A Data Reform Strategy for the Victorian Public Service

Better decisions underpinned by data

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Message from the Secretary, Department of Premier and Cabinet

Every day, the Victorian Public Service works to improve the lives of Victorians. To support this important work, we must ensure that we have the best available information to inform policy and service design, and provide the foundation for good decision-making.

Better decisions are at the heart of the Data Reform Strategy. This key enabler of public sector reform will strengthen evidence-based policy and service design, allow more reliable performance monitoring, and facilitate better citizen engagement. But we will only realise these benefits by making data analytics a mainstream function within our departments and agencies.

Data reform takes place in the context of numerous inquiries and initiatives calling for more effective use of data by the public sector, in Victoria and nationally. It will help us keep in touch with the rapid pace of technological change, and the expectations of Victorians who are increasingly accustomed to data-driven services in the digital economy.

As this strategy highlights, great work is already underway to lift the data analytics capabilities of the Victorian Public Service. The strategy builds on this work, and sets an ambitious vision for the future. Its success depends on strong engagement and leadership from across the public sector.

I look forward to working with all of you to achieve our collective vision for data reform.

CHRIS ECCLES AO
SECRETARY
DEPARTMENT OF PREMIER AND CABINET

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Strategy in context

VISION: BETTER DECISIONS UNDERPINNED BY DATA

This strategy is about harnessing data to help us make better decisions. Data analytics offers new ways to improve government policy and service design, accurately model future programs, and save significant time and money. Done right, it can lead to more effective and efficient government, and better outcomes for Victoria and its citizens. This strategy sets the direction for the Victorian Public Service (VPS) to achieve this vision.

Data reform is about seizing the opportunities of 21st century data-driven technologies, but it is also about avoiding the pitfalls of inaction. Major social and economic changes are taking place on a global scale, driven by the combination of high-volume data flows and new technologies. Unless we keep pace and put data at the heart of our decision-making, we will fail to deliver outcomes that match the rising expectations of our citizens.

SCOPE OF THE DATA REFORM STRATEGY

Data is "facts and statistics collected together for reference or analysis."[01] A government data strategy could be about a number of different things, from technical and operational practices, through to the role of open data in driving economic growth. This reform strategy is specifically focussed on the use of data for policy and service design, the core business of the public sector. Hence our vision: *Better decisions underpinned by data*.

A range of data related activities are already in progress across the VPS. Under the *Information Technology Strategy 2016-20,* we are moving ahead with our Information Management Framework, which will address many key issues concerning data collation and quality. Further, the VPS continues to build and expand its open data platform, **data.vic.gov.au**, with a view to making data publicly available for innovation and greater transparency. This strategy complements the work in these important areas, and fills critical gaps in our whole-of-government approach to data.

We acknowledge that we cannot build the data future of the VPS overnight, and this strategy does not seek to provide a comprehensive fix to all our data issues. The actions principally address capability uplift, process improvements, and building a data-driven culture, which are the foundational precursors of more extensive, deeper data reform. As the data capabilities of the VPS become increasingly sophisticated, we will be in a much stronger position to tackle new and emerging challenges.

Data reform is a crucial plank of the broader Public Sector Reform agenda, a wide-ranging program to make the VPS work smarter. By making better decisions underpinned by data, we will help drive the Public Sector Reform agenda to deliver exceptional outcomes for Victorians. For more on how this strategy interacts with other reform activities across the VPS and nationally, we encourage you to refer to Appendix 1.

Data reform through the lens of supply and demand

The challenges the VPS will have to meet to achieve the data reform vision can be broken down into the categories of **supply and demand.**

Supply

Is about building capability to better leverage our data and run analytics. On the supply side, we are pursuing two high-level outcomes:

A. High-quality data that is fit for purpose: the VPS has access to the right data at the right time.

B. Skilled and connected workforce: the VPS has the expertise, technical capabilities and infrastructure to optimise its use of data.

Demand

Is about the cultural, organisational and behavioural factors needed to drive better data practices and the uptake of analytics. In our consultation for this strategy, a recurring message was that it is equally as important to address these factors as it is to build capability. With that in mind, we are pursuing one demand-side outcome:

C. Data-driven decision-making: data is valued, used to support decision-making, and fully embedded in policy and service design.

Our strategy on a page illustrates how the actions under this strategy align to these outcomes (see page 18).

The double-horizon: looking to 2030 while continually adapting

The **far horizon for this strategy is 2030**. This is far enough out to be able to envisage significant transformation of the VPS, but close enough that we can begin to adapt. In the following section of this strategy, we provide a high-level overview of some of the major trends that we expect to see emerge by 2030. Our horizon-scanning under this strategy will continuously monitor emerging developments, which will inform our course-corrections over the life of the strategy.

Of course, no strategy could realistically plan twelve years in advance, particularly in such a fast-changing domain. For this reason, the strategy establishes a **rolling horizon of 18 months**. Actions under the strategy will be reviewed and updated on an ongoing basis, so that we maintain an 18 month pipeline of work. This test-and-learn approach will enable us to evolve and adapt the strategy over its lifespan. In this way, the strategy will serve as an exemplar of agile, iterative policy.

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Opportunities and challenges as we move towards 2030

HOW DATA IS RESHAPING THE WORLD: THE FOURTH INDUSTRIAL REVOLUTION

The Founder and Executive Chairman of the World Economic Forum, Klaus Schwab, has recognised that the world is on the brink of a fourth industrial revolution "that will fundamentally alter the way we live, work, and relate to one another."[02] The catalyst for the current technological burst is the convergence of factors such as cloud computing, automation, connected devices and artificial intelligence.[03]

But it is the large-scale volumes of data that these technologies create and consume that will drive this revolution forward. **Change will happen rapidly.** By one estimate, there will be more technological acceleration and development over a five year period than over the last 20 years combined.[04]

To understand the speed and scale of these changes, we need only look at the way in which data-driven tech companies have rapidly overtaken all others in terms of market capitalization. Apple, Alphabet (Google), Microsoft and Amazon are now the most valuable companies in the world by a comfortable margin, whereas in 2006 only Microsoft featured in the rankings.[05]

The Productivity Commission, in its report *Shifting the Dial*, acknowledges this new paradigm in stating: "Data (and its analytics) is the **most significant renewable resource** discovered this century".[06] This is because connected, high-volume data opens the door for transformative innovations such as the internet of things (IoT) and machine learning, allowing us to generate valuable new insights from real-time analytics.*

* The **internet of things** (IoT) refers to the mass integration of devices and assets through web connectivity. **Machine learning** is a form of analytics by which programs are able to train themselves on large datasets to make models or predictions.

As we move towards 2030, society will increasingly embrace IoT and the **analytics capabilities embedded in smart devices** (including machine learning). Horizon-scanners speak of the emergence of autonomous vehicles that optimise traffic flows, smart infrastructure that addresses its own maintenance issues, and lifesaving wearable medical technology. Connected devices will generate ever growing volumes of data. The International Data Corporation predicts a tenfold increase in the amount of data created globally between 2016 and 2025.[07] The volume and complexity of this data will present significant new opportunities and challenges.

Machine learning techniques allow us to unlock **data insights that were previously out of reach**, enabling pattern recognition at a speed and scale that no amount of human exertion could match. Already, machine learning is being applied to areas as diverse as share-trading, fraud detection, entertainment content generation, medical research and policing. Machine learning is just one form of artificial intelligence, a broader field of cognitive computing which a Stanford University panel predicts will have "potentially profound positive impacts on our society and economy" by 2030.[08]

Along with the positives, **there will be disruption**. The Productivity Commission, in its report on *Digital Disruption*, cited a CEDA report that found nearly 40% of all jobs are at risk of automation by 2030.[09] The Commission noted this does not mean mass unemployment, as new jobs will be created. In fact, as an Innovation and Science Australia report concluded, digital technologies could provide better jobs, as production and transactional jobs are replaced by jobs requiring creative problem solving and entrepreneurship.[10] The most successful organisations of the future – public and private sector alike – will be those that best adapt to these changes.

HOW DATA CAN HELP THE VPS MEET THE COMING CHALLENGES

The VPS agenda for Public Sector Reform is to *deliver exceptional outcomes for Victorians*. But like all public sectors, we will have to do this in the face of emerging fiscal challenges, due largely to demographic pressures and increasing commitments.[11] Data can help us to **target and optimise our expenditure**, coordinate our services, and manage our infrastructure and assets. Our case studies in Appendix 3 provide real-life examples of data being put to use for the public good, from policing and medical research through to farming and transport. These examples are just the tip of the iceberg.

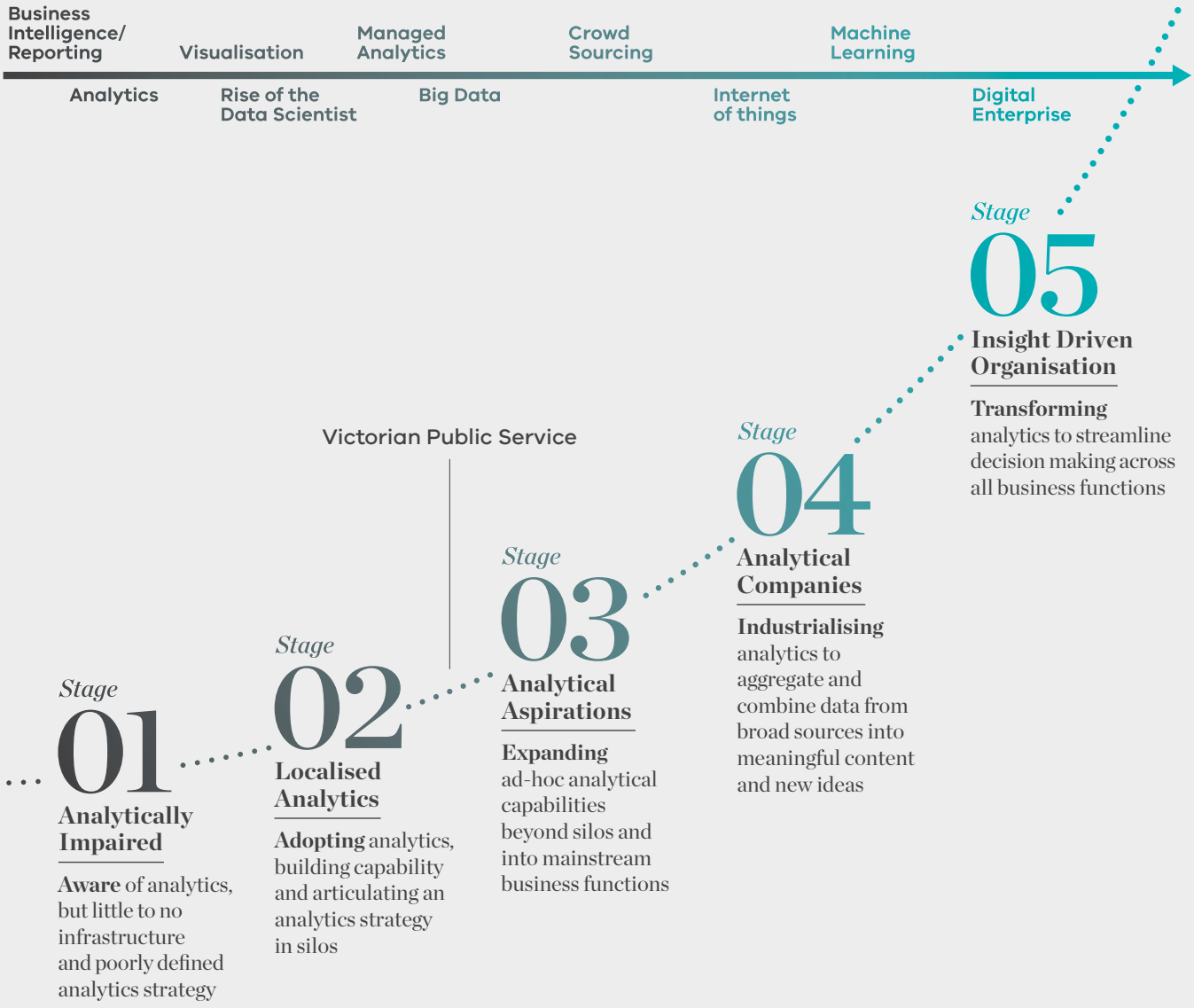
As the Public Sector Reform agenda notes, "Government is increasingly a designer, manager and steward of systems, rather than a direct deliverer of services."[12] This requires us to think in systemic terms about the systems we oversee.[13] As **systems steward**, the public sector will set goals, monitor performance, and ensure the systems work smoothly. **Data can provide optimal system-level visibility**, helping us move away from narrow, KPI-based indicators towards dynamic, real-time monitoring. This requires that we have maximum access to data generated through our service delivery supply chain, and the data capabilities to be able to dynamically interact with it. This strategy addresses these issues.

