Research evidence, technological innovation and scientific standards in policing workstream report

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Independent advisory group on emerging technologies in policing

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Executive summary

This work stream has focused on understanding the role of technology adoption and innovation within Police Scotland, and outlines three main areas: existing approaches to the adoption of technological innovation; barriers to adoption; and a study into viewpoints of technology providers into the future horizon for technological innovation. The responses from the study touch on a number of themes such as: data driven innovation; putting the victim at the centre with any new technology adoption; data interoperability and standards; and what next generation standards for digital evidence management looks like.

For evidence-based decision making:

- **Police practices should be based on scientific evidence about what works best with pilots developed with in collaboration with industry and academia**. Using a combination of best practice research evidence, industry knowledge and experience, and the experiences of the victims of crime is key in order to make informed decisions on the adoption of emerging technology. It is also thus important to understand when an evaluation is needed, and how it can be implemented ahead of the change happening. A core part of this must be to seek the support of the Scottish Institute for Policing Research (SIPR) or others in commissioning the evaluation *prior to* the technology coming into effect.

- **Change Board within Policy Scotland may wish to define criteria in the Case for Change section of the business case**. To better support the adoption of innovation, and, When met, these criteria would require further research and evidence to be generated/gathered in order to support the case for change. The prerequisite for supporting more research and evidence could be determined by the risks (perceived and/or potential) associated with a technology's adoption, and/or the value of the investment. For high risk proposals, it may be appropriate for external and independent research to be carried out and reviewed by change board.

- **Democratise the decision making in relation to the adoption of new technologies to ensure representation from a variety of Scotland's community**. This could mitigate potentially negative societal impacts to society through providing differing perspectives and viewpoints. Arguably, this would be ideally suited to an earlier stage in the process than is currently the case. Along with this, Police Scotland may consider introducing the evaluation of the impact of new technologies. A baseline impact measurement could be confirmed ahead of the introduction of technology and ultimately be used to assess the implementation of technology.

Barriers and facilitators to technological adoption:

- Police organization needs a clear innovation strategy and vision on technology. The use of technology in the daily routine of police practice often depends on: flexible and customized support from facilitating services; the motivation and perseverance of project leaders and police chiefs; a clear organizational structure and governance; and the related timely and fitting decision-making on project development.

- Technology innovation is not just about getting the technology right, but about sociotechnical change which includes cultural change in practice, institutions, and oversight. Successful adoption into practice needs to take into consideration stakeholder perceptions, existing systems and practices at practitioner, policy and oversight levels, and a variety of other elements that may be impacted on and are likely to have to innovate at the same time.

- Technology innovation should be a longer-term process, also at the implementation level. This means that decisions about procurement, replacing of systems, changes to practices, need to focus on establishing understanding and the willingness to experiment, e.g., in small scale test-runs.

- Technological innovation should be about partnership. Developing stable, longer-term mutual collaboration with industry, academia, public representatives, various relevant agencies and across the police force can strengthen the capacity for sociotechnical change, encourage benefits to arise from such change, and render innovation socially more acceptable.

Adoption of new technology:

- Victim at the centre. From the viewpoints of technology providers is that as new technologies are developed, it is important to put the victim at the centre of any innovation. This will enable an improved response rates through data interoperability and data sharing though a secure platform for multi-agency working and knowledge sharing. Along with this there will be a better understanding of touchpoints that a victim could interact with during a police investigation.

- Next generation standards. These must be designed to meet the needs of the user in line with the Digital Scotland Service Standard and Government Digital Service Standard. A key focus is that they standards must enable *interoperability within and between forces* to reduce cost, risk and complexity and, conform to published specifications for storage, sharing and security to ensure a common understanding of what good looks like.

- Integrating with developing standards. A number of recommendations for Police Scotland have been flagged when exploring what standards emerge from outside of policing POLE standards will be critical when enabling interoperability and, with the adoption of emerging technologies ISO27001 which looks at how to manage information security and how to avoid issues with human error has been suggested as this will ensure staff know how to manage the data properly. Further recommendations include: The GOV.UK Technology Code of Practice; GOV.UK Data Ethics framework; and the NHS Digital, data and technology standards framework.

Contents

Chapter 1

Introduction

1.1   Motivation

In June 2019, the Cabinet Secretary for Justice outlined a report on digital triage devices used by Police Scotland. This resulted in the forming of an Independent Advisory Group (IAG) that would explore the legal and ethical considerations arising from emerging technological developments [1]. The IAG thus focuses on Police Scotland's use of emerging technologies, and where this is compatible with human rights and other applicable legislation and best practice [1]. Sheptycki et al [2] defines that there needs to be *normatively ground policing practice in concerns about social justice*, and where technology could be used to undertake surveillance and also to implement use-of-force in the service of governance.

The group thus aims to investigate and propose ways that Police Scotland could best use emerging technology. This document relates to one of the workstreams within the IAG, and which focuses on evidence and scientific standards.

1.2   Focus areas

The Workstream 2 within the IAG focuses had a number of key aims:

1. Analyse and map the existing approach taken by Police Scotland to the use of research evidence (both quantitative and qualitative) for the consideration, adoption and implementation of emerging technologies. If, as anticipated, a variety of approaches are taken by Police Scotland then short case studies will be provided which highlight where and what research evidence was used in the lifecycle of emerging technology decision making. See Chapter 2.

2. It is recognised that not all emerging technologies in policing will be commercially procured. Police Scotland has both the skills and the opportunity to innovate internally and in partnership. A qualitative analysis will be undertaken of the barriers (and facilitators) to research and innovation (Note: the scope of this activity will be limited to innovation that may lead to technology that assists in operational policing). See Chapter 3.

3. Horizon scan to identify emerging and developing capability and practice in the gathering of digital data and evidence (including those related to body cameras, mobile phone analysis, and data sharing). Consider preparatory research and

scientific standards that may be required should future adoption of technology/practice be considered. See Chapter 4.

4. Understand areas of innovations in the usage of digital data and evidence, and how to support a scale-up in their usage. See Chapter 5.

5. Using the information generated above (item 1, 2 and 3) and input from key stakeholders and practitioners, explore the preferred place and role of research evidence in the process of considering, adopting and implementing emerging technologies in policing. This will allow for a *target operating model* for the use of research evidence to be proposed.

The key outputs of this workstream are the investigation areas of innovation for Police Scotland, and how best challenges can be setup, and which integrate with SMEs.
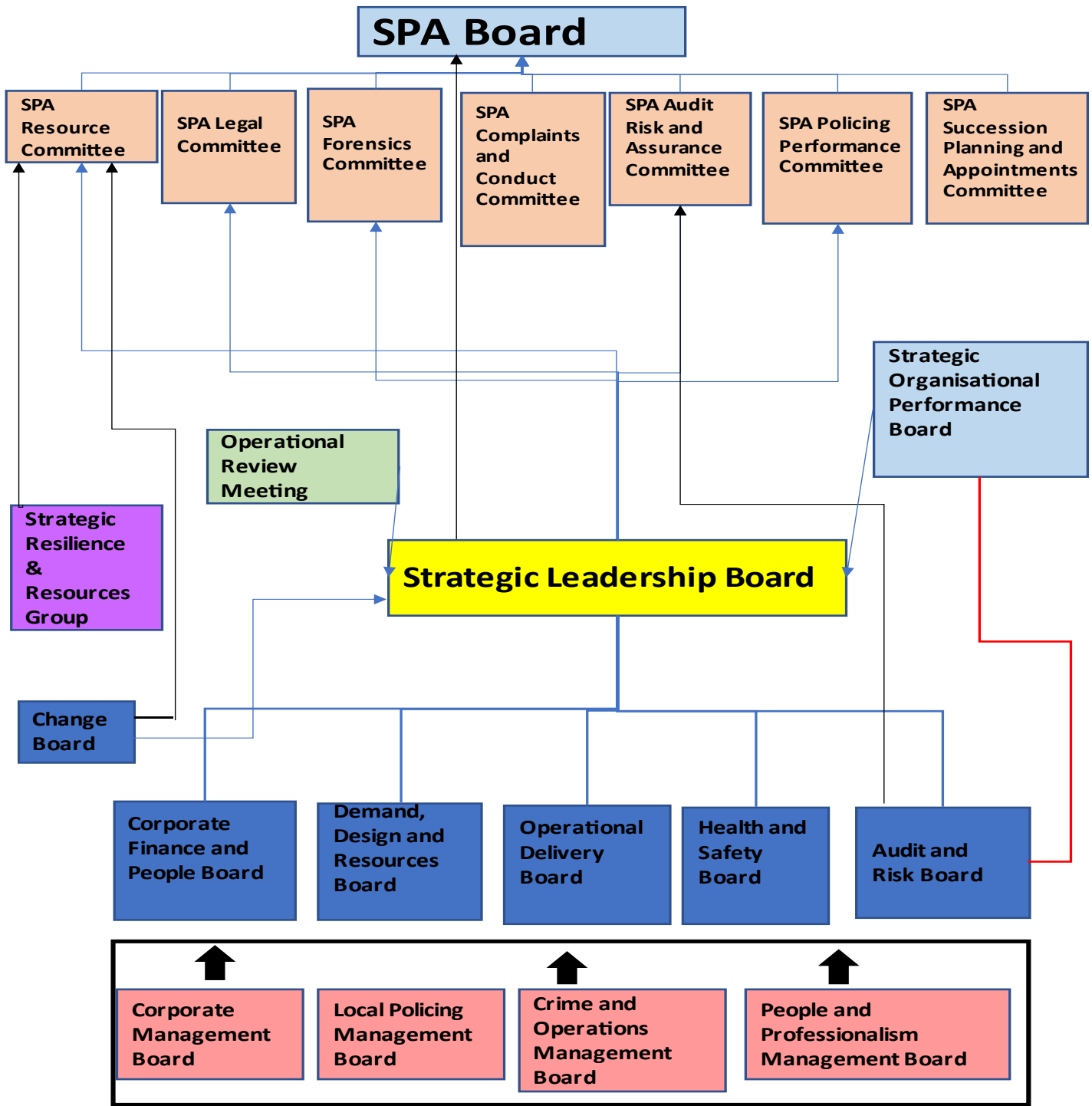
Existing approaches

2.1   Introduction

Technology now touches every corner of our lives. Policing is no different, with police forces across the globe increasingly looking to technology to support them in their role to keep people and communities safe. However, the adoption of technology is not always straightforward, and may pose ethical dilemmas that need to be considered. It is therefore crucial to understand the full impact of emerging technology to enable appropriate decisions to be made before its implementation in Scottish policing.

