



# Actuarial Technology

## A Roundtable Discussion on Current Issues



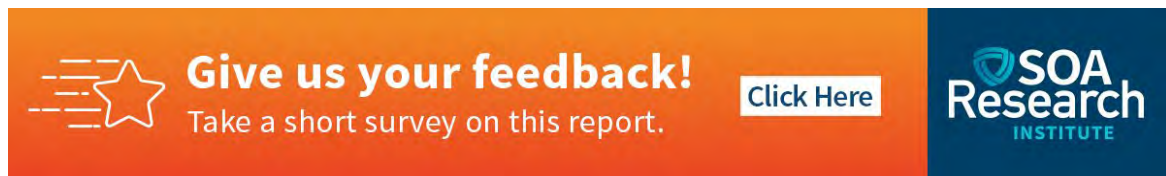




# Actuarial Technology

## A Roundtable Discussion on Current Issues

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**SPONSOR** Actuarial Innovation and Technology  
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# Actuarial Technology

## A Roundtable Discussion

### Background and Objectives

Advances in technology continue to evolve at a rapid pace, and actuarial work continues to benefit from the adoption and use of new and better tools as they become available. The pace of change creates many issues around optimal use of technology tools and the training and management of actuaries who use them.

On November 30, 2021, the SOA Research Institute assembled an industry expert panel to discuss current issues in actuarial technology. Each participant who volunteered to be part of the discussion was selected because of their management-level responsibilities for the application of technology in an actuarial context. The group was diverse in terms of employment, including company actuaries from life, health, and property/casualty backgrounds, as well as consultants from various kinds of firms.

The objectives of this panel discussion were:

- to develop an outline and improve understanding of current issues in the general area of actuarial technology
- to help identify directions for future research efforts.

This document summarizes the discussion that occurred during the three-hour meeting. To encourage candor during the discussion, participants were assured that this report would not attribute comments to individuals or companies, so no names appear in the body of the report. The names of those who participated are included at the end of the report.

## Executive Summary

The discussion focused on five specific topic areas:

1. Actuarial data
2. Actuarial tools
3. The Actuarial operating model
4. Single-platform vs. multiple-platform
5. Vendor risk management

The first three topics generated the most extensive discussion and engagement by the panelists.

Actuarial data has received increasing attention recently. The scope of actuarial data has expanded beyond the statistical and policy inventory data used for traditional actuarial pricing and reserving work; it includes marketing and policyowner behavior and lifecycle data and even information from outside the company that may affect the direction of strategic marketing efforts. New technology has increased focus on the data platform, that is, the toolset used to organize, store, and analyze actuarial data. And the availability of facilities in the cloud has led to new ways to store, securely share, and analyze large amounts of data within an organization.

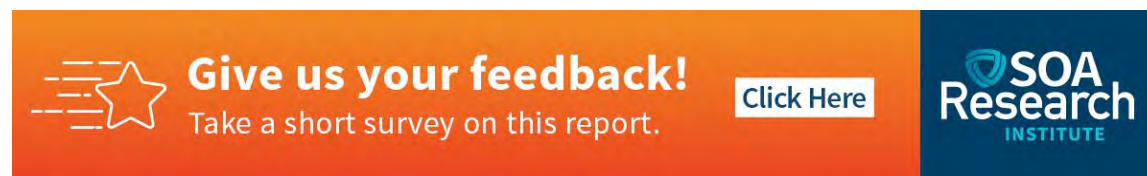
Actuarial tools continue to evolve. Such change creates issues in managing human resources – updated training is required and there can be some resistance to it. The diversity of available tools creates a need to manage tool selection and limit use to a selected set. The complexity of some tools can create model risk due to incomplete understanding of their underlying methodology. And the increasing use of open-source libraries and modular systems creates a need to manage the set of modules and libraries approved for use within an organization.



The actuarial operating model becomes an issue due to specialization that is a natural consequence of increasing tool complexity. There can be a separation between experts in hands-on use of technological tools and experts in the interpretation and use of the analysis that those tools produce. It is not always clear whether such separation should be encouraged or discouraged. The approach taken has implications for actuarial career paths and organizational structure.

The choice of using one single platform or multiple platforms is connected to the operating model and the degree of alignment between the platforms and the tasks to be performed.

