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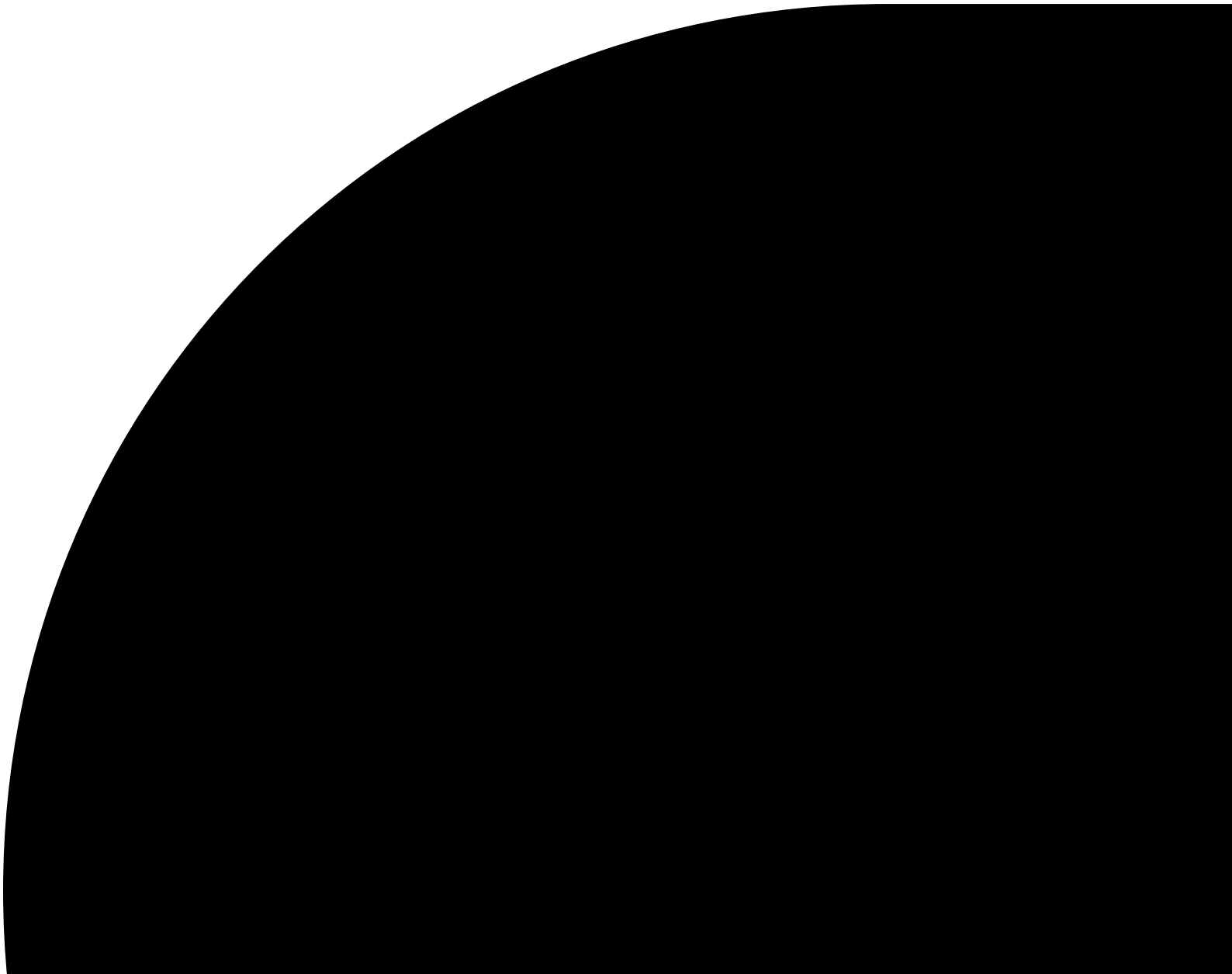
White Paper

How to become a data-driven government organization

A five-step plan for a successful data transformation journey



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How to become a data-driven government organization

Most government organizations today aspire to become data driven, embracing all kinds of data to drive better services. What exactly is a data-driven government organization? Why should yours become one — and how to do so.

According to one source: *"[A] … data-driven government [organization is one] where actionable information (data that can be used to make specific business decisions) is available for all critical decisions. The benefits include sound governance and control; optimized fraud and error detection; and improved services." (GovLoop, 2015)* The term "data-driven government" itself was created by software vendors to sell big data projects and technology to government organizations, and these organizations are now taking up the approach as part of their overall data strategy.