In June 2019 the then Cabinet Secretary for Justice announced the formation of an independent advisory group (IAG) to scope the possible legal and ethical issues arising from emerging technological developments. The purpose of the IAG is to ensure Police Scotland's use of emerging technologies in relation to operational policing is compatible with equality and human right legislation and best practice.

The chapter provides an overview of the governance that is followed during the consideration of new and emerging technology prior to any subsequent adoption. This document gives particular focus to the role that research evidence plays in the process of considering, adopting and implementing emerging technologies in policing. The chapter is structured so as to follow the pathway of technology adoption from initial idea/concept to Business as usual adoption of the technology. Areas that may benefit from further consideration are highlighted throughout this report.

2.2   Police Scotland and SPA governance

Police Scotland and the Scottish Police Authority (SPA) have a mature and robust governance framework in place to maximise appropriate governance, oversight and scrutiny (detailed in Figure 2.1). In recent months, this process has been further strengthened by the adoption of a joint Memorandum of understanding (MoU) between Police Scotland and the SPA. This MoU aims to ensure early visibility and oversight of any new and emerging strategy, policy or practice under consideration by Police Scotland.

SPA Board

SPA Resource Committee

SPA Legal Committee

SPA Forensics Committee

SPA Complaints and Conduct Committee

SPA Audit Risk and Assurance Committee

SPA Policing Performance Committee

SPA Succession Planning and Appointments Committee

Strategic Organisational Performance Board

Operational Review Meeting

Strategic Resilience & Resources Group

Strategic Leadership Board

Change Board

Corporate Finance and People Board

Demand, Design and Resources Board

Operational Delivery Board

Health and Safety Board

Audit and Risk Board

Corporate Management Board

Local Policing Management Board

Crime and Operations Management Board

People and Professionalism Management Board

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Figure 2.1: Police Scotland and Scottish Police Authority governance framework

Although neither Police Scotland nor the SPA have a specific board for consideration of new and emerging technology or research evidence, many of the Boards detailed above will have a role to play in ensuring the highest standards are maintained. Furthermore, the SPA's function in oversight of change enables questioning of change initiatives.

Within the governance framework detailed above, there is a most likely governance route that would be followed when considering the adoption of new or emerging technology on transformational change (see Figure 2.2). It is vital to understand ethical aspects of technologies and their potential use in policing prior to adoption, i.e., at the stage of considering need for change.

Equally important at this stage is to understand the societal and cultural aspects of need for change, and of the technology and its deployment perceived as resolution to identified needs. As such, consideration should also be given to required socio-technical innovation when assessing needs for change.

All these aspects need to be analysed and evaluated together (since, e.g., operational technologies deployed with the aim of identifying a suspect population can aggravate inequality and distrust by drawing from in-built bias in technologies, practices, and institutions).
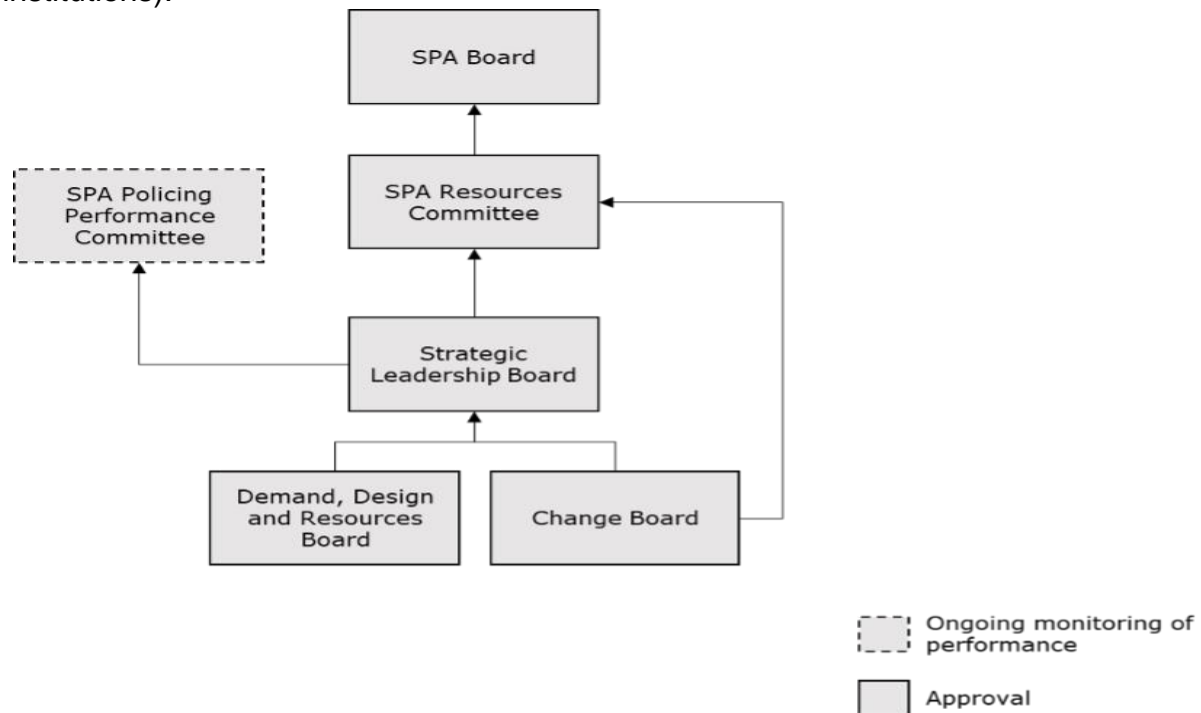
Figure 2.2: Governance route for new and emerging technology

2.2.1   Stage 1 – Identifying and considering the need for change

The need for change will be identified. This may relate to the restructuring of a department or the introduction of a new system or process. Whatever the change requirement is, it will be aligned to one or more of the principles of business change.

2.2.2   Stage 2 – Local management board

A project can be initiated from any business area both Operational and Corporate. Where is it Corporate eg: Finance, Estates the idea will be approved by a Director. In relation to the Operational areas it is likely that a brief is prepared and submitted to one of the following Management boards:

- Local Policing

- Crime and Operational Support

- DCC Designate

Each board will consider and manage the progress of changes relating to their area of business, where this is an approved project this will be managed via the Change Board. If a change is approved in principle by a Local Management Board, the person leading the project will be asked to prepare a Potential Project Assessment (PPA), this is done in conjunction with any enabling functions such as IT, Procurement and this is presented to the Demand Management Board, in line with the Investment Governance Framework. It will then be agreed what type of activity this is eg: BAU (Business As Usual), Project. If it is deemed a project an Initial Business Case (IBC) which brings together all of the key information needed to initiate the project will be completed. It may also be required to complete a Programme Brief if the activity is deemed of sufficient size and scale. The Business Case includes aspects such as the case for change, project plan, controls and communication plan. Importantly, the IBC should include details of the benefits and dis-benefits of the proposed change. Benefits should be quantifiable wherever possible and be based on robust research and evidence.

As it stands there is no mandated requirement for scientific research to be included as part of the IBC. However, it should be noted that upon dip sampling recent IBCs it is common for there to be a strong reference made to existing scientific literature or evidence (with a particular focus on evidencing the benefits of proposed technology).

2.2.3 Stage 3 – Change board

Once an IBC has been prepared, it will be considered by the Change Board. The Board will consider aspects such as the benefits the change will bring, impact on the organisation, timescale for delivery and any cost or resource implications which will be required to support the delivery. If approved the person leading the project will be asked to prepare a Full Business Case (FBC) which provides further information and will outline options for moving forward. The FBC is then submitted to the relevant Programme Board then the Change Board. The Investment Governance Framework for approving such business cases can be found in Appendix A.

The business case template used by Police Scotland lends itself to the inclusion of research and evidence. The following business case structure is currently used (Table C.3).

As outlined above the business case process articulates the case for change, the benefits that are anticipated and the financial cost implications. It also recommends a

preferred option for implementation and provides details of the project management process and resources available.

Although effective at articulating why a project/proposal should be approved, of the business cases sampled there was a lack of scientific evidence and research provided to support the case for change.
Opportunity exists to strengthen the business case process by mandating for the inclusion of evidence to substantiate the case for change. Wherever possible this should be in the form of quantitative data (however qualitative data may be appropriate in certain circumstances). To ensure balance, evidence should also be provided for any identified drawbacks or pitfalls associated with the implementation of the change.

If approval is given, the project will progress to the next stage. The next stage in the process is dependent on the type of change to be implemented. If the change impacts on staff employment or officer terms and conditions, it will move to stage 4. If there is no impact on people's working conditions, for example the introduction of a new computer application, then the project will move to stage 5 – implementation.

> Consideration 1: Change Board may wish to define criteria in the Case for Change section of the business case. When met, this criteria would require research and evidence to be generated/gathered in order to support the case for change. The prerequisite for supporting research and evidence could be determined by the risks (perceived and/or potential) associated with a technology's adoption, and/or the value of the investment. For high risk proposals, it may be appropriate for external and independent research to be carried out and reviewed by change board.

2.2.4   Stage 4 – Consultation process

All Organisational Change proposals will be presented to the Joint National Consultative Committee (JNCC) prior to any consultation beginning with staff. The JNCC includes representatives from relevant staff associations and trade unions. Although most projects relating to new and emerging technology will not involve organisational change, details of this step have been included as there may be circumstances where major technology projects have associated organisational implications.