While vendor risk cannot be completely eliminated, there are approaches that can be used to mitigate it.

The remainder of this document provides further details of the panel’s discussion on these topics.



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## Section 1: Defining “Actuarial Technology” and the Biggest Current Issue

To start the discussion, each panelist was asked to provide a short description of their background and then answer two very general questions: What is actuarial technology, and what is the most important current issue in actuarial technology? Here is a summary of the ensuing discussion:

### 1.1 WHAT IS ACTUARIAL TECHNOLOGY

Definitions of actuarial technology started out rather narrow and then expanded considerably as discussion went on. The narrow definition focused on the tools and processes used to carry out an actuarial task. But it became clear that both the concept of “tools and processes” and the scope of the “actuarial task” were meant very broadly.

“Tools and processes” involve much more than just the computers and software that actuaries use day-to-day to perform actuarial analysis. Tools need to be viewed in the context of an end-to-end process that involves people and the sharing of information. In the context of a world where the available tools continue to evolve, evaluating the future desired state of a process and getting to that future state is a major area of focus.

“The actuarial task” involves much more than statistical and financial analysis. Holistically, an actuarial task involves sourcing and formatting input data, performing calculations, analyzing the results, preparing reports, communicating recommendations, and ultimately making decisions. Technology affects not only the calculations and analysis, but each step of the process.

Panelists frequently referred to the concept of a technology platform. The platform is viewed as an enabler, something that enables a certain kind of work to be done. But that work, like the actuarial task, needs to be viewed broadly – as broad as the entire operation of an insurance enterprise – and almost always involves non-actuaries. The unique actuarial role is in understanding how an entire process works from end-to-end and designing or assembling a technology platform to enable the entire process to work smoothly and efficiently. It was acknowledged, however, that while insurance enterprise initiatives should influence platform decisions, the actuarial requirements are sufficiently different that actuarial-specific tool and platform choices are often warranted.

So, while actuarial technology can be thought of as the tools and processes used to carry out an actuarial task, it seems important to view both the tools and the nature of the task holistically as an integrated ecosystem, not as independent, isolated activities. Section 3 expands on the topic of Tools.

### 1.2 WHAT IS THE MAIN ISSUE IN ACTUARIAL TECHNOLOGY TODAY

Given the broad way in which the discussion participants defined actuarial technology, along with the diversity in their backgrounds and current responsibilities, it is not surprising that a great variety of different issues were mentioned as most important in actuarial technology today. Issues that were mentioned as important include all of the following:

- **Training actuaries** to use the tools that are available, especially the more complex tools that involve a significant learning curve.
- **Using available tools effectively**, including building connections between different tools to form a coherent technology platform.
- **Finding a way to ensure future support** for both the users and the developers.
- **Identifying the future state of technology** and developing a path to get there.
- **Onboarding of new technology** and getting comfortable with a change to a new toolset can be a challenge.
- **Properly managing change** is important. One needs to control the temptation for too much change. People are good at finding many new ways of doing things and solving problems, but one needs to manage proposed changes to focus on those that achieve economies of scale and provide the most value.

- **Articulating the desired state** is a challenge. Actuaries need to describe requirements to define what the solution should be and how it should fit in.
- **Finding talent that has both technology expertise and an actuarial understanding of problems** is difficult. IT experts often don't understand the business problems the way actuaries do, and that stands in the way of conceiving and implementing optimal solutions.
- **Avoiding IT silos** is important. Putting IT in a silo refers to dividing responsibilities so that positions that deal with IT and hands-on use of computer tools are separated from those with more traditional actuarial responsibilities. This leads to career paths that split actuaries between those with IT knowledge and those with more traditional actuarial responsibilities. Such a career path split can lead to communication barriers that inhibit effective application of technology to actuarial responsibilities. Blended teams could be an option.
- **Expanding actuaries' roles in data management** helps to keep the data aligned to its purpose. When actuarial technology is limited to financial modeling, the disconnection to the data can be a significant issue.
- **Adopting and effectively using modern communication tools** is a significant issue, and not just in the context of a pandemic and working from home.

While there were a variety of specific issues that were raised as the participants built upon prior responses to further elaborate on challenges, three consistent themes emerged. These themes are expanded upon in the following sections.

