Institute and Faculty of Actuaries

Wearables and the Internet of Things: Working Party Update

Anna Spender – Director of Actuarial & Data Analytics, Psyon
Colin Bullen – Partner, Habits at Work

23 May 2018

Agenda

- **Introduction**
- **Overview of wearable devices and the Internet of Things**
- **Types of measurements**
- **Current examples of use**
- **Data considerations**
- **Risks and challenges**
- **Technical developments – what the future may bring…**
- **Considerations for the future of insurance**

Introduction to Working Party and Brief

Working Party Brief

This Working Party aims to look at the **emergence of wearable technology and the internet of things** and their current and potential use within the **health and care area**

Wearable technology related to healthier wellbeing is developing quickly and the working party looks to develop an understanding of the **currently available technology**, and the **capabilities of the next generation**. This includes considering the impact of wearables on individually underwritten protection products and/or employee benefit scheme*s*

Working Party members

Workstream 1 – Stakeholder analysis	Workstream 2 – Devices and uses
Chair: Anna Spender	Deputy Chair: Colin Bullen
James Cripps	Lisa Altmann-Richer
Robin Duffy	Mark Farrell
Chris Falkous	James Wigzell
Tony Horn	Wendy Yeap
Expert: Oliver Werneyer	Expert: Cother Hajat

Institute
and Faculty
of Actuaries

Introduction

- Rapidly developing area

- Wide and ever expanding range of wearables, devices, apps, data aggregators & platforms

- Increasing numbers of insurers have started incorporating technology into their product offerings

- More than **30% of insurers worldwide*** are already using wearable technology for customer engagement

Institute
and Faculty
of Actuaries

Devices Investigated

Wrist – activity/HR	Clothing	Body	IoT	Medical
Apple Watch	Tune shoes	Ouraring	Sentiance	Quell
Fitbit	Under Armour SpeedForm	Prevent - mouthguards	AliveCor - Kardia Mobile	SEEQ Mobile Cardiac Telemetry
Mio Global	ATO-Gear Arion	Kokoon	mybitat	Stedi
Sence	Iofit shoes	Neuroon	OnKol	DIA-VIT
HELO	OMBra	Sleep Shepherd	3rings	Shade
Garmin	Samsung WELT	Muse	Canary care	GlucoTrack
Striiv	Lumo Run shorts	Modius Health	Howz	SwellFit
Misfit	VSP Global	Moodmetric	Preventice Solutions	BeVITAL
Jawbone	InSenth IN1	Bloomlife	Mimo	ADAMM
Moov	Osterhoutgroup	Qardio Arm	Philips lifeline	Valedo
Xiaomi		Freestyle Libre	Future path	iTBra
TomTom		Omron RS4/6/8	my-signals	
		iHeart	Smartplate	
		Qardio	Smart cities	
		Lifepatch	NHS "test beds"	
			TZOA	
			Alcove	

Devices Investigated

Wrist – activity/HR	Clothing	Body	IoT	Medical
Apple Watch	Tune shoes	**Ouraring**	**Sentiance**	Quell
Fitbit	Under Armour SpeedForm	Prevent - mouthguards	AliveCor - Kardia Mobile	SEEQ Mobile Cardiac Telemetry
Mio Global	ATO-Gear Arion	Kokoon	mybitat	Stedi
Sence	Iofit shoes	**Neuroon**	OnKol	DIA-VIT
HELO	OMBra	Sleep Shepherd	3rings	Shade
Garmin	Samsung WELT	Muse	Canary care	GlucoTrack
Striiv	Lumo Run shorts	Modius Health	Howz	SwellFit
Misfit	VSP Global	**Moodmetric**	Preventice Solutions	BeVITAL
Jawbone	InSenth IN1	Bloomlife	Mimo	ADAMM
Moov	Osterhoutgroup	Qardio Arm	Philips lifeline	Valedo
Xiaomi		**Freestyle Libre**	Future path	iTBra
TomTom		**Omron RS4/6/8**	my-signals	
		iHeart	Smartplate	
		Qardio	Smart cities	
		Lifepatch	NHS "test beds"	
			TZOA	
			Alcove	