Table 2.1: Current business case structure

Section	Description
Primary Driver for Change	To provide a high level summary of an internal or external pressure or opportunity that has established the need for change.
Purpose of the Full Business Case (FBC)	Sets out what is being asked for in terms of approval and high level associated costs.
Strategic case	Outlines how the proposal aligned with the priorities set out on the 'Policing 2026' strategic programme
Case for change	This section forms the bulk of the business case and outlines the key drivers for change. This will typically include a qualitative assessment of the status quo and the benefits that the change/proposal will bring. Opportunity exists for this to be strengthened with the inclusion of quantitative data and scientific standards, for example through a baseline for future evaluation.
Benefits realisation plan	This section will list the benefits that are expected to be realised. This are typically 'qualitative' and opportunity exists to strengthen these with the inclusion of quantitative measures that assess both the benefits and potential pitfalls/trade-offs associated with adoption of the change.
Dependencies	Describes the work or projects that must also be delivered in order for the benefits of the proposed change to be realised (e.g. training, ICT platforms). Opportunities exists to formalize the

	importance of training in the successful deployment of technology.
Economic case	This section will outlines and describe the different investment options that are available and provide a cost analysis for each. It will also make recommendations on which option should be taken forward.
Financial case	A financial case will then provide a detailed cost profile (capital and revenue) for the preferred option across a 3-5 year period.

Once the JNCC has been consulted, consultation can then begin with those affected. Initially (and where appropriate) this will be done in groups to discuss the broad change and provide staff the opportunity to make any redundancy mitigation counter proposals thereafter individual consultation meetings will take place on a one to one basis to discuss how the proposals may impact individuals. The consultation process will take a minimum of 45 days.

Following appropriate consultation, and confirmation of the final impacts through HRC, the project will then move into the implementation phase.

> Consideration 2: There is opportunity to democratise the decision making in relation to the adoption of new technologies to ensure representation from a variety of Scotland's community. This could mitigate potentially negative societal impacts to society through providing differing perspectives and viewpoints. Arguably, this would be ideally suited to an earlier stage in the process than is currently the case.

Taking steps to ensure diversity amongst decision makers will facilitate better decision making by bringing different perspectives to support constructive and challenging dialogue. The criteria for selection to decision making structures should be clear, measurable and objective, and must not place people with particular protected characteristics at a disadvantage.

Police Scotland should monitor diversity in their decision making structures in order to identify barriers preventing people with protected characteristics progressing to positions on decision making structures, and take mitigating action where necessary. Gathering and using this data will help Police Scotland satisfy the requirements of the Public Sector Equality Duty.

Where appropriate, consideration can be given to the use of positive action, including proportionate steps to develop people from under-represented groups and encourage them to apply for membership of decision making structures. Reasonable adjustments for disabled people should also be made where appropriate, to remove or reduce any barriers affecting selection, and participation in, decision making structures.

2.2.5   Stage 5 – Implementation

Once the project moves to the implementation phase, it will be delivered in line with the timescale set within the project plan.

> Consideration 3: Consider introducing an evaluation of the impact of new technologies. A baseline impact measurement can be confirmed ahead of the introduction of technology and ultimately be used to assess the implementation of technology.

2.3   SIPR

Established in 2007 and supported during its initial five year phase by investment from the Scottish Funding Council and the Association of Chief Police Officers in Scotland, SIPR is a collaboration between Police Scotland, the Scottish Police Authority, and 14 Scottish universities* established to carry out high quality, independent research and to make evidence-based contributions to policing policy and practice. The work of SIPR is advisory in nature (not decision making) and the intelligence and evidence generated will support several decision making for a (e.g. Change Board, Strategic Leadership Board, SPA Board).

SIPR will be asked by Police Scotland and the SPA to assist in commissioning academic researchers to evaluate new technologies before the implementation of different technologies and approaches (e.g. Benefits of implementation of mobile devices with frontline officers in Police Scotland 2019-2020). SIPR will also be requested to research and consider the implications for the adoption of new and emerging technology in Policing (e.g. Drones, BWV). There is no formal route for this

work to be commissioned and research typically transpires from discussions at committees, boards or with senior leaders.

SIPR will also be requested to research and consider the implications for the adoption of new and emerging technology in Policing (e.g. Drones, BWV). There is no formal route for this work to be commissioned and it research typically transpires from discussions at committees, boards or with senior leaders.

> Consideration 4: Determine when an evaluation is needed, how it can be implemented ahead of the change happening and seek SIPR's support in commissioning the evaluation PRIOR TO the technology coming into effect.

2.4   Citizen Space

Police Scotland also conduct research through Citizen Space. This website hosts consultations and engagement run by Police Scotland and enables Police Scotland to gain an understanding of public opinion on a variety of issues. For example, it was recently used to gain a deeper understanding of public opinion on the use of Body Worn Video.

2.4.1   Comparison with comparable police forces

Sampled business cases showed little comparison to how comparable new and emerging technologies were implemented in similar police forces. This could also form research included as part of the proposal for change as it could potentially provide further considerations and lessons learned for Police Scotland to build upon as this new technology is explored.

2.5   Concluding remarks and recommendations

At present, Police Scotland and the SPA have a governance process to oversee the implementation of new and emerging technology. However, there is no formalised inclusion of research in this process. Whilst research is undertaken in certain cases to inform the implementation of new technology (for example, Body Worn Video), there is no agreed process or criteria in place to formally mandate this. This should therefore be

a consideration as part of the change process to enable the appropriate governance mechanisms to make informed decisions.

Furthermore, as it is crucial to consider the implications of new technology on the communities it impacts. Engaging with representative organisations from an early stage gives an opportunity to mitigate barriers to successful implementation early in the process.

Barriers and facilitators to technological innovation

Author: Matthias Wienroth and Megan O'Neill

3.1 Innovation in policing and crime prevention

Technological innovation refers to research, development and deployment of new devices, materials, equipment, but also of procedures and processes, including software, novel services (e.g. forensic services) and systems (e.g. novel data aggregation and exchange), and analysis approaches. A vital element in technological innovation is that of socio-legal, political and practice innovations: novel changes in the way that things are understood, done, and governed. For policing this means that innovation in technology also affects how policing is understood and provided, and it may require changes in practice and oversight [3]. For example, when DNA profiling enabled DNA databasing, changes in law and in policing practices have had to accompany technological innovation in order to enable DNA databasing. As such, when we consider technological innovations, we need to consider these as part of wider socio-technical processes [4]. Key questions arising from this pertain to how novel technological innovations draw from, and contribute to, existing user practices, technologies and systems, and how expectations about technology's contribution to desired futures function as barrier, facilitator and modulator to change [5, 6, 7].

The concept of the *adoption space* provides an analytical focus for sociotechnical change as it provides a lens through which to analyse how and why technologies may or may not be adopted into practice. This lens describes a dynamic *spatial and temporal space ... populated by human and non-human actors ... where attitudes, practices, interactions and events, together with the technology's material features, shape technology perceptions in ways that are instrumental in decisions about its use* [8]. The concept alerts to the wide range of actors, organisational and ecological factors that are aspects of technological

innovation and how it links to practice. It also provides a way of understanding how technologies may be adapted into practice, that is how they are perceived and used not necessarily as intended by those who developed the technologies. One key analytical aspect here is that of technology identities (ibid.). These refer to understandings of how a technology may work and impact on society, including on relationships between different social actors and on the organisation of social life. Technology identities are socially constructed and relate to *novelty, effectiveness, utility, risks and requirements* and as such shape the *desirability, acceptability and adoptability* (ibid.) of technologies.

The way that technologies are perceived by stakeholder groups contributes to their adoption or their rejection in practice, or the need for further adoption work to render the innovation reliable, useful, and legitimate to stakeholders. As such, adoption space and technology identities mark the need to involve diverse stakeholder groups and to understand not only a technology, but its wider sociotechnical field, in order to identify and approach barriers and facilitators of innovation.

Significant research on barriers and facilitators for technological innovation has been conducted in the health domain, and to a lesser extend in the policing domain. We draw from both domains to identify key aspects for barriers and facilitators to technological innovation in the first part of this report, and in the second part apply this to emerging policing technologies in Scotland.

3.2   Key dimensions of barriers and facilitators

McNeil et al. [9] provide an exceptionally rich account of barriers and facilitators of technology innovation in the health care system of Canada and suggest six dimensions within which to analyse and address these: development, assessment, implementation, policy context, resources, and partnerships/communication. The authors challenge the strong commercial focus of technology procurement in Canadian health technology policy; critique the siloed approach to innovation as preventing meaningful communication and mutual understanding between different stakeholders; and suggest a longer-term focus for innovations that exchanges an emphasis on cost containment with one of value to the domain. With value they refer to contributions of technological innovation to achieving the goals and priorities of policy, users, and society, and to addressing user needs, without prioritising one over the other. The following section offers a summary of four out of the six dimensions and their most relevant barriers and facilitators as they can be transferred to policing.

3.2.1   Key barriers and facilitators in four dimensions of technology innovation

Development

Dimension: [9] (Page 205).

Barriers:

- Exclusion of groups

- Reinforcing hierarchical social arrangements

- Lack of awareness of goals and needs of the application field (e.g. focus on easily commercializable technologies that do not meet user needs)

- Focus on empowering users

- Uncritical comparison with other countries

Facilitators:

- Local seed funding to spur innovation activities

- Building awareness among developers of needs and unmet priorities

- Opportunities for developers to consult with user groups early in the development

- Developers incorporating user groups' feedback into development

Implementation

Dimension: [9] (Page 208-209).
Barriers:

- Competitive model of procurement focused on cost-containment may disadvantage more innovative products

- Focus on short-term outcomes of innovations may prevent gains only realisable in the longer term

- Block-procurement may disadvantage smaller, local developers

- Commercial focus

Facilitators:

- Enhanced collaboration via risk-sharing and value-based pricing

- Move to value-based procurement with a focus on the life cycle of technologies and on user outcomes

- Develop support materials for procurement ('how to')
- Enable universities to be involved and hold IP

- Develop metrics that consider societal impacts of technological innovations

- Develop insight into how technology is transferred into practice

3.2.2   Resources

Dimension [9] (Page 210).
Barriers:

- Allocation on basis of 'what we have always done' or political factors can disadvantage investment into innovative development

- Focus on cost-containment

- Fee-for-service basis of resource allocation does not provide incentive to participate in innovation, nor on the value of the service to the field due to a focus on cost

Facilitators:

- Tax credits for innovation

- Identify successful programmes and scale these up

- Value-based approach to resource allocation (what do we aim to achieve, rather than what does this cost)

3.2.3   Partnerships/communication

Dimension: [9] (Page 210).
  Barriers:

- Inconsistent consultation with users and publics

- Lack of robust inclusion of their views into innovation

- Publicly inaccessible needs and delivery plans of users

- Lack of signposting through bureaucracy and to seed funding

- Lack of collaboration on understanding the value of a technology

- Lack of communication between innovators, policy-makers and oversight bodies

- Differences in motivations and priorities unclear

Facilitators:

- Forming early partnerships across stakeholders during innovation process
- Involving users in testing early

- Forming partnership entities to better translate research into practice

- Developing a collaborative environment with communication tools that enable trust, information sharing, understanding etc.

