icmif

Virtual Meeting of Reinsurance Officials

MORO 2021

ICMIF Virtual Meeting of Reinsurance Officials 2021

Tuesday (2-4pm BST)

Current state of the reinsurance market

Wednesday (2-4pm BST)

Emerging risks

Thursday (2-4pm BST)

Digitisation and collaboration in reinsurance

MORO: Emerging risks

MODERATOR

Luc Boghe

General Manager, Reinsurance

QBE Europe (Belgium)

Michael Wrightman

Head of Casualty Treaty

Berkley Re (UK)

Matt Cullina

Head of Global Insurance Business

Sontiq (USA)

Jeff Bohn

Senior Advisor

Swiss Re (Switzerland)

MORO 2021

Emerging Risks in Casualty Insurance

ICMIF MORO – 9th June 2021

Casualty Emerging Risks

- What do we mean by emerging risks?
  - Risks where the underlying exposure is evolving and may not be adequately reflected in the historical experience we are basing our risk assessment and pricing on
- Evolving exposure:
  - Exposure evolving
  - Legal system evolving
  - Insurance product evolving
- Different types:
  - Natural
  - Technological
  - Demographic

What are we going to focus on?

Berkley Re

- Technological Risks
  - Autonomous Vehicles
  - Additive Manufacturing
  - Artificial Intelligence
- All of these risks are live now, but developing rapidly
- All of these risks at root are altering the way product liability insurance works / will work
- All of these risks are going to lead to both intended and unintended consequences

Caveats

- Three key areas we're not focusing on:
  - Pandemic
  - Cyber
  - Climate change
- This is going to be a relatively non-technical presentation
- This presentation will take as broad a global outlook as possible
- Intention is to stimulate thought and debate
- There are no answers to any of this yet

Autonomous Vehicles

Autonomous Vehicles

- What’s the big issue?
- How does the technology work?
- What are the problems with the technology?
- What are the liability and insurance implications?

What's the big issue?

- First we need to talk about product liability
  - Covers claims brought against a manufacturer for injury or damage caused by a product
  - One of the main sections of most general liability policies

- Next we need to talk about motor insurance
  - Covers claims brought against the driver / owner of a vehicle for injury or damage caused through the operation of the vehicle

What's the big issue?

- This has worked as a split for many years
- In the event of a motor accident, in the first instance the operator of the vehicle responsible for the accident is liable (and the motor insurance responds)
- If it transpires that there was a failure of the vehicle itself (either design or manufacturing), the motor insurer may subrogate against the manufacturer (and the product liability insurance responds)
- The rise of autonomous vehicles is changing how this is going to work

How does the technology work?

- Autonomous driver assistance systems are nothing new:
  - Cruise control – 1958
  - ABS – 1966
  - Adaptive cruise control - 1995
  - Park assist – 2003
  - Blind spot monitoring - 2008
- These technologies are being linked to produce car systems which can “drive themselves”
- This has been being worked on for decades but only recently have computers become powerful enough to be credibly useful

How does the technology work?

How does the technology work?

- Autonomous vehicles are on a spectrum
- SAE Automation Levels – Human Monitoring:
  - Level 0: No Automation

    Normal Car
  - Level 1 (“hands on”): Driver Assistance

    Driver is responsible for either steering or acceleration / deceleration. Vehicle is responsible for the other (Adaptive cruise control / Park assist)
  - Level 2 (“hands off”): Partial Automation

    Vehicle is responsible for both steering and acceleration / deceleration.

    Driver is required to monitor driving and be prepared to intervene if necessary

How does the technology work?

- SAE Automation Levels – Vehicle Monitoring:
  - Level 3 (“eyes off”): Conditional Automation

    Driver can turn their attention away from driving tasks and i.e. text / watch a movie. Vehicle may request the driver intervenes in some circumstances for safety reasons
  - Level 4 (“mind off”): High Automation

    As Level 3 but no driver attention required for safety i.e. driver may go to sleep or leave the driver’s seat
  - Level 5 (“steering wheel optional”): Full Automation

    No human intervention required in any circumstance

How does the technology work?

- We're currently somewhere between SAE 2 and SAE 3 (although Tesla claims their current platform has the sensor package and processing power to handle SAE 5)
- Sensors and processing are the key to moving past SAE 2 – allowing the vehicle to properly monitor its environment and react
- Most self-driving vehicles use a mixture of GPS data, mapping, cameras, radar, ultrasonic location and LIDAR
- Redundancy important (verify multiple sensor inputs / failure protection) although Tesla announced May 2021 they are abandoning radar to concentrate on camera vision

What are the problems?

- All of these sensor technologies have issues:
  - Williston, FL – May 7 2016. First fatal crash of a Tesla in Autopilot Mode. Car drove under a truck at 74mph having failed to spot the white truck trailer against a bright sky. Driver believed to have been watching a movie at the time of crash
  - Mountain View, CA – March 23 2018. Tesla got left and right lane markings on an off-ramp confused and drove into concrete lane divider at 71mph. Driver killed.
  - Culver City, CA – January 22 2018. Tesla crashed into fire engine parked at side of road. Radars designed to detect moving objects but not very good at detecting stationary objects at motorway speeds
  - Harris County, TX – April 19 2021: Tesla missed a curve in the road. Driving seat empty according to police. Two passengers killed.

What are the problems?

- It’s not just Tesla:
  - Mountain View, CA – February 14 2016. Google self driving Lexus pulled into the path of a bus causing a collision
  - Tempe, AZ – March 18 2018. First pedestrian fatality involving a self-driving car. Uber Volvo in SAE 3 testing failed to spot an pedestrian in the dark and ran her over. Backup safety driver failed to intervene as she was watching TV on her phone until 0.5 seconds before the accident. Design of sensor package (roof-mounted LIDAR) not good at spotting small / low objects like pedestrians / cyclists

What are the problems?

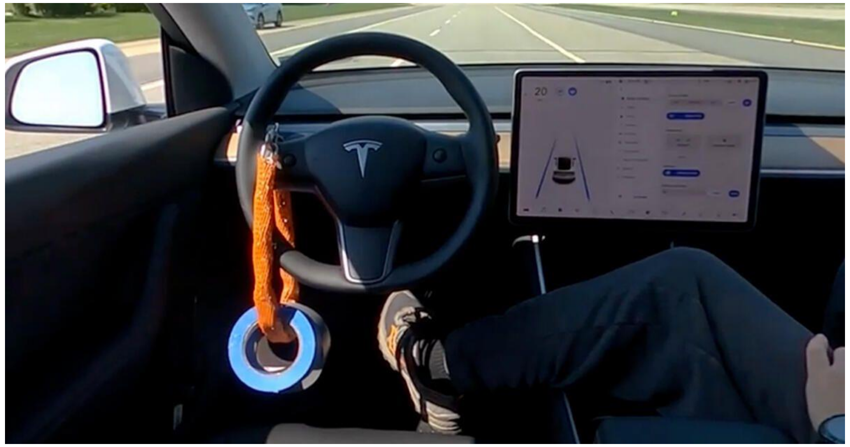
- There are some bigger technology issues:
  - Current networking speeds not sufficient to handle autonomous vehicles and sensors adequately – 5G
  - Sensor processors cannot distinguish dots on the road as lines
  - LIDAR not effective in rain / fog / snow or in environments with reflective surfaces.
  - Mapping relies on up to date surveys
  - Cars "see" differently to humans
    - Cars build up from the pixel layer and use algorithms to compare object to existing database
    - Humans have an innate / evolved view of the world and their interaction with it.
    - Moravec's Paradox: "it is comparatively easy to make computers exhibit adult level performance on intelligence tests or playing checkers, and difficult or impossible to give them the skills of a one-year-old when it comes to perception and mobility"

What are the problems?