Sensors

- Accelerometer
- Compass/magnetometer
- EEG biosensor
- ECG biosensor
- Galvanic skin response (stress monitor)
- GPS
- Gyroscope
- Heart rate monitor
- Oximetry monitor
- Skin conductance
- Skin temperature

Institute
and Faculty
of Actuaries

Measures Available

Measurements current available			
Activity time	Coughing	Goal progress	Respiration rate and patterns
Ankle curvature	Distance	Heart rate/pulse	Sleep duration
Ascent/Decent (Floors)	ECG/EKG	Heart rate variability (HRV)	Sleep quality (N3/light/REM)
Blood pressure	EEG	Impacts to head (forces)	Steps
Blood sugar	Falls (in the elderly)	Light exposure (pre-sleep)	Swimming lengths
Body composition	Fitness (Cardiovascular)	Location	Swimming strokes
Body temperature	Focus/attention	Pace/speed/cadence	UV exposure
Calories	Galvanic skin responses (emotional health)	Pollution	V02 Max (derived from HRV)
Contractions	Girth	Posture and balance, pressure distribution and weight shift information	Weight

Measures Available

Measurements current available			
Activity time	Coughing	Goal progress	Respiration rate and patterns
Ankle curvature	Distance	Heart rate/pulse	Sleep duration
Ascent/Decent (Floors)	ECG/EKG	Heart rate variability (HRV)	**Sleep quality (N3/light/REM)**
Blood pressure	EEG	Impacts to head (forces)	Steps
Blood sugar	Falls (in the elderly)	Light exposure (pre-sleep)	Swimming lengths
Body composition	**Fitness (Cardiovascular)**	Location	Swimming strokes
Body temperature	Focus/attention	Pace/speed/cadence	UV exposure
Calories	**Galvanic skin responses (emotional health)**	Pollution	V02 Max (derived from HRV)
Contractions	Girth	Posture and balance, pressure distribution and weight shift information	Weight