For the policing domain, Laufs and Borrion [10] provide a practitioner-based analysis of key barriers and facilitators for technological innovation in policing practice. Their analysis reflects key elements identified in the previous section, but with a narrower focus. They were surprised by the higher-than-expected openness to innovation but identify a significant level of scepticism. The authors' key findings comprise:

1. Efficiency and effectiveness are portrayed as key facilitators for users to accept technological innovation: If innovations can reliably and evidently enhance efficiency and effectiveness in policing practice, they are more likely to be welcomed and adopted. This suggests that, in turn, a lack of evidence would present a barrier to adoption into practice.

2. However, a key barrier to innovation can be lack of interoperability with existing systems, both within a force as well as between different agencies cooperating with the force: lack of compatibility, new user interfaces, limited functionality arising from using different technological capacities in one system.

3. Another identified barrier is that of social acceptability. From a user perspective this was seen to be a strategic concern to be addressed at organisational and political levels where it can lead to a rejection of adoption into practice. It is a key barrier to innovation, and can occur both externally (e.g., public protest) and internally in policing (e.g., resistance by practitioners). Metrics of benefit to public order (e.g., crime reduction) are raised as potential means to address acceptability, but difficulties in producing reliable metrics may require qualitative approaches to understanding and engaging with social acceptability instead.

4. Practical impacts can offer significant burdens for technology adoption where innovations can affect established daily routines; administrative processes such as workload, communicating and reporting; workspace design. Repeatedly, Laufs and Borrion point to the potential discrepancy between front-line workers and management in perceiving barriers and facilitators such as these.

5. Political and financial commitments can function as facilitator to innovation uptake: Laufs and Borrin identify such commitments as vital for developing a supportive ecology within which innovations can be introduced and adopted: Flexible and innovation-open structures with strong, visibly supportive leadership and clear innovation adoption guidelines.
6. Public-private partnerships are raised as an issue based on the need for collaboration, pointing to private developments that may be out of control of police and can potentially interfere with policing needs.

3.3   Lessons for technology innovation in policing

Throwing technology at policing practices tends not to lead to successful adoption unless a fruitful ecology, including flexible structures and a strong institutional framework (Garicano and Heaton [11]; Mastrobuoni [12]), as well as sustainable innovation practices exist. The two above discussed studies provide a rich tapestry for drawing lessons for technology innovation in policing. This section attends to three key areas of immediate interest for consideration: procurement, change in practices, and social acceptability. They address elements of development, implementation, and overall legitimacy of sociotechnical change in policing.

3.3.1 Procurement

Decisions and practices of law enforcement can influence decisions by researchers and commercial providers, e.g., which areas to invest into, what types of innovations to propose, and how to strategically promote specific innovation trajectories. A key barrier to research and development for technology innovation can be procurement practices as the availability of finance – as well as the capacity to build lasting partnership (e.g., [13]) – impact on the capacity for investment and development of sociotechnical innovation.

Commercial providers, within a system of block-procurement, will focus on low-cost technology development and offer of services that can easily and quickly show results. This may be a detriment to a longer-term strategy of innovations where short-termism causes either a lack of longer-term effects, or – in the shape of a stop-and-start approach – necessitates extra efforts and funding over time to continue research and development.

The UK forensic DNA market, for example, has lost its innovative edge it held during the years of the Forensic Science Service (up until 2012) because commercial service providers focus on delivering low-cost services that are requested by police via block-procurement, where police forces have been satisfied that these services – e.g. DNA profiling, paternity/maternity testing – deliver reliable results and are used sufficiently frequently. More complex, and innovative services – such as the genetic analysis of body fluids, genetic age, or appearance traits – have more recently been developed outside the UK since police forces in England and Wales tend not to request these. Block procurement makes it more difficult to request specialist services, they are of higher cost, and police forces are less certain about the utility of these analyses. As such, past and current decisions about what technologies to procure have impacted on the availability of capacities for conducting innovative research and development (cf. Gallop and Brown [14]).

Procurement benefits from an analysis of needs, capacities in existing practice to adopt to be procured technologies and services, and from a longer-term perspective on which partnerships to develop and which longer-term aims to pursue.

3.3.2 Change in practice and culture

Innovation has become a key value of policing, next to accountability and legitimacy. These are political commitments that need translation into practice domains of policing in order to encourage the investment into and uptake of technological innovation. Laufs and Borrin [10] refer to political and financial commitments as a potential barrier or facilitator, depending on strength and effect. Therefore, leadership plays a vital role in the innovation process. Sufficient organisational and financial support for development and implementation, adequate training, clear guidelines and rules, can facilitate innovation. Perception of lack of support from superiors and from policy on the other

hand may reduce benefits, delay, or even bring to a halt innovation processes (Koper et al.
[15])

Whereas McNeil et al. [9] identified a focus on empowering users, and the entrenchment of social hierarchies as key barriers to innovation development, Skogan and Hartnett [16] suggest that these two may help in the adaption, or implementation of innovation into policing practices, based on their interviews and survey of police officers' uptake of information technology. This reflects on potential rejection by those who may feel threatened by innovative devices, procedures, or systems as barriers to innovation (Laufs and Borrion [10]) and suggests that involvement of users in decision-making about introducing technology into policing can facilitate their useful uptake into practice. Concerns around how new technologies can impact on performance requires understanding of what the technology can and cannot do, but also requires the technology to be capable of addressing needs and priorities of policing users. A significant hurdle to adoption can arise from the imposition of innovation on existing structures, either to replace them, or to reshape them significantly, without evidencing the value of doing so, and without drawing on stakeholder groups such as users in the design, implementation, and deployment of new technologies. Incompatibility of old and new systems, practices, devices etc. can mean a significant barrier to innovation in practice. Organizational structures and cultures play a key role in the adoption of technology into policing and can significantly affect the extent and nature of this process (Bullock et al. [13], Manning [17]) Understanding and ensuring interoperability is an often-praised goal for innovation, but such interoperability can also lead to a loss in legitimacy via public criticisms of function creep, as can be seen in the use of cross-database searches (see, e.g., [18, 19].

The capacity for adoption, therefore, depends on whether the technology affects relatively easy to accommodate aspects of practice, e.g., when considering the use of taser, or whether it requires a more comprehensive, perhaps even systemic change, e.g., when considering the introduction of facial recognition software and hardware, which will see police forces likely also engage in juridical and social debates, as seen in the case of South Wales police using live facial recognition at football events and other public spaces since 2018.

However, the ways that technologies have been developed, and existing technological systems and practices may prevent certain uses or aspects of uses (what Bijker and Law [20] have referred to as 'path-dependency' and 'lock-ins'). These need to be clarified in conversation with diverse stakeholder groups during the development and implementation phases.

3.3.3 Social acceptability

Over time, technologies may take on new roles and their use new forms, showing innovation in practice with existing technologies, e.g., the use of CCTV and body-worn video cameras for facial recognition purposes. Such changes may be easier to implement, and innovation is more likely to be adopted, when technology innovations enable the enhanced and/or widened use of existing capabilities, what Laufs and Borrion [10] have referred to as concerns around efficiency and effectiveness. However, the development of further uses of technology and data, of interoperability between different systems and technologies, may negatively affect their social acceptability. In order to understand concerns and already in the design of technologies take public and critical views into considerations, engagement with wider stakeholder groups outside policing and policy rooms is vital. Social and cultural aspects, such as prejudices and institutional bias, can be translated into and proliferated by technological innovation, even lead to aggravating inequality in the lives of communities. This may not necessarily be an issue of the underlying science – although more attention needs to be paid to assumptions and choices that inform technology development – but does sound science necessarily translate into sound policing practice? Does the understanding of a scientifically successful deployment of a technology equate to one of successful policing use?

3.4 Considerations

> Consideration 5: Technology innovation is not just about getting the technology right, but about sociotechnical change which includes cultural change in practice, institutions, and oversight. Successful adoption into practice needs to take into consideration stakeholder perceptions, existing systems and practices at practitioner, policy and oversight levels, and a variety of other elements that may be impacted on and are likely to have to innovate at the same time.

All of these elements can and should be considered in an equality impact assessment. There is a legal requirement on Police Scotland to publish their assessments proposed new or revised policies – including those relating to the development and adoption of new technology and artificial intelligence – against the needs of the Public Sector Equality Duty. This process helps Police Scotland better understand the aims and impacts of the policy and how they relate to equality. It also helps them frame mitigating actions where appropriate, for example to take steps to address negative stakeholder perceptions of new technology, eliminate discrimination, advance equality of opportunity and foster good relations.

> Consideration 6: Technology innovation is a longer-term process, also at the implementation level. This means that decisions about procurement, replacing

of systems, changes to practices, need to focus on establishing understanding and the willingness to experiment, e.g., in small-scale test-runs.

Consideration 7: Technological innovation is about partnership. Developing stable, longer-term mutual collaboration with industry, academia, public representatives, various relevant agencies and across the police force can strengthen the capacity for sociotechnical change, encourage benefits to arise from such change, and render innovation socially more acceptable.

Emerging technologies innovation and standards

Author: Georgina Henley, Head of Justice and Emergency Services, techUK

4.1 Introduction

techUK [21] is a membership organisation launched in 2013 to champion the technology sector and prepare and empower the UK for what comes next, delivering a better future for people, society, the economy and the planet.

