SOA Research Institute

Actuarial Innovation and Technology

Actuarial Technology A Roundtable Discussion on Current Issues – March 2022 Update

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Actuarial Technology

A Discussion on Current Issues – March 2022 Update

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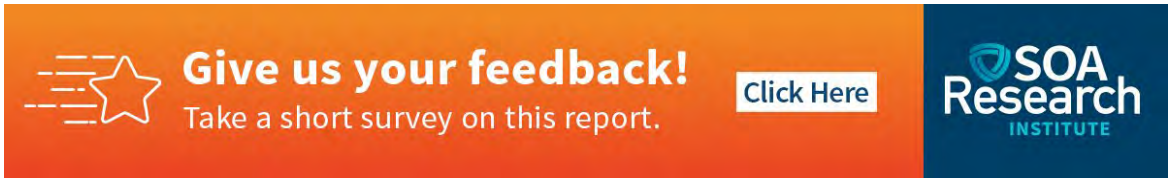

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A Discussion on Current Issues – March 2022 Update

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 the optimal use of technology tools and the training and management of actuaries who use them.

On March 21, 2022, the SOA Research Institute assembled an industry expert panel to discuss current issues in actuarial technology. This was the second time the panel was assembled; the first was on November 30, 2021. Each participant who volunteered to be a 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:

- further develop an outline and improve the understanding of current issues in the general area of actuarial technology and
- 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 three specific topic areas:

1. The Actuarial operating model
2. Technology risk
3. Open-source software

Discussion of the actuarial operating model was framed in terms of the organizational chart. The actuarial function requires expertise that relates to positions with titles like Chief Actuary, Chief Financial Officer, Chief Data Officer, or Chief Risk Officer. Panelists discussed the various ways in which these titles are positioned in the organizational chart and the way cross-functional teams are created.

Along with the need for cross-functional teams, several panelists mentioned another common issue. Sometimes, top management is focused narrowly on generating new business. Actuarial functions other than new business pricing, such as experience analysis, financial reporting, and regulatory compliance, can be viewed as overhead and cost centers and tend to be starved for resources. This complicates relationships between various C-level officers because it is difficult to align priorities. Some approaches to addressing that issue were discussed.

Another issue raised was the need to balance the need for control over the production environment with the need for ad hoc analysis capability. Production benefits from stability, while analysis requires flexibility. Approaches to balancing them were discussed.

Technology risk refers to the consequences of either adopting and using new technology without proper understanding or avoiding the use of new technology and becoming a late adopter. Introduction of this topic generated a wide-ranging discussion by the panelists. Each of the following issues was raised and discussed:

- When using complex analytical tools and methods, it is important to know in advance what a reasonable result would be.
- Regulatory requirements are being developed in this area, particularly around the development and use of complex data models.
- Consulting firms frequently take on quite a bit of technology risk by being on the cutting edge of new technology adoption. Clients rely on their consultants to properly manage this risk and view it as transferred to them. However, it was noted that giving control over data algorithms to a consultant or vendor is like giving a loaded gun to someone else – you need to be very sure you can trust them.
- The adoption of new technology to solve a problem involves the risk of an adverse result; you could end up with a bigger mess than when you started. The decision about whether to adopt new technology must consider this risk.
- In the context of actuarial modeling, portability was mentioned as an important consideration and a way to minimize technology risk. Portability refers to the use of standard interfaces and the ability of any new tool to connect with existing software.
- Management of shelf life is an important aspect of technology risk. In the context of actuarial modeling and analysis, a proliferation of ad hoc add-on procedures, sometimes referred to as “spaghetti code,” is a sign of the end of shelf life for a system and the need to consider major change. It is not necessarily a sign of mismanagement if it is understood from the outset that all systems have a finite shelf life.

Open-source software offers ready-made solutions for some problems and several panelists mentioned the benefit of using available open-source tools. One panelist said that actuarial recruiting has benefited from the mention of the use of such tools – it generates interest among the pool of candidates.

