when needs are identified to the actual operationalisation of the tool. By the time the tool is ready to roll out, the requirements may have already changed, which requires reworking the tool.

33.   **As with other financial authorities, insurance supervisors are faced with insufficient human resources to support suptech initiatives.** This challenge manifests itself in terms of limited capacity to develop tools or execute projects. Finding talent with experience and skill sets in both data science and supervision necessary to deploy suptech applications can be difficult. Because of the scarcity of staff with the right background, in some authorities each suptech solution may be dependent on just one or two key people and this raises continuity issues should the key people leave the authority.[15]

34.   **Some insurance supervisors highlighted that it is important to have resources available not only for the development of suptech tools but also to follow-up on findings from the tools.** It is not prudent to base supervisory actions solely on the outcomes of automated processes without proper consideration and expert judgment. Beerman et al (2021) warn of the risk that the quality of supervisory judgment may diminish as suptech tools take on a greater role in supervisory processes. This could lead to supervisory blind spots and a broader loss of institutional knowledge built on judgment-based

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[14]   See also Beerman et al (2021).

[15]   See also Broeders and Prenio (2018).

supervision. To counter this, respondents highlighted the importance of fostering a culture that appreciates the value and appropriate use of information gleaned from data in a digital world. Hence, supervisory authorities need to continue to strengthen their core expertise in addition to broadening the profile of their staff to include knowledge in different digitalisation-related areas such as information and communications technology and data science.[16]

35.   **Respondents also mentioned other culture-related challenges.** In some cases, the rate of adoption by staff of a suptech tool is lower than expected. Respondents partly attributed this to staff already having established work habits. Some respondents also noted that use of suptech tools may require a different mindset to the use of more traditional tools. Some staff may find it difficult to adapt to a new approach to supervision. Consequently, there is a significant learning curve that staff have to go through to become familiar and proficient with a suptech tool.

36.   **Another cluster of challenges is related to data.**[17] It includes challenges related to the quality, accuracy and availability of data needed to support the identification, development and execution of suptech tools. There might be a limited number of data points available to train a suptech tool or the data sets used to train the tool may be incomplete, which could lead to inaccurate output. Additionally, data used in suptech applications might be classified as confidential. Hence, several measures should be undertaken to mitigate potential leakage of confidential information. One respondent highlighted the importance of integrating public and private data sets as a way to access more comprehensive data. While this is possible, it could be expensive and difficult without preliminary standardisation.

37.   **Inevitably, technology-related challenges arise in the context of suptech.** As mentioned above, some respondents find it challenging to identify the appropriate technology solutions available and to ascertain the maturity and limitations of new technologies. Adoption of new technologies may also be a complex and costly process (see Box 1 for EIOPA's experience). It might also be difficult to integrate suptech tools (eg certain AI-related tools) with legacy IT systems. One authority noted that if the solution is developed on site, it requires regular infrastructure maintenance. This means that there may be (un)scheduled downtime due to system upgrades and this can affect use of the solution.

Box 1

Challenges to adopting innovative solutions – EIOPA's experience

For the European register of insurance undertakings, EIOPA considered three approaches: (i) a central register; (ii) point-to-point integration (ie interconnecting all national registers); and (iii) a central interface plus streamlining the business process. EIOPA decided to follow the third approach since it relies on an IT tool already under development (ie the Cooperation Platform to exchange cross-border notifications among NCAs and EIOPA) and allows for better adaptation to the different IT systems of each NCA. The first and second approaches are significantly more complex and would probably not be reasonable in terms of cost/benefit for NCAs that only supervise a few dozen insurance undertakings. In addition, some markets have specific requirements regarding their registers that might introduce legal complexities if the other approaches were followed.

    In terms of IT solutions to submit data to EIOPA, four alternatives were considered: three "innovative" (ie blockchain; microservices and webservices; and an event-based streaming platform) and one "traditional" (web interface, EIOPA HUB and REST API). The traditional solution is the same IT solution that is currently being implemented for the pan-European personal pension product (PEPP) register. EIOPA eventually decided to adopt the traditional solution for the following reasons:

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[16]   Crisanto et al (2022) note that supervisory authorities are increasingly putting more importance on the data- and IT-related expertise of staff and this is reflected in their hiring practices.

[17]   See also Broeders and Prenio (2018), Coelho et al (2019) and Beerman et al (2021) for further discussions about suptech data-related challenges.

1.   The increased complexity of the innovative solutions would require significant efforts from NCAs to implement and maintain.

2.   The blockchain technology is still at a nascent stage.

3.   The innovative solutions are significantly more expensive, not only in terms of implementation costs but also in terms of total cost of ownership.

The traditional solution leverages two ongoing projects – the PEPP register and the Cooperation Platform – thereby creating significant synergies in terms of costs.

38.   **Some respondents also cited challenges related to reputational risk and practical implementation.** Reputational risk could arise if improper validation of data used in suptech applications takes place. This could lead to misinterpretation and possibly wrongful supervisory actions. Practical implementation challenges include the need for supervisors to adhere to relevant rules and procedures on procurement, building, testing and implementing suptech solutions. This may delay the rolling out of suptech applications. The complexity of the overall project management was also highlighted.