Wearables accuracy and consistency
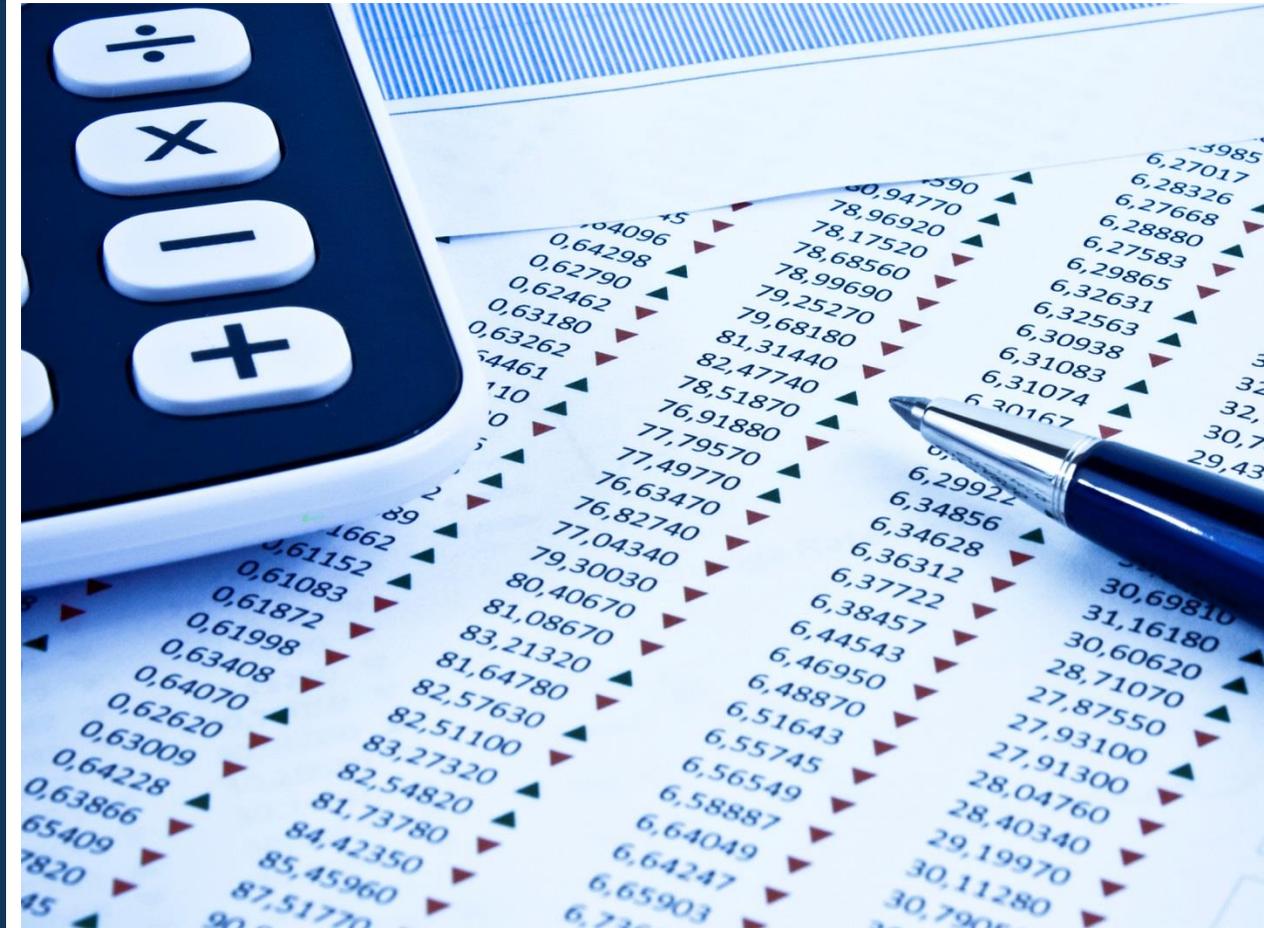
Laboratory conditions

- +/-10% accuracy on steps
- Heart rate measures +/-5% accurate
- Derived energy measures unreliable

Considerations

- How device is worn
- Self reported information
- Direct measures versus derived measures

Real world

- Over 100% variance in real life steps tracked
- Consistency is better – individual issues seem to be systematic