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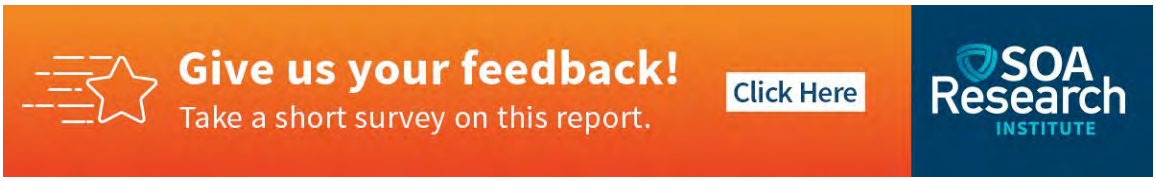
In the context of actuarial modeling, open-source tools are mainly being used in pre- and post-model processing of data and model output. This is mainly ETL activity (extraction, transformation, and loading of data). Open-source tools are not used much in actual model processing where commercial model platforms dominate.

Open-source can refer either to tools developed externally and used internally, or to tools developed internally and made available to the public. Panelists indicated that most open-source activity among actuaries is the former, involving the use of tools developed elsewhere.

Panelists noted that where open-source software is used, there is often active management of its use, including the need for approval of each package and a professional search for malicious code.



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?

For most panelists, actuarial technology is a broad term that refers to what actuaries need to do their jobs efficiently and well, with a focus on computer hardware and software for calculations and data management.

Several panelists focused on the concept of technology as an end-to-end process. A model is implied as the center of the process that involves both modeling and data management. These comments may reflect the background of the panelists because several have responsibility for modeling operations for their employer or consult on model implementation.

A distinction was drawn between operating technology and actuarial technology. Besides there being differences in purpose, actuarial technology tends to be more complex with flexibility to allow ad hoc analysis, in contrast to operational technology that is more focused on efficiency. The end-to-end process mentioned above involves elements of both.

1.2 BIGGEST ISSUE IN ACTUARIAL TECHNOLOGY

The key issues identified by the panelists fell mostly in two general areas: the relationship between actuaries and software engineers, and data management. Some issues were identified that span both of those areas.

The issue concerning the relationship between actuaries and software engineers was expressed in several ways. One view was simply that "actuaries are not software engineers" and the issue is how to develop teams and organizational structures where both can work together effectively. Another view was that the need for blending these skills can be facilitated by a variety of career paths, some of which blend the two areas of specialization. The motivation that makes this an important issue appears to be the trend towards model-based financial management, which requires a high level of expertise in both areas.

Issues around data management can be classified in two areas. One is understanding how to use big data and incorporate it into regular processes, such as experience studies, assumptions, and underwriting. Another is making data access easier and more efficient, including both the organization of data and the tools that enable effective use.

One central issue spans both data management and the actuarial/IT interface, and it was approached slightly differently by each panelist who mentioned it. It is the need for judgment and balance when managing the complex issues presented by the availability of new technology. Here are some ways in which this issue was expressed.

- There needs to be balance between complexity and flexibility for change. Flexibility is reduced with complex models, but model complexity is often required due to actuarial considerations, including the need for ad hoc analysis. The use of modular architecture is one approach to try bridging this gap.
- "Just because you can doesn't mean you should." For example, the availability of limitless computation capacity in the cloud doesn't mean you should use it to perform endless complex analyses.
- The management of process improvements requires a balance between an open and closed tool; open to allow ad hoc analysis and thinking, and closed to provide a locked down and efficient environment.

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The customer experience should be considered as technology is developed. As a user is presented with more choices, the user interface can become more complex and overwhelming, so the skills needed to run the process can increase.

Section 2: The Actuarial Operating Model

Actuarial modeling involves expertise that spans many areas in an organization. Sometimes, these areas are headed by separate people with titles like Chief Actuary, Chief Financial Officer, Chief Data Officer, or Chief Risk Officer. The question at hand is how these various leaders fit into the organizational chart and how they and their staff relate to each other and work together. The concept of a Chief Modeling Officer could be relevant here. Panelists were asked to discuss the actuarial operating model as it exists in their organizations, what worked and what didn't, and different approaches that had been tried.

To begin the discussion, one panelist described their position at a large insurer with international operations. The position encompassed what might be termed "chief modeling officer." It reported directly to the global chief actuary and its peer to regional chief actuaries. It had a large support staff that served people across the organization. The group was created 10 years ago with sub-teams for each of the development, testing, and production phases. It was found that production for the global organization all in one sub-team was too much, so the teams restructured regionally. That gave better flexibility and led to more responsiveness to customers. It also provided more interesting jobs for actuaries because the jobs focused narrowly on production were not so interesting.