What are the problems?

- Expectation Gap
  - Tesla has two autonomous modes:
    - “Autopilot”
    - “Full Self Driving Capability”
  - Small print does make clear that neither mode offers full autonomy but unsurprisingly people believe that they do.
  - Tesla have also included safety features to ensure that the driver has their hands on the wheel before the autonomous modes will operate.
  - However…

What are the problems?



What are the problems?

- Most accidents involving autonomous vehicles highlight a misunderstanding of what SAE level a car is operating at:
  - Drivers / owners assume SAE 3 or 4
  - Reality is SAE 2
- Also issues with systems being beta-tested by users and updated over time – software approach rather than safety critical machinery

Self-Driving Cars – Implications

- Increased number of self-driving cars should lead to a move from motor insurance towards product liability (as more driving is delegated to the vehicle the liability shifts to the manufacturer)
- What limits will be required for product liability?
- What impact does this have on insurers with existing large motor portfolios?

Self-Driving Cars – Implications

- Also a shift in how product liability works
- Historically product liability insurance has dealt with damage or injury caused by the failure or incorrect operation of a product, or an ancillary health issue
  - Airbag failed to operate and passenger died
  - My toaster was badly designed and electrocuted me
  - The chemicals in the product caused cancer
- Self-driving cars will lead to a situation where insurance is having to deal with damage or injury caused by a product operating exactly as designed

Self-Driving Cars – Implications

- The Trolley Problem
  - Philosophical thought experiment dating back to the 1960s
  - Runaway trolley (tram) heading down a track towards 5 incapacitated people who will be killed by it
  - You have control of a switch which can divert the tram from it's track on to a side track where it will not hit the 5 people but kill another, different person
  - Should you throw the switch?
- Clear application to self-driving cars which must be programmed to choose between multiple courses of action all of which result in harm

Self-Driving Cars – Implications

- Assuming a utilitarian decision to spare the 5 / kill the 1 there are a number of interesting liability issues:
  - What is your position as the single person killed by a deliberate action of a product operating as designed?
  - Who is responsible? The driver? The manufacturer? The coder?
  - What if the vehicle decides the best outcome is to take action which kills the driver / passengers? You've purchased a product which has deliberately decided to harm you. What duty is owed to you?

Self-Driving Cars – Summary

- It's complicated
- The underlying technical issues will be difficult to overcome to the level of a societally acceptable failure rate
- We're going to have to deal with a radically different type of product liability exposure in future
- The market for motor insurance will diminish over time as the exposure moves to the products side

Additive Manufacturing

Additive Manufacturing

- 3D Printing
- Material solidified under computer control to create a three-dimensional object based on a downloaded plan

Additive Manufacturing

- Will lead to home / distributed manufacturing
- Think back to our definition of product liability:
  - Covers claims brought against a manufacturer for injury or damage caused by a product
- From a product liability perspective, who is the manufacturer?
  - Person who makes the item?
  - Manufacturer of the 3D printer?
  - Creator of the file?
- What does this mean for homeowners insurance?
- What does this mean for product liability? Is it being channelled back to the customer

Additive Manufacturing

- What about Crime:

Additive Manufacturing

- What about Crime:

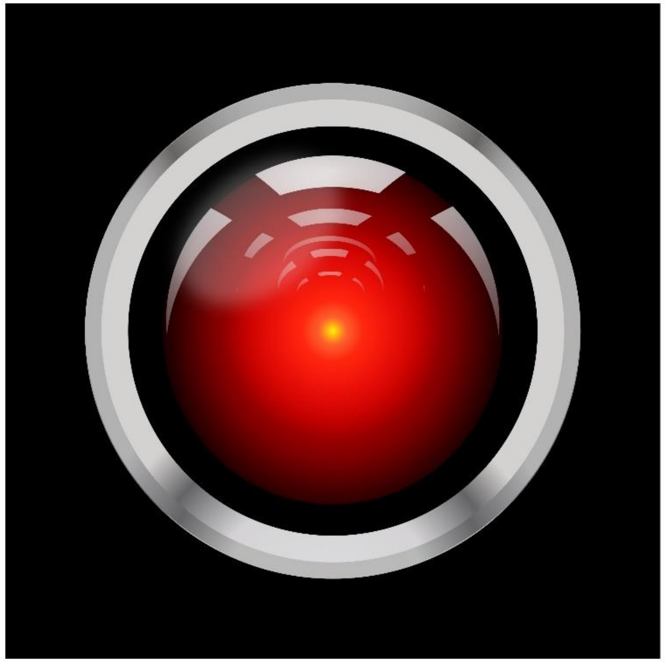
Additive Manufacturing

- What about manufacturing patented / copyrighted products
- What about things which require testing / certification?
  - Bike helmets
  - Medical products

Additive Manufacturing

- Health issues:
  - Dust / particle inhalation
  - Volatile organic compounds
  - Powder metal dust explosions
  - UV exposure
  - Carbon nanofiber / nanotubes
  - Layer separation

Artificial Intelligence



Artificial Intelligence

- Difficult to define (one school of thought says it should not be defined), but for our purposes:
- The ability of a machine to mimic human-like intelligence including:
  - Learning from experience and examples
  - Recognising objects
  - Understanding and responding to language
  - Making decisions
- And combining these capabilities to perform functions a human might perform

Artificial Intelligence

- 3 major features of AI which impact us:
  - Learning ability – behaviour not totally preconceived by programmer
  - Robotics – coupling of digital systems with physical sensors and actuators. Products can now cause BI / PD without human action
  - Connectivity – IOT backbone

Artificial Intelligence

- Back to product liability
- Most product liability laws designed for products which don’t change after manufacture / sale
- No longer the case
- Combination of:
  - Hardware
  - Software
  - Services

Artificial Intelligence

- Most product liability laws are technology neutral
- Currently in EU – product = movable good
- Status of software unclear – what if software failure causes a loss rather than a hardware issue.
- Services not covered
- What happens if your system interacting over a network causes a loss to another system?

Artificial Intelligence

- Regulatory intervention will be required and is in play
- Very early days
- EU setting the pace – European Commission Communication “Fostering a European Approach to Artifical Intelligence” – April 2021.
- US also reviewing – White House Office of Science and Technology. Much earlier stage of development.
- EU proposals offer some guidance as to direction of travel which are likely to feature elsewhere

Artificial Intelligence

- EU communication calls for the creation of a single legal framework when developing, deploying or using AI.
- It is proposed that AI be split into 4 categories:
  - Unacceptable Risk
  - High Risk
  - Limited Risk
  - Minimal Risk

Artificial Intelligence

- Unacceptable Risk
  - Social scoring by governments
  - Exploitation of vulnerabilities of children
  - Subliminal techniques
  - Live remote biometric identification systems in public spaces (with narrow specified exceptions)
  - Will be banned

Artificial Intelligence

- High Risk
  - Potential adverse impact on safety or fundamental rights
  - We’ll come back to this
- Limited Risk
  - Chatbots, Alexa, etc.
  - Transparency key i.e. users must be made aware they are interacting with a machine
- Minimal risk
  - Everything else (Spam filters, AI enabled video games, etc.).
  - No proposed changes to legal environment

Artificial Intelligence

- High risk list – AI technology used in
  - Critical infrastructure (including transport)
  - Educational or vocational training
  - Safety components of products
  - Employment and worker management
  - Essential private and public services
  - Law enforcement
  - Migration, asylum and border control management
  - Administration of justice
  - Democratic processes
- Also includes use of AI in all non-real time biometrics