Institute
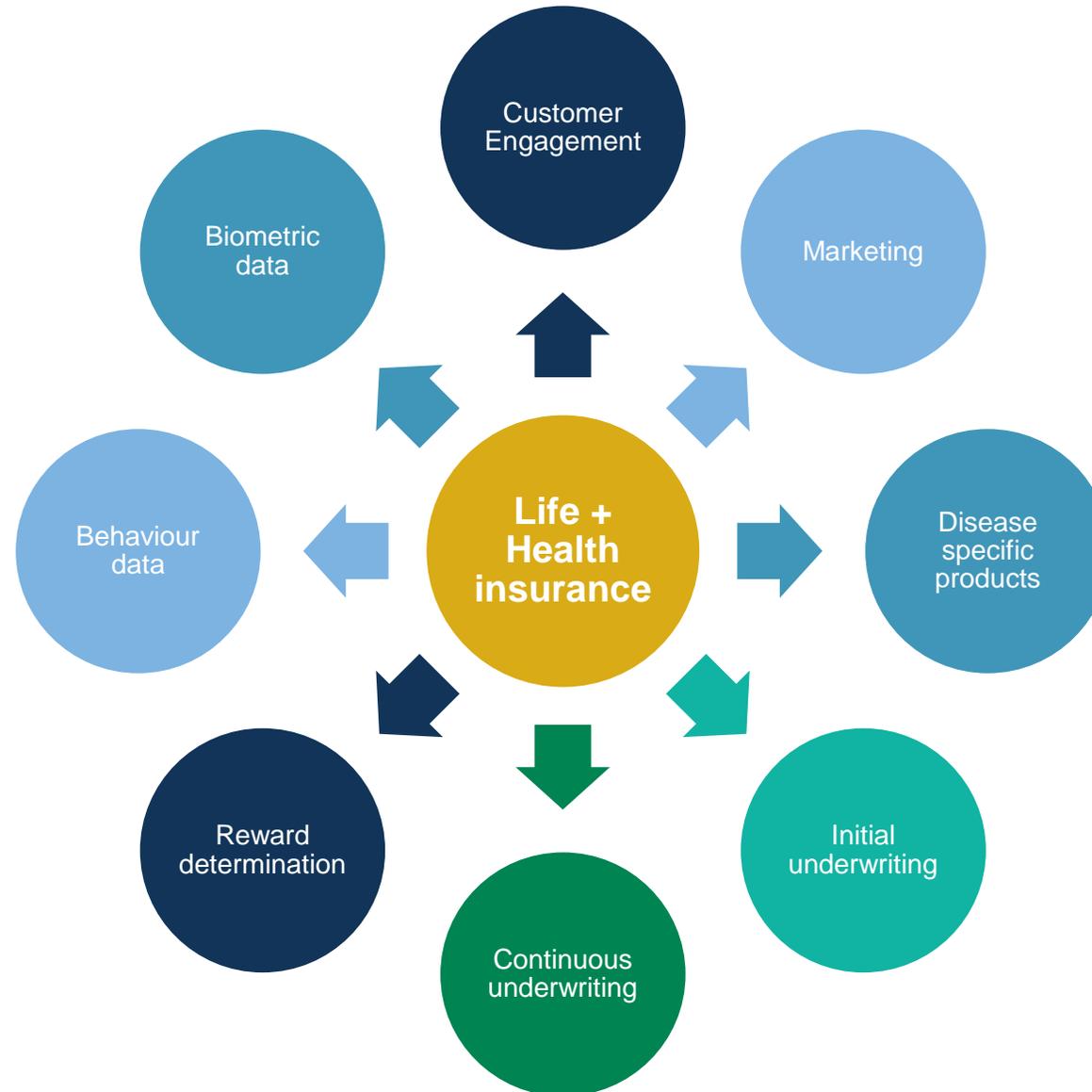and Faculty
of Actuaries

Current uses

Overview of Uses

- Measure health biometrics, health-related behaviours and outcomes

- Engage customers in new ways

- Potentially improve health as part of wider program of change

- Offer disease specific products while tracking disease management

- Manage chronic conditions

Institute
and Faculty
of Actuaries

Current Uses

Institute
and Faculty
of Actuaries

Current Uses

Monitoring health behaviours

Coaching to the wrist

Wellbeing

Monitoring health biometrics

Performance feedback

Institute and Faculty of Actuaries

Current Uses

Other Uses

Medical monitoring

Home diagnosis

Mental health

Sports coaching

Institute
and Faculty
of Actuaries

Data Considerations

Data considerations

Value of data

What data?

Future Use?