39.   **Respondents pointed out some concrete challenges related to specific tools.** For example, in building a speech recognition tool, identifying different speakers and disregarding interfering noises have been challenges. One authority highlighted the challenge it faced when developing a tool to make the process writing supervision letters more efficient and the tone of communications more consistent. In developing the tool, the authority had to label sentences from past supervisory letters as to their appropriateness and tone but due to the nuanced language used in such letters, the process was difficult and had to be manually performed by supervisors. Meanwhile, authorities that have built dashboards based on information from public sources cited some of the challenges involved. For example, the collection of key information documents for insurance products from insurers' websites cannot be fully automated. Web scraping software could be used but some websites do not allow scraping. For authorities developing data visualisation tools that use data from various sources, the challenge is to ensure that data are structured in a way that support enhanced visualisations.

Specific challenges for insurance supervisors in EMDEs

40.   **Resource constraints are more acute for insurance supervisors in EMDEs, hence they are especially cautious when investing in suptech.** Given limited resources, insurance supervisors in EMDEs are particularly keen to make sure that their investments in suptech pay off. As is the case for their counterparts in other jurisdictions, they are concerned that technologies supporting suptech solutions may become obsolete within a short period of time and/or be rendered less useful by changes in regulations. Hence, they seek to learn from the experiences of their peers to better understand how to approach identifying and implementing suptech solutions in a cost-effective manner. They may also consider partnering with academic institutions or technology companies in conducting one-off explorations of technologies and solutions that can address their specific needs.

41.   **A2ii's engagement with insurance supervisors from EMDEs has also revealed the need for capacity building to better assess and define their suptech needs.** This includes undertaking cost-benefit analyses of possible solutions before decisions are made. In the case of regulatory reporting solutions – which is what insurance supervisors in EMDEs are most interested in – not all insurers and other regulated stakeholders may have the capacity to implement technology requirements. Crisanto et al (2020)

discuss some of the challenges to implementing regulatory reporting solutions and how financial authorities are addressing these challenges.[18]

Other suptech tools or use cases that insurance supervisors wish to have or develop

42.   **Despite the challenges, insurance supervisors are continuing to explore various suptech tools or use cases.** Most authorities would welcome the chance to explore all available suptech tools, if resources were not constrained. One authority, however, prefers to further improve and refine its existing tools by fine-tuning them to the needs of their users, improving their accuracy through solution upgrades, and improving processing speed with enhanced hardware capabilities.

43.   **Many insurance supervisors expressed interest in developing integrated supervisory systems.** These refer to systems or platforms that contain all types of qualitative information (eg insurers' applications, email correspondence), quantitative information (eg risk indicators) and application programmes for different supervisory tasks (eg review and analysis of information, approval process). These systems therefore help ensure seamless, efficient and transparent supervisory processes. One authority sees a lot of potential for such systems in areas in which workload is high (eg approval of insurance intermediaries, analysing complaints from consumers). Another authority believes such systems, if implemented across national supervisors, can facilitate easier monitoring of international insurance groups, including their main shareholders, transactions and vulnerabilities (in terms of solvency, this includes exposure to risks from certain assets and interconnections with reinsurer-covered risks such as climate and cyber risks). One authority also sees the potential of such systems to improve its ability to make connections between different risks. For example, by having all of the information in one place, models could be deployed to measure the likelihood and impact of climate change, and its corresponding impact on insurers and policyholders.

44.   **Respondents also mentioned other suptech tools or use cases that they are planning to develop or would like to have.** These include better systems for reporting, automation of internal processes through application programming interfaces (APIs) and the application of AI/ML across different areas of supervision, such as data validation, identification of outliers and assessment of prudential and conduct risks. Insurance supervisors also look to the potential of AI/ML in supervisory sampling that is risk-driven and avoids bias or random samples which are not meaningful. There is also a lot of interest in NLP tools to automate the extraction of insights from unstructured data or narrative reports.

45.   **Insurance supervisors in EMDEs are likely to continue to follow the COTS approach to meet their suptech solutions for the foreseeable future.** This is due to limited in-house technical expertise in developing suptech solutions, as well as limited expertise in undertaking experimentation or developing proofs of concept. Their focus in the future is likely to be on looking for COTS solutions that will enable greater effectiveness in risk-based supervision and that will help them adopt regulatory standards. There is also interest in tools that enable capacities to pull and analyse data from regulated entities in real time, and to identify, predict and address potential supervisory issues.

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[18]   For example, to address the capacity constraints of smaller financial institutions, the National Bank of Rwanda has invested heavily in hardware and infrastructure investments in order to reduce costs for the industry. The Bangko Sentral ng Pilipinas, on the other hand, implemented different solutions for larger and smaller institutions.

