Digital transformation is happening across all levels of government. Digital transformation involves all missions, from national security and public safety, to public health, tax collection, economic development, and welfare. Data is at the center of Digital Transformation. The fundamental challenge for governments is not so much about how to capture, archive and retain information, but about consistent information governance, and analysis of data to extract the insights that help optimize, orchestrate, and reinvent services.

The following questions were posed by SAP to Massimiliano Claps, Associate Vice President, and Adelaide O'Brien, Research Director, on behalf of SAP’s customers.

Q. What is the value of garnering better insights using big data and analytics technologies in the context of government digital transformation?

A. Government digital transformation is about taking advantage of the widespread and lower cost of digital technologies and approaches to reimagine existing business models and processes. Digital transformation will enable governments to meet citizens’ expectations for improved responsiveness, transparency and accessibility of services, while reducing the cost of service delivery through automating and optimizing processes.

Governments around the world recognize that data is the core currency of government digital transformation. Government digital transformation strategies, articulated in the following quotes, aim to harness the power of data as the raw material of information, knowledge and insights that can support better decision making, increased transparency, personalization of service, economic development and reduction of waste:

"Information is a valuable national resource and a strategic asset to the Federal government, its partners, and the public. To ensure that the Federal government is taking full advantage of
its information resources, executive departments and agencies...must manage information as an asset throughout its life cycle to promote openness and interoperability, and properly safeguard systems and information.” –U.S. Federal Government OMB Open Data Policy: Managing Information as an Asset

“The Administration will take an evidence-based approach to improving programs and services—using real, hard data to identify poorly performing organizations and programs. We will hold program managers accountable for improving performance and delivering high-quality and timely services to the American people and businesses.” –U.S. Federal Government OMB 2018 Budget Blueprint

“Make better use of data - not just for transparency, but to enable transformation across government and the private sector;” is one of the five key building blocks of the UK Government Transformation Strategy 2017-2020

Singapore’s “Smart Nation is also built upon collection of data and the ability to make sense of information. Insights gathered from data will then contribute to forming solutions that can help improve lives.”

In this context, big data and analytics technologies will represent a primary area of investment for government finance, program and technology officers. Big data and analytics is not just about the tools. It has swiftly materialized as a mindset change from "what I need to do" to "what I need to know," using more granular enterprise data as the foundation for strategic government decisions. Governments need to establish a comprehensive analytics strategy that prioritizes technology innovation as the enabler of fact-based processes to gain clearer insights for informed decision making, rather than simply keeping the lights-on.

Q. How can governments leverage the value of big data and analytics to better manage taxpayer money?

A. Big data and analytics is one of the substantial transformative forces helping agencies tailor services delivery, accelerate operational performance, drive optimization, attack fraudulent transactions, and improve compliance by using data-driven decision making. IDC's surveys indicate that there are a variety of use cases, where big data and analytics and, soon, the next generation of machine learning capabilities can add value. These include:

- Harnessing the value of the increased volume, variety and speed of data brought about by the Internet of Things, particularly in the context of smart cities, to optimize traffic, improve public safety and enhance environmental resiliency.

- Personalizing services through digital-first, open-data architectures.

- Increase efficiency of back office processes, such as finance, human capital management and procurement.

- Reducing waste, fraud and abuse, in areas like tax collection and health and human service programs.

- Increase ability to prevent and respond to cyber-threats

For government finance officers, these use cases come down to applying data-driven decision making that can enrich a continuous cycle of budget planning-program execution-performance review to better manage taxpayer money and provide services that meet or exceed citizen expectations.
At the planning stage, big data and analytics solutions can help reduce the disconnect between policy decisions taken at the elected official level and the process changes that program officers need to implement to rapidly translate policy decisions in effective and efficient services.

At the program execution stage, big data and analytics solutions can help streamline operations. For example, IDC predicts that by 2019, 15% of government transactions (such as tax collection, welfare disbursement, and immigration control) will have embedded analytics. In the case of these complex government transactions, analytics can act as an intelligence agent by providing extra functionality and greater ROI.

At the performance review stage, big data and analytics can be used to enhance compliance through continuous monitoring and forensic analysis of risks represented by exceptions in workflows, documents, and users. That is a very different approach to random audits that uncover the problem, when the improper payments have already happened. And this is true both for internal processes, such as approving an invoice, and for external services, such as stopping fraud in tax filing and welfare claims, in real-time.

Q. What are the inflection points in terms of technology architecture, when it comes to realizing the value of data as a strategic asset in government?