Citizens increasingly expect government to deliver services that match the responsiveness and ease of use of private sector services, such as ride-sharing transport services, tasking platforms, and online shopping and banking. These expectations will only grow as technology advances.

Yet recent Galaxy research ranked state governments the lowest of all sectors (including the Commonwealth Government) at using technology to deliver services.[14] **Improved data analytics capabilities** – combined with a sharp citizen focus – **are essential to staying in touch with evolving citizen expectations**.

In addition to better services, citizens also **expect government to be more transparent and accessible**.[15] By embracing 'open data' and making key datasets publicly available, as stipulated by the DataVic Access Policy, we can promote transparent and accountable government. Of no less importance, open data has a proven record of **stimulating economic activity and innovation**. Commonwealth Government research estimates that open government data could generate "up to $25 billion per year, or 1.5 per cent of Australia's GDP."[16] Appendix 4 talks in more detail about how governments across the world – including the Victorian Government – are unlocking the benefits of open data.

Figure 1: Insights Maturity Curve



THE VPS HAS A WAY TO GO TO HARNESS THE BENEFITS OF DATA, BUT CHANGE IS UNDERWAY

The Productivity Commission's 2017 inquiry report on *Data Availability and Use* found: "**Fundamental and systematic changes are needed** to the way Australian governments, business and individuals handle data."[17] The Victorian Government, like other governments around the country, has acknowledged the need for change. This strategy is an important part of driving that change.

The Department of Premier and Cabinet (DPC)-commissioned VPS Data Analytics Capability Recommendations Report found that the VPS has an analytics maturity of between 2-3 on a scale of 5 (see Figure 1 above).[18] As set out in Appendix 3, there are a number of exemplars of data-driven initiatives across the VPS that we can build on as we set a course for more holistic reform. However, the key to improving the overall VPS rating is to move away from siloed capabilities towards a VPS-wide approach, while **making analytics a mainstream business function of VPS agencies**.

The ultimate measure of the long term success of this strategy is to get the VPS as close as possible to the top of the Insights Maturity Curve, to the point that data analytics is an integral, indispensable part of our decision-making toolkit.

03

Strategic framework

THE FIVE STRATEGIC PRIORITIES OF DATA REFORM

In formulating the actions under this strategy, we have identified **five strategic priority** areas. Each of the strategic priorities speaks to a pressing problem that currently inhibits data reform across the VPS. The strategic priorities are the immediate tasks that need to be addressed to accelerate data reform in Victoria.

Strategic Priority	Challenge
1. Incentivise better use of data	There is a lack of impetus to change old patterns of behaviour across the VPS. Current practices in the VPS do not reward data analytics or sharing between departments, and in fact often deter it. We need to motivate the VPS to change the way it does business.
2. Establish data linkage and analytics environment	The VPS lacks the technical environment and tools to be fully data-driven. As a consequence data has remained in departmental silos, is of varying quality, and is underused. We need to build the data infrastructure of the future.
3. Develop people capabilities	The VPS has insufficient people capabilities to leverage the value of its data. While the VPS has a highly talented pool of personnel, we need to adapt our team structures and address our skills gaps to become more data-driven.
4. Strengthen and streamline analytics processes	Analytics processes across the VPS are inconsistent and hampered by delay. The VPS needs to create a consistent methodology for data analytics that is seamless and easy to navigate, remove the bottleneck in our authorising environment, and move away from solely viewing data through the prism of privacy (see Box 1).
5. Drive data analytics innovation	The VPS must transform to meet the increasing pace of change of data-driven technologies. We need to build a culture of data analytics innovation, look outwards and to the future, and use data to continuously improve how we design policy and services.

The strategic priorities address the immediate challenges the VPS faces, and will evolve as we overcome some challenges and encounter new ones. To anchor the strategy and assist decision-makers with strategic choices and trade-offs over its duration, we have developed **six enduring design principles** for data reform (see Appendix 2). The design principles will serve as signposts on the road to the data and analytics future of the VPS, and will keep us consistent as we adapt and evolve this strategy.

ACCOUNTABILITY, REPORTING AND PERFORMANCE MONITORING

Accountability for delivery of the strategy ultimately rests with the Victorian Centre for Data Insights (VCDI), which sits as a business unit within DPC. The Chief Data Officer is the accountable Executive Officer.

VCDI will report on the progress of the strategy at intervals of no longer than six months. Reporting will address:

a. Progress of the actions, measured against the Implementation Plan set out in Appendix 5 (as updated from time to time).

b. Progress against our strategic outcomes: high-quality data that is fit for purpose; a skilled and connected workforce; and data-driven decision-making (see page 5).

Reporting against the **actions** is important to track whether we are meeting our implementation commitments. However, reporting against **outcomes** will enable us to know whether we are having the intended impact. Outcomes reporting also helps us to communicate and collaborate more easily, identify shared aspirations and areas of work, and remain consistent in identifying and measuring results. VCDI's outcomes measurement approach will be consistent with the Outcomes Architecture established by DPC.[19]

BOX 1

Moving from a security and privacy only approach to a risk-based approach

The VPS has rigorous security standards and a strong privacy and security governance framework. The *2016 Victorian Protective Data Security Standards* provide a set of criteria for the consistent application of risk-managed security practices across Victorian government information. Further, the Victorian Government *Cyber Security Strategy*, launched in August 2017, takes a whole-of-government approach to sustaining strong and resilient cyber security defences that protect the delivery of public services. In addition, the Office of the Victorian Information Commissioner has an important role to play in regulating security and safeguarding the privacy of citizens.

The Victorian Government's strong emphasis on security is vital to maintaining the trust of the public. However, as the Productivity Commission inquiry report on *Data Availability and Use* called out, we must not "fall victim to fear."[20]

New ways of working with data always raise questions about privacy and security, and it is proper that these questions are worked through. But as the Productivity Commission emphasised, government needs to take a risk-based approach to data sharing and release to harness the benefits of its data assets. This means ensuring that appropriate security measures are in place, rather than simply denying access.

As the inquiry found:

"The potential value of data is tremendous; as is the scope for Australia to forgo much of this value under the misconception that denial of access minimises risks."[21]

The *Victorian Data Sharing Act 2017* is an example of getting the balance right between data sharing across government and privacy considerations. The Act provides a clear legal framework for government departments and agencies to share data for policy making, service planning and design, while building in strong safeguards to protect citizen privacy and health information.

Sharing and using data in new ways can entail risk, but these risks can be managed. The VPS needs to acknowledge that denying access to data also entails risks. If the VPS adheres to a strictly siloed approach to data, Victorians will miss out on the social and economic benefits that come with a culture of data sharing and analytics.

VISION: BETTER DECISIONS UNDERPINNED BY DATA

Outcomes	*Strategic Priority 1:* INCENTIVISE BETTER USE OF DATA	*Strategic Priority 2:* ESTABLISH DATA LINKAGE AND ANALYTICS ENVIRONMENT
High-quality data that is fit for purpose: the VPS has access to the right data at the right time	**Action 3.** Right of review of analytics findings	**Action 5.** Technical and governance architecture
		Action 6. High-quality enduring linked datasets
Supply		**Action 7.** Data discovery capability
Skilled and connected workforce: the VPS has the expertise, technical capabilities and infrastructure to optimise its use of data		**Action 8.** Reference architecture and analytics toolkit
	Action 1. One-stop-shop for data resources	
Data-driven decision-making: data is valued, used to support decision-making, and fully embedded in policy and service design	**Action 2.** Data valuation and analytics maturity methodology	
Demand	**Action 4.** Actionable recommendations to drive cultural change	

	Strategic Priority 3: DEVELOP PEOPLE CAPABILITIES	*Strategic Priority 4:* STRENGTHEN AND STREAMLINE ANALYTICS PROCESSES	*Strategic Priority 5:* DRIVE DATA ANALYTICS INNOVATION
Supply		**Action 14.** Implementation of *Victorian Data Sharing Act 2017*	**Action 20.** Review procurement practices and implement recommendations
		Action 15. Privacy Preserving Mechanisms	
	Action 9. Career paths for data and analytics professionals		**Action 19.** Approach for agile VPS-wide deployment of analytics expertise
	Action 10. Sourcing strategy for data expertise		
	Action 12. VPS-wide Data and Analytics Community of Practice		**Action 17.** Cross-sectoral Victorian Data Partnership
Demand		**Action 13.** Best practice data analytics lifecycle methodology	
	Action 11. Learning and Development package		**Action 18.** Rolling forecast of emerging trends in data and analytics
		Action 16. Community Advisory Group	

Strategic Priority 1:

INCENTIVISE BETTER USE OF DATA

To create an environment in which data analytics can flourish, the VPS needs to shift its mindset towards viewing effective use of data as a fundamental public sector function. By giving departments a mechanism to value data and measure their analytics maturity, we can help foster such an environment. Along the way it is important that the voices of data custodians are heard, as trust and consultation are at the heart of data sharing and collaborative analytics. Above all, we need to understand and address the cultural and organisational factors that inhibit better use of data.

