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How do actuarial and data science skills converge at life insurers?

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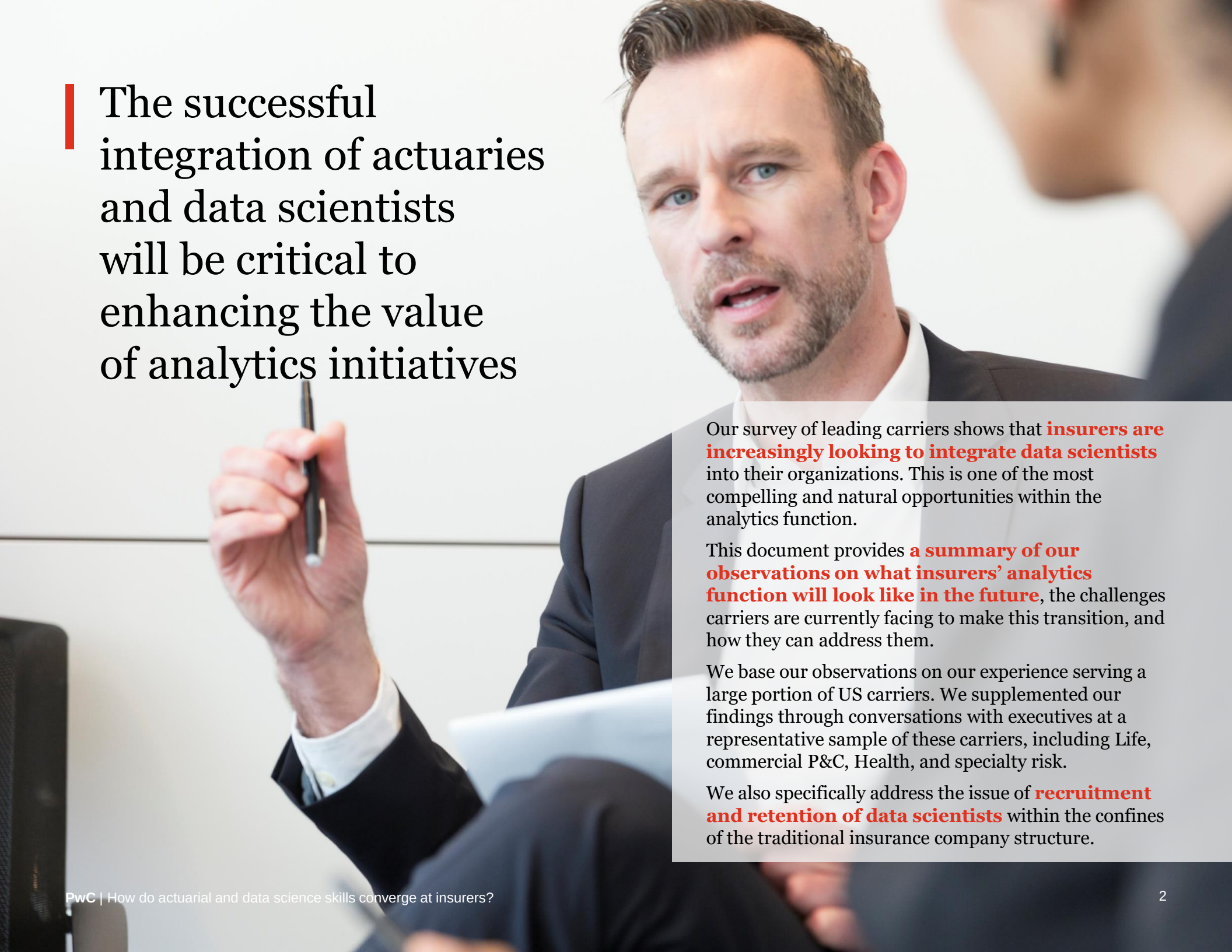
The successful integration of actuaries and data scientists will be critical to enhancing the value of analytics initiatives



Our survey of leading carriers shows that **insurers are increasingly looking to integrate data scientists** into their organizations. This is one of the most compelling and natural opportunities within the analytics function.

This document provides **a summary of our observations on what insurers' analytics function will look like in the future**, the challenges carriers are currently facing to make this transition, and how they can address them.

We base our observations on our experience serving a large portion of US carriers. We supplemented our findings through conversations with executives at a representative sample of these carriers, including Life, commercial P&C, Health, and specialty risk.

We also specifically address the issue of **recruitment and retention of data scientists** within the confines of the traditional insurance company structure.

The roles of actuaries and data scientists will be very different in 2030 than they are today

Actuaries have traditionally been responsible for defining risk classes and setting premiums. Recently data scientists have started getting involved in building predictive analytics models for underwriting, in place of traditional intrusive procedures such as blood tests.