It is the UK's leading technology membership organisation, with more than 850 members spread across the UK. It is a network that enables its members to learn from each other and grow in a way which contributes to the country both socially and economically. By working collaboratively with government and others, it provides expert guidance and insight for its members and stakeholders about how to prepare for the future, anticipate change and realise the positive potential of technology in a fast-moving world.

techUK's role on the IAG is to provide a voice for the tech sector, feeding into the report, recommendations and calls for evidence as the group explores Police Scotland's use of emerging technologies [1].

4.2 Evaluation

techUK, as part of its role on the IAG, published its own independent call for evidence requesting members to submit written responses to the following questions:

1. How can the victim be put at the centre of the discussions around technological development? This applies to both data sharing practices/ developments internally as well as external engagement.

2. What do next generation standards look like for data/ digital evidence?

3. What are the standards industry should be aware of? What standards emerge from outside policing?

4. Evidence based decision making in the adoption of tech. How can industry engage academia when developing evidence-based pilots? Research, experience in adoption of technologies.

5. What is your offering to Police Scotland in their adoption of emerging technology (relating to the gathering of digital data and evidence)?

Every force, especially with the impact of COVID-19, is trying to digitally transform services and, through the group, there is an opportunity to help improve and shape policing strategies to improve public safety and equip officers with the digital tools they need to keep the public safe and protect victims.

The following provides a summary of the 16 responses techUK received as part of the call for evidence from its membership.

4.3   Question 1

How can the victim be put at the centre of the discussions around technological development? This applies to both data sharing practices/ developments internally as well as external engagement.

4.3.1   Challenge driven innovation is key

Organisations historically have sought new tools to better manage lengthy and complex processes, reduce risk and accelerate time to market for products or solutions. The technology or solution tends to be the focus rather than the challenge itself. Policing must focus on the challenge first and how technology will solve it.

4.3.2   Technological developments in evidence preservation

Victim Support Schemes and Services could be updated on technological developments in evidence preservation and sharing within policing and the wider CJ System, and how the use of technology aids investigations. This sharing would allow victims who are receiving support from the VSS (Victim Support Service) to better understand how their position is central to the prosecution and what may be asked of them and why, by police, Procurators Fiscal (COPFS) and defence teams.

4.3.3   Speed of access to information

The speed in which officers and investigators can access relevant information on a case is critical to victim care. There are subsidiary benefits of course, such as reducing case load, managing the public purse and being able to make investments in other areas of policing when efficiencies are realised by technology advocate a comprehensive user-centred design (UCD) approach, putting appropriate tools and techniques in place to seamlessly navigate the complex and sensitive user landscapes and understand in depth user / victim needs.

4.3.4   Navigating sensitivities

Speed of access to data for victim care. Putting appropriate tools and techniques in place to seamlessly navigate the complex and sensitive user landscapes and understand in depth the victims needs. For example, Ensuring technology can make it easier for victims to submit evidence from home and withdraw consent easily. Technology also needs to understand some of the issues which may affect why a victim could withdraw from reporting a crime: in some areas victims' mobile devices are removed for analysis for weeks/months which can be traumatic.

4.3.5   Digitising manual and repetitive functions

Cell Site Analysis Suite/Communications Data Automated Normalisation – increase operational efficiency, which ultimately leads to improved victim satisfaction as crimes are solved successfully and at speed.

4.3.6   Data interoperability and data sharing

Consider the process touchpoints a victim (or suspect) would interact with during a police investigation, whether to identify a suspect for a crime against individual or property, or to identify the common victims for a single suspect. There is a fundamental need for appropriate Police Scotland personnel to have access to data from many potentially unrelated systems in order to identify a single thread that goes through those systems:

- A platform for data to be shared auditably and seamlessly. The best data repositories are built on a collaborative platform that ensures all business and data stakeholders share the same knowledge.

- Accessible digital entry point to CJ/ victim support, data sharing between police and partner agencies, victim support groups to be consulted re designing digital solutions

- Access to data from different unrelated systems. People Object Location Event (POLE).

- Sharing the experience of victims with technology companies might open their broader thinking on how the products they produce and promote have an impact beyond their technological intent and how it can lead into the cause and tools of crime and damage or injury to others. • Improving data quality through force-wide education about how systems such as AI and ML work, and their requirements of data. We need to have next generation level data, and enable this through a bottom up approach rather than a top down requirement for standards. Equally important is the definition of a common data scheme across forces/divisions, and even across blue light and wider public services

4.3.7 Improving network connectivity

No technology should be looked at in isolation.Training. Ensuring the correct training is provided to officers. Police having access to mission-critical software, hardware solutions and training which provides a significant contribution and are designed to improve the investigation process by reducing time, costs and improving judicial outcomes.

An example of appropriate collaboration may be seen in the Scottish Government DESC (Digital Evidence Sharing Capability), where multi-agencies will be able to share data throughout criminal investigations and prosecutions. To put the Victim at the centre of technological development, we must observe and address:

- Accessible digital entry point to criminal justice / victim support;

- Data-linkage within Police Scotland and with partner agencies;

- Seek input from Victim support groups when designing digital solutions.

4.4 Question 2

What do next generation standards look like for data/ digital evidence management?

The UK Government has committed to setting out cross-governmental standards for algorithmic transparency, and are also in the process of defining new standards for data foundations in the UK, stressing poor quality datasets and their negative impacts.

- The European Commission has proposed the Artificial Intelligence Act, that highlights the need for transparency, interpretability and confidentiality of high risk AI systems. In particular, this work stresses the need to understand the capabilities and limitations of AI systems, interpret the system's outputs, as well as being able to override, reverse or simply not use the AI output.
- The USA's National Security Commission has highlighted that for use of AI by federal agencies, AI should "continuously monitor performance", "document sources and origins of data", as well as creating procedures for "human supervision". Whilst not yet enacted legislation, this highlights that these standards are recognised as the hallmarks of accountable AI systems.

- Data sharing. Standards should outline processes that enable data to be shared, without large amounts of administration which will be a factor in discouraging forces from setting up data sharing. Silos can also be broken down across the police force by cataloging data and sharing business concepts, repositories, and models to enhance collaboration.

- Ease of process Standards which can be adapted to be machine readable/ to allow automated validation of data.

- Accuracy and compliance with legislation. The presentation and potential use of data/ digital evidence will need to be available and accessible by both sides, and so the next generation standards will need to show fairness and an audit trail that satisfies the rule of law.

- Common language. No shared interpretation or understanding of what one particular type or source means and the common language to share meaning and interpretation is missing, nationally. Next generation standards ought to seek ways by which the taxonomy and language is common and understood to the same degree across the country.

- Encouraging interoperability and improving data quality. Consistent and uninterrupted integration and information flow among various systems is the key prerequisite for fully connected systems. These will need validations on the ethical grounds as some of this data might be unproven intelligence and may lead to unfair use or dissemination of sensitive information. Data quality needs to be improved through forcewide education about how systems such as AI and ML work, and their

requirements of data. We need to have next generation level data, and enable this through a bottom up approach rather than a top down requirement for standards. Equally important is the definition of a common data scheme across forces/divisions, and even across blue light and wider public services.

- Interoperability and integration have to be achieved not just within the force but across partner organisations. It's vital that there is seamless information flow to, from and between the force and the other partner agencies including health, education, social services. in order to reap the real benefits of operational effectiveness.

Current focus on digital evidence is around continuity of evidence and being able to show that data has been extracted without altering it. There is little focus currently on whether the data can be correctly understood by the investigators whose job it is to review the data.

Next generation standards for data/digital evidence should be designed to:

- meet user (e.g. victim) needs in line with the Digital Scotland Service Standard and Government Digital Service Standard;
- encourage and enable data interoperability within and between policing organisations, thereby reducing the cost, risks and complexity currently associated with data sharing and systems integration; and,
- conform to published specifications for storage, sharing and security, thereby ensuring a common understanding of 'what good looks like' and improving the quality and utility of data.

- Evidential standards are traditionally slow to evolve and changes occur normally in bursts as a result of court rulings or media focus. As digital data becomes more ubiquitous within investigations, it is more likely to come under scrutiny, particularly around the necessity to obtain large datasets in order to extract a small amount of data.
- For potential next generation standards and when considering the lifecycle of a crime, the sheer number of type of data and digital evidence that could be captured, analysed, maintained and presented highlights the complexities that the framework must address. To aid the discussion, we have assumed a simplistic lifecycle model.

4.5 Question 3

What do next generation standards look like for data/ digital evidence management?

Recommendation. Police Scotland consider:

- ISO27001 which looks at how to manage information security, not necessarily data practices but more a focus on security and how to avoid issues with human error, confidentiality and data integrity and ensure your people know how to manage this properly. Additionally ISO9001 looks at Quality Management standards, how customer/end user satisfaction i.e. public contact is handled. This will enable Police Scotland to ensure public contact is handled within regulatory requirements. Regarding digital evidence ISO 27037 and ISO 27041 apply.

- POLE Standards. These will be critical with enabling interoperability of data and information between systems and forces, particularly as they cover 4 of the key aspects of data in policing.

- Pre-cursor Policy and Legal constraints. The use of technology and the audit of what/how, when, by whom and why technology was used and to what outcome. As well as legal and user guidelines, there will be local nuanced policies on the uses along with maintaining the evidential sanctity of the outputs gained from the tech from a preservation of best evidence point of view.

- The Digital Scotland Service Standard and Government Digital Service Standard for creating public services in a user-centred way.

- The GOV.UK Technology Code of Practice, which provides criteria to help design, build and buy digital solutions.

- The GOV.UK Data Ethics Framework, which provides guidance on how to use data appropriately and responsibly when planning, implementing, and evaluating a new policy or service.

- The NHS digital, data and technology standards framework, which aims to set out useful, usable and clear standards for enabling better use of data within a sector that has comparable complexity and sensitivity to that of policing.

- MAIT standard [22]. MAIT provides the ability for emergency services to securely share electronic incident records in the form of XML (eXtensible Markup Language). The CAD to CAD information exchange time is significantly reduced and allows accuracy and timeliness of information allowing informed decision making when dealing with other agencies. This frees up more time spent with callers and obtaining quality information. This is currently being used in South

Wales Police, Gwent Police and South Wales Fire and rescue services and has cut resource deployment by more than three minutes per agency.