- Actuarial Data: establishing a robust data foundation – acquisition, management, transformation, access, etc. – to support actuarial use cases.
- Actuarial Tools: selection of tools as well as associated culture change necessary for adoption.
- Actuarial Operating Model: actuarial team organization, skills, and alignment, especially as it relates to technical/IT skills and career path.

## Section 2: Actuarial Data

Issues that came forward while discussing actuarial data were focused on the scope of data in use, the data platform, and use of the cloud.

### 2.1 DATA SCOPE

There was a strong emphasis on the idea that actuarial data is not limited to traditional sources and uses, such as pricing, reserving, and experience studies. Data from outside the actuarial function, and even from outside the company, is often valuable for actuarial work. The scope and variety of data being made available and used by actuaries is expanding. However, not all the data that is available to actuaries is useful for their needs, and some of the most useful data may come from nontraditional or unavailable data sources.

Nontraditional data domains within a company may include sales and underwriting. A company can benefit from understanding which cases are lost, what a typical customer is like, and what a customer or contract life cycle is.

Nontraditional data domains outside the company can also be useful in some kinds of business. For example, group business may use external data when marketing, when selecting and underwriting customers, and in other ways focusing on risk management. The value of such external data depends much on the subject matter and on the context; the insuring of first responders was mentioned as one interesting example.

### 2.2 DATA PLATFORM

The movement away from “spaghetti-style” data structures (i.e., customized data flows for each use case) to data organized around holistic needs is a common area of attention with many facets.

There is often difficulty in maintaining current activity and output when transitioning to a new state. For example, a large model conversion requires continued support of the existing platform for production while a new structure is being built and tested, sometimes with the same staff supporting both.

Whenever a transition is made, there can be reluctance to change. Staff may have learned to work with an existing “spaghetti-style” data structure. The idea that actuaries have an “Excel problem” or a “SAS problem” in being tied to old tools and old data structures came up more than once – there is reluctance to move away from something that has been made to work. In many professions, one’s tools represent one’s identity. Being asked to abandon tools you’re skilled at using can feel like a personal rejection.

To address these issues, sometimes it takes a top-level organizational commitment with rules and enforcement. Such an effort would not be just in actuarial but more widely throughout an organization. Rules may go beyond just what tools and what platforms are used, but also include governance around things like what must be in a report.

Strong governance must be balanced with ensuring all needs continue to be met. This, in turn, needs to be balanced against the danger of scope creep. Data platform issues tend to get very complicated in terms of balancing many competing needs. To deal with this, an organization may decide to use multiple platforms to meet all needs and avoid over-commitment to one platform.

### 2.3 DATA IN THE CLOUD

The option to migrate data to the cloud was mentioned several times. It can help reduce reliance on spreadsheets and bring new tools into use when data cubes start failing due to the scale of the data.

In one case, this was done to prepare for new accounting models with reporting seen as the impetus. Part of the benefit is to reduce the number of model jobs that are needed.



A close partnership with IT is viewed as critical to making this work. The closer the partnership, the better – having all members of the team report to the same manager is ideal. Sending data to the cloud requires tight stewardship of the data as regulators may limit what data can be sent to the cloud and where those servers can be located.

## **2.4 OTHER DATA-RELATED ISSUES**

Several other data-related issues came up during the discussion.

Advanced analytics and black box data analysis need to be used with care. Testing for bias is important – it can sometimes be hidden.

Data quality is an important issue and is not just an actuarial responsibility. But it is especially important to actuaries and increasing actuarial responsibility for data quality can indirectly lead to more actuarial responsibility and influence in other areas.

The granularity of data is of particular interest to actuaries. It is very important to reconcile the aggregate data used in much actuarial work with the granular data used elsewhere.

## Section 3: Tools

The discussion of tools was wide-ranging. The list of tools that were mentioned is long and includes a wide variety of both hardware and software. Many issues, challenges and choices arise in selecting a toolset and managing the way people use it within an organization. The five topic subsections below were defined after the discussion took place to summarize areas of focus that came up repeatedly.