CHANGING THE MINDSET: VIEWING DATA ANALYTICS AS A FUNDAMENTAL FUNCTION OF THE PUBLIC SECTOR

From the consultation undertaken to develop this strategy, a recurring issue was that data management and analytics is too often viewed as a subset of information technology. In other words, it is treated as a peripheral function carried out by technologists. Conversely, the most successful organisations in the modern world put data at the heart of everything. They understand that data is the critical business asset that enables them to learn and understand their domain. As former General Electric CEO Jack Welch said: "An organization's ability to learn, and translate that learning **into action rapidly, is the ultimate** competitive advantage."[22]

Data reform requires behavioural change at all levels of the VPS. In concrete terms, we need policy officers at the VPS level to look to data and incorporate it in their decision-making. We need to properly resource data collection and management. Executives and managers need to build data analytics capabilities within their teams, and embrace data sharing and open data. We need effective and innovative use of data to be a key performance metric, at both an individual and a departmental level.

We have a number of levers to drive behavioural change in the VPS, but the overarching theme is that we want people to change because they see the benefits for themselves and their work.

GIVING VPS STAFF THE MEANS AND THE INCENTIVES TO USE DATA

We know that many personnel across the VPS want to make better use of data, but they don't know how. We need to provide our staff at all levels with an intuitive resource to help them to use data effectively, which will take the form of a **one-stop-shop** for data resources hosted on the Innovation Network. This will include proactive advice on the various datasets across the broader data ecosystem that can help policy officers and leaders to make data-driven decisions (see Box 3). We will also leverage the Innovation Network to **celebrate successes** across the VPS, to demonstrate the value of data insights.

ENABLING DEPARTMENTS TO MEASURE THE VALUE OF THEIR DATA AND THEIR ANALYTICS MATURITY

Data will never truly be recognised as an asset unless it is treated as such and valued. Valuing data will not only emphasise the worth of our data assets, but will provide insight into the different forms of value that departments can extract from the data they hold.

A mechanism for departments to **value data** and **assess their data analytics maturity** will offer a benchmark for departments to measure the impact of their reform activities in lifting their analytics capabilities. This will assist departments to be accountable for leveraging the value of their data assets and help drive continuous improvement.

ENSURING THAT THE VOICES OF DATA CUSTODIANS ARE HEARD

Just as importantly, we need to remove the current barriers in the system to using and sharing data effectively. Departments and staff are often concerned that they will be embarrassed by the findings from data analytics if they expose their data. Providing original data custodians with a **right of review** over prescribed categories of analytics findings both supports business units to better understand their data and mitigates the risk of misrepresentation of the data.

In addition to the right of review, our communications work to clarify when and how data can be legally shared **across departments and agencies** – which will form part of the implementation of the *Victorian Data Sharing Act 2017* under strategic priority 4 – will provide clarity and confidence in VPS data sharing practices.

BEHAVIOURAL CHANGE IS A LONG-TERM PROJECT THAT REQUIRES FURTHER STRATEGIC CONSIDERATION

Changing patterns of behaviour across a large organisation is a complex and nuanced task. While the actions identified under this strategic priority will help, we need to acknowledge that we don't yet have a comprehensive understanding of all the cultural and organisational factors at play. As part of our ongoing strategic work, we will grapple with these issues and develop **actionable recommendations for departments** to drive the changes needed for more effective use of data.

WHAT SUCCESS LOOKS LIKE

The end state we are aiming for is that the **VPS has the right incentives and behaviours in place to make better decisions underpinned by data**. Through our combination of incentives, accountability measures, and removing the sources of anxiety around data sharing, we are confident that we can get there.

Actions and implementation

Action 1.
Due Qtr4 2018

Develop a one-stop-shop for data resources on the Innovation Network, to help VPS staff to use data and analytics more effectively.

Action 2.
Due Qtr2 2019

Develop a data valuation and analytics maturity methodology, to assist departments to invest in and extract value from their data.

Action 3.
Due Qtr2 2018

Establish a 'right of review' of analytics findings in prescribed circumstances, to ease the concerns of data custodians and facilitate sharing.

Action 4.
Due Qtr3 2018

Develop actionable recommendations for departments to adopt in order to drive the cultural and organisational changes needed for more effective use of data.

Strategic Priority 2:

ESTABLISH DATA LINKAGE AND ANALYTICS ENVIRONMENT

The creation of a data linkage environment (or 'hub' for short) will give the VPS a modern data infrastructure and the right platform to support excellent analytics. It will provide the ability to find and link data within a secure, intuitive environment. In establishing the hub, the VPS will improve the quality and usefulness of its data assets. The hub will be a vehicle to drive better social and economic outcomes, within the public sector and beyond.

THE VALUE OF LINKED DATA

The hub will provide the capability to link datasets from multiple disparate sources to maximise their power and potential. Combining datasets provides a more complete resource to answer broad questions across government. It does so by enabling analysis based on data across the VPS data ecosystem, as opposed to a siloed approach where each department is restricted to its own data.

Creating the hub will enable the VPS to understand how different social and economic policy outcomes interact. This will provide a far more in-depth understanding of the different factors that impact upon citizens, the physical environment, and the economy. VPS personnel will then be able to draw on policy questions of correlation and causality in a more connected, nuanced way. This will also facilitate collaboration between departments, organisations and agencies.

HOW THE HUB WILL FUNCTION

At the centre of the hub, we will develop three enduring linked datasets for policy and service design, falling under the themes of **'Person', 'Place'** and **'Economy'**. Together these three high-level themes encapsulate the key data needs of the public service. The first tranche of work will focus on the Person theme, and is expected to deliver significant social outcomes for some of the most vulnerable Victorians (see Box 2). This linked dataset will provide data from multiple departments and agencies.

BOX 2

The first linked dataset – 'Person' theme

We recognise that people's lives and problems are not structured around government departments, agencies or programs. We need to focus more on the actual effectiveness of services and to shift the conversation within government from policy to outcomes. Victorians facing challenges have a whole range of complex needs and to look at them through a single lens, rather than as a whole, is a lost opportunity.

With that, the first and arguably the most important dataset within the hub will focus on the 'Person' theme, providing clean and quality-assured, integrated, longitudinal data to improve the evidence base for policy and service design affecting Victorian citizens. It will replace the current ad hoc lengthy processes to obtain access to linked data across multiple agencies.

The Person dataset will provide improved efficiency of linked data provision in line with best practice, and reduce barriers for partner agencies in accessing timely and comprehensive data to answer key cross-cutting and whole-of-government questions. It will incorporate strong privacy protections and streamlined processes into its design and governance, while allowing it to be used for activities that benefit all Victorians.

The Person dataset builds on the Victorian Linkage Map – work led by the Centre for Victorian Data Linkage – and in its first release will begin to map government investment in health and human services, education and justice. The Person dataset will be enhanced in subsequent releases as further datasets, including high-value, high-demand Commonwealth datasets, are brought online.

Our work on the Person dataset is being implemented in line with work being progressed by the Commonwealth and reflects learning from the New Zealand Integrated Data Infrastructure.

As a necessary component of our hub, we will develop the **capability to know where data is** – a process that is often referred to as '**data discovery**'*. Essentially, this will function as a search engine for data across the VPS and in the broader data ecosystem (see Box 3). This will ensure that users are able to find the data they need in an intuitive manner.

To extract value from this data, we need to give VPS personnel the **right reference architecture and analytics tools** to enable high-quality integrated analytics. Located within the hub, the reference architecture will provide a best practice guideline for teams to leverage, including infrastructure, tool shortlists and data models. Functional capabilities within the toolkit will include accelerators (to enable reuse) and collaboration (e.g. model and code repositories), visualisation tools, security and operational adaptability. The reference architecture and tools will be designed for connectivity and scalability.

Privacy and security will be at the core of the hub. All information relating to individuals will be **de-identified** before being accessible for analysis through the hub, and access will be mediated with **appropriate security controls**, depending on the user and the type of data in question.

THE HUB WILL LIFT DATA QUALITY

Increased use of the data in the hub will mean more feedback to data custodians around data collection standards and data quality issues. The overall impact is to improve quality and reduce the cost of undertaking analysis to inform policy, service design and research questions.

This is important, because poor quality data leads to poor decisions, lost opportunities, duplication of effort, and huge costs in data cleansing. To put this into perspective, IBM estimated that poor quality data cost the U.S. economy US$3.1 trillion in 2016.[23] Poor data quality impacts traditional data matching and linking processes, causing a cascade of issues and downstream process and service failures.

Added to this are the social costs of poor quality data. The Royal Commission into Family Violence found that greater sharing of data across the VPS will support the fight against family violence (recommendations 1, 5, 6, 7, 8, 25, 28, 31, 136 of the report relate to sharing information). The Royal Commission stated: "Sharing information about risk within and between organisations, is crucial to keeping victims safe.[24] However, poor quality data is a barrier to linking and sharing.

Data quality is a process, not an end point. We need to continually improve every dimension of data quality, take steps to bring departmental practices into line with the VPS Information Management Framework[25], and improve our collection processes at source.

THE HUB WILL BE AVAILABLE FOR A RANGE OF ACTIVITIES THAT BENEFIT VICTORIANS

The primary purpose of the hub is to allow the Victorian Government to improve policy and service design for better outcomes for Victorians. However, the VPS recognises that better social and economic outcomes are often driven by researchers, universities, and innovators. In due course, the hub could provide a mechanism to share linked data for these activities, with appropriate access restrictions for personal or sensitive data.

WHAT SUCCESS LOOKS LIKE

The end state we are aiming for is for VPS personnel to have **simple, intuitive access to high-quality linked datasets** in a secure environment with access governance controls and best practice privacy protection methods, together with the **analytics tools** to enable them to do their job more effectively.

* Data Discovery is a term commonly used to describe the process of collecting and consolidating information from various sources, then manipulating and analysing it to uncover patterns, trends, relationships, and anomalies. It benefits from collaborative and crowd-sourced inputs to augment automated (machine-led) discovery, and depends on appropriate governance and relevant metadata.

Actions and implementation

Action 5.
Due Qtr3 2018

Establish the technical and governance architecture for the VPS linkage and analytics environment, to provide clear and robust strategic direction.

Action 6.
Due Qtr3 2019

Create the first enduring linked dataset based on the 'Person' theme, extending to Place and Economy, to serve as a VPS-wide data policy resource.

