



# ACTUARIAL ASSOCIATION OF EUROPE

**Challenges in professional judgment  
with Big data and AI**

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**What does technology and digitized  
information mean to us?**



## 40 ZETTABYTES

[ 43 TRILLION GIGABYTES ]  
of data will be created by  
2020, an increase of 300  
times from 2005



## Volume SCALE OF DATA

It's estimated that  
**2.5 QUINTILLION BYTES**  
[ 2.3 TRILLION GIGABYTES ]  
of data are created each day



Most companies in the  
U.S. have at least  
**100 TERABYTES**  
[ 100,000 GIGABYTES ]  
of data stored



The New York Stock Exchange  
captures  
**1 TB OF TRADE  
INFORMATION**  
during each trading session



By 2016, it is projected  
there will be  
**18.9 BILLION  
NETWORK  
CONNECTIONS**  
— almost 2.5 connections  
per person on earth



## Velocity ANALYSIS OF STREAMING DATA

Modern cars have close to  
**100 SENSORS**  
that monitor items such as  
fuel level and tire pressure



# The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015  
**4.4 MILLION IT JOBS**  
will be created globally to support big data,  
with 1.9 million in the United States



As of 2011, the global size of  
data in healthcare was  
estimated to be

**150 EXABYTES**

[ 161 BILLION GIGABYTES ]



**30 BILLION  
PIECES OF CONTENT**  
are shared on Facebook  
every month



**1 IN 3 BUSINESS  
LEADERS**

don't trust the information  
they use to make decisions



in one survey were unsure of  
how much of their data was  
inaccurate

# The four V's of Big Data

**Volume:** the amount of digital data is increasing by 60 % every year, the amount now in 2020 is 40 zettabytes (1 ZB =  $10^{21}$  bytes = 100000000000000000000000 bytes = 1000 exabytes = 1 million petabytes = 1 billion terabytes)

**Velocity:** according to the so-called Moore's law computing power doubles every year/every 1,5 years/every two years

**Variability:** different data from different sources (sensors/IoT/telematics/social media etc.)

**Veracity:** validation of data challenging

# Two ways of understanding insurance

Insurance can be understood

- Either as a product sold by an institution, based on its solvency and in the effort of trying to earn a profit for the invested capital, to cover the risks of the insured, or
- As a cooperative of insureds where they get cover by sharing and pooling their risks with the use of a separate designated operator.

# Consequences of these competing characterisations

This could be thought to resemble separating insurers to limited companies and mutuals – however also an insurer in the form of a limited company always needs to base its business on pooling and on the law of large numbers:

- > the core responsibility of an insurer is to take care of the pool
- > there always needs to be a balanced approach between the interests of a single insured and the interests of the pool

# Insurance sector is a dataholic

Taking care of the pool requires knowledge of the risks included, i.e. data.

Data has always existed, but

- Collecting the data has been impossible or at least expensive, and
- Manipulating the data has been slow and expensive.

The way out has been to use simple and easily verifiable proxies like age, gender etc.

Big Data and new technologies can mean that the insurance sector can satisfy its data obsession by collecting and analysing digitised data

# Current initiatives on the EU level

High Level Expert Group on Artificial Intelligence:

- The [Ethics Guidelines for Trustworthy Artificial Intelligence](#) (AI), April 2019
- [Policy and investment recommendations for trustworthy Artificial Intelligence](#), June 2019

EIOPA establishes Consultative Expert Group on Digital Ethics in Insurance (Sept 7, 2019)

- [Big Data Analytics in Motor and Health Insurance: A Thematic Review](#), April 2019

Commission White Paper on artificial intelligence – a European approach (draft 12/12)

Communication from the Commission to the European Parliament etc – A European strategy for data (draft 01/20)



# Professional judgment and actuarial code of conduct

# APPLICATION OF PROFESSIONAL JUDGMENT BY ACTUARIES, JANUARY 2020

Professional judgment is the judgment of the actuary, based on actuarial (or other relevant) training and experience, bound by the Standards and Code of Conduct of the profession. This professional judgment is based on strict scientific arguments and the discipline of our profession