It was observed that putting a modeling officer on the same level as regional leaders (regional chief actuaries) is a powerful statement on the importance of modeling to the organization. Actuarial students who start their careers in modeling can see a path to a senior level role.

In some cases, management is focused mainly on new business. The Chief Data Officer and Chief Analytics Officer are focused on marketing and sales. The Chief Risk Officer may be focused mainly on assets and investment risk. In situations like this, actuarial modeling can be viewed mainly as a cost center and have more difficulty getting project funding or support to build and maintain an actuarial database that encompasses all business including older inforce blocks.

The issue may be not just resource allocation; it can be structural. This can happen when the Chief Data Officer is under an IT umbrella, and IT is viewed as part of operations, while actuarial is under the umbrella of finance and risk management. That can be a structural problem because any relationship between IT and actuarial involves not just reaching across an organization, but instead first climbing up one silo on the organizational chart and then down another silo.

Success stories in this area involve cross-functional teams. One panelist described a team inside the IT organization that was dedicated to supporting finance. The actuarial modeling team worked effectively with them. Other panelists observed that the greatest barrier to the formation and success of cross-functional teams was the need to get the interests of senior executives aligned.

Aligning the interests of senior executives can require redefining responsibilities. Actuarial responsibilities can be redefined as managing risk and capital rather than managing data and generating reports.

One panelist noted that decisions on strategy in the application of IT resources and development of modeling and data capabilities were financially important and asked who had a senior-level committee to set such strategy. Another panelist described a situation where such a committee existed and included an actuary, but actuarial issues still did not get priority - the actuary was not heard. Others commented that an actuary needed a strong technical IT background to be effective in such a group.

Switching to a different issue, quite a bit of discussion focused on balancing the need for control over the production environment with the need for ad hoc analysis capability. When resources are short, sometimes shadow

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processes arise to get around the red tape of changes to production. Comments on this issue included the following:

- One panelist cited an example where people were reporting production results by reversing all entries from the production system and replacing them with ad hoc entries.
- Barriers to production change are required to limit the number and frequency of trivial changes. Trivial changes can introduce unnecessary complexity. The temptation to determine sensitivity to every assumption and get near-perfect precision can lead to such trivial changes; models are inherently simplifications and it is important to get comfortable with the level of approximations used.
- There can be confusion about the meaning of "production." Does it refer to the model itself or does it include all or only some use of it? A production model can be used for ad-hoc analysis.
- Production does not have to be rigid. One can allow for reruns and adjustments in a controlled way. A key part of a robust production process is the ability to accommodate limited in-cycle changes.

Panelists expressed interest in revisiting the issue of production management in a future panel discussion like this one. Other related issues in which interest was expressed included:

- The use of workflow tools and BPM (Business Process Management) in designing production environments and managing technology
- "Low code, no code" tools in relation to the required skill set and HR issues

Section 3: Technology Risk

The concept of technology risk is focused on the consequences of either adopting and using new technology without proper understanding or avoiding the use of new technology and becoming a late adopter. A related question is how to ensure that users of complex technology understand it and, therefore, have informed professional judgment.

As explained by one panelist, you can use a car without knowing much about how it works, but current actuarial technology requires an understanding of how each part of the process works. Another noted we need to know what could go wrong when using technology. For example, a data model requires training data, but poorly selected training data could dramatically reduce the model's usefulness, resulting in an over-fitted model or a model with little predictive power.

A mapping or categorization of technology risk was expressed as something we need. It would help in understanding what to be aware of and prevent problems from arising.

An understanding of what a reasonable result should look like was mentioned as important. If you run a query or process and don't understand what it is supposed to do, it can be hard to tell if the result is reasonable.

Regulatory requirements are becoming more demanding because of this risk, according to one panelist. Some emerging regulations require that bias be controlled when using artificial intelligence (AI) or machine learning (ML) tools, which requires advanced proficiency with these techniques.

One panelist mentioned that a consulting firm takes a lot of that risk upon themselves by acting as an interface between technology and business users. They employ a consistent paradigm for change control. An example of risk they have experienced was with hosting modeling software in a cloud platform. There have been instances where a change in the cloud hosting platform resulted in changes to the financial results from a model hosted in the cloud, even without changes to the model itself.

A key question is whether to use available new technology. If a new technology is adopted without carefully considering its deployment and use, there is a risk that it could create poorly built or fragmented solutions and lead to even more problems. The potential for negative outcomes is a key consideration.