A. By looking at government strategies and ongoing initiatives, there are multiple signs that indicate that there are two major inflection points in big data and analytics: platforms and advanced analytics. For example, the Government of Canada Information Technology Strategic Plan 2016-2020 states that "Interoperable platforms are the backbone of data and information sharing, big data analytics and collaboration. By seizing on these opportunities, government can create a modern workplace in which employees have the enabling tools needed to keep pace with the expectations of the Canadians and businesses they serve."

The Canadian Federal Government strategic plan calls out:

- Platforms as the fabric of interoperability "to provide a dedicated, secure and high-speed information access layer to enable information sharing and collaboration". Multi-tiered solutions, based on cloud computing and application programming interfaces (APIs), can help establish a standard language for cross government federated, on-demand data collection and processing, that builds incrementally on the existing data management tools.

This is a key inflection point, compared to past efforts to build whole-of-government master databases that are unaffordable to develop and govern. The Canadian Government strategic plan, the previously mentioned UK Government Transformation Strategy and other ongoing initiatives, such as the London Datastore and the Copenhagen Data Exchange, also recognize the value of platforms as the basis to create open data marketplaces that will allow private sector, academia and communities to launch innovative products, services and business models that will benefit the whole digital economy.

- Advanced analytics capabilities for the ability to provision, scale, and contextualize real-time predictive and prescriptive insights at the point of decision making. The ability of big data and analytics, and machine learning to look beyond siloed reporting structures and discover patterns through increasing volumes and varieties of data is the second key inflection point. In the old days of business intelligence, governments were using analytics mostly for annual, or at best monthly expenditure reporting, driven by compliance requirements. Now they can start at the planning stage, by analyzing "what if" scenarios that can help make better policy and budgetary decisions.
At the program execution stage, governments can predict traffic flows based on weather conditions, public transport travel patterns and road conditions; hence, recommend the best way to avoid congestion. Performance reviews can be concurrent with execution to ensure continuous feedback through event triggered alerts, when exceptions, such as expenditure above appropriated budget, or suspicious tax filing occur.

Governments in the U.S. and beyond are already finding that real gains in insights occur when data from multiple agencies can be combined through open platforms and analyzed through advanced analytics to derive new insights and findings. For example, the U.S. Department of Transportation (DOT) has built a dashboard that integrates multiple data sets, including accident and safety information received from states, and overlays railroad crossings, zip codes, and census data, such as population growth, to visualize areas of high traffic accidents and fatalities, pedestrian accidents, and unusual amounts of Hazmat spills and storyboard causes.

One case, for example, analyzed the expected correlation of snow in January–March with auto accidents and pedestrian and bike accidents occurring in evenings from October to December when there is less daylight. The DOT was also able to correlate an unusual number of train fatalities on Fridays at midday with step-in-front-of-the-train suicides.

The State of Indiana is using big data and analytics to tackle infant mortality and drug abuse. The Indiana Management and Performance (MPH) Hub started to work with Indiana's police forensic laboratories to track and visualize the types of illegal substances that officers are finding on the street, and how often they are finding them. MPH built a dashboard and gathers data from law enforcement and public health agencies to visualize data by creating geospatial maps, colour-coordinated line graphs with trend data and even a time-lapse map that shows how the drug epidemic has evolved over time to identify hot spots and best allocate resources to combat the problem.

The City of Buenos Aires uses the power of analytics in combination with modern LED fixtures to enable smart street lighting. The system provides the city with real-time insight into power outages, broken lights, and vandalism. The city can also track installation speed and contractor information in real time, saving on maintenance costs and ensuring that issues are fixed quickly.

Q. What challenges are government finance officers, program officers and technology officers facing, as they deploy big data and analytics solutions?

A. A December 2015 IDC survey of 210 U.S. federal government respondents indicates that, only 4.3% of respondents have operationalized big data and analytics across the organization with continuous coordinated process improvements and value realization, 26.6% are operating at the enterprise level of having project, process, and program measurement to influence investment decisions. 35% are at the repeatable maturity stage of recurring projects and funded program management. 33.3% are still at the unbudgeted and inefficient resource allocation stage and <1% are at the experimental, or ad hoc, stage.

The challenges to making further progress in the usage of big data and analytics come from multiple sides:

- **Vision:** although governments are coming full circle to recognize the value of data as strategic assets, both for the inter-government collaboration necessary to modernize public services and to support the broader intent to stimulate the digital economy, a few institutions still apply a regulatory compliance view to information management. Such an
approach makes it difficult to approve the business cases for the necessary investments in data platforms and analytics.

- **Process**: gaps in cross-departmental collaboration and information governance practices. Government executives often indicate that projects are hamstrung by either policy or historical practice of data being trapped in silos of individual departments of agencies. Whereas government that already thrive in big data and analytics are precisely those that can connect multiple data types (e.g., structured transactional data, rich media, web clicks, GIS, social media, IoT sensors) across organizational boundaries.