Section 4 – Conclusion

46.   **Insurance supervisors – like their banking counterparts – are actively using and exploring suptech tools.** Their focus is on tools that can be used for data collection-related processes, such as reporting, validation, consolidation and visualisation. Such tools benefit both prudential and conduct supervision. The tools that insurance supervisors use for prudential supervision are quite similar to those used by banking supervisors and are meant to help in the identification, assessment or measurement of prudential risks, including systemic risks. Given the emphasis on conduct risks in insurance, insurance supervisors are also using, developing or experimenting with tools that aim to help them ensure the fair treatment of customers by insurers and intermediaries.

47.   **While insurance supervisors raised familiar challenges – lack of resources, challenges related to data, internal processes etc – a few novel ones also emerged.** In particular, insurance supervisors highlighted challenges related to the identification of the suptech tools they need. These may be due to evolving regulatory requirements that suptech tools are meant to process or a lack of understanding of the available technologies and their limitations, among others. Moreover, while human resources with the right skills and expertise are needed in developing and using suptech tools, insurance supervisors pointed out that expertise is also needed to follow-up on the findings of the tools. This is where experienced supervisors are relevant and it highlights the important role that supervisory judgment continues to play.[19]

48.   **Insurance supervisors in EMDEs are facing even greater challenges.** They are focusing on suptech tools that can be used for data collection-related processes. This is a good starting point since supervisors need to have access to good quality data first before they can exploit the analytical capabilities of new technologies. Unlike their counterparts in developed economies, insurance supervisors in EMDEs typically rely on COTS solutions and customise them rather than developing solutions internally. This is due to a lack of in-house expertise and a general lack of resources, both of which are more acute in EMDEs than in other countries. Lack of resources makes them cautious about which suptech tools to use or develop. They have little to no room to undertake innovation-related activities such as experimentation and developing proofs of concept on their own. Thus, there may be scope for them to partner with academic institutions or technology companies in their jurisdictions and conduct one-off explorations of potential solutions to a specific need (eg through a tech sprint).[20]

49.   **Insurance supervisors find suptech useful but they do not yet have clear KPIs or methodologies to measure effectiveness and efficiency.** Insurance supervisors using suptech tools typically solicit user feedback on the effectiveness and efficiency of the tools. This could be in the form of subjective assessments on the usefulness of the tool or in more objective metrics, such as time saved in completing a task. Nevertheless, there are certain tools that have clearly been beneficial, particularly during the pandemic. Such tools include online data submission systems and the remote access to supervision data that they make possible, as well as virtual on-site visits through the use of virtual meeting tools. These tools have enabled insurance supervisors to continue to undertake their tasks and maintain supervisory engagement with insurers despite pandemic-related restrictions.[21]

50.   **Insurance supervisors are continuing to explore suptech tools and this must be accompanied by corresponding expertise and a culture of innovation.** In addition to specific suptech tools, many insurance supervisors are aiming to develop integrated systems or platforms that contain different applications – from data collection to data analytics – and that span the whole supervisory

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[19]   Beerman et al (2021).

[20]   For authorities that want to explore specific suptech tools first before committing substantial resources, there are helpful avenues such as innovation labs, accelerators and tech sprints (di Castri et al (2019)).

[21]   See also Badat et al (2021).

process. Investments in these technologies require corresponding digital and data expertise. More importantly, fostering a culture of innovation that relies on data-driven decision-making, openness to experimentation and questioning "legacy thinking" is required within financial authorities. There are no easy solutions to the expertise and culture challenges, but capacity building programmes can help. Acquiring new talent, and raising the data and technical literacy of existing staff through training programmes will not only develop the required expertise, it will also help foster a more innovative culture.

Annex: List of authorities that responded to the survey

Jurisdiction	Authority
Bermuda	Bermuda Monetary Authority (BMA)
Brazil	Superintendence of Private Insurance (SUSEP)
Canada	Office of Superintendent of Financial Institutions (OSFI)
Chinese Taipei	Financial Supervisory Commission (FSC)
European Union	European Insurance and Occupational Pensions Authority (EIOPA)
France	French Prudential Supervision and Resolution Authority (ACPR)
Georgia	Insurance State Supervision Service of Georgia (ISSS)
Germany	Federal Financial Supervisory Authority (BaFin)
Guernsey	Guernsey Financial Services Commission (GFSC)
Hong Kong SAR	Hong Kong Insurance Authority (HKIA)
Hungary	Magyar Nemzeti Bank (MNB)
Italy	Institute for the Supervision of Insurance (IVASS)
Malaysia	Central Bank of Malaysia (BNM)
Republic of Korea	Financial Supervisory Service (FSS)
Singapore	Monetary Authority of Singapore (MAS)
Slovakia	National Bank of Slovakia (NBS)
South Africa	Prudential Authority (PA) and Financial Sector Conduct Authority (FSCA)
Switzerland	Swiss Financial Market Supervisory Authority (FINMA)
United Kingdom	Financial Conduct Authority (FCA) and Prudential Regulation Authority (PRA)
United States	National Association of Insurance Commissioners (NAIC)
Zambia	Pensions and Insurance Authority (PIA)
Zimbabwe	Insurance and Pensions Commission (IPEC)

Sources: IAIS member survey (2022); A2ii complementary survey of insurance supervisors in EMDEs (2022).

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