Before changing to a new technology, it is important to consider the company's data practices. If actuaries have poor data management skills, new technologies will not address the data issues and can produce misleading results. In this case, the underlying issue is one of knowledge, not technology, and the company would be better served by training its employees on proper data management techniques.

In the modeling context, portability was expressed as an important consideration. Common or standard interfaces between user input and model code can help, as can a modular code structure that defines what the user sees.

The idea of shelf life was discussed. Actuarial models have a shelf life, and data algorithms probably do as well. As a model is maintained, additional layers of code may be added, which can result in a proliferation of connections like "spaghetti." This is powerful evidence that the shelf life of the solution is expiring. By setting the expectation up front that technology will expire, it can become easier to plan for the next phase.

Sometimes, life expectancy can come to an end even when there isn't new technology – just a new approach with existing technology or a need to refactor an existing model. These are not necessarily signs of mismanagement. Sometimes, shelf life can be extended through refactoring the code, although it can be harder to get approval for refactoring an existing model than a complete platform replacement.

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The discussion also focused on technology risk in the context of big data and predictive analytics. In the property/casualty marketplace, there has been market pressure for the adoption of predictive analytics. Smaller companies may employ such technology to compete, but there are hurdles. A small company may use a vendor with appropriate knowledge and the ability to spread cost, but small data may not provide the anticipated benefits. And when using such a vendor, they need to have in-house staff who are fully engaged to prevent nonsensical use.

One panelist opined that giving control over data algorithms to someone else (a vendor) is like giving a loaded gun to someone. There is a real risk of giving too much power to the outside vendor.

A final comment was that the topic of technology risk in data management is very wide, and that a strategy to migrate away from relational data structures may help mitigate risk.

Section 4: Open Source Software

The discussion of open-source software focused on three main issues:

- Where it is used
- How it is managed
- Its role in education, staffing, and recruiting

In the actuarial modeling setting, open-source software is being used mainly for pre- and post-model work involving ETL (extraction, transformation, and loading of data). It is less commonly used for model processing where commercial modeling platforms are much more prevalent.

Several panelists mentioned the use of Python, mainly for ETL activity. One mentioned a review of Julia for speed and the ability to use the GPU, but others opined that Julia was still new and in need of development, but may see more adoption over time.

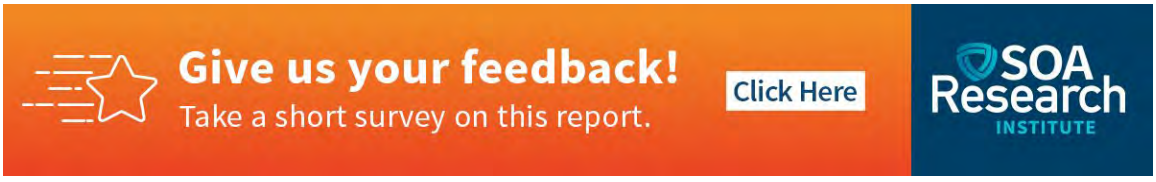
There are two sides to open source: use of software developed by others versus creation of software to be used by others. In managing this activity, panelists indicated they were mainly users and not creators. Where software is created internally, it is typically managed internally but not released externally, although there are instances of releasing some for outside use. It was noted that the Society of Actuaries is working on a GitHub repository for open-source projects.

The internal management of open-source software spans both that developed externally and internally. Internal management generally includes a review of any package before putting it in a controlled library for wide use. The review includes checking for any malicious code. Management may include requiring administrator approval to install any open-source library, and it may include a help desk with people familiar with the packages approved for use.

One panelist noted that if external code was imported for internal use, it should be done on a focused basis. The panelist provided an example of a user who had imported many thousands of lines of code but had just called a few functions in their process. While this was not malicious, the company had to do a substantial quarantine to review all of the imported code before it could be used.

Several panelists expressed recognition of the benefit of using available open-source tools as ready-made solutions. One noted that his company mentioned the use of Python in recruiting because it creates excitement for prospective candidates.

There is some coding on the syllabus for SOA exams. It was noted that the SOA debated whether to use R or Python and did not want to use both. They chose R, and one panelist had expected the use of R in practice to increase but had not seen it. The decision to use R may be one that has a shelf life, given the rising use of Python in practice.



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Section 5: Acknowledgments

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