Artificial Intelligence

- Example of a High Risk AI – Amazon recruitment tool
  - AI developed to sift and select recruitment candidates
  - Trained on historical Amazon data which reviewed resumes
  - Historical hiring skewed male given prevalence in the tech industry
  - AI taught itself that male candidates were preferable to female
  - Downrated resumes involving the word "women's" as in "women's chess club captain"
  - Downrated graduates of all-women colleges
  - Team disbanded as Amazon could not solve for working around the biased training data

Artificial Intelligence

- Proposals for High Risk AI include:
  - Include software in the scope of product regulation
  - Shifting responsibility to the "person best able to address risk". Could include developers, distributors, service providers or even users. Currently only producers or importers.
  - Ongoing requirement to risk assess product throughout lifecycle.
  - Introduce specific requirements to deal with faulty / biased training data – what if your customer trains it themselves?
  - Reverse burden of proof
  - Strict liability

Artificial Intelligence

- Strict Liability
  - Move away from fault based approach
  - Injurer pays
  - Downside is that it would be a deterrent on innovation but likely to be outweighed by consumer safety concerns
  - Causation can be difficult to prove so it’s being discussed whether burden of proof should be reversed i.e. assume causation unless disproved.
  - Should it apply to:
    - Producers
    - Operators
    - Users

Any Questions?

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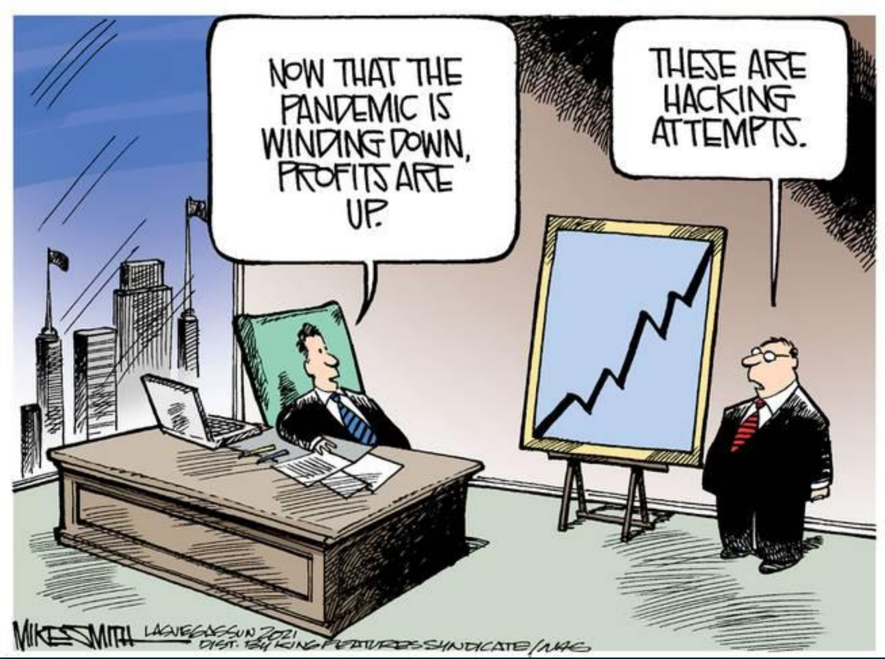
PERSONAL CYBER INSURANCE

Solving the Personal Lines Cyber Risk Gap

SONTIQ™
Intelligent identity security.

IdentityForce® CYBERSCOUT® EZShield®

Copyright Lisa Benson



CYBERSCOUT
A Sontiq™ Brand

WORKING FROM HOME INCREASES CYBER RISKS

- Post-pandemic, between 25-30% of workers may continue as remote workers, a **7X-8X increase over pre-pandemic numbers**

- Phishing Emails increased **+667% in one month**

- **One quarter of all employees** have noticed an increase in **fraudulent emails**, **spam** and **phishing** attempts in their corporate email

STOLEN PERSONALLY IDENTIFIABLE INFORMATION (PII)

- **Number of victims: 39 Million**
- **Cost to consumers: $56 Billion**
- **Records compromised: 37 Billion**
- **Year over year increase: 141%**
- **Online Scam losses: $4.2 Billion**
  (Complaints to FBI increase: 48%)
- **Tax ID Fraud: $2.3 Billion**
- **Fraudulent websites increase: 350%**
- **Vishing & smishing increase: 300%**
  (PI captured in phone scams increase: 270%)

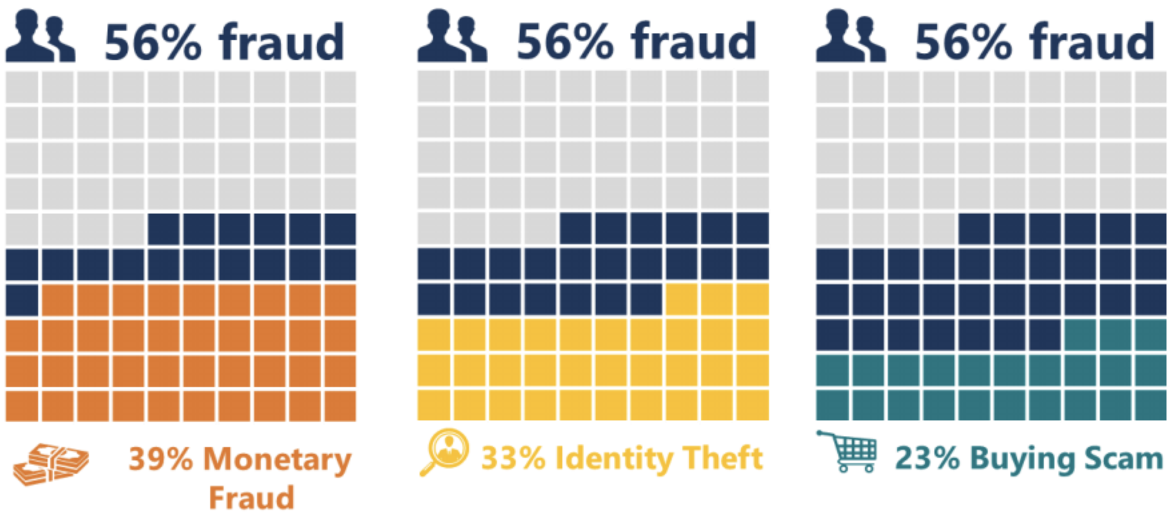
FRAUD VICTIMS ACROSS THE EU

56% of Europeans surveyed experienced at least one of these types of fraud/scams in the last two years.

MONETARY FRAUD

IDENTITY THEFT

SHOPPING SCAMS



European Commission

Directorate-General for Justice and Consumers

SENIOR FRAUD: A GLOBAL PROBLEM

Nearly 8 million cases in the **US** resulting in $148 billion in losses

Elderly People in the **UK** Lost Over £4m to Cybercrime Last Year

France: 4-fold rise in online shopping scams last month (Dec 2020)

Senior citizens in **Denmark** are more at risk than any other group of losing money to online criminals