Action 7.
Due Qtr4 2018

Embed in the VPS a 'data discovery' capability, to enable VPS personnel to find the data they need.

Action 8.
Due Qtr4 2018

Construct a reference architecture and analytics toolkit, to enable departments to implement best practice analytics technologies.

BOX 3

The data ecosystem

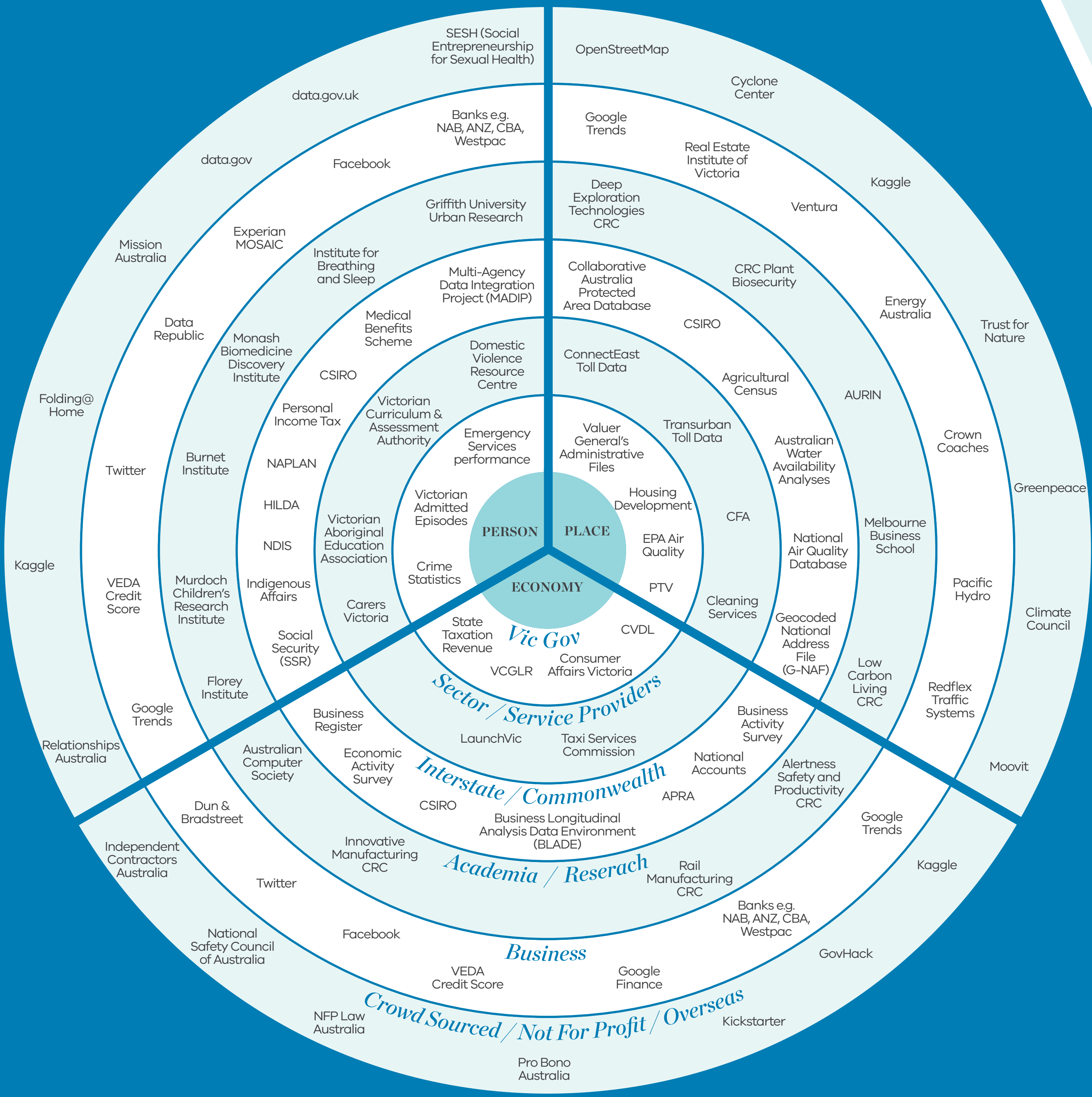
The VPS needs to look beyond its own datasets to access the best information to deliver exceptional policy and services.

This means knowing how to tap into the various **layers of the data ecosystem**. Both through the data linkage environment (hub), and as part of the **one-stop-shop for data resources** (see action 1 in strategic priority 1), VPS personnel will have access to, and proactive advice on how to find, the data they need from across this ecosystem.

It is intended that the hub will draw on data from each layer of the ecosystem. In turn, de-identified data within the hub could be made accessible (with appropriate access controls) to partners across the ecosystem, who can help generate social and economic benefits for the state using our collective data. To secure maximum access to data across the ecosystem, it is critical that the VPS cultivates relationships with partners. The Victorian Data Partnership will serve as a vehicle to build these relationships (see action 17 in strategic priority 5).

The diagram on the next page[†] represents the layers of the ecosystem, grouped under the themes of Person, Place and Economy. Particularly useful resources within the ecosystem include the linked data resources which the Commonwealth Government is developing, beginning with the Multi-Agency Data Integration Project (MADIP) and the Business Longitudinal Analysis Data Environment (BLADE).

[†] The diagram on the next page shows a small sample of data and is not intended to accurately represent all data that may be relevant to decision-makers in the VPS. Datasets are not included to suggest (explicitly or implicitly) any usage intent, agreement or authority to share.


PERSON
PLACE
ECONOMY
Vic Gov
Sector / Service Providers
Interstate / Commonwealth
Academia / Reserach
Business
Crowd Sourced / Not For Profit / Overseas
Victorian Admitted Episodes
Crime Statistics
Emergency Services performance
Valuer General's Administrative Files
Housing Development
EPA Air Quality
PTV
CVDL
Consumer Affairs Victoria
VCGLR
State Taxation Revenue
Domestic Violence Resource Centre
Victorian Curriculum & Assessment Authority
Victorian Aboriginal Education Association
Carers Victoria
ConnectEast Toll Data
Transurban Toll Data
CFA
Cleaning Services
LaunchVic
Taxi Services Commission
Multi-Agency Data Integration Project (MADIP)
Medical Benefits Scheme
CSIRO
Personal Income Tax
NAPLAN
HILDA
NDIS
Indigenous Affairs
Social Security (SSR)
Business Register
Economic Activity Survey
CSIRO
Business Longitudinal Analysis Data Environment (BLADE)
APRA
National Accounts
Business Activity Survey
Geocoded National Address File (G-NAF)
National Air Quality Database
Australian Water Availability Analyses
Agricultural Census
CSIRO
Collaborative Australia Protected Area Database
Griffith University Urban Research
Institute for Breathing and Sleep
Monash Biomedicine Discovery Institute
Burnet Institute
Murdoch Children's Research Institute
Florey Institute
Australian Computer Society
Innovative Manufacturing CRC
Rail Manufacturing CRC
Alertness Safety and Productivity CRC
Low Carbon Living CRC
AURIN
CRC Plant Biosecurity
Deep Exploration Technologies CRC
Banks e.g. NAB, ANZ, CBA, Westpac
Facebook
Experian MOSAIC
Data Republic
Twitter
VEDA Credit Score
Google Trends
Dun & Bradstreet
Twitter
Facebook
VEDA Credit Score
Google Finance
Banks e.g. NAB, ANZ, CBA, Westpac
Google Trends
Redflex Traffic Systems
Pacific Hydro
Melbourne Business School
Crown Coaches
Energy Australia
Ventura
Real Estate Institute of Victoria
Google Trends
SESH (Social Entrepreneurship for Sexual Health)
data.gov.uk
data.gov
Mission Australia
Folding@ Home
Kaggle
Relationships Australia
Independent Contractors Australia
National Safety Council of Australia
NFP Law Australia
Pro Bono Australia
Kickstarter
GovHack
Kaggle
Moovit
Climate Council
Greenpeace
Trust for Nature
Kaggle
Cyclone Center
OpenStreetMap

Strategic Priority 3:

DEVELOP PEOPLE CAPABILITIES

To become a data-driven organisation, the VPS must create a workforce with the people capabilities to harness and apply data insights. This means attracting the right data expertise in a highly competitive employment market, while equipping existing staff with essential data literacy skills. It also requires a cultural shift towards openness and cross-departmental collaboration, driven by leaders who champion data analytics.

THE COMPOSITION OF A DATA-DRIVEN TEAM

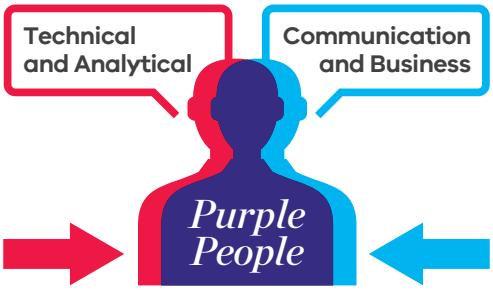
Data analytics capability requires the right combination of skills. It requires the essential technical capabilities around conducting analytics and using technology ('red skills'), as well as the non-technical capabilities around communication and business acumen ('blue skills'). It is unlikely that a single individual will possess the perfect combination of these skills. Rather, the goal is to have the right combination of red and blue skills within teams and business units (see Figure 2 [26]).

If we want analytics to be embedded in our decision-making processes, we need to rethink our skills distribution. We need to begin by **embedding more data expertise** in our departments and agencies. DPC has already commissioned and distributed a Data Analytics Capability Framework to assist departments and agencies to diversify their teams with the skill sets they require to move up the Insights Maturity Curve (see Figure 1 on page 11).[27]

Ultimately, however, leaders across the VPS need to make resourcing decisions to support and nurture the workforce skills of the future. The Victorian Centre for Data Insights is available to assist with this important challenge.

Figure 2: Purple People

Being able to ask the right questions, interrogate and model data to answer them, and then present the insights in a compelling way are important skills to have, either in a single individual or as complementary skills within the analytics team. "Red" employees bring critical thinking, problem solving and maths-led skillsets, while "blue" people's strengths lie in creativity, soft skills, and the ability to visualise and draw business insights from data.



ATTRACTING THE RIGHT TALENT IN A HIGHLY COMPETITIVE MARKET

The market for data expertise is a highly competitive one. With that in mind we have to transform the VPS into an **employer of choice** for data and analytics professionals. The current organisational structure of the VPS was not designed with data analysts and engineers in mind, meaning that there can be fewer opportunities for advancement and promotion than in the private sector. We need to offer **new career paths** for these prospective employees.