By 2030, automated underwriting will become the norm, and new sources of data may be incorporated into underwriting. Mortality prediction will become ever more accurate, leading to more granular (possibly at individual level) premium rate setting. Data scientists will likely be in charge of assessing mortality risks, while actuaries will be the ones setting premiums, or "putting a price tag on risk" – the very definition of what actuaries do.

Risk and capital management requires extensive knowledge of the insurance business and risks, and the ability to model the company's products and balance sheet under various economic scenarios and policyholder assumptions. Actuaries' deep understanding and skills in these areas will make them indispensable.

We do not expect this to change in the future, but by 2030, data scientists will likely play an increased role in setting assumptions underlying the risk and capital models. These assumptions will likely become more granular, based more on real-time data, and more plausible.

Actuaries have traditionally been responsible for performing experience studies and updating assumptions for inforce business. The data used for the experience studies are based on structured data in the admin system. Assumptions are typically set at a high level, varying by a few variables.

By 2030, we expect data scientists to play a leading role, and incorporate non-traditional data source such as call center or wearable devices to analyze and manage the business. Assumptions will be set at a more granular level – instead of a two percent overall lapse rate, new assumptions will identify which two percent of the policies are most likely to lapse.

Actuaries are currently entirely responsible for development and certification of reserves per regulatory and accounting guidelines, and we expect signing off on reserves to remain the remit of actuaries.

Data scientists will likely have an increased roles in certain aspects of the reserving process, such as assumptions setting. Some factor-based reserves such as IBNR may also increasingly be established based on data-driven and sophisticated techniques, which data scientists will likely play a role in.

Comparing actuarial and data science skills

Although actuaries and data scientists share many skills in common, there are distinct differences between their competencies and working approaches.

	Actuaries	Data Scientists
Strengths	• Specialist insurance domain knowledge gained through training/exams • Robust, methodical and proven approach to solving common problems in a mature industry with extensive data and experience	• Natural ability to "think outside the box" in solving data problems • Possess ability to handle unstructured data such as text, image, audio, video
Weaknesses	• Restricted and relatively narrow competencies – data visualization, programming, and extracting information out of unstructured data likely to be less developed • Primarily focus on financial items – less experience addressing wider issues (e.g. marketing)	• Lack insurance-centric perspective; limited understanding of how model results impact carriers and their decisions • Less systematic and rigorous approach • Less institutionalized understanding of the profession by non-technical stakeholders
Mentalities/ Constraints: What influences approaches?	• Problem solving approach driven by training/examination syllabuses • Strong regulatory compliance tendencies - structured professional standards • Tend to have respect for hierarchical staffing structures • Tend to focus on getting the average right	• Influenced by the "tech mindset;" used to working with less formal staffing structures • Typically focused on profession (data science) rather than a specific industry • Tend to focus on getting the prediction right at individual data point
Tool: What are standard skills?	• Standardized, insurance-focused methodologies • Tend to be users of pre-developed systems/software • Stochastic/probabilistic approach to problems, including uncertainty quantification	• Tend to be systems and data architects/developers • Constantly developing algorithms to develop prediction-focused solutions

Executives at leading carriers share a number of common data science integration challenges

We formed our perspective after discussions with executives at leading carriers who shared some of the challenges they've experienced with data science integration.

While the carriers we spoke with varied in terms of data science capabilities and maturity, they've experienced common challenges, including:

PwC sees three main ways to accelerate integration and improve combined value

1. **Define and implement a combined operating model.**
   Clearly defining where data scientists fit within your organizational structure and how they will interact with actuaries and other key functions will reduce friction with traditional roles, enhance change management and enable clearer delineation of duties.
   In our view, developing a combined analytics center of excellence is the most effective structure to maximize analytics' value.

2. **Develop a career path and hiring strategy for data scientists.**
   The demand for advanced analytical capabilities currently far eclipses the supply of available data scientists. Having a clearly defined career path is the only way for carriers to attract and retain top data science (and actuarial) talent in an industry that is considered less cutting edge than many others.
   Carriers should consider the potential structure their future workforce, where to locate the analytics function to ensure adequate talent is locally available, and/or consider remote working arrangements.

3. **Encourage cross-training and cross-pollination of skills.**
   As big data continues to drive change in the industry, actuaries and data scientists will need to step into each others' shoes in order to keep pace with analytical demands. Enabling knowledge sharing will reduce dependency on certain key individuals and allow insurers to better pivot towards analytical needs.
   It is essential that senior leadership make appropriate training and knowledge sharing resources available to the analytics function.

Options for integrating data scientists

Depending on the type of carrier, there are three main approaches for integrating data scientists into the operating model.