# AAE Code of Conduct - Integrity

- An actuary must perform work with integrity, skill and care and should fulfil the actuary's responsibility to the principal.
- An actuary must not provide, or knowingly be associated with the provision of, information, ..., that the actuary knows or ought to know is materially false or misleading.
- An actuary must perform ... only if the actuary is competent and appropriately experienced to do so...
- Before communicating the results of professional services performed, the actuary should ensure that, ..., the results are free from material error
- An actuary must act in a manner that fulfils the actuarial profession's responsibility to the public



# European Standards of Actuarial Practice – ESAP1

**ESAP1 provides guidance to actuaries when performing actuarial services to give intended users confidence that**

- actuarial services are carried out professionally and with due care;
- the results are relevant to their needs, are presented clearly and understandably, and are complete; and
- the assumptions and methodology (including, but not limited to, models and modelling techniques) used are disclosed appropriately.

# ESAP1 – Data Quality

**Sufficient and Reliable Data** – The actuary should consider whether sufficient and reliable data are available to perform the actuarial services...

**Data Validation** – The actuary should take reasonable steps to review the consistency, completeness and accuracy of the data used. These might include:

- Undertaking reconciliations against audited financial statements, trial balances or other relevant records, if these are available;
- Testing the data for reasonableness against external or independent data;
- Testing the data for internal consistency and consistency with other relevant information; and
- Comparing the data to those for a prior period or periods

Additionally: **Sources of Data for Assumptions, Data Modification, Deficiencies in Data**

# ESAP1: Selection of Assumptions and Methodology

- The actuary should select the assumptions and methodology that are appropriate for the work
- The actuary should consider the needs of the intended users and the purpose of the actuarial services.
- In selecting assumptions and methodology, the actuary should consider
  - the circumstances of the organisation,
  - the subject of the actuarial services, and the assignment, as well as
  - relevant industry and professional practices.
- The actuary should consider to what extent it is appropriate to adjust assumptions or methodology to compensate for known deficiencies in the available data.
- The actuary should consider to what extent it is appropriate to use assumptions or methodology if they have a known significant bias to underestimation or overestimation of the result



# International Standard of Actuarial Practice

## 1A Governance of Models(ISAP 1A)

The actuary involved in selecting, modifying, developing, or using models should:

- Be satisfied that there is in place an appropriate model risk management framework that ...
- Be satisfied that an appropriate model validation has taken place... The validation should be performed by individual(s) who did not develop the model, unless to do so imposes a burden that is disproportionate to the model risk.
- Understand the context in which the model will be used, how model input will be provided, and how the actuary expects the results of the model will be used.

# EIOPA Consultative Expert Group on Digital Ethics in Insurance



## I. Introduction

- i. Role of insurance in the economy and society, impact of digitalisation across the insurance value chain, EU values, philosophy of law and responsibility

## II. Principles of digital responsibility in insurance

- i. **Fairness\* and non-discrimination:** Article 17.1 IDD: "Insurance distributors always act honestly, fairly and professionally in accordance with the best interests of their customers"
- ii. **Transparency and explainability:** Article 20.1 IDD: "provide the customer with objective information about the insurance product in a comprehensible form to allow that customer to make an informed decision"
- iii. **Sound governance framework:** Article 44.1 Solvency II: "Insurance and reinsurance undertakings shall have in place an effective risk-management system"

For each of the principles:

- What does it mean in an digital insurance context
- What are the issues / trade-offs / dilemmas
- How can they be addressed in a practical and proportionate manner

\* Article 5 of the Unfair commercial practices Directive (2005/29/EC) specifies that unfair commercial practices are those that are contrary to the requirements of professional diligence and are likely to materially distort the economic behaviour with regard to the product of the average consumer or of the average member of the group when a commercial practice is directed to a particular group of consumers