This needs to be coupled with a properly targeted **sourcing strategy**. Job candidates in the data domain have a wealth of choice, and are less likely to respond to static job advertisements. We need to specifically target the skills we need, while leveraging our main competitive advantage: the opportunity we offer to work with immense, complex datasets of huge significance to the community.

In such a fast-moving domain as data analytics, all organisations require the ability to obtain talent in a timely manner. We need to be ever mindful of how we can bring in the right talent at the right time, while remaining consistent with our VPS values and commitments.

BRIDGING THE GAP BETWEEN DATA AND DECISION-MAKING

Creating a data-driven organisation also means ensuring that all staff have an understanding of how data can help them to do their jobs more effectively. This means everything from knowing which data to collect, generating reports and interacting with dashboards, and understanding how analytics can be built into policy and service design. To this end, we need to **upskill existing staff** to be data literate through Learning and Development and knowledge sharing.

By this we are not attempting to convert all our policy people into data experts, which would not be practical or beneficial, but to increase data literacy and get policy and service designers looking to data to assist them. By spreading data literacy across the VPS, we will get the red skilled and blue skilled employees working in synchrony to drive better outcomes for Victorians.

BUILDING A DATA-DRIVEN CULTURE

In many respects, a data-driven culture will follow naturally if the actions in this strategy hit their mark. However, creating this culture also requires the right **leadership and ethos**. This means viewing data as a business-critical asset, embracing openness and data sharing, encouraging risk taking and innovation, and always asking for evidence to support decisions.

We can accelerate our progress towards a data-driven culture by establishing and supporting a VPS-wide **Data and Analytics Community of Practice** (aligned to the Innovation Network), to foster collaboration and champion analytics. This will help us leverage our developing analytics capabilities and share insights.

WHAT SUCCESS LOOKS LIKE

The end state we are aiming for is **increased data capabilities across the VPS**. This doesn't simply mean that we can count a few more heads with 'analyst' in their job title. What it means is agile, fully data-driven teams, who rapidly tap into the data they need through sophisticated infrastructure, and do it with the full support (and insistence) of senior leaders.

Actions and implementation

Action 9.
Due Qtr1 2019

Design new VPS career paths and job descriptions for data scientists, analysts, and engineers, to make the VPS an employer of choice.

Action 10.
Due Qtr3 2019

Develop a sourcing strategy for data expertise, to attract the right technical personnel to the VPS.

Action 11.
Due Qtr2 2019

Develop and pilot a scalable Learning and Development package, to raise data literacy across the VPS.

Action 12.
Due Qtr4 2018

Establish a VPS-wide Data and Analytics Community of Practice, to foster cross-departmental cooperation and knowledge-sharing.

Strategic Priority 4:

STRENGTHEN AND STREAMLINE ANALYTICS PROCESSES

The VPS must embed analytics in its policy processes, by developing a consistent and rigorous methodology that maps to the policy lifecycle and removes points of friction. Streamlining analytics processes requires us to remove the major bottleneck in our authorising environment, and develop reproducible practices that will deliver more timely insights. Our process initiatives are designed to make data access and analytics as smooth and efficient as possible.

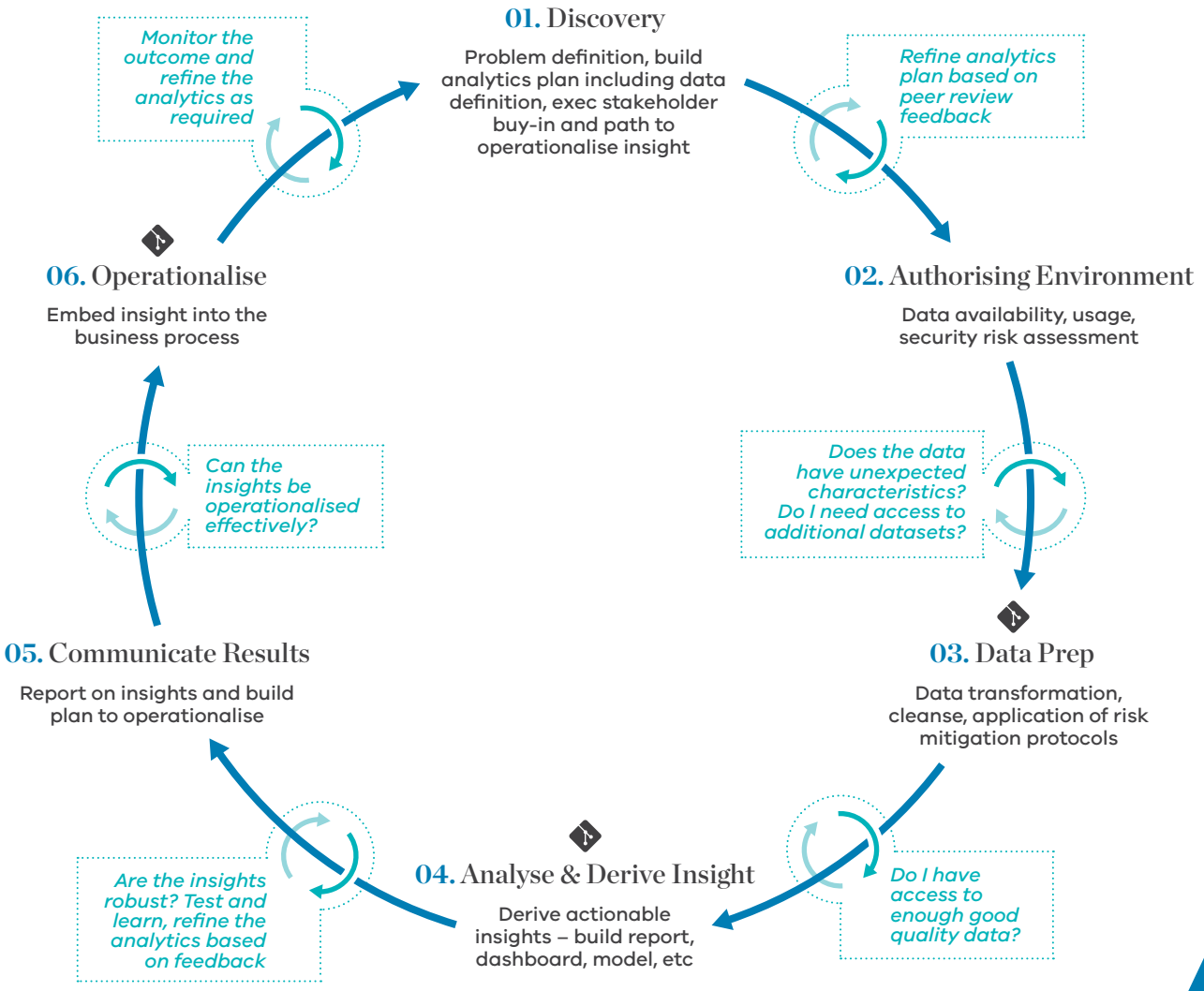
THE DATA ANALYTICS LIFECYCLE IN THE POLICY CONTEXT

The data analytics lifecyle is the process we need to go through from the inception of an idea to the operationalising of analytics findings. As Figure 3 shows on the next page, it is not a linear process, but a cyclical, iterative one that employs feedback loops throughout.

The Public Sector Reform agenda highlights the importance of these mechanisms, in stating:

"International evidence shows that the development of robust outcomes approaches includes the capacity to have a continuous feedback process that promotes a dynamic and responsive review."[28]

Figure 3: Data analytics lifecycle



DEVELOPING A VPS-SPECIFIC DATA ANALYTICS METHODOLOGY

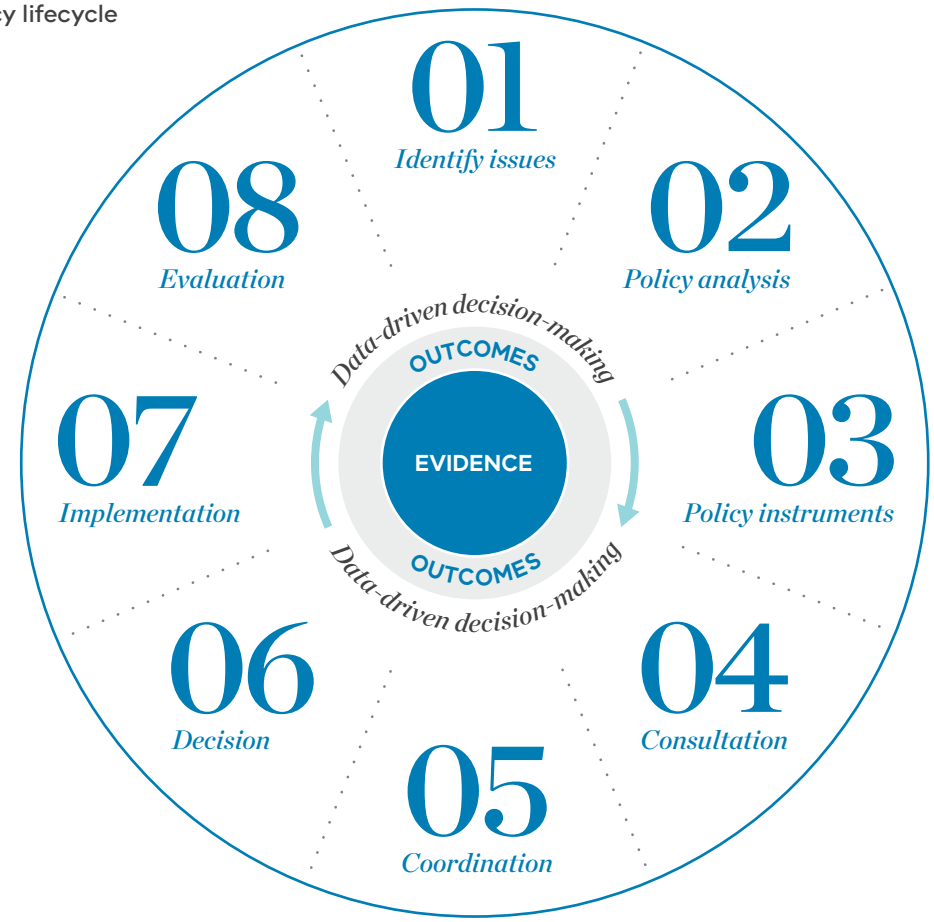
To date there has been no VPS-wide systematic approach to conducting analytics projects and to capturing the lessons learnt. As the VPS Data Analytics Capability Recommendations Report found, this siloed approach means that the VPS is not consistently using best practice in its analytics work. Current practices such as departments and agencies using different regional boundaries add a layer of difficulty.

We will develop a **consistent and rigorous methodology** for conducting analytics work. Such a methodology will enable analysts to navigate through the process in the most efficient manner.