PERSONAL COST OF CYBER FRAUD

LOST PRODUCTIVITY

6 MONTHS and
100 to **200**
Hours Worth of Work

SOURCE | Various Industry Stats

SEVERE EMOTIONAL DISTRESS

77% Reported
INCREASED
Stress Levels

SOURCE | *ITRC Identity Theft: The Aftermath 2018*

CONSUMER COST

Average **LOSS**
of **$1,343**
Per ID Theft Incident

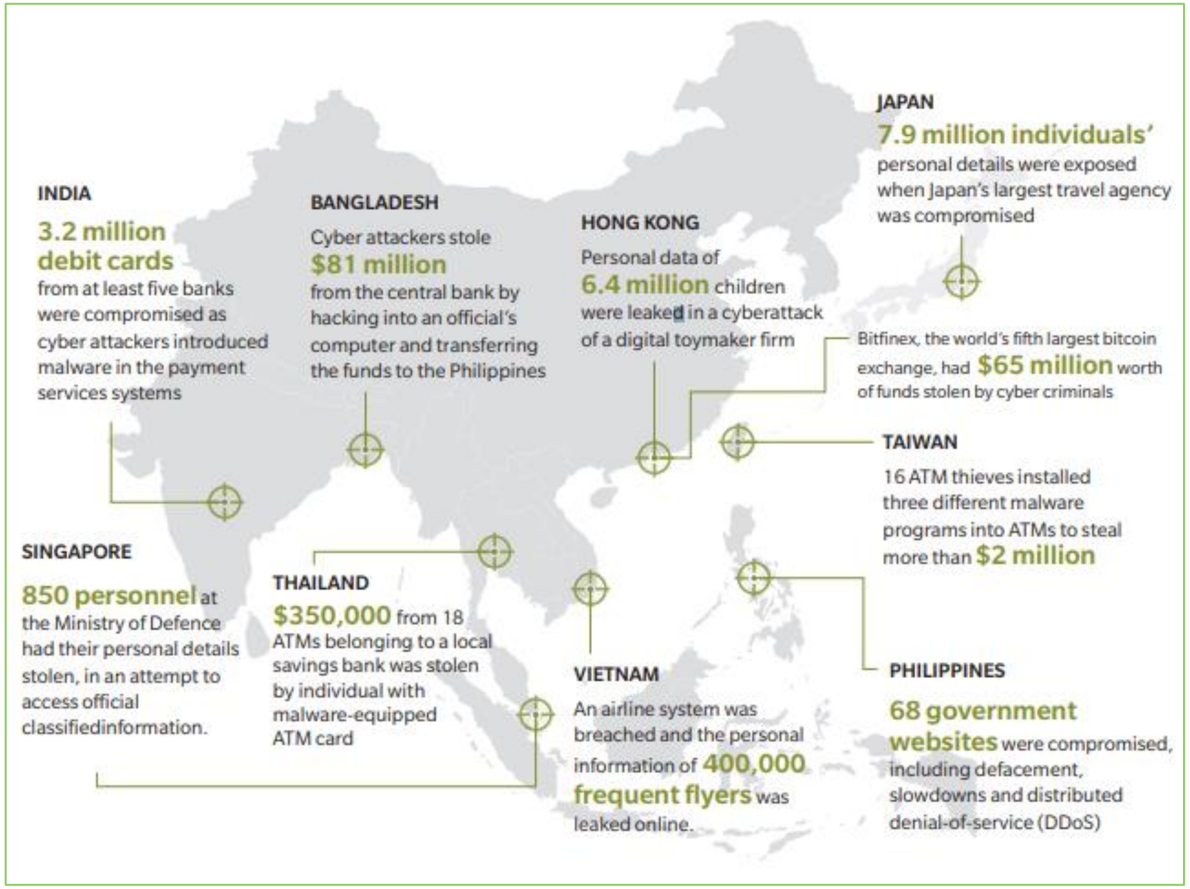
SOURCE | *U.S. Department of Justice*

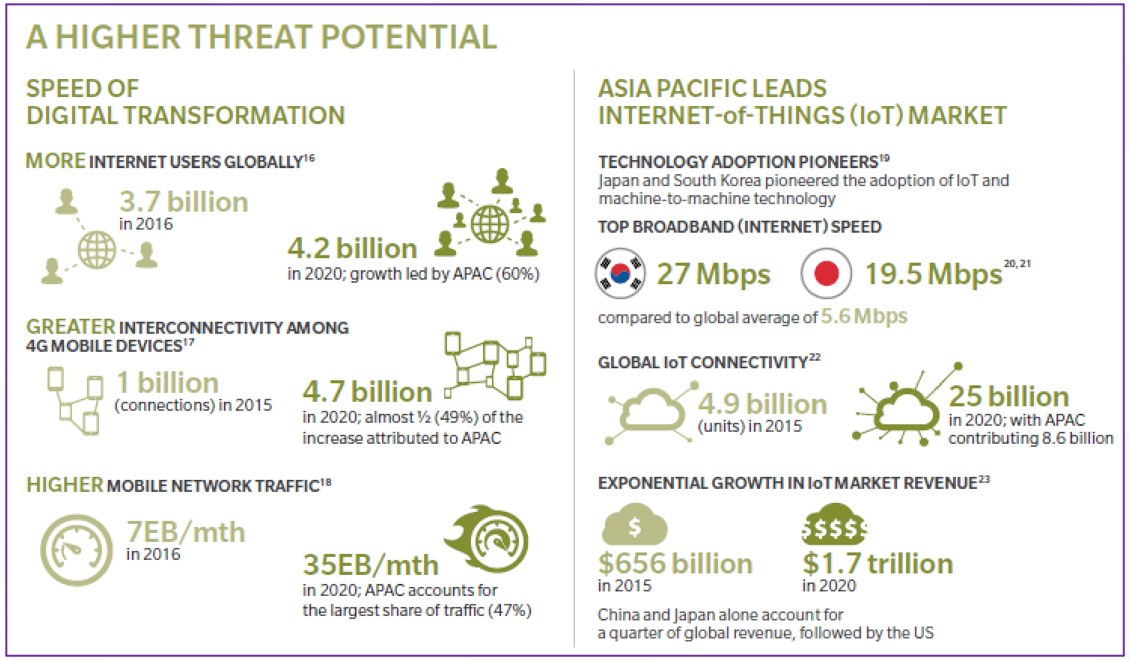
1.4 Million
reported cases of identity theft fraud in 2020

$3.3 Billion
lost to fraud

SOURCE | Federal Trade Commission

ASIAN CYBER RISK LANDSCAPE SNAPSHOT





Reasons for the relatively higher cyber threat potential in APAC are twofold:

1. The **growing speed and scope of digital transformation.**
2. The expanding sources of vulnerability stemming from **increasing IoT connectivity**.

Asia is 80 percent more likely to be **targeted by hackers** than other parts of the world. The number of high-profile cyber incidents has risen in recent years is a proof.

SOCIAL ENGINEERING SCAMS

Makes up **33% of all cyberattacks** on employees and their employers, **up 500%** in most recent reporting period[1]

What is it?: psychological manipulation of people into performing actions or divulging confidential information like passwords and bank information. Candidates range from a corporate executive to an elementary school student.

1. 2020 Cyber Security Statistics The Ultimate List Of Stats, Data & Trends https://purplesec.us/resources/cyber-security-statistics/#SocialEngineering

RANSOMWARE ATTACKS

In 2021, an attack will take place every **11 seconds** [1]

The increased virtual environment of 2021 means employers and employees are at increased risk – as hackers are increasingly targeting home-workers in order to compromise their employer.

Additionally, for employees using devices for personal and business use, there's increased stress over losing digital family photos or videos.

1. https://cybersecurityventures.com/top-5-cybersecurity-facts-figures-predictions-and-statistics-for-2019-to-2021/

CONSUMERS **TOP CYBERCRIME FEARS**

Illicit access to **personal financial credentials**

Identity theft that leads to fraudulent purchases

Loss of **personal data**, files, photos, videos

Unauthorized publication of
private information

Swiss RE Research Study, 2020

WHO DO HOMEOWNERS LOOK TO FOR CYBER HELP?

- TELCO?
- Bank?
- PC Manufacturer?
- Home security provider?