Cost of collection vs benefit

GDPR

Actuarial constraints

Limitations

Permissions and availability

IT constraints

Institute
and Faculty
of Actuaries
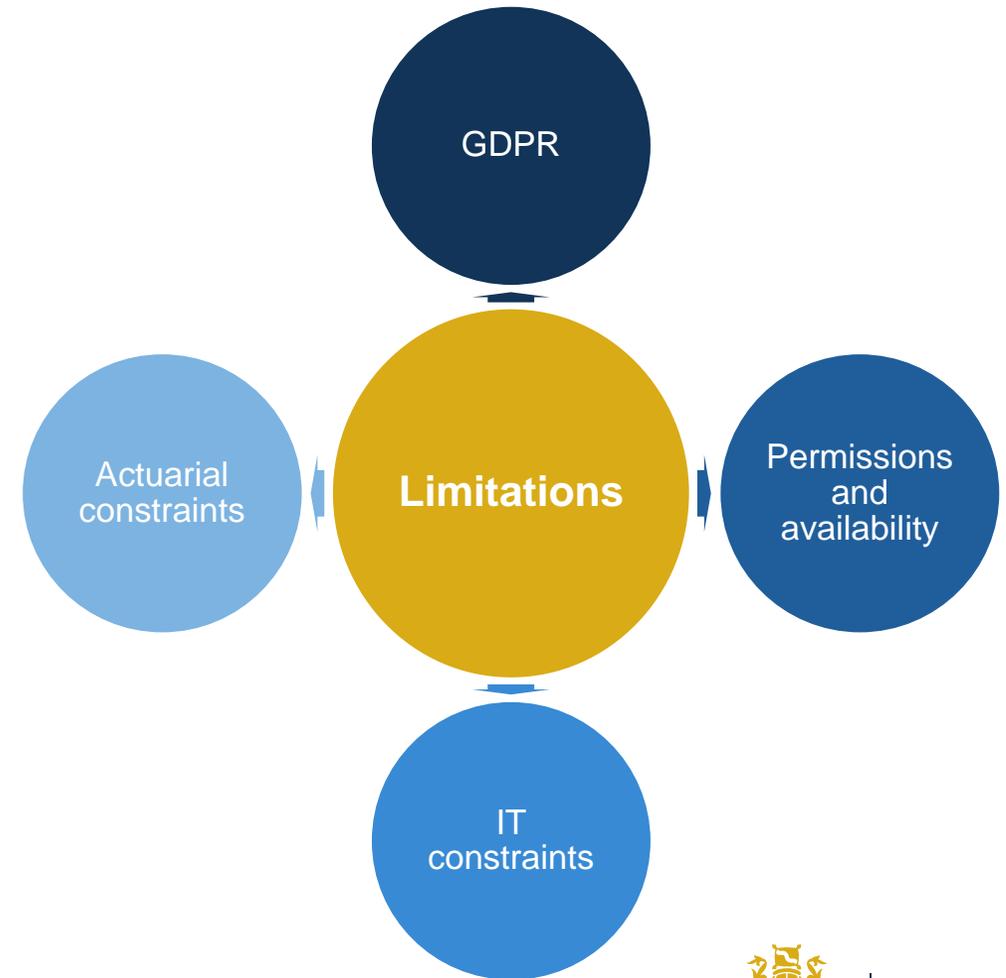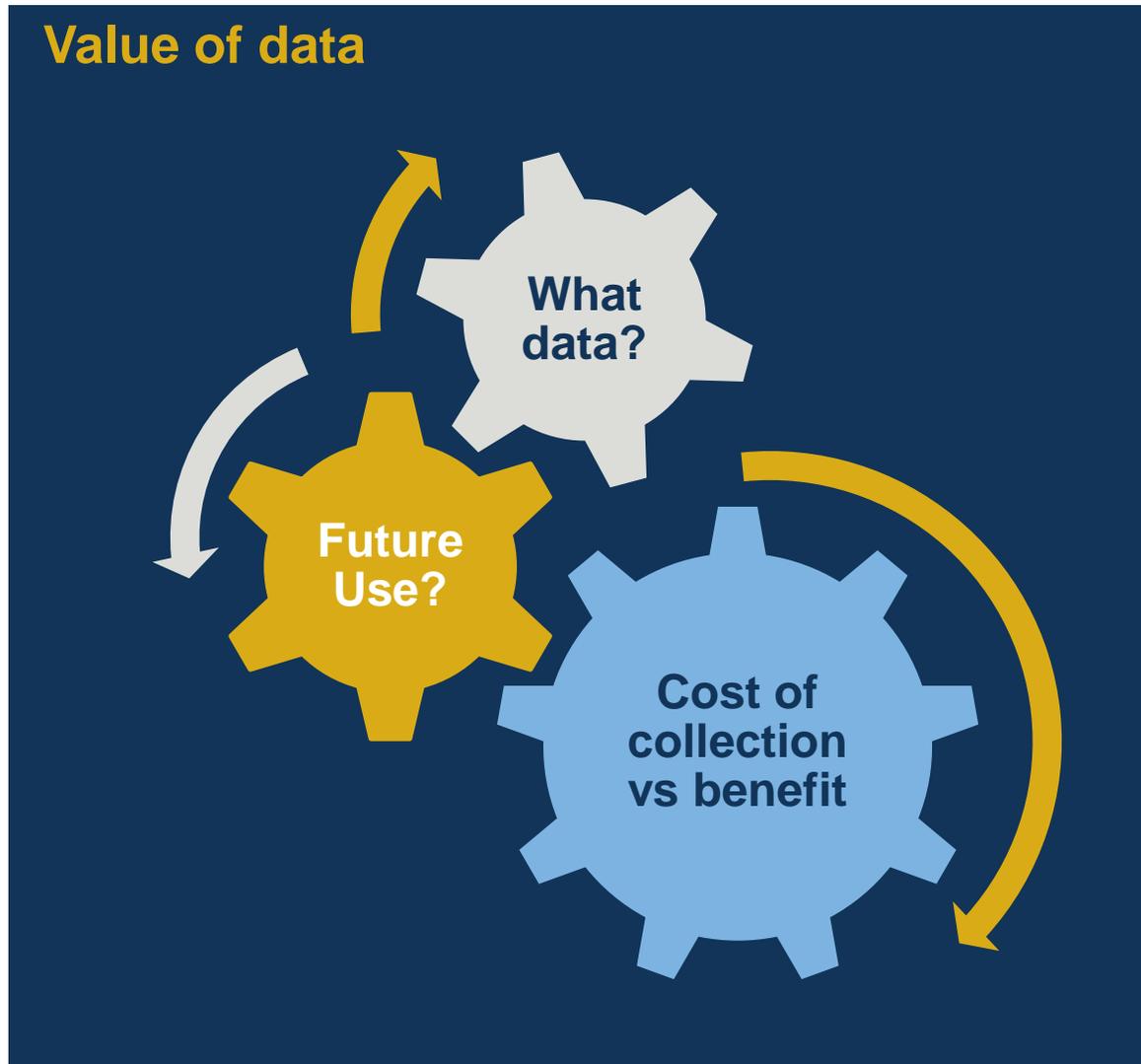
Data considerations