It will include a 'test-and-learn' based approach with a series of **feedback loops**, enabling lessons learnt to be incorporated back into the lifecycle for **continuous improvement**. This approach is consistent with the overarching Outcomes Architecture approach being used across the VPS.

It is important that the methodology we develop is sensitive to the existing policy lifecycle. Figure 4 on the next page shows the policy lifecycle with the various stages as defined in the Australian Policy Handbook; we have added high-level examples of where data and analytics can add value at every stage.[29] The new VPS analytics lifecycle methodology will take Figures 3 and 4 as a starting point.

Figure 4: The policy lifecycle



01 Scope of problem/**issue definition using data** and other evidence

02 Identify desired impact and outcomes

- What does success look like?
- **Aggregation of existing data** and other evidence

Existing policy assessment

Identification of stakeholders

03 Choose approach

- Identify and **analyse** model options and **data on their effectiveness**

Create policy approach including:

- Consultation plan
- Implementation approach
- Evaluation approach (**continuous feedback loops based on data** and other evidence)

04 Pre-issue caucusing

Decision-maker 'buy-in'

Promotion and recruitment

Consult with stakeholders – data and evidence gathering

- Qualification – focus groups
- Quantification – surveys
- Sentiment analysis
- Invite feedback – formal submissions

05 **Data collection, presentation and analysis**

06

- Decision-making/taking based on **evidence including data analysis**
- Policy instrument drafting and **budgetary analysis**

07 Implementation development and coordination

Program promotion

Apply the policy

- **Monitor policy as it is implemented using data** and other evidence
- Refine outputs and outcomes

08 Assess impact

- **Data collection and analysis**
- Are desired outputs and outcomes achieved?

Adjust and modify

- Lessons learnt
- **Continuous improvement feedback loops based on data** and other evidence

ATTACKING THE BIGGEST BLOCKER IN OUR ANALYTICS LIFECYCLE: THE AUTHORISING ENVIRONMENT

From the consultation undertaken to develop this strategy, stakeholders across the VPS identified that the biggest blocker to getting data analytics projects off the ground is the **authorising environment**. Many projects encounter lengthy delays while awaiting approvals or negotiating memorandums of understanding for cross-departmental data sharing.

The *Victorian Data Sharing Act 2017* helps address the authorising environment by providing the **legal clarity** that public sector bodies need to share data, together with appropriate protections and oversight functions. In addition, this strategy sets out a plan to implement **practice guidance for intra-governmental data sharing**, a necessary corollary to the Act, to establish a pre-set authorising environment for departments and agencies to share data. We are one VPS.

To further increase confidence in the process, DPC has been working on **Privacy Preserving Mechanisms** with Data61 and others. This will provide a safe, effective and scalable approach to combine data from different sources within the VPS, to enable the development of deep insights into issues relevant for policy development in Victoria.

It is also important not to lose sight of the fact that our broader authorising environment requires us to have the **ongoing consent of citizens** for our activities. In the data domain, this consent is often referred to as having the 'social licence' to use public data in new and creative ways (see Box 4). To this end the VPS will establish a **Community Advisory Group**, to continuously gauge public sentiment around government use of data.

THE LINKED DATA ENVIRONMENT AND PEOPLE CAPABILITY UPLIFT WILL HELP OPTIMISE THE LIFECYCLE

Our ability to run analytics projects through the lifecycle in an efficient and expeditious manner depends on having the infrastructure and people capabilities in place. By building the linked data environment, we will dramatically shorten the time for data discovery and preparation, as much of the data will already be easily discoverable and ready for analysis. By having the people in place and a Data and Analytics Community of Practice to collaborate and share best practice, we will expedite the 'time to insight'.

WHAT SUCCESS LOOKS LIKE

The end state we are aiming for is a **more efficient and effective data analytics lifecycle**. We want data projects to be able to get off the ground rapidly, be executed smoothly and without delay, and findings delivered in time for them to be operationalised and integrated into the policy cycle in a meaningful way.

Actions and implementation

Action 13.
Due Qtr4 2018

Develop a best practice data analytics lifecycle methodology, to give the VPS a repeatable analytics process aligned to the policy process.

Action 14.
Due Qtr2 2018

Implement the *Victorian Data Sharing Act 2017*, including practice notes, to facilitate data sharing between and within departments.

Action 15.
Due Qtr3 2019

Roll out and continuously upgrade Privacy Preserving Mechanisms, to provide a safe and effective approach to combine data from different sources.

Action 16.
Due Qtr4 2018

Establish a Community Advisory Group consisting of diverse interest groups, to gauge public concerns and inform VPS data initiatives.

BOX 4

Social licence – meeting the expectations of Victorian citizens

Social licence refers to when people grant their consent – either directly or implicitly – for the types of data processing activities proposed by a data custodian. In the context of data reform, it means having the public on-board for greater data sharing and new uses of data.

It is incumbent on government to know what falls within the limits of social licence, and ensure that it obtains broad community consent for its data processing activities.

Despite much talk of the constraints of social licence, the Productivity Commission's inquiry report on *Data Availability and Use* found no evidence of widespread concern among citizens about providing personal information to government, and referred to a finding by the Office of the Australian Information Commissioner that 70% of citizens trust government to handle their information. Citizens were particularly supportive of government sharing their de-identified data for medical research and care.[30] Separate research commissioned by DPC found that most Victorians expect that government is already sharing data internally to improve policy. Overall, there is broad support for more data sharing and use.[31]

However, the DPC-commissioned research also found that around 23% of Victorians feel uneasy and sceptical about government use of their information and seek to avoid providing it. Around 45% of Victorians say that they want reassurance about security if they have to provide their information.

The VPS can only fully harness the potential of data if it speaks to those citizens who remain uneasy around government use of their information. The research indicates this can be done by addressing 'who' is collecting the information, 'what' is being collected, and 'why'.

By taking common approaches to public communication around data collection, and supporting whole-of-government interfaces such as Service Victoria that give the VPS a unified public presence, we can help to establish the 'who'. To demonstrate the 'what', the VPS needs to clearly communicate the types of data it is collecting about people. The VPS must also communicate 'why' that data is being collected, and that it uses data to improve services, program delivery and policy. Finally, the VPS needs to demonstrate that it can keep people's data safe and secure, and set out who is accountable for doing so.

If the VPS continually strives to achieve these goals in its dealings with the public, there is every reason that it can remain aligned with community expectations as it increasingly shares and uses data.

Strategic Priority 5:

DRIVE DATA ANALYTICS INNOVATION

For the VPS to be in a position to leverage the possibilities of the new digital age, it is imperative that we have an outward and forward-looking focus. This means building ongoing partnerships with data innovators outside government, scanning the horizon for emerging trends, and applying new approaches to problem solving. It will be increasingly important to secure full access to data through our supply chain, so that we have a complete view of the systems we steward. These steps are essential if we are to accelerate our move to a data-driven future and not be left behind by the pace of change.

PAVING THE WAY FOR A DATA-DRIVEN FUTURE

The pace of change in the new digital age is such that organisations need to anticipate and prepare for innovations in their space. We can already discern irreversible trends that will have a transformative effect on public administration:

- Government infrastructure and assets will increasingly be connected through the internet-of-things. IoT devices will have embedded intelligence and in-built analytics functions, which will enable infrastructure to monitor and analyse its own performance and maintenance issues in real time.
- Decision-making will be enhanced through prescriptive analytics. We can already see the value of predictive analytics in policing and improving health outcomes (see Appendix 3). As Figure 5 demonstrates on the next page, this trend will evolve to a point where we have a widespread, advanced capability for decision support and (where appropriate) automation.
- The role of the public sector will increasingly move away from service delivery towards a model of 'systems stewardship'. As such, the VPS will work with multiple actors across the policy implementation and service delivery supply chain, overseeing the functioning of the systems under our control and intervening where necessary to achieve desired outcomes.

This list is far from exhaustive, and the reality is that we do not yet know what specific innovations are over the horizon. However, we can position ourselves to take advantage of these changes and create the conditions for innovation. This means being as collaborative and agile as possible, and constantly evolving our strategic plan in response to broader developments.

Figure 5: Data-driven decisions and the evolution to 'system stewardship' *

Driving action from insight	Traditional decision-making	Data-driven decisions in 2030 The world of 'system stewardship'
01. Discovery	**"Answer" first** then find the data to support the hypothesis.	**All questions/hypotheses use data** to drive the decision.
02. Authorising Environment	**Data is difficult to find and access** as a result of the authorising environment and fact that data is often collected through analog means: surveys, spreadsheets, ethnographies, etc. • Knowledge about data typically sits in people's heads. • Data is stored in many mediums, not all of which are digitally enabled. • Risk-averse culture of sharing data given a lack of confidence in the quality and what is allowed to be shared. MOUs are used to enable data sharing.	Important **data is discoverable, pre-linked and of high quality** with role-based access controls. Privacy and security are managed by machines using Privacy Preserving Mechanisms. • Sensors passively measure or capture information with no user input. • Data is seamlessly transmitted between objects or from objects to a central point. • Data is aggregated as devices communicate with each other; machine learning algorithms predetermine what information is important.
03. Data Prep	**Data is wrangled into a usable format** with appropriate subject matter expertise forming IP (basic metadata) typically stored in an individual's head.	
04. Analyse and Derive Insight	**Data is manually developed into a report**. Reports from different sources are bought together; an analyst determines what information is important.	**Artificial Intelligence algorithms detect patterns and variances** across disparate data points and previously unrelated events.
05. Communicate Results	**DECISION**: Data is presented to a **decision-maker who then determines how to proceed**.	**DECISION SUPPORT: Real-time signals make insights actionable**, by presenting choices around policy/decision-making and monitoring service delivery without emotional bias.
06. Operationalise		**DECISION AUTOMATION: directly initiating an action** with a safety net to 'stop' processes that deviate beyond an established threshold.

FAST FEEDBACK LOOPS

Efficiency and effectiveness are constantly measured against measurable policy/service delivery outcomes and optimised using amplified intelligence (fast feedback loops)

SYSTEM STEWARDS focus on goal-setting and the overarching performance of the system

* Refer to data analytics lifecycle Figure 3 on page 35.

THE VICTORIAN DATA PARTNERSHIP: BUILDING CRITICAL RELATIONSHIPS

Government can play a key role in nurturing innovation in the complex field of data and its associated technologies. The Victorian Data Partnership will bring together key players across government, the private sector and the research space. It will provide a forum for the exchange of ideas and best practice, and an opportunity to broker new collaborative initiatives. The Victorian Data Partnership will serve as a **unifying intelligence** in the data and analytics space across Victoria.

Cross-sectoral collaboration offers significant benefits for all involved. It can stimulate vital research and new industries, and unlock rich new seams of external data for public policy. We know through our consultation that there is significant appetite in the broader data ecosystem for the VPS to play a role in such collaboration.