Humans and AI approach problems in a very different way, with AI working much quicker than humans can even compute. To ensure that the decisions being made are in line with human standards, complying with regulation and adhering to ethical considerations, humans need to be able to understand the governance chain and be present in it.

4.6   Question 4

Evidence based decision making in the adoption of emerging technology. How can the tech industry engage with academia when developing evidence-based pilots?

Research, experience in adoption of technologies.

- Evidence based decision making for policing are verified strategies and well researched policies and practices. It makes policing more rational, increasing their capabilities to prevent crime. Forces are more connected with the community and improve quality of life.

- Police practices should be based on scientific evidence about what works best and hence it's important that for any evidence-based pilot developing, industry must engage academia. Academia are keen to support the development, testing and promotion of innovative practice to help build the evidence base solution and understand what would work best.

- Using a combination of best practice research evidence, industry knowledge and experience (both policing and technology) and the experiences of the victims of crime when making informed decisions on the adoption of emerging technology by Police Scotland.

- Organisations who adopt a collaborative, consortia-based model achieve better results than those that use traditional prime/sub or 'ecosystem' approaches which frequently stifle agility, innovation, and genuine engagement from those experts that have the most to contribute.

- Using a combination of best practice research evidence, industry knowledge and experience (both policing and technology) and the experiences of the victims of crime when making informed decisions on the adoption of emerging technology by Police Scotland". Indeed, this definition would be very analogous to the health

sector if we replaced *victim of crime* with *patient*. Looking specifically at academia's role in this definition, there are a number of areas where academia can bring fresh insight into the process.

- Police practices should be based on scientific evidence about what works best and hence it's important that for any evidence-based pilot developing, industry must engage academia. Academia are keen to support the development, testing and promotion of innovative practice to help build the evidence base solution and understand what would work best

- Partnerships, mentoring schemes, apprenticeship and test panels/groups which can road test new technologies and share ideas/challenges to ensure that new technologies are approached from an outcomes perspective.

- Example 1. Research, experience in adoption of technologies. In 2020/21 The Scottish Institute for Policing Research (SIPR) conducted an evaluation of the *Digitally Enabled Policing Programme* (DEPP), the 'Police Scotland Mobile Working Project' (MWP). This project equipped operational officers with a digital mobile policing solution to replace the traditional paper notebook and to provide remote, live access to key policing information systems. This is an excellent example of how academia can assist and support the review of policing projects, whilst remaining independent and transparent.

- Example 2. The Digital First and GDS Service standards emphasise (1) using evidence to quickly demonstrate that there's a good understanding of the problem to be solved before making substantial commitments (2) using research with real users and real data to quickly establish whether a worthwhile solution can be delivered before undertaking significant development and (3) focussing on rapid, iterative prototyping against agreed KPIs to drive effective design.

- Ensure that pilots ascertain the feasibility of the considerations most important to delivering actual operational business value, including policy and compliance, ethics and safety, availability and fitness for purpose of data, and operational readiness

- Undertake pre-work in key areas to help increase pilot success and avoid unnecessary delays and constraints e.g. secure approval for use of cloud platforms for rapid prototyping where needed, ensure suitable (potentially redacted) representative data is ready and can be readily accessed and consumed by those involved

- Take advantage of established relationships with technology partners. For example, explore the technology partnerships at NatureScot.

techUK as part of its call for evidence also requested responders to include their offerings to Police Scotland in their deployment of emerging technologies.

The following member organisations responded to the call for evidence and provided the content covered in Chapter 4:

- Spatial

- Capita

- Chorus Intelligence

- Cloud Gateway

- Cyan Forensics

- ESRI

- Forensics Analytics

- HCL

- Informed Solutions

- Leidos

- MEGA

- Mind Foundry AI

- Motorola Solutions

- Oracle

- Roke

- Spirent

Thank you to the members who contributed. The above is a summary but if you would like to speak with any of the above organisations directly about their input or offerings, please reach out to techUK's Head of Justice and Emergency Services, Georgina Henley.

4.7   Conclusions

techUK, as part of its role on the IAG, published its own independent call for evidence requesting members to submit written responses to four questions, with a fifth question asking for their own offering to Police Scotland.

The responses touch on a number of themes such as data driven innovation, putting the victim at the centre with any new technology adoption, data interoperability and standards and what next generation standards for digital evidence management looks like.

Putting the victim at the centre as new technologies are developed will allow victims who are receiving support from VSS's to better understand how their position is central to the prosecution and what is being asked of them. It will also improve speed of access to relevant information/ data for victim care and ensure those working on the case are able to navigate sensitivities seamlessly. By improving data interoperability, data sharing and standards through, for example, a secure platform we see improved multi-agency working, knowledge sharing and a better understanding of touchpoints a victim would interact with during a police investigation and what support for that victim might looks like for all agencies involved in the case.

Next generation standards must be designed to meet the needs of the user in line with the Digital Scotland Service Standard and Government Digital Service Standard. The standards must enable interoperability within and between forces to reduce cost, risk and complexity and, conform to published specifications for storage, sharing and security to ensure a common understanding of what good looks like.

A number of recommendations for Police Scotland have been flagged when exploring what standards emerge from outside of policing. POLE standards will be critical when enabling interoperability and, with the adoption of emerging technologies ISO27001 which looks at how to manage information security and how to avoid issues with human error has been suggested as this will ensure staff know how to manage the data properly. Further recommendations include – The GOV.UK Technology Code of Practice, GOV.UK Data Ethics framework and the NHS Digital, data and technology standards framework.

For evidence-based decision making, police practices should be based on scientific evidence about what works best with pilots developed with most industry and academia. Using a combination of best practice research evidence, industry knowledge and

experience, and the experiences of the victims of crime is key in order to make informed decisions on the adoption of emerging technology.

Innovation and standards

Author: Prof Bill Buchanan OBE

5.1   Introduction

There can often be weaknesses within organisations in regard to innovation around technological developments. Along with this there can be external concerns around the adoption of technology. Within policing, there have been many studies on the adoption of technology [23, 24], and many point to the requirement for strong leadership from project leaders and chiefs in the roll-out [25], along with making sure that there is sufficient training involved [23], the involvement with internal stakeholders [26], and in understanding issues related to moral and ethical issues.

The chapter outlines some of the background around how innovation around technology is currently handled, and also outlines some key areas of technological advancement which would further support the work of Police Scotland.

5.2   Background

Matusiak et al [27] define a classification for innovations within policing. In terms of ranking innovation, they investigated the chief officer's perception of the impact of the innovation (a full listing is given in Appendix C), of which the top areas of innovation were ranked as:

1. Combined DNA Index System (CODIS).

2. Mobile data terminal (MDT).

3. Electronic fingerprint services.

4. Computer-aided dispatch (CAD).

5. Automated Fingerprint Identification System (AFIS).

6. Crime lab testing.

7. Next-generation 911/Text-911.

8. Body-worn video cameras or recording devices.

9. Facial recognition.

10. Facebook for public relations and reputation management.

11. Aerial drones/UAVs.

12. National Integrated Ballistic Information Network (NIBIN)/Integrated Ballistic.

13. Identification System (IBIS).

14. Facebook as an investigative tool.

15. Mobile thumb and fingerprint scanners.

16. GPS tracking of suspects (e.g., cell phone).

5.3 Innovation programmes

Walsh [23] conducted research around the usage of technology for the Bureau of Justice Assistance Strategies for Policing Innovation (SPI) program. This included two strategies: risk terrain modeling (RTM) and social network analysis (SNA). While successful in creating interventions, the report outlines weaknesses around the lack of buy-in at the line level and for the need for specialized training and staff. Within a 13-week trial, and using RTM, one area saw a 36% reduction in violent crime within high-risk areas. With SNA, officers were able to source links between individuals and for ranking offenders within criminal networks.

Delle et al [24] studied the adoption of social media within Quebec police organization. They found that the the perception of the technology had a fundamental role in its adoption, and around organizational factors (such as the person's role within the organisation).

Tatcliffe et al [26] investigated whether micro-grid crime prediction conflicted with the role of police offices on the beat. The limitations of the technology included *spatial, temporal, and spatiotemporal inaccuracies and/or unresponsiveness conflicted with officers' craft-based knowledge*, along with the technology overriding officer's experience. Some officer's, though, identified that the technology complimented their experience. A key finding is that internal stakeholders should be involved involved in the planning process for a roll-out at any early stage.

Ernest et al [25] define the lessons learnt from the National Police of the Netherlands. The key finding was that the:

- use of technology in the daily routine of police practice depends on flexible and customized support from facilitating services, the motivation and perseverance of project leaders and police chiefs, a clear organizational structure, and governance and the related timely and fitting decision-making on project

development. Overall, the police organization needs a clear innovation strategy and vision on technology.

Alosani et al [28] investigated the impact of technological change with the Dubai Police. For innovation the work found RBV (resource-based view) theory [29] was useful in innovation and strategic planning. This method too was successful applied by Abdulhabib et al [30] when understanding the affect on technological change within the Sharjah Police.

5.3.1 Predictive policing

Mastrobuoni [12] defines that predictive policing improves policing productivity within crime clearance rates. In many cases criminal strategies are fairly predictable, and that predictive methods have a significant effect on crime rates.

5.3.2 Body worn

Nowacki et al [31] outlines a study of body-worn camera (BWC) within 823 agencies, and found that departments which successfully implement technology are more likely to adopt further methods.