Insurers have opportunity to address their policyholders' needs with advanced insurance coverage and expert services

THE PARTNERSHIP

REINSURERS CURRENTLY OFFERING PERSONAL CYBER TURNKEY PROGRAMS

Munich RE

Swiss Re

hannover re

TOKIO MARINE

ASPEN

Berkley Re Solutions | a Berkley Company

beazley

HAMILTON INSURANCE GROUP

Gen Re

TURNKEY COVERAGES

Extortion & Reputation Damage
(Social Engineering, Cyber Bullying)

System & Data Compromise

Identity Theft & Fraud

Financial Fraud & Loss

Online Retail Fraud

Ransomware

Liability Exposure

Always expert help:

Answer questions	Notify authorities	Liaise with banks & financial service providers	Determine if backups are available
Provide advice	Review account security	Assist with changing passwords	Refer to claims per pre-agreed process

CYBER-AS-A-SERVICE FOR PERSONAL LINES

Services

- **24/7 cyber helpline**
  - Proactive advice
  - Incident remediation
  - Fraud Resolution
- **Claims handling**

Education

- **Cyber Content**
  - Tips and guidance for cyber safety
  - Helpful articles and case studies
  - Training for sales agents

Tools

- **Credit monitoring**
- **Dark web monitoring**
- **Social media monitoring**
- **Password Protectors**
- **Data Back up storage**
- **Data Recovery**

PERSONAL CYBER INSURANCE SOLUTIONS

Small sampling of insurers that have introduced Personal Cyber to their personal lines insureds

Coverage bundles vary and limits can range €2k to up to €40k for HNW policies average limits around €12k/Retail premiums from gifted to €60.

WHAT ROLE DOES PERSONAL CYBER PLAY?

- **Growth / New Business**
  - Attract new customers
  - Increase average premiums
  - Capture new segments like GenZ and Millennials
  - Market differentiator which will fast become table stakes
- **Retention / Customer Service**
  - Close coverage gaps/address silent cyber risks with affirmative offer
  - Increase brand loyalty & relevancy w/ modern offerings
  - Significant value in retaining customers with a positive, "claims free" customer support experiences
  - Drive customer retention and competitor differentiation

THANK YOU

Let's Discuss What's Next.

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Managing Director, Insurance Solutions
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Swiss Re Institute

Physics-based/machine learning (ML) hybridized modeling

Dr. Jeffrey Bohn, Senior Advisor, Swiss Re Institute
ICMIF webinar, 9 June 2021

Shifts in the insurance industry

We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely.

E.O. Wilson

Data deluges, advanced algorithms, and powerful computational tools enable physical and natural system modeling like never before.

Data

IDC forecasts worldwide data to grow by CAGR of 23% to 181 ZB till 2025. A third of these data will be real-time.

Advanced algorithms

Hybrid algorithms can lead to better data curation by addressing issues related to data quality and lack of compute power.

Better processing

Synchronized edge and cloud computing can ease data processing by on-demand access to computing resources.

Computational tools

Modern computational tools' ability to study complex systems enable extreme events analysis at multiple levels.

Source – Swiss Re Institute

Simulating physical phenomena is evolving from component design to systems assembly to developing *digital twins* of physical assets

Early steps in modelling

3D component design

Holistic systems assembly

Physics aware digital twin

Timeline

- Development of basic models
- Better understanding of phenomena

~ 1985

- Rapid advances in 3D modelling from computers
- Use of computer aided technology (CAD) in product component design

~ 2000

- Advances in model-based systems engineering
- Holistic approach to systems assembly

~ 2015 onwards

- Hybridization of ML by combining the virtual and physical world
- Creation of reduced order models (ROM) to bridge value chains

Key challenges in physics aware ML implementation

- Parametrizations of complex real-world processes
- Keeping physical and digital worlds 'in sync' easily
- Closing the data loop from operations back to design
- Generating knowledge from distributed models
- Overcoming expertise-limited scalability of use
- Applying novel simulation technologies and convergence with data analytics and IoT

Swiss Re Institute

Source – 1) Connecting physics based and data driven models: The best of two worlds, Siemens AG, 2018
2) Swiss Re Institute

Why aren’t generalized linear models good enough?

Challenges

- Data challenges
  - Sparsity
  - Noise
  - Confounders
- Model challenges
  - Non-linear relationships
  - Frequent regime shifts
  - Overfitting risk
  - Complexity

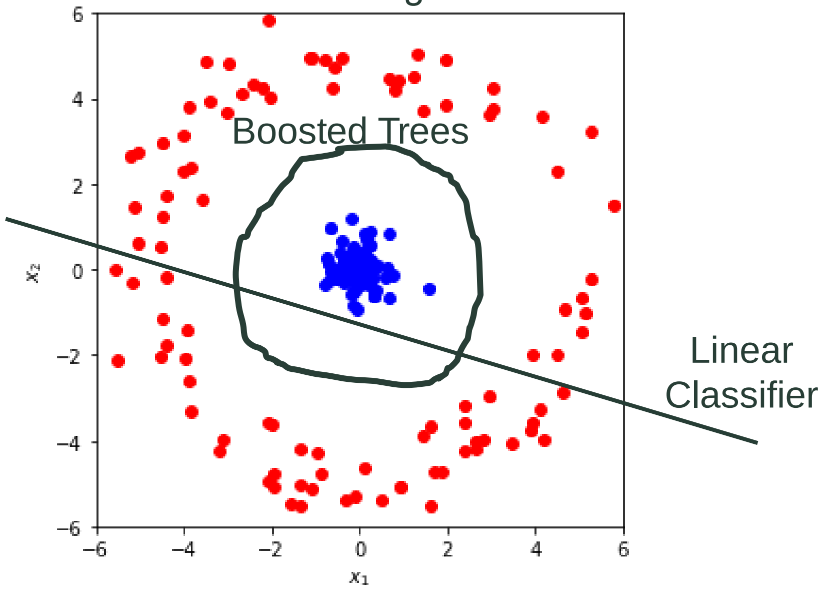
Solutions

- Alternative data
  - Non-standard structured
  - Unstructured
  - Meta
- (More) Data curation
- Regularization
  - Model complexity constraints
  - Incorporate better loss functions
  - Combine “weak learners” i.e., boosting
- ***Model hybridization***

Data limitations & imperfections drive the challenges

“Data Doughnut Challenge”: Capturing non-linear relationships

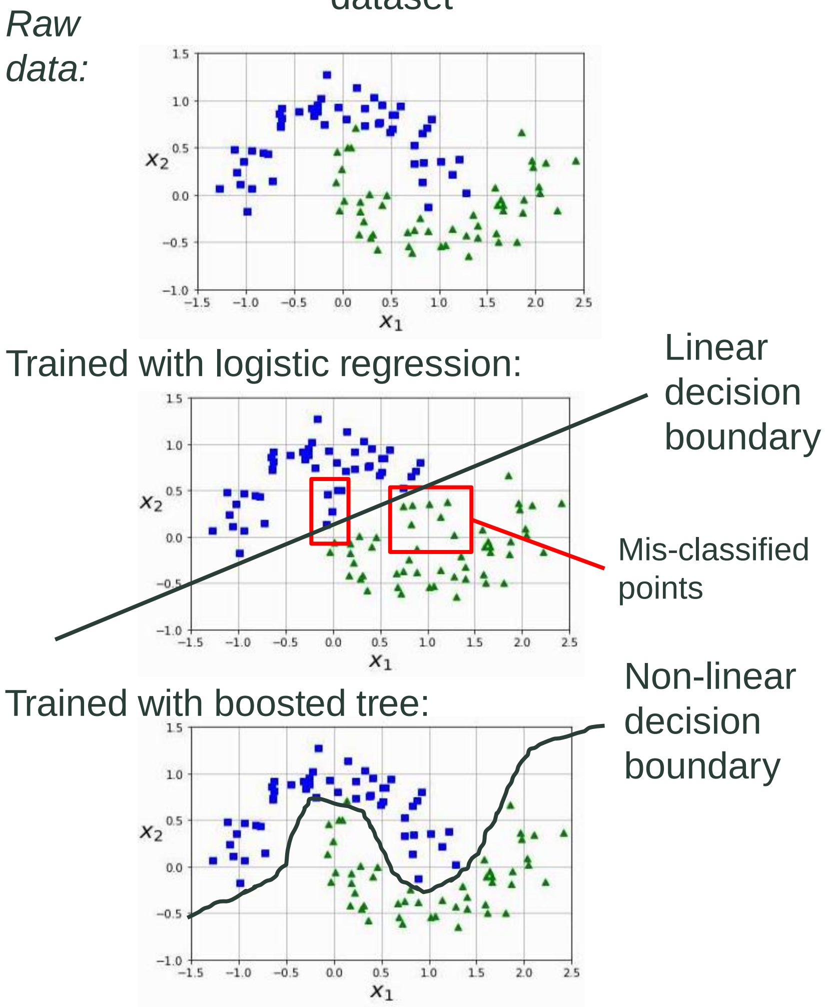
“Data Doughnut Challenge”