Data reliability

- Fraud
- Selective tracking vs frictionless tracking
- Fit for purpose?

Potential systematic errors

- The device itself, and changes in the device during the data collection period
- How the device is used when collecting data of interest
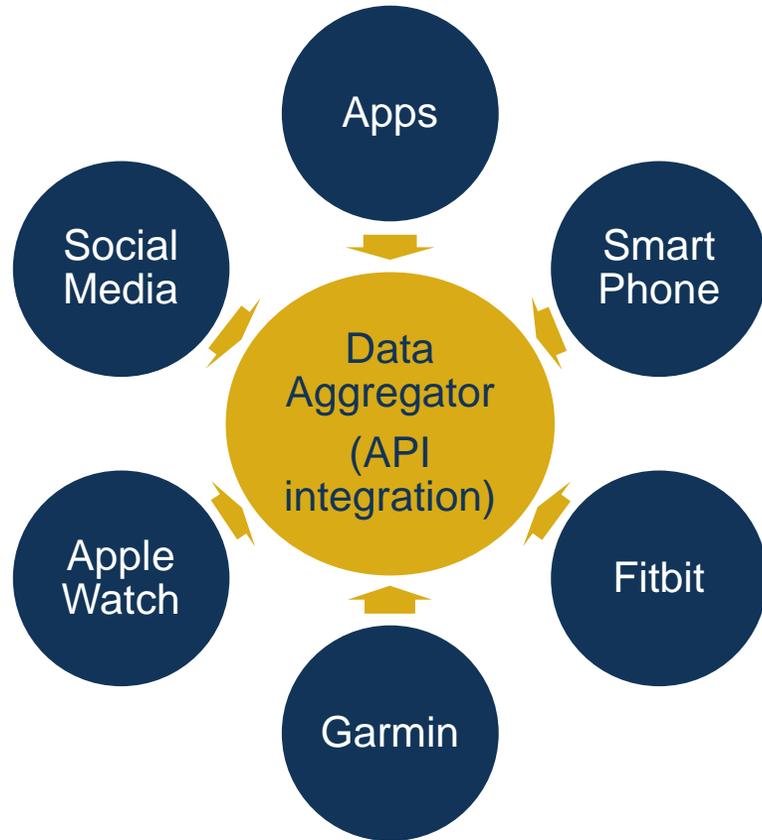- How the device is worn, and impact on results