SCANNING THE HORIZON AND CONTINUALLY ADAPTING

In such a dynamic domain as data and analytics, it is important for organisations to be aware of emerging trends and opportunities. The world is awash with predictions about the various applications of data-driven technologies, and it can be difficult to sort through the hype to know which ones merit serious consideration. Horizon-scanning is a data-driven means of achieving this.

Horizon-scanning is a tool for systematically gathering evidence about trends, developments and issues in a given field. To realise the full benefits of horizon-scanning it should be repeated regularly and embedded in an organisation's institutional framework.[32] Horizon-scanning requires a robust methodology. As the UK Parliament's Select Committee on Science and Technology found in 2014, failure to adequately plan and consult can result in the horizon-scanning process becoming a government echo chamber.[33]

We will **establish a rolling forecast of emerging trends and developments in data and analytics**. The forecasting methodology will be modelled on international best practice, and will leverage the collective intelligence of the Victorian Data Partnership and Community Advisory Group. By building a horizon-scanning function into our strategy, we will be well-placed to adapt to our changing operating environment and prevent the strategy becoming a 'set and forget' policy.

AGILE DEPLOYMENT OF RESOURCES

As well as being able to identify new opportunities, it is important that we are able to quickly respond and take action, deploying the right resources to the right initiatives as and when they are needed. Timely deployment of resources is the key to effectively applying data insights.

To achieve this the VPS requires an **approach for the agile deployment of analytics expertise to VPS-wide challenges**. Such an approach will enable mobility across government and the rapid progression of analytics projects.

SYSTEMS STEWARDSHIP REQUIRES A SYSTEM-WIDE VIEW

If we are to truly embed analytics and be optimal system stewards, we need maximum visibility of the data being generated and the analytics taking place throughout our supply chain, including our service delivery agencies and partners.

To this end, we will **review VPS procurement practices and implement recommendations** to ensure greater oversight of data through the VPS supply chain. This will enable the VPS to closely monitor performance and social outcomes, intervene where necessary, and ensure that the Victorian public is getting the best value for money for government funded services.

WHAT SUCCESS LOOKS LIKE

The VPS will be a **leading-edge public sector organisation** when it comes to innovative uses of data analytics. The VPS will be able to rapidly respond and adapt to deliver more effective and efficient government, leveraging insights from outside government, emerging opportunities on the horizon, and the rich seams of data within its own supply chain.

Actions and implementation

Action 17.
Due Qtr4 2018

Scope and establish the Victorian Data Partnership, to explore cross-sectoral partnering opportunities and leverage best practice.

Action 18.
Due Qtr3 2018

Establish a rolling forecast of emerging trends and developments in data and analytics, to inform strategic actions and accelerate early adoption.

Action 19.
Due Qtr3 2019

Develop a VPS-wide approach for the agile deployment of analytics expertise, to solve cross-departmental analytics challenges.

Action 20.
Due Qtr2 2019

Review procurement practices and implement recommendations, to give greater oversight of data through the VPS supply chain.

04

Appendices

Appendix 1: Strategy in context

Initiatives to reform and modernise the public sector

Key WoVG reform initiatives	Information Technology Strategy	Related initiatives in other jurisdictions
Public Sector Innovation Strategy: fostering innovative work practices	**Digital Workplace Strategy:** transitioning the VPS to a fully digital workplace	**Digital Transformation Agency:** transforming Commonwealth government services
Behavioural Insights: using BI to improve policy and service design	**CenITex:** defining CenITex's direction and governance for an evolving IT environment	**NSW Data Analytics Centre:** leading analytics work and better data use
Outcomes approach: a consistent approach to measuring outcomes	**Service Victoria:** a one-stop portal for citizen transactions with the Victorian Government	**SA Office for Data Analytics:** leading analytics work and better data use
Public participation: refreshing how the VPS consults and engages	**Cloud procurement model:** reducing the friction for the VPS to make use of the cloud	**ABS upgrades:** $250 million to upgrade infrastructure and processes to produce more timely, high-quality, secure data
My Victoria: a place-based open data portal		

Initiatives that directly interact with data reform in the VPS

Victorian Centre for Data Insights: with a broad portfolio of work including coordinating and leading data reform	**Information Management Framework:** framework to support VPS data to be better managed, open and shared	**PC inquiry into Data Availability and Use:** defining a nation-wide vision for data reform
Evidence Strategy: fostering stronger evidence in policy (incl. data analytics)	**API Gateway:** piloting a platform to support open data and sharing	**Data Integration Partnership for Australia:** APS-led initiative to maximise use and value of public data
data.vic.gov.au: Victoria's open data directory, governed by the DataVic Access Policy	**ICT capability uplift:** improving ICT capabilities to enable modern government	**Social licence initiative:** PM&C-led work to build greater social licence
People capability uplift: building the skills and workforce of a leading-edge public sector		**Data61:** a public digital research centre with a mandate to accelerate Australia's data-driven future

Appendix 2: The six enduring design principles for data reform

The principles	Examples of how the principles apply in practice
1. Build scalable systems, processes and capabilities	If the amount of data processed by a system doubles in volume, the system is designed to grow without requiring redevelopment (with a decreasing marginal cost at scale).
2. Invest in data as an asset	Invest in data quality and maintenance proportionate to its asset value, in the same way as with physical infrastructure.
3. Remove unnecessary barriers to data access	Data will always be shared unless there are legitimate legal grounds to refuse. Data should be made open on **data.vic.gov.au** in accordance with the DataVic Access Policy.
4. Design data landscape for a hyper-connected world	Design processes such that insights are generated from a diverse collection of data sources (such as IoT devices).
5. Embed analytics capabilities through to the point of service delivery	Give front-line personnel easy-to-use analytics tools (e.g. dynamic dashboards) to track and optimise performance.
6. Use data to continuously improve policy and service design	Build data-driven feedback loops into policy and service design and adapt accordingly.

Appendix 3: Exemplary uses of data for public policy

Accurate, accessible land data critical to maximise public value – Land Use Victoria (DELWP)

Land Use Victoria (LUV) is tasked with delivering greater public value from the Victorian Government's $114 billion land portfolio. Access to accurate land information across government agencies is a key enabler to achieve this goal. LUV is leading the delivery of the Government Land Information Service (GLIS), an online platform to deliver user-friendly access to information about government land. GLIS will enable government and the community to unlock greater public value from government land by bringing together numerous government land datasets, making information easier and quicker to access.

The benefit of improved access to government land information was recently evidenced as part of the *Homes for Victorians* strategy. Using government land data, LUV quickly identified sites suitable for temporary housing to accommodate rough sleepers. Without this data, the task would have been complex and time-consuming, requiring access to multiple datasets held across numerous agencies.

Using data to forecast epidemic thunderstorm asthma events (DHHS)

In the wake of the world's largest epidemic thunderstorm asthma event in November 2016, the Victorian Government invested in one of the first – and arguably the world's most sophisticated – data-driven epidemic thunderstorm asthma forecast and warning systems. The system uses a variety of data to predict the risk of an event, and issues twice daily epidemic thunderstorm asthma forecasts during the Victorian grass pollen season (1 October through to 31 December).

The system requires a number of data inputs and processes, including pollen forecasts and weather observations. Computer generated pollen forecasts are dependent on many factors, including wind, temperature, rainfall, relative humidity and grass coverage and condition. The meteorological component relies on the forecasts for thunderstorms and their characteristics (wind speed, outflows, squall lines). These two are synthesised into a single output by the Bureau of Meteorology and then provided to DHHS, which publishes the forecast for use by the community, health and emergency services.

The science behind the forecasting is new and emerging, and as with all forecasts there is an element of uncertainty. The Victorian Government is investing in ongoing research to better understand the mechanisms of epidemic thunderstorm asthma and increase our future forecasting capability.

Data-driven conversations to improve student outcomes (DET)

The Department of Education and Training's Regional Performance Framework (RPF) is a tool for understanding, measuring and monitoring outcomes of government school students. It enables DET Areas, Regions and Central Office to use an enquiry based approach to decision-making. The RPF supports the Regions with place-based data, to provide evidence leading to actionable insights for change.

The Department has been conducting Regional Performance Review (RPR) meetings since 2016, providing a forum for deep and structured conversation between the Regional Executive Team and the Department's Executive Board. Discussions are based on key data and insights to enable forward-thinking decisions.

The discussions at the RPRs result in tangible actions for senior leaders in DET to be implemented, reported and monitored at the Area and Region level. The Region staff work with schools and networks to implement strategies for improving performance in line with these actions, with the Region supported in this work by data products designed to help monitor progress at the school, network, Area/Region and State level.

Supporting Youth at Risk – Victoria Police and others

Victoria Police and other government departments often deal with youth who may be at risk of harm and ongoing involvement with the justice system. Historically, different agencies would be unaware of how these youth and their families interact across government, and as a result deal with them in isolation.

The Supporting Youth at Risk initiative is a joint project in the City of Latrobe between Victoria Police, government departments, and child and community support groups. The aim is to share information in relation to youth at risk and their families in workshop settings, to understand the full picture of how they interact across government and other support services. By connecting up these disparate data points, the group can design tailored intervention strategies using a holistic approach to existing family networks.

A $700,000 grant has been secured to fund the ReBoot program, a program solely developed to support youth referred from the workshops. Designed by over 20 partner agencies in Latrobe City, ReBoot is an early intervention program that will provide intensive support to young people and their families, who have a demonstrated risk of engaging with the criminal justice system. Data is an essential input into the design and future success of this program.

Electronic ID of sheep and goats to protect livestock markets – Agriculture Victoria (DEDJTR)

The Government, through Agriculture Victoria, has established a reform that requires sheep and goat producers to electronically tag their tag their animals. So far, producers have purchased 10.7 million government subsidised RFID tags. The government has also funded the rollout of RFID tag readers to saleyards and abattoirs around the state. The data is managed by Meat and Livestock Australia, a peak industry body, and is available for producers and businesses to use and link to other datasets to gain insights into market performance, individual sheep genes and breeding programs, and for improved management through the supply chain.

Once fully established, this new system will allow for rapid tracking of outbreaks of disease, reducing disease spread and the economic impacts of loss of market access. For example, in 2016 a suspected case of Bovine Johne's Disease was found in a consignment of 321 cattle destined for Japan, resulting in suspension of the Japanese live export market. Using EID information, the full life histories of all 321 cattle were confirmed within one hour, involving livestock movements to more than 120 properties over five states. The ability to quickly and accurately trace the cattle involved was critical in ensuring the Japanese live export market re-opened.