### 3.1 MANAGING THE HUMAN RESOURCE SIDE OF TOOL ADOPTION

New tools are becoming available continuously and each is designed to make some kind of work easier. But each has a learning curve, so time and resources are needed to train people in their effective use. “Change management of people is the hard thing.” There can be reluctance to invest the time needed to learn a new tool, even if it is said to be more powerful. Examples<sup>1</sup> mentioned were PowerBI, which was described as “Excel on steroids,” and DataRobot, which makes it easy to create a predictive model.

Each generation of students who enter the workforce bring skills with a new set of tools. Recent graduates often know R<sup>1</sup> and Python<sup>1</sup>, but their managers often do not. It can be difficult to know and decide when it’s time to adopt new tools – it depends on what is easiest to teach and learn, and subject-matter experts need to be engaged to get everyone on the same page.

Use of technology tools often means building a process to get something done, but building for oneself and building for others are very different. In an organization, sustainability is important and that means building for others which, in turn, means using a toolset with which others are familiar, building into an ecosystem of existing solutions, and providing documentation and training as needed for staff to move from one task to another. An example of this issue is the use of APL<sup>1</sup>, a powerful programming tool for the individual user, but one that has fallen out of use partly due to the complexity of long-term support needs.

### 3.2 MANAGING THE VARIETY OF TOOLS USED TOGETHER

The requirements and tasks for actuarial work have become more diverse, and more technical, as methodologies and tools have evolved. It was acknowledged that specialized tasks can benefit from specialized tools. Examples were shared where organizations had selected individual tools for data storage, modeling, and ad hoc analysis, and had benefitted from each. However, it was also recognized that a broader set of best-of-breed tools led to a greater learning curve, integration challenges, and sustainability and ownership challenges. Balancing enterprise tool selection and actuarial tool selection were also noted as important considerations.

### 3.3 TOOL COMPLEXITY AND MODEL RISK

Some actuarial tools are extremely complex and require specialized knowledge to be used appropriately and effectively. It was noted that some of the new tools for predictive modeling can be dangerous because it’s not always clear “what’s under the hood,” which could lead to inexperienced users misusing the models.

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<sup>1</sup> Examples listed here were mentioned by participants for illustration purposes. The group noted that other tools exist. This is not an endorsement.

### 3.4 OPEN SOURCE, LIBRARIES, AND INTERNAL CODE DEVELOPMENT

Actuarial analysis often involves the development of new complex calculations and manipulation of proprietary data. This requires actuarial software development or programming. While often done in an ad-hoc manner, more controls and standardization are being introduced in the actuarial programming environment.

Such controls take many different forms. The first is control over which tools are being used. There are a great many programming languages and data analysis tools available in the market, but most organizations limit their staff to a chosen few.

Many more recently developed tools have evolved to enable modularization, which is the creation of libraries or packages of reusable code. These libraries and packages have clearly defined interfaces or connections and are well-documented, thereby facilitating reuse. Some organizations are creating teams to oversee and control the development and reuse of such libraries and packages by users across the organization.

The use of open-source software has been rising, particularly in connection with open-source libraries and packages. Open-source modules for special purposes have become widely available on the internet and are widely used. Organizations that control the internal use of libraries and packages often include oversight of open-source software in the same control structure. It's important to consider the security of open-source libraries and ensure that they have been vetted by the IT department.

The use of open-source software brings issues of copyright and maintainability as well. Copyright issues are more easily handled when the software being developed is for internal use rather than external sale, but care and attention are still required. Maintainability becomes an issue because open-source software is often created by organizations that lack permanence. Relying on open-source software is like relying on any other vendor – there is a risk that the vendor will fail and be unable or unwilling to maintain the tools they provide. Nevertheless, the rise in use of open-source software results from the availability of established libraries that are supported by organizations that are expected to last.

Turning back to the internal development of software and tools, the actuarial software environment has started including some of the project management and testing tools that have long been used in IT shops. Part of this may be because such tools have, in recent years, become widely available through the internet and are widely used for public open-source projects. GitHub<sup>1</sup> is perhaps the most widely used change management tool, and several discussion participants mentioned its use in their organizations. There are also tools for developing, automating, and documenting testing in a standardized way.

### 3.5 DATA SECURITY AND CONTROL ISSUES SURROUNDING TOOL SELECTION

Two data security issues arise particularly in the context of actuarial programming.