# Potential issues to be addressed

## ➤ Horizontal issues

- The use of datasets (internal and external) or rating factors that could potentially be biased and/or undermine the fair treatment of consumers
- The power of technologies such ML/AI to identify complex correlations between different variables and datasets and infer additional personal information therein
- The trade-offs between efficiency and explainability towards consumers in the use of (black-box) AI/ML technologies and transparency towards supervisors in certain use cases

## ➤ Pricing and underwriting issues

- Should insurance pricing and underwriting only depend on risk related factors? How to define risk related factors in terms of insurance?
- The fairness around the use of price optimisation / behavioural pricing practices, in particular with regards to their impact on vulnerable consumers

# Potential issues to be addressed

## ➤ Marketing and sales

- Ensuring that all customers during their consumer journey are offered, sold and/or nudged towards products and services which are suitable to their demands and needs and on their best interest

## ➤ Claims management (including fraud prevention)

- Claims optimisation practices and fair treatment of consumers: should claims settlement offers only depend on objective facts like damage, cost for repair or medical expenses?
- How to use fraud prevention techniques such as network analytics\* without endangering the fair treatment of consumers – what safeguards and burden of proof should be in place?



# Professional Judgement and Big Data



# Data quality and models

- Integrity, skill and care, not to provide materially false or misleading information, perform only if the actuary is competent (CoC)
- Professionally and with due care, results presented clearly, the assumptions and methodology disclosed appropriately (ESAP1)
- Sufficient and reliable data are available, consistency, completeness and accuracy of the data used (ESAP1)
- Appropriate model risk management framework, appropriate model validation, context in which the model will be used, ..., and how the actuary expects the results of the model will be used. (ISAP1A)

# Serving the public

An actuary must act in a manner that fulfils the actuarial profession's responsibility to the public... (CoC)

Ethical “positions” are often expressed as coexisting, partly overlapping, competing values, e.g. in no particular order:

- Accountability
- Dignity of human beings
- Fairness
- Forms of government, e.g. democracy
- Freedom, autonomy and self-determination
- Governance
- Non-discrimination
- Privacy
- Solidarity
- Sustainability
- Transparency, etc.

Societies balance these values in their constitutions, legal systems and public structures.

The established balance is in constant motion, as politics, courts of justice, and new inventions create new challenges.

The debate on “digital ethics” seems to make mainly use of existing values – expressed as: ethics is technology neutral

It is globally debated how “digitalisation” of society challenges the current balance and if it renders part of it unsuitable

The discussion takes place in front of an ethical backdrop that is very diverse globally and varies significantly throughout Europe

# Fairness?

**Actuarial / Economic Idea** - Every insured should carry the allocated costs (including capital cost!) of her/his cover.

**Justness** – The individual situation of the insured should be taken into account when setting premium and claims payment to avoid hardship

**Equality** - The same cover should have the same price for all (prospective) insured. Differences need solid justification.

**Solidarity** - Basic or necessary or social insurance should be financed regardless of the risk and should be affordable for every member of the society.



# Fairness continued

## **Honesty and acting in the best interest of customers -**

Insurers should treat every insured honestly and act either in or with due regard to the best interest of the customer. They act in compliance with law and regulation

**Autonomy and self-determination** - Insurers should offer fair choices for customers that are reluctant to share data with the insurer. Insurers should not exercise deciding influence on what people do or don't do.

**Freedom** - The insurer should be free to whom he offers its services and set prices in a competing market. He should decide freely how to produce the services offered.

# Discrimination and Differentiation

Differentiation shall mean making differences. It should not imply any moral or legal judgement.

Discrimination is often, but not exclusively used for non-desired or prohibited differentiation.

Anti-Discrimination usually addresses unlawful differentiation related to attributes, such as sex, age, race, ethnicity, nationality, disability, mental illness or ability, sexual orientation, gender identity/expression, creed, political opinion

Indirect discrimination is given if a apparently neutral provision, criterion or practice puts persons with a particular characteristic in a less favourable position



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