- When addressing non-linear data relationships, more complex algorithms ensure higher accuracy than simple algorithms.

- Looking at the “Data Doughnut Challenge” graphically illustrates how complex algorithms can solve non-linear problems. Challenge lies in how to classify data in light of non-linear clustering.

Self-trained example – with “make moons” dataset



Data-value-chain process as part of an enterprise data fabric (part 1)
New data sources becoming more important: ***Meta, Unstructured, Privacy-preserved, and Synthesized/Simulated***

Identify
- Compare data catalogue
- Explore data ontologies
- Review compliance

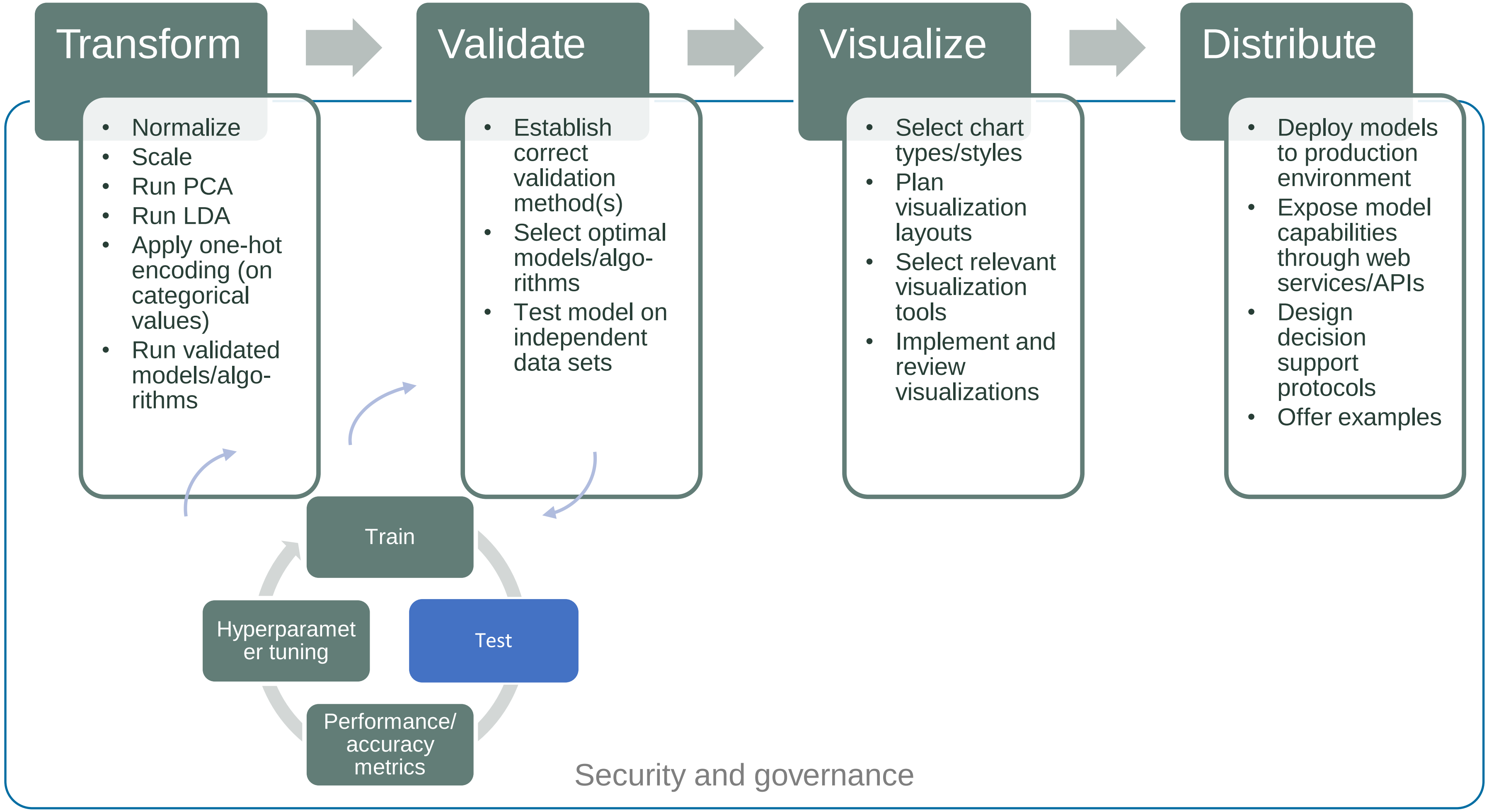
Ingest
- Retrieve and store data from source systems, file feeds, web services, etc.

Curate
- Clean
- Combine
- Standardize
- Conform
- Interpolate missing data *(e.g., EM algo)*
- Test data items against criteria: i) Possible ranges; ii) Plausible ranges; iii) Plausible relationships

Collaborate
- Provide access credentials
- Create and share notebooks
- Visualize data
- Run exploratory analytics
- Develop models

Security and governance

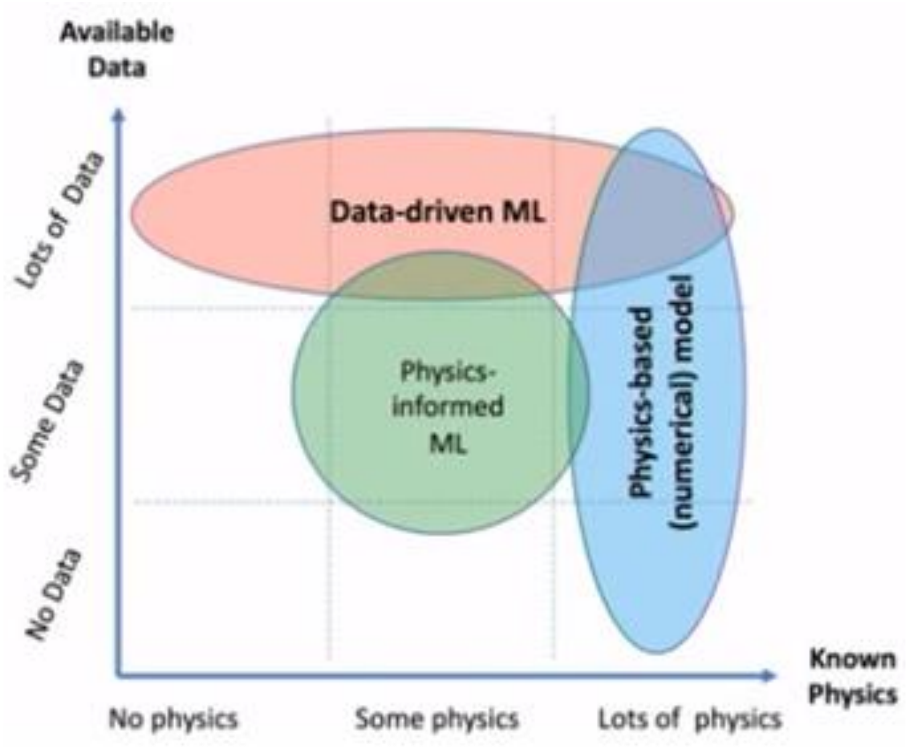
Data-value-chain process as part of an enterprise data fabric (part 2)