5.4 POLE standards

POLE (Person, Object, Location or Event) Standards being developed by the Police Digital Service [32]. Depeau [33] outlines that graph technology could considerably help the adoption of the POLE data model for crime data (Figure 5.1). This includes using the Neo4j browser [34], and where graphing could be used not only by the police, but by other government agencies. This may relate to the relationships that people have to others with criminal records. Depeau [33] created a Neo4j graph database of 29,000 crimes in 15,000 locations, and generating 106,000 relationships between these nodes. This type of model allows for the investigation of complex relationships and associations. Bruggen outlines graph model for a GTD (Global Terrorism Database) (Figure 5.2) and which integrates a POLE methodology.
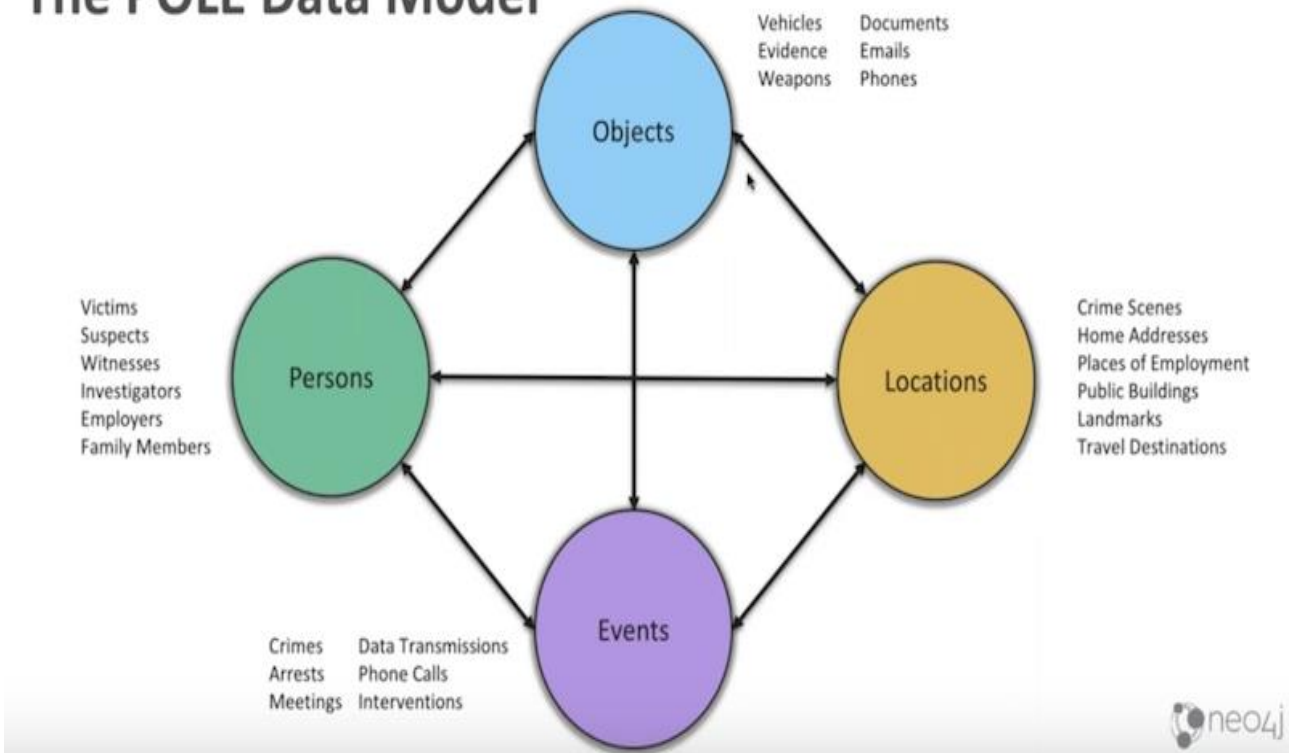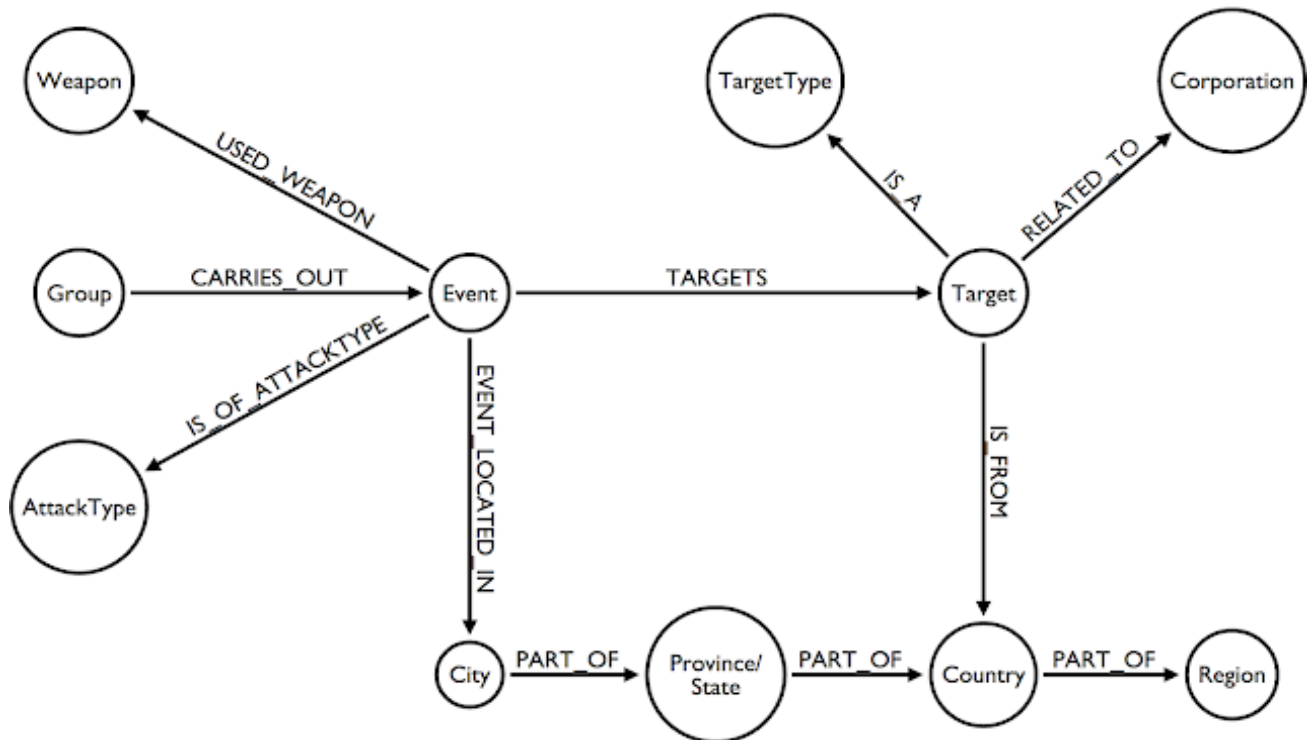
Figure 5.1: POLE data model [33, 34]

Figure 5.2: POLE data model example for a Global Terrorism Database 5.2
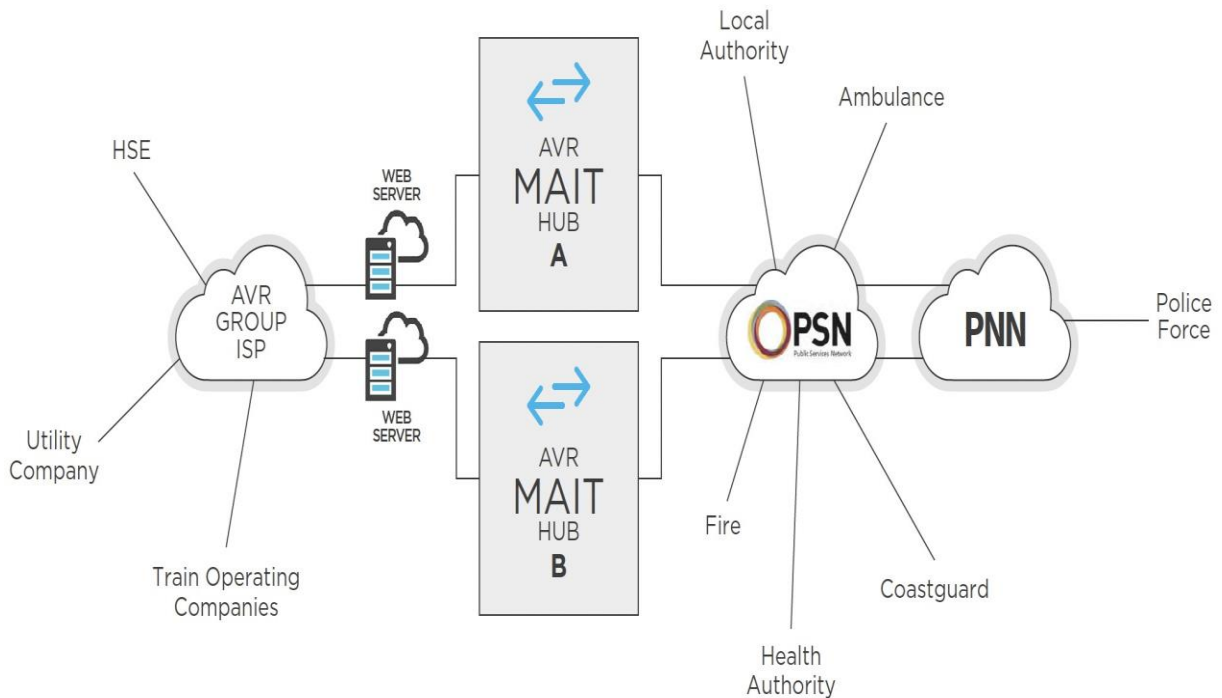
Figure 5.3: MAIT Hub [35]

5.5 MAIT standard

MAIT (Multi Agency Incident Transfer) [22] provides the ability for emergency services to securely share electronic incident records in the form of XML. The CAD to CAD information exchange time is significantly reduced and allows accuracy and timeliness of information allowing informed decision making when dealing with other agencies. This frees up more time spent with callers and obtaining quality information. This is currently being used in South Wales Police, Gwent Police and South Wales Fire and rescue services and has cut resource deployment by more than three minutes per agency.

The AVR Group Hub is defined in Figure 5.3. It can that the hub links to the police network through the PNN, and links to Fire, Health, Coastcast and Ambulance through the PSN (Public Service Network). There is then links to train and utility companies through a trusted hub. Overall, it has been found that the time taken to log and respond to emergency calls has reduced from an average of four minutes to 16 seconds. Core

benefits of the MAIT protocol include: fast CAD-to-CAD data exchange; a consistent view of incident data; and improved shared situational awareness [35].

In the US, a MAIT approach has been used within the response to serious traffic incidents, and where officers are trained in the use of vehicle dynamics, scene photography, CAD software and surveying equipment [36].