One issue is keeping control over extracts and copies of data. When the data platform is based on one tool, such as SQL databases, and actuarial analysis uses another tool, such as Python, one can often find multiple extracts or copies of the same data that have been created in a form more easily used by Python. This makes it more difficult to identify whether the data is consistent or being used appropriately in each instance. Some sort of governance or control is needed to prevent the proliferation of copies of the same data in different formats.

A second security issue arises when data is accessed remotely or resides in the cloud. Network data security is important and can depend on the choice of equipment and software used for data connections.

## Section 4: Actuarial Operating Model

The actuarial function tends to overlap IT, accounting, and finance. Management's challenge is to organize these functions and enable them to connect and work together.

Recent "actuarial transformation" projects have highlighted that some actuaries gravitate to coding and ETL (extraction, transformation, and loading of data) while others avoid those areas. This raises a question as to the appropriate actuarial role in a multi-functional transformation project.

It was noted that what sets actuaries apart is their standards of practice and knowledge, not their IT skills. A blend of staff is needed to bring in the best set of skills to accomplish the outcomes, which may include IT, actuarial, project management, and finance enablement. Working side-by-side leads to cross-pollination where IT staff learn to understand models and the business, while actuaries learn about IT issues and methods. One comment was that when such cross-functional teams report to separate leaders, it doesn't work well. It's "not a real team."

A question was raised: should there be a separation between the producers and consumers of actuarial work? It was noted that implementation of GAAP-targeted improvements has sometimes resulted in such separation. The benefits noted included the more efficient production of actuarial results, the ability to optimize for skills that are more technical (production) vs. actuarial (consumption), and more capacity for those who are focused on the outputs to analyze and interpret the results. This was balanced against the requirement, and the risk, of the production team to be able to meet the needs of the consumers.

## Section 5: Single- or Multi-Platform

Most companies have multiple lines of business. Should all lines of business and all actuarial functions use the same modeling platform? Comments on this question included the following:

- Benefits of using multiple platforms include avoiding reliance on only one vendor, along with recognition that no one system is perfect and different systems have different strengths for different businesses.
- Use of a single platform tends to avoid key-person risk. When using multiple platforms, there tends to be one key person for each platform / line-of-business combination.
- Use of a single platform gives some economies of scale by providing consistent data layouts and functionality.
- The need for specialized reinsurance capabilities can affect the choice.
- Sometimes, a multi-platform strategy is the only choice because there is no one platform that covers all product lines.
- Even when there is just one platform, it can be used in very different ways by different product line users.
- In the past, it was often necessary to have separate systems for projections vs. valuation. Now, it is possible to combine both into one system.
- Some companies feel that pricing needs to be flexible and so cannot use a vendor's canned system. However, it was noted that some vendor systems are flexible through the use of "open code."

## Section 6: Vendor Risk Management

Reliance on vendors for IT systems creates a risk of vendor non-performance. The vendor may go out of business or may simply stop maintaining an existing product. What can be done to mitigate this risk? Panelist comments included these:

- Vendor risk management can be included as part of continuity planning.
- One can avoid vendor risk by developing all systems internally, but that can lead to key-person risk.
- Closed systems (where code is locked down and entirely managed by the vendor) present more risk if the vendor fails than if open systems do.
- Some countries have outsourcing regulations that are relevant here. Sometimes, data and system backups must stay in-country.
- One organization made bets on some vendors a few years ago and are now revisiting the risk. A concern is vendor non-performance and the need to monitor vendor performance. It's not clear how such monitoring should be done. Another commenter mentioned that such monitoring would be a good idea for actuarial modeling platforms because the monitoring of modeling platforms is less common than other kinds of vendor-supplied systems (such as admin systems).
- Having multiple vendors and/or in-house development capabilities gives an organization leverage to encourage vendor performance. This has to be balanced given steep transition costs associated with changing platforms.
- Vendor user groups are a good avenue through which to influence vendors. When formal user groups do not exist, informal conversations with other users of the same vendor have helped.



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## Section 7: Acknowledgments

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## About The Society of Actuaries Research Institute

Serving as the research arm of the Society of Actuaries (SOA), the SOA Research Institute provides objective, data-driven research bringing together tried and true practices and future-focused approaches to address societal challenges and your business needs. The Institute provides trusted knowledge, extensive experience and new technologies to help effectively identify, predict and manage risks.

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