Data for safer communities – Victoria Police

The Victorian Government is ramping up its digital policing capabilities. In 2017, the Government announced a $227 million investment in police technology, which includes an overarching intelligence management solution to fully leverage information held in police databases, including LEAP and Interpose. The advanced analytical tool will help police close in on terrorists, perpetrators of family violence, organised criminals, networked youth gangs and other serious offenders. It will enable Victoria Police's 600-plus specialised crime analysts to gather highly valuable intelligence in minutes instead of hours.[34]

The benefits of data analytics in policing are being demonstrated internationally. For example, according to a study by Apolitical, "Risk Terrain Modelling" has helped reduce gun crimes by 35% in Newark, vehicle-theft by 33% in Colorado Springs, and contributed to a more than 40% reduction in robberies in Glendale, Arizona.[35] Risk Terrain Modelling works by telling police the likelihood that an offence will be committed at a particular place and time, enabling them to deploy resources to hotspots to deter the crime before it occurs.

Know Your Council – Local Government Victoria (DELWP)

Established in 2015, the *Know Your Council* website, **knowyourcouncil.vic.gov.au**, provides valuable insight into the performance of local government. It allows citizens to compare and contrast the performance of similar councils across an array of measures, such as the provision of aquatic facilities, health services for children, the council's financial performance and many others.

The *Local Government Performance Reporting Framework* requires councils to report annually with the relevant data to Local Government Victoria. The website fosters greater accountability and transparency in local government, while helping decision-makers identify trends over time and make more informed choices around policy and service design.

In addition, the Know Your Council reporting mechanism drives more efficient and systematised collation of data, helps to detect and remediate errors in the data, and seeks to prevent duplication of data collection effort across a range of government departments.

Timely data-driven medical research – Routes to Diagnosis project (UK)

In 2009, health practitioners sought to find out why cancer survival rates were lower in the UK than in the EU. The Routes to Diagnosis project analysed 118 million records obtained from a variety of sources. It found that around 24% of cancer cases were being diagnosed in accident and emergency wards, when the cancer was often further advanced. This led to successful initiatives to catch cancers earlier. In 2013, diagnoses in emergency had dropped to 20%.[36] In this instance, data analytics was applied to assist in earlier diagnosis for tens of thousands of UK residents, giving them a better chance to overcome their illnesses.

Contrasting Australia with the UK, the Productivity Commission found that the Australian health sector has a long way to go in terms of sharing data to improve health outcomes and systems efficiency. The inquiry report on *Data Availability and Use* found that researchers in Australia have had to wait up to eight years to access data "in areas of life-saving significance."[37]

A system-wide view of transport network disruptions – Transport for Victoria (DEDJTR)

With a wide range of improvements to our transport network currently underway, it is critical that we minimise the impacts of these works on citizens, neighbourhoods and freight. The Network Impact Management Plan (NIMP) is a data-driven approach to keeping our network flowing as we build the transport infrastructure of the future.

NIMP will bring together data from all parties involved in disruption management, including the Level Crossing Removal Authority, Metro Tunnel, Public Transport Victoria, VicRoads, and private operators such as Metro Trains and Yarra Trams. NIMP data will be located in a single location, and available for use by Transport for Victoria through interactive dashboards.

The NIMP Insights stream will then use the aggregated data and analytics tools to inform user-centric disruption management. NIMP will help us measure how disruptions impact performance, usage and user experience of the network, and design responses to minimise the impacts.

Appendix 4: The benefits of open data

Open Data – a global movement

There is a growing global consensus about the importance of open government. Open data not only promotes transparent government, but can also act as a significant driver of economic activity. Jurisdictions that embrace open data have reaped the rewards.

The United Kingdom is one such jurisdiction. In 2015, the Open Data Institute looked at 270 companies that use, produce or invest in open data. These companies had a combined annual turnover of over £92 billion, and employed more than 500,000 employees, demonstrating the scale of use of open data in the business community. As the Institute states:

"Pioneering, diverse companies are using open data to create innovative products and services that fill gaps in markets, generate income and bring wide social, environmental and economic benefits."[38]

Taking the **complex London transport network** as an example, Deloitte estimates that the city has generated £130 million in annual economic benefits and savings solely by making Transport for London (TfL) timetabling data available.[39] The apps that were created using this data – including Citymapper – save vast amounts of time, stimulate economic activity, and allow TfL to make service improvements.

In the skills and education space, Mime Consulting has developed Skills Route, a platform that uses open data to **help students make choices** about career paths and educational decisions. The platform combines the student's chosen subjects, grades and location with open data from sources including the Department for Education, Higher Education Statistics Agency and UK Commission on Employment and Skills, to provide the student personalised options. It helps students and families better understand how different choices can influence the student's career path.[40]

data.vic.gov.au – Victoria's open data platform

The Victorian Government recognises the value of open data. As part of Victorian Government's reform agenda, the VPS is publishing more datasets through **data.vic.gov.au**, making them available to researchers, app developers and citizens. This allows citizens and innovators to understand and challenge government policy, and contribute to the economic and social health of the state.

For example, Public Transport Victoria (PTV) publicly released their timetable data in 2015. The PTV Timetable API provides access to data for metropolitan and regional train, tram and bus services in Victoria, including real-time data, disruption information and Myki retail outlet data. This has resulted in Victorians now having access to a range of new public transport apps, including Google Maps' public transport feature which shows when the next bus or tram is scheduled and suggests the most efficient route.

Bushfire Powerline Vegetation Detection Algorithm Challenge

In line with the recommendations of the Victorian Bushfires Royal Commission, the Victorian Government's Powerline Bushfire Safety Program (PBSP) aimed to reduce the risk of fires started by powerlines. The PBSP found that the ability to detect which species of vegetation is touching a powerline is an important capability to predict and prevent the outbreak of fires.

Candidates were invited to take part in a challenge to develop a way of discovering what plant species is touching a powerline based on the data that is going through the line. Research from PBSP was made publicly available on **data.vic.gov.au**, together with DELWP sources including mathematical data, spatial data, and test logs regarding interferences with powerlines.

DELWP and DPC ran the challenge, and a Melbourne-based mechanical engineering and computer science team – which provided a proof of concept – was announced the winner on 1 December 2017. All of the teams were then invited to work with CSIRO's Data61 on further research. When operationalised, it is anticipated that a vegetation detection algorithm will be an important tool for bushfire detection and prevention.

Appendix 5: Implementation Plan

Priority	Action	Horizon 1					
		2018				2019	
		6 months		12 months		18 months	
Incentivise Better Use of Data	1. Develop a one-stop-shop for data resources on the Innovation Network.		Qtr3	Qtr4			
	2. Develop a data valuation and analytics maturity methodology.			Qtr4	Qtr1	Qtr2	
	3. Establish a 'right of review' of analytics findings in prescribed circumstances.	Qtr2					
	4. Develop actionable recommendations for departments to adopt in order to drive the necessary cultural and organisational changes.	Qtr2	Qtr3				
Establish Data Linkage and Analytics Environment	5. Establish the technical and governance architecture for the VPS linkage and analytics environment.	Qtr2	Qtr3				
	6. Create the first enduring linked dataset based on the 'Person' theme, extending to Place and Economy.	Qtr2	Qtr3	Qtr4	Qtr1	Qtr2	Qtr3
	7. Embed in the VPS a 'data discovery' capability.		Qtr3	Qtr4	///	///	///
	8. Construct a reference architecture and analytics toolkit.	Qtr2	Qtr3	Qtr4			
Develop People Capabilities	9. Design new VPS career paths and job descriptions for data scientists, analysts, and engineers.	Qtr2	Qtr3	Qtr4	Qtr1		
	10. Develop a sourcing strategy for data expertise.			Qtr4	Qtr1	Qtr2	Qtr3
	11. Develop and pilot a scalable Learning and Development package.		Qtr3	Qtr4	Qtr1	Qtr2	
	12. Establish a VPS-wide Data and Analytics Community of Practice.		Qtr3	Qtr4	///	///	///
Strengthen and Streamline Analytics Processes	13. Develop a best practice data analytics lifecycle methodology.	Qtr2	Qtr3	Qtr4			
	14. Implement the *Victorian Data Sharing Act 2017*, including practice notes.	Qtr2					
	15. Roll out and continuously upgrade Privacy Preserving Mechanisms.	Qtr2	Qtr3	Qtr4	Qtr1	Qtr2	Qtr3
	16. Establish a Community Advisory Group consisting of diverse interest groups.		Qtr3	Qtr4	///	///	///
Drive Data Analytics Innovation	17. Scope and establish the Victorian Data Partnership.		Qtr3	Qtr4	///	///	///
	18. Establish a rolling forecast of emerging trends and developments in data and analytics.		Qtr3	///	///	///	///
	19. Develop a VPS-wide approach for the agile deployment of analytics expertise.					Qtr2	Qtr3
	20. Review procurement practices and implement recommendations.			Qtr4	Qtr1	Qtr2	

KEY: ONGOING ACTION ///

6 months

Sharing data and creating a living strategy

In the first six months we will make data sharing a reality, by implementing the *Victorian Data Sharing Act 2017* ***(actions 3, 14 and 15)*** and beginning to build our linkage and analytics environment ***(actions 5, 6 and 7)***.

We will embed a forward and outward-looking approach into how we implement data reform, by establishing a horizon-scanning function ***(action 18)*** and developing key relationships ***(actions 12, 16 and 17)***.

We will also undertake key strategic work to identify and remove the behavioural, process and resourcing constraints that impede data reform ***(actions 4, 9, 13)***.

12 months

Collaboration, careers and tools

In the second six months we will have in place partnerships within the VPS and across the broader data ecosystem, to cross-pollinate ideas and best practice. We will also establish our Community Advisory Group to ensure our activities meet citizen expectations ***(actions 12, 16 and 17)***.

At the same time, we will accelerate our people capabilities uplift work, with a focus on developing attractive career paths for data and analytics professionals ***(actions 9, 10 and 11)***.

We will continue to evolve our data linkage and sharing environment, enabling staff to answer broad cross-government questions around the 'Person' dataset ***(actions 6 and 7)***. We will give the VPS access to the right tools and resources to find data and use it effectively in policy and service design ***(actions 1, 8, 13, 15 and 20)***.

18 months

Maximising value, capability and data insights

In the third six months we will empower the VPS to assess and extract value from its data assets, while improving its ability to measure the performance of its supply chain ***(actions 2 and 20)***.

We will rollout our strategy to source the best data and analytics talent, as well as our data literacy program and agile approach to deployment of resources ***(actions 10, 11 and 19)***.

We will expand our data linkage and analytics environment to encompass the themes of 'Place' and 'Economy'. This will give VPS personnel an increasingly sophisticated ability to make better decisions underpinned by data ***(actions 6, 7 and 15)***.

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