5.6   Data sharing

The ability for the general public to share data with the police should not be dismissed, but should, of course, be handled with care. Shore et al [37] outlines that *high situational severity crimes causes a high intention to share data with police*. This type of data is often useful in gathering data on evolving incidents, but should be understood for the trustworthiness of the data gathered.

In terms of crime investigation, Jing [38] outlines Crime Prediction Techniques Based on Big Data in Table 5.1.

Table 5.1: Crime Prediction Techniques Based on Big Data

Prediction target	Prediction technology
Crime Location / Victim Advanced	hot spot identification models Regression, classification, and clustering models; Near-repeat modeling
Crime time	Spatiotemporal analysis methods
Crime place	Risk terrain analysis

5.7   Conclusions

As shown in Chapter 4, there are evolving standards that could provide a foundation for future innovation. MAIT [22] and POLE (Person, Object, Location or Event) are two such standard that could provide a platform for future integration. Overall, the use of technology in the daily routine of police practice often depends on: flexible and customized support from facilitating services; the motivation and perseverance of project leaders and police chiefs; a clear organizational structure and governance; and the related timely and fitting decision making on project development. Overall, the police organization needs a clear innovation strategy and vision on technology.

> Consideration: There should a strong focus on inter-agency approaches to secure data sharing, including the adoption of POLE and MAIT.

Workstream membership

Authors and contributors

- Bill Buchanan OBE (Edinburgh Napier University) (Chair)

- Megan O'Neill (Dundee University)

- Georgina Henley (techUK)

- Samuel Curran (Scottish Police Authority)

- Stevie Dolan (Police Scotland)

- Fiona Douglas (SPA Forensic Services)

- Stephen Roberts (HO Accelerated Capability Environment)

- Matthias Wienroth (University of Northumbria)

- Rachael Walker (Scottish Police Authority)

- Vassilis Manoussos (Edinburgh Napier University).

Investment governance framework

A.1   Existing process

Police Scotland has a well-practiced governance framework in place to enable effective decision making for both capital and revenue investments. Such investments are broadly defined as follows:

- Small Change Activity – Any spending proposals that are of a value less than circa £100k and will be completed in a six month time period; • Business Change – Any spending proposals that are of a value greater than £100 K, lesser than £1m, non-contentious and can be compliant with internal procurement processes (for additional information on procurement thresholds see table at the back of the document); or Any proposal enabling the draw down of funding and not requiring a procurement exercise in order to execute strategic objectives such as VR/VER; and

- Project – Any spending proposals that are of a value greater than £100k, are of high value and/or high risk or more than £1m.

An idea for investment can be brought forward by anyone within the organisation (referred to as 'the originator'). The originator should propose the idea to their Assistant Chief Constable (ACC) or Director, who will make an assessment on whether the idea is worthy of further consideration. If so, the ACC/Director will ask the originator to take forward the idea to the Portfolio Management Office (PMO). The originator will then be required to complete a Potential Project Assessment form (PPA) with support from the PMO. This is an assessment as to whether this is a project that would meet the objectives of 'Policing 2026' and other organisation strategies.

If it is decided that the proposal meets the objectives of 'Policing 2026' and other organisation strategies then the PMO will determine the classification of the project (as above).

It should be noted that the project classification criteria includes the terms 'non-contentious (Business change) and 'high risk' (Project). The Police Scotland process does not clearly define what is meant by these terms so it will fall to the professional judgment of the PMO following consultation with relevant stakeholders e.g. Finance, HR, IT, Procurement, Legal, Policing / Design Authority, Corporate Communications, Information Management.

For 'small change activity' a Potential Project Assessment will be completed by the Originator. Once complete and reviewed by PMO this will go to the Director of Change for consideration. The Director of Change will be responsible for making the funding decision, notifying Change Board and the Capital Investment Group of decisions made.

For 'Business Change' proposal a Business Justification case should be completed. The principle of 'proportionate effort' should be employed based on the scale of the investment (a greater level of evidence, justification and analysis should be provided for a £700K business change as would be expected for £100k). The Business Justification Case should be produced following consultation with relevant stakeholders e.g. Finance, HR, IT, Procurement, Legal, Policing / Design Authority, Corporate Communications, Information Management. The Business Justification Case will be submitted to the PMO for assurance once all relevant stakeholders have signed off the content. If the assured Business Justification Case is of a value between £100k and £500k it will then be presented to the Director of Change for approval, who will in turn notify the Change Board. If the assured Business Justification Case is of a value between £500k and £1m it will then be presented to the Change Board for approval. It may also be necessary to notify and/or seek approval from the SPA Accountable Officer, SPA Finance Committee and the SPA Full Board depending on the value being sought and Scottish Government if it is seeking funding from the reform budget.

For a 'Project' proposal, the Director of Change will appoint a suitably qualified and experienced Project Manager to complete an Initial Business Case. The Initial Business Case should be produced following consultation with relevant stakeholders and sets out the case for change, project benefits, risks, options and initial financial estimates and is aligned to the principles of the HM Treasury Green Book. Once assured by PMO, the Initial Business Case will then be presented to the Change Board for approval to proceed with procurement process. It may also be necessary to notify and/or seek approval from the SPA Accountable Officer, SPA Resources Committee, the SPA Full Board and/or Scottish Government depending on the nature, scope and scale of investment before undertaking a procurement exercise.

If the Initial Business Case receives full approval then a Full Business Case should be prepared. Full Business Cases will be submitted to Change Board through the PMO for funding approval. It may also be necessary to notify and/or seek approval from the SPA Resources Committee, the SPA Full Board and/or Scottish Government.

The table below shows the approvals required for all funding requests that fall under the Change Portfolio.

Business Case Approval Director of Change
Change Board
SPA Accountable Officer

SPA Resources Committee
SPA Board
Scottish Government
Small Change Activity

Current business case structure

B.1 Change board

To ensure all change activity aligns to Police Scotland's long term strategy: • To provide scrutiny and ensure accountability is being maintained by Senior Responsible Officers

- To consider, scrutinise and where appropriate approve business cases
- To consider, scrutinise and where appropriate, authorise requests for transformation budget spend

B.2 Demand, design and resources board

Can't locate ToR.

B.3 Strategic leadership board

To review and consider brief updates from Primary Boards and where relevant, ratify Primary Board decisions: to discuss other relevant matters affecting the Force and approve, where appropriate, an agreed course of action

B.4 SPA policing performance committee

Policing Performance Committee will not approve the adoption of new technology, however it will oversee and scrutinise the performance and implications of any adoption. The purpose of this Committee is to provide oversight and scrutiny of continuous improvement in policing. It will do this through scrutinising policing performance against agreed strategies, plans and statutory requirements. The Committee will seek to continuously improve the way in which policing performance is measured and reported. The Committee will also consider any proposed changes to operational policing which may have particular public interest, ethical or human rights implications.

B.5 SPA resources committee

The Resources Committee will review and scrutinise business cases for adoption of technology and make recommendations to the SPA Board. The purpose of this Committee is to provide oversight, scrutiny and assurance to the Board on all significant

resources matters, including financial planning, performance and financial stewardship, and on significant people-related matters. The Committee will provide advice and assurance to the Board on these matters and any other specific items which the SPA Board requests of it in relation to financial sustainability, employee-related and other resourcing aspects of Police Scotland and the SPA. In addition the Committee will seek to ensure that continuous improvement is embedded within financial and people-management and development processes and procedures in line with Best Value principles, and will seek evidence of Police Scotland and SPA operating as responsible employers and of progress being made towards mainstreaming of equality, diversity and human rights.

B.6   SPA board

As described above, the SPA's Resources and Policing Performance Committee will oversee and scrutinise situations where new and emerging technology meet certain thresholds or are of significant public interest. However, certain matters which may have implications for technology adoption are reserved for the SPA Board. These include, but are not limited to:

- Recommendation the Strategic Police Plan to SG for approval

- Approval of local police plans

- Approval of the strategic performance framework

- Approval of organisational/ transformational change proposals

Innovation areas

C.1 Outline

Table C.1: Current business case structure

Ranking	Innovation
1	Combined DNA Index System (CODIS)
2	Mobile data terminal (MDT)
3	Electronic fingerprint services
4	Computer-aided dispatch (CAD)
5	Automated Fingerprint Identification System (AFIS)
1	Crime lab testing
6	Next-generation 911/Text-911
7	Body-worn video cameras or recording devices
8	Facial recognition
9	Facebook for public relations and reputation management
10	Aerial drones/UAVs
11	National Integrated Ballistic Information Network (NIBIN)/Integrated Ballistic
12	Identification System (IBIS)
13	Facebook as an investigative tool
14	Mobile thumb and fingerprint scanners
15	GPS tracking of suspects (e.g., cell phone)

Table C.2: Current business case structure

16	Twitter for public relations and reputation management
17	Electronic traffic citations
18	Dash cams
19	Twitter as an investigative tool
20	Mental health/crisis intervention response teams (CIT)
21	Automated license plate recognition (ALPR)
22	Thermal imaging cameras
23	GPS tagging of suspects (non-cell phone)
24	Computer forensics
25	Interagency communications interoperability system (ICIS)
26	YouTube as an investigative tool
27	Consumer-focused police department smartphone apps for community member use
28	GPS patrol vehicle tracking
29	Cloud computing
30	Audio/video alarm verification systems
31	Anonymous tip software
32	Light detection and ranging (LIDAR)
33	Leadership succession planning and leadership development programs
34	YouTube for public relations and reputation management
35	Craigslist as an investigative tool
36	Video recording of suspect interviews
37	Child abuse response unit
38	Fusion centers
39	Accident reconstruction software
40	Internet crimes unit
41	Crime mapping
42	Neighborhood-based social networks
43	Real-time policing
44	Human trafficking unit
45	Victim assistance
46	Sexual assault response unit
47	Software for personnel development

Table C.3: Current business case structure

48	Audio recording of suspect interviews
49	Online citizen reporting systems
50	Taser/ECD
51	Using Backpage.com for investigative purposes
52	ShotSpotter
53	Hot spots policing
54	Software for deploying or delegating patrol resources
55	Procedural justice (procedural fairness)
56	Sworn minority officers
57	Strategic crime analysis (long-term solutions to long-term crime problems)
58	Community coordinated response/Multidisciplinary response teams (CCR/MDT)

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