Data use

- Changes over time vs a point in time
- Data aggregation and analysis of cohorts
- Application at individual level

Institute and Faculty of Actuaries

Data considerations

Aggregators

- Choice of technology = better engagement
- Upgrading technology
- Using API integration data aggregators collect, format and clean data from multiple sources
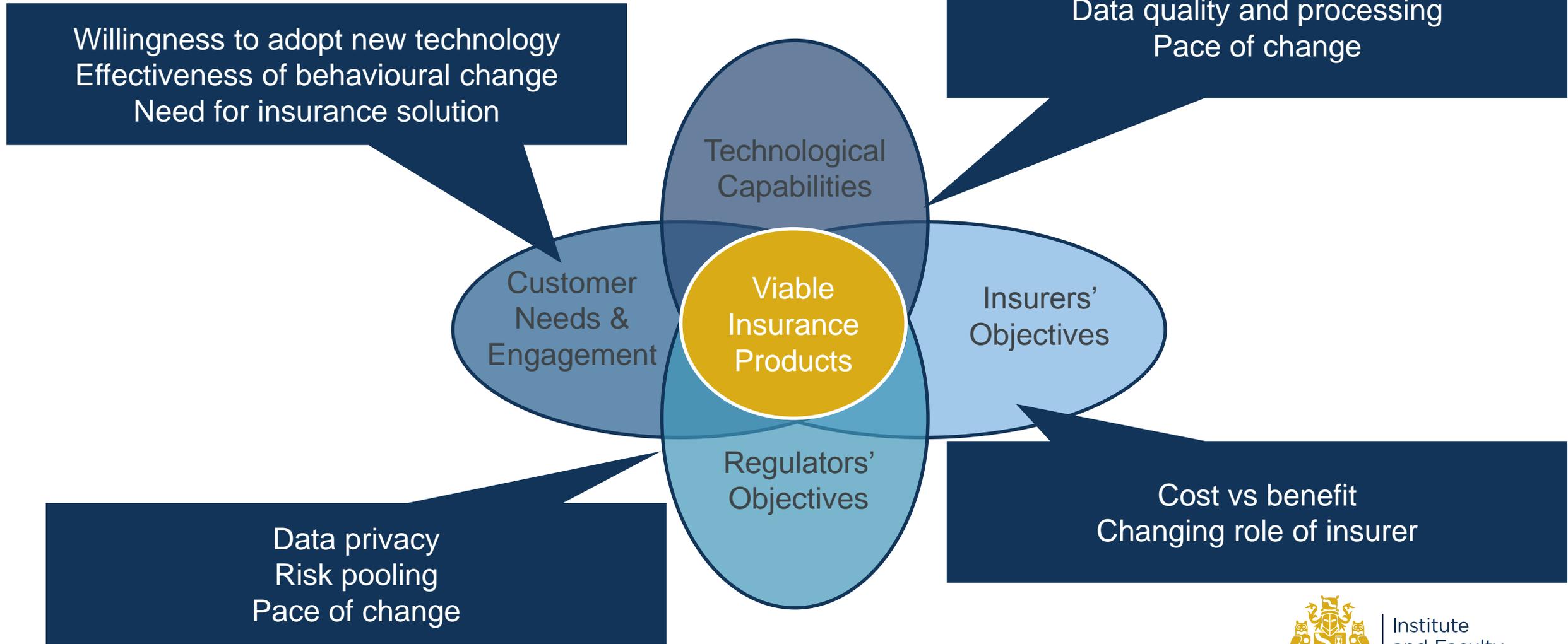
Risks and challenges