	Embedded	Standalone	Hybrid
Description	• Data scientists are hired directly into the actuarial group and report to chief actuary.	• Data scientists exist as a standalone team or center of excellence.	• A small data science team is incorporated into each of the carrier's business units.
Strengths	• Provides best framework to leverage data scientists' predictive modeling skills. • Regular interaction with actuaries encourages cross-pollination of skills.	• Allows data science to function in a traditional service role and provide ad hoc support and modeling. • Can define value on a project basis similar to other service hubs (IT, etc.).	• Allows for different product groups to obtain data science insight based on their specific needs. • Provides data scientists with exposure to actuaries, underwriting ,and claims, etc.
Weaknesses	• Often relegates data science to a role supporting pricing. • Largest potential for clashes between the two disciplines.	• Can be difficult to impart data science function into the overall organizational culture. • Poses unique career path challenges.	• Difficult to define expectations of the data science role and correspondingly understand its impact throughout the organization.
Types of carriers using approach	• Larger carriers writing primarily standard lines of business.	• Carriers writing specialty and non-standard risks where deep-level precision is secondary to ad hoc models.	• Carriers with a wide range of products that require different types of support from data scientists.

Talent acquisition: Growing data science acumen

Data science talent acquisition strategies are top of mind at the carriers with whom we spoke.

Challenges:

- Difficulty attracting top talent when competing with more well-known data science career paths (e.g., Google, Facebook, startups)
- Compared to actuarial, carriers struggle to consistently identify top data science talent during the recruitment process
  - Lack of standardized qualifications (e.g., actuarial exams)
  - Hiring managers are unfamiliar with leading data science tools (e.g., R, Hadoop) and therefore unable to challenge and validate a candidate's competency during the recruitment process

Mitigation strategies:

- Involve technical resources in the interview process to probe technical acumen
- Clearly define the data science role and be able to articulate the group's mission
- Develop relationships with data science departments and professors at feeder schools
- Lobby for H1B Visas to obtain data science talent from offshore sources
- The actuarial profession is itself evolving. For example, predictive analytics topics have been added to the exams, and the portion will likely increase over time

Carriers have had success targeting new talent directly from masters degree programs, citing:

Advantages of building relationships with data science departments at **feeder schools**

Lack of experience with modern analytics techniques in deeply **experienced hires**

Lack of data science depth and complex analytics techniques from **undergrad hires**

Challenges transitioning from academia and applying theory to business problems with **PhD hires**

Data science career path challenges

The following can help carriers overcome common data science career path challenges.



Situation	Symptom	Strategy
Unclear career path Data scientists lack a clearly defined career path that can vary depending on operating model.	**Unfocused data science development** Carriers with an unclear career path face challenges defining data science responsibilities and developing existing talent in targeted areas.	**Select an operating model** Identify, communicate, and implement the operating model that best fits the carrier. Use the operating model to focus and grow data science talent in the most logical places.
Lack of insurance acumen Data scientists who work in the actuarial space don't have adequate insurance business knowledge.	**Poor recommendations and lost credibility** The solutions that data scientists without industry insight propose often lead to impractical solutions and lost credibility.	**Integrated project teams** Partner data scientists with business unit and actuarial support teams. Some carriers have found it valuable to rotate data scientists to other departments to help them better learn the industry.
Career growth ceiling Data scientists working in the actuarial space don't have the career growth opportunities that actuaries do (e.g., the chance to become chief actuary).	**Challenges obtaining and retaining talent** Data scientists working within an actuarial department tend to look outside the department and companies for career growth as they struggle to determine what's next.	**Broaden opportunities** Broaden the opportunities for data scientists to work outside of the actuarial function so they can add value elsewhere, as well as envision upward career progression outside the actuarial department.

Case study: Integration of data science and actuarial skills

PwC integrated data science skills into actuarial in-force analytics for a leading life insurer so the company could gain significant analytical value and generate meaningful insights.

Issue

This insurer had a relatively new variable annuity line without much long-term experience gauging its risk. Uncertainty about excess withdrawals and rise in future surrender rates had major implications for the company's reserve requirements and strategic product decisions. Traditional actuarial modeling approaches were limited to 6 – 12 months of confidence at a high level, with only a few variables. They were not adequate for major changes in the economy or policyholder behavior at a more granular level.

Solution

After engaging PwC's support, in-force analytics expanded to use **data science skills such as statistical and simulation modeling** in order to explore possible outcomes across a wide range of economic, strategic, and behavioral scenarios at the individual household-level.

Examples of data science solutions include:

- Applying various machine learning algorithms to 10 years of policyholder data in order to better **identify most predictive variables**.
- Using statistical matching techniques to **enrich the client data** with various external datasets and thereby create an accurate household-level view.
- Developing a simulation model to **simulate policyholder behavior in a competitive environment** as a sandbox in order to run scenario analysis over a 30-year period.

Benefit

The enriched data factored in non-traditional information, such as household's employment status, expenses, health status and assets. The integrated model which simulated policyholder behavior allowed for more informed estimates of withdrawals, surrenders and annuitizations. Modeling "what if" scenarios helped in reducing the liquidity risk stemming from uncertainty regarding excess withdrawals and increase in surrender rates.

All of these allowed the client to better manage its in-force, reserve requirements, and strategic product decisions.

For more information

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