- **People**: lack of advance analytical skills and resistance from elected officials, officers and civil servants who are not sure how their job will be impacted by data-driven decision making.

- **Technology**: siloed legacy systems pose significant challenges to interoperability with and migration to open architectures that are better place to realize the benefits of advanced analytics. Multi-Tiered archetypes, such as APIs, offer a more affordable, incremental approach to overcoming the siloes, but still require investment in appropriate tools and skills.

- **Data**: data protection laws augment the process and technology barriers to inter-departmental information sharing; in fact, per a September 2016 IDC survey of 278 government IT executives in Western Europe, security and data protection is their primary priority and data leakage the number one security concern. Also, the advent of big data and analytics did not eliminate the risk of low quality data.

Q. **What are the lessons learned from around the globe that government executives should consider to realize the benefits of big data and analytics?**

A. Government finance, program and technology executives that want to harness the value of data and analytics should apply the following lessons learned.

- **Vision**: By making the data meaningful to lines of business (LOB) executives, IT executives can work across silos and integrate data sharing practices into policies and processes to leverage data and analytics for strategic planning and service management. IT executives should place small bets on big data and analytics tools and competencies to get the quick win, then prove ROI to business and scale from there to fulfil the long-term digital transformation vision.

Examples of quick wins include energy saving from smart street lighting in smart cities and segmenting taxpayers based on risk profiles to speed up revenue collection in tax agencies. Big Data champions need compelling stories of internal agency value and external citizen value as evidenced by use cases and a road map of stages. Innovations with returns within the fiscal year and reinvestment for additional returns, such as using Big Data and analytics to find and prevent fraud, waste, and abuse, can be sustainable.

- **Process**: Enhance the management practices and disciplines needed to create, collect, retain, dispose, archive, protect, appropriately share, and analyze information. As agencies become more mature in their Big Data and analysis processes, the IT organizations collaborate with LOBs to develop agency-wide governance processes, including discovery and experimentation.

The guidelines regarding information and decision management need to be developed, documented and disseminated across government. For example, the UK Government Transformation Strategy 2017-2020 aims to appoint a Chief Data Officer that will assume
the role of a government-wide steward of information governance and information value realization. Also, State of Indiana invested in solutions to these process and governance issues at the enterprise level, and then provided those solutions back to agencies as a service.

**People:** Use all instruments, from recruiting to sourcing specialized contractors, to augment the big data and analytics skills needed to harness the strategic value of data. Talent sourcing of data scientists is the first step. Data scientists are easier to retain when the burden of data calls and gathering/correlating data is reduced, and they are free to explore trends, relationships, and correlations across areas such as people, assets, security, funding, and investment data and use modeling and predictive analytic tools to better answer "what if" questions.

Have executives, such as finance and program officers, sponsor the value of data as a strategic asset so that data-driven decision making becomes part of the culture. Build strong enterprise architecture competencies in house to align platform and analytical tool selection with the overall business needs, rather than relinquish choice to specialist contractors that have locked in their skills with one or few products.

**Technology:** Invest in cloud based platforms that enable governments to scale big data and analytics in an agile and affordable manner. Deploy advanced and predictive analytics software. to discover relationships in data that are hidden, not apparent, or too complex to be extracted using query, reporting, and multidimensional analysis software. When coupled with dashboards, and data visualization software, advanced and predictive analytics can make it easier for the user to understand the key insights in each usage scenario, and predict outcomes.

**Data:** Take care of the quality of the data and promote interoperability standards to favor information sharing. Data architectures that support timely data available to decision makers and analysts — data that is trustworthy, complete, accurate, granular, secure, and actionable - are critical to increase confidence in data assets.

Apply a security-by-design principle when implementing big data and analytics solutions to ensure constituents trust how government use data. New laws, such as the General Data Protection Regulation in Europe, and policies, are stimulating new practices to classify data and use cases, so that an explicit and informed consent can be collected from the user to process data in innovative ways.

Simply put, government should treat data as a strategic asset and should leverage analytics to provide the insights needed to capitalize on that asset.

**ABOUT THESE ANALYSTS**

Massimiliano Claps is Associate Vice President for IDC Government Insights and IDC Health Insights in EMEA. Mr. Claps core research coverage includes digital transformation in government, with a primary focus on the citizen experience, operating model transformation, including cloud computing, shared services and government as a platform, and smart cities. Mr. Claps healthcare research focuses primarily on integrated care delivery models. And his research in the education sector covers blended learning and smart campus.

with increased agility, flexibility, and scalability. Ms. O’Brien’s research also includes a particular emphasis on Maturity Models in Big Data/Analytics, and cloud, as well as benchmarking government maturity levels.