* Optimal architecture separates the development environment (i.e., starts with train) from the production environment

Swiss Re Institute

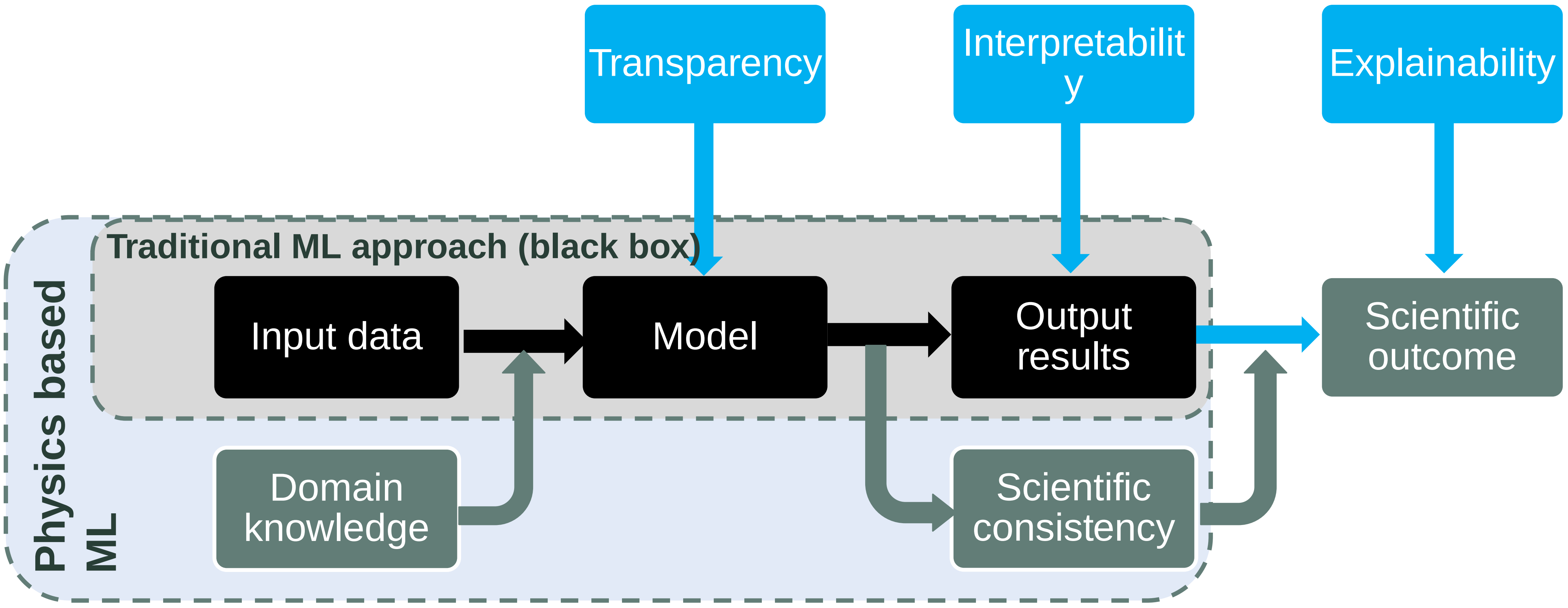
Physics-based, hybridized machine learning approaches can offer the best of data science and mathematical models to develop new hybrid solutions



Source – 1) Pacific Northwest National Laboratory
2) Swiss Re Institute

Approaches	Advantages	Disadvantages
Pure science or physics-based approach	• Tried and tested. • Explainable. • Governing equations. • Structure and stability preserving. • Predictive (error estimators).	• Slower. • Many assumptions • May not factor in new data. • May not capture relationships.
Purely data intensive machine learning	• Multidimensional analysis. • Discover hidden structures. • Non-intrusive implementation. • Flexible, accessible & available.	• Not explainable – Blackbox. • Data intensive. • Does not respect physical constrains. • Noisy and incomplete data.

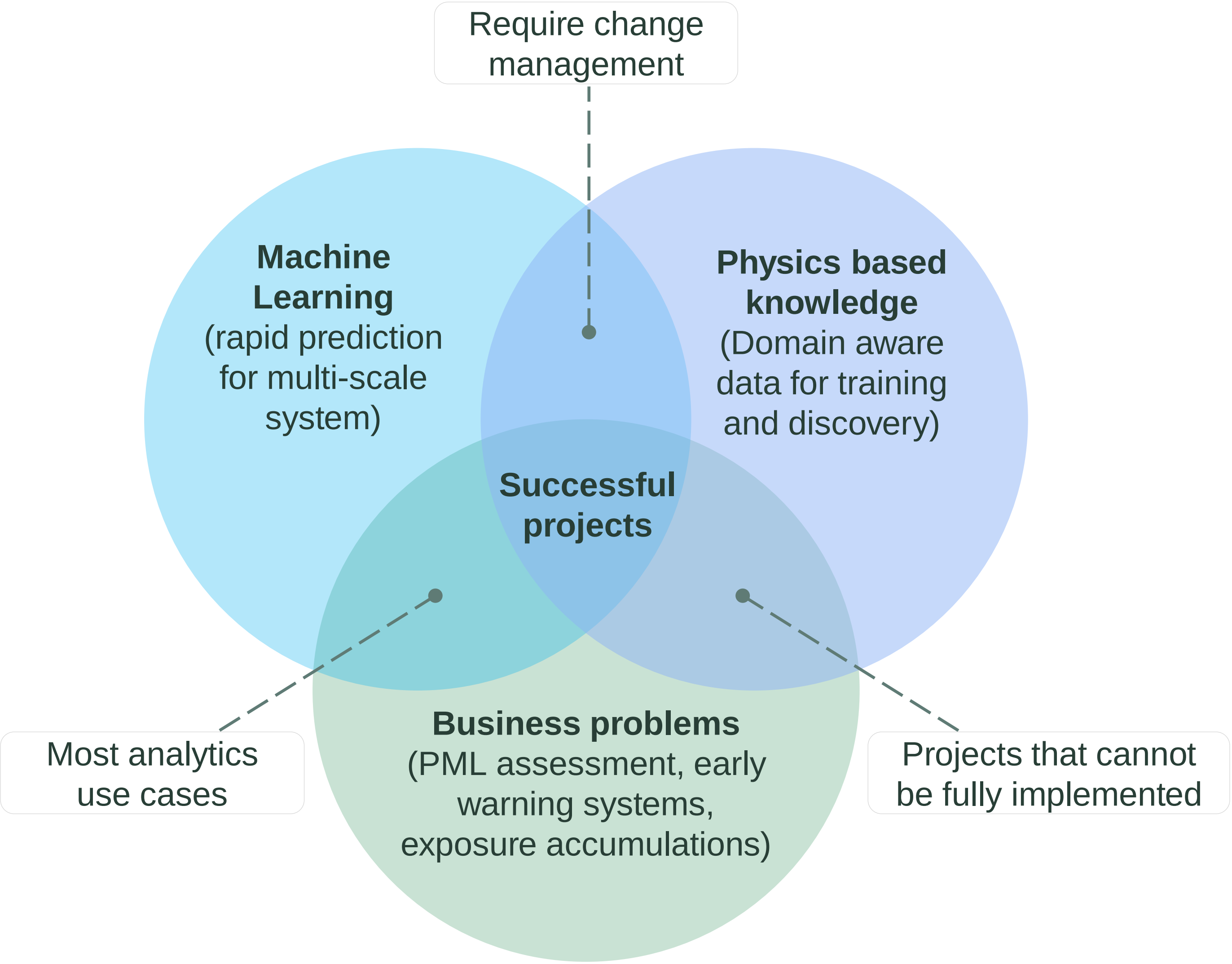
Scientific outcomes can be made more consistent, transparent, and explainable by combining physics-based domain knowledge with ML models