Risks & Challenges

Willingness to adopt new technology
Effectiveness of behavioural change
Need for insurance solution

Data quality and processing
Pace of change

Technological Capabilities

Customer Needs & Engagement

Viable Insurance Products

Insurers' Objectives

Regulators' Objectives

Data privacy
Risk pooling
Pace of change

Cost vs benefit
Changing role of insurer

Institute and Faculty of Actuaries

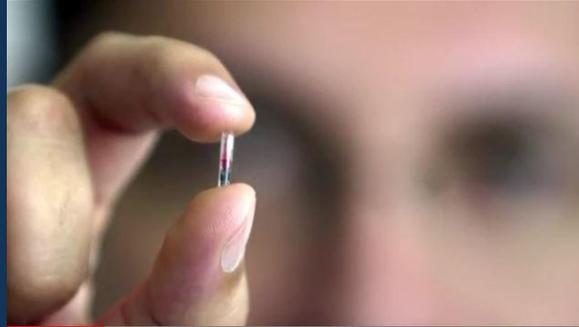# Tech Developments – What the future might bring…

Tracking emotional states

Affective computing attempts to recognise and interpret human emotional states via:

- Camera-based systems
- Voice patterns
- Brainwave activity
- Electrodermal activity
- Breath analysis

Embedded Technology

- Microchipping humans!
- Tracking, payment, make calls, send texts and emails, monitor health, access buildings, attend events…
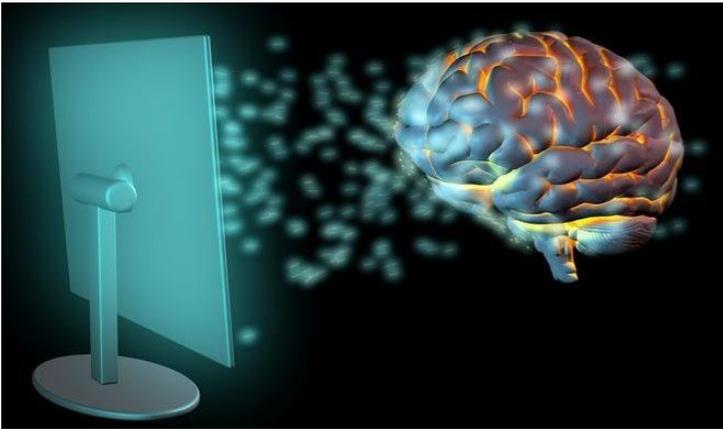- Less than 10 years away…

Wearables in sport

- Often at forefront of technology uptake
- Can give us an indication of current and future uses of technology
- Some uses deemed as unfair advantage

Institute
and Faculty
of Actuaries

Tech Developments – What the future might bring…

Brain – computer interface

- Directly reads users' thoughts
- Control augmented and virtual realities

Exoskeletons

- Bionic suits controlled using thought
- Rehabilitation help for spinal cord injuries
- Smart underwear as a solution for back pain
- A "chairless chair" for use in industries such as manufacturing

Considerations for the future of insurance

The future of insurance	Revolution or evolution

Technology take up	Asymmentries / anti selection	New opportunities	Evolution vs revolution	Living up to the hype	Who will take advantage?

Beyond reported conditions & claims	How will you collate data & analyse it	Short term vs long term	Game changing innovations

When will you get involved & how?

Institute
and Faculty
of Actuaries

Conclusion

- Rapidly developing area
- Market opportunity vs catalyst for change
- Technology is only part of the solution
- Data considerations – data capture, legislation and interpretation
- Ethical and moral behaviour in terms of sensitive personal data
- Risk of market fragmentation through reduced cross subsidization
- Specialist products
- Those engaging will be on an evolving business case and product development journey
- When will you get involved and how?

Institute
and Faculty
of Actuaries

Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenters.

Institute
and Faculty
of Actuaries