Source – 1) Explainable Machine Learning for Scientific Insights and Discoveries, IEEE, 11 March 2020
2) Swiss Re Institute

Careful selection of physics-based machine learning projects can enable productive enterprise scale transformation at insurers

- **Physics-based** reduced order models of complex assets and processes combined with **machine learning** can allow Re/Insurers to **uncover hidden entanglements** between insured assets and the external world.
- **Solutions can be made available to clients** via scalable SaaS platforms for better monetization. Internally, these can be applied to synthesize exposure data, claims data and physical models to better quantify and monitor risks.
- **Successful** physics aware machine learning **projects need** substantial investment and **cross-industry collaboration** for alignment of interest between insurers, governments and other stakeholders.



Swiss Re Institute

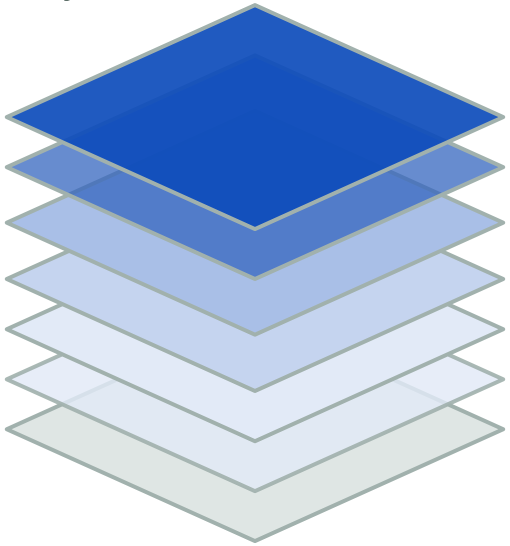
Source – Swiss Re Institute

Physics-based modelling of cities could allow insurers to use a systems approach to assess the impact of extreme events on each layer

Physical footprint of a city

- Transit system data
- Water system data
- Utility system data
- Critical infrastructure & hubs (CIH)
- CIH dependencies
- Asset footprint data
- Natural environment data

Digital footprint of a city

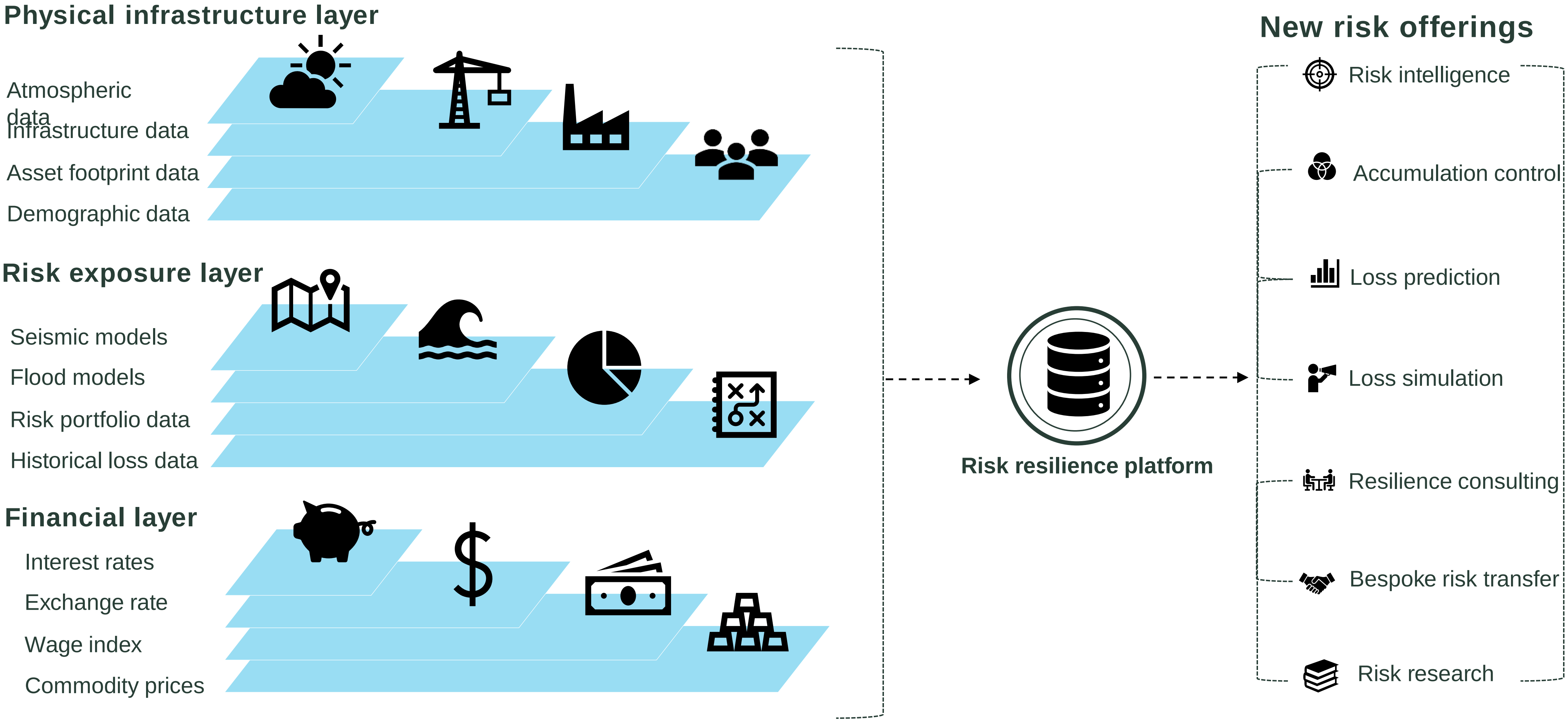


Risk footprint of a city

- Seismic impact analysis
- Flood impact analysis
- Wildfire Impact analysis
- Supply chain vulnerability

Source – Swiss Re Institute

Physics-based resilience models can help insurers develop new risk offerings and improve their portfolio view for pricing, reserving and large event losses



Source – Swiss Re Institute

Case Study

- **One Concern**, a California based start-up, and **Sompo**, one of Japan's leading insurance companies, deployed a hybridized physics-based/machine learning (ML) based disaster prevention and mitigation system for real-time prediction of damage from earthquakes and floods in Kumamoto City, Japan
- The system uses a combination of physics-based models and ML for model development and validations:
  - Physics-based models for simulating earthquake and flood events and their impact (hazard and vulnerability analysis)
  - ML to derive missing building attributes, and to train the system based on a variety of data (damage data from historical events, and live incidents such as detection of river water levels and earthquakes)

Any questions?

Legal notice

MORO: Emerging risks

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