You've heard that other government entities are moving toward becoming a data-driven organization, and you wonder how to approach this for your own organization. But you have concerns: How will you be able to not only trust the data (e.g., in the operational reports), but to actually trust in algorithms based on artificial intelligence (AI) providing you with recommendations — or even making decisions — in real time?

An expert in the area notes: *"Technology doesn't provide value to a business, but that technology's value comes from doing business differently because technology makes it possible."* (Westerman, 2018) Accordingly, in this paper, we position technology as a means to achieving business goals, a way for a government organization to become better and more efficient at delivering services to citizens.

Outside of the government sphere, in many industries and domains, services are being transformed or will be transformed by a more analytical usage of data. Examples include:

Archetype of disruption	Domains that could be disrupted
Business models enabled by orthogonal data	• Insurance • Healthcare • Human capital/talent
Hyperscale, real-time matching	• Transportation and logistics • Automotive • Smart cities and infrastructure
Radical personalization	• Healthcare • Retail • Media • Education
Massive data integration capabilities	• Banking • Insurance • Public sector • Human capital/talent
Data-driven discovery	• Life sciences and pharmaceuticals • Material sciences • Technology
Enhanced decision making	• Smart cities • Healthcare • Insurance • Human capital/talent

Does your organization have a data problem?
If the following scenario seems all too familiar to you, then your organization has challenges with the way it handles data and how quickly you can make it available to business leaders to analyze situations and make important decisions. It is time to take action with your approach to data. And, it is not the IT guy down the hall who will be able to guide you.

Imagine that you are the leader of a government organization, attending the weekly executive leadership meeting to discuss progress on a matter important to your business leaders. As you open the standard business report that has been emailed to you for years by your IT guy, you suddenly spot an anomaly in the data: Despite the accompanying pivot table reports and visual graphics, the numbers seem to not be what you expect at this time of year. You try drilling down in the report, but the bottom line numbers still seem way off from what you had expected. The financial analyst suggests that you ask the IT guy. No one trusts the data at this point, and all of you wonder, "What if the report is wrong or has been wrong … for years … are we making the right decisions, if based on the wrong data?"

A few days later the analyst reports that there was a problem with one of the imported files from the financial system. Still skeptical, you ask for a dump of the financial files. The agency spent a lot of money installing the latest reporting tools, and you expect a return on that investment. You ask the analyst if the latest formula for calculations was applied in this report; you request that the most recent calculations be forwarded to you along with supporting data. But the analyst responds,

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This paper provides some tips on how to start your transformation toward becoming a data-driven government organization, based on DXC's recent experience working with various agencies. We will focus on improving efficiency in the operational part of the organization rather than the policymaking part of it.

What does it mean to be(come) a data-driven organization?

A lot of questions spring to mind when thinking about becoming a data-driven government organization, such as what is the value, what are the risks and what does it all mean for the operating model?

Value drivers

Let us start by answering the most important question first: What are the value drivers for becoming a data-driven organization?

Becoming a data-driven organization means that you can enhance your service delivery on the following dimensions — by being/becoming predictive, proactive, preventive and personalized:

- **Be(come) predictive.** What trends can you see in your data, and how can these shape or impact service delivery? Can you predict where the need will shift to and then adjust budgets and workloads accordingly?

  The Department of Public Roadworks of the Flemish Government created an algorithm that — based on various input data sets from different sources — can predict when and where the next traffic accident is likely to happen. This can trigger preventive actions, such as traffic messages broadcast by the public radio station.

- **Be(come) proactive.** If you have all the data available, you can send out a proposal to citizens.

  The Department of Education of the Flemish Government has begun proactively sending out proposals for granting scholarships. Parents of students receive a letter with a proposal in it, and they only have to acknowledge the proposal.

- **Be(come) preventive.** Based on data, you can spot an early warning sign or indicator and take precautions to minimize or avoid a bad situation from arising.

  Today, we see an increasing usage of drones and real-time data; for example, drones capture visual images of areas at risk of being flooded, and the organization uses that data to then open certain flood gates or river locks.

- **Be(come) personalized.** What is the best service option for this particular case or situation? The data can guide you. Personalization aims to provide users with what they want without asking them explicitly about their needs (Brusilovsky, 2007).

  When we go to our barber or hairdresser, we expect him or her to cut our hair in our usual, desired style. The barber/hairdresser will consult their knowledge base (i.e., data) about you, your past preferences, any specific requests today, etc. and then apply the correct set of tools and techniques in a personalized way. In a way, the same principle applies to government services: If the government has the right data about me, my situation and my behavior, then it should be able to provide personalized service.

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"I do not have immediate access to that data, and it will take the IT department some days to process my ticket so I can get access to it." You are not pleased.

This is the time to start changing the way that data is treated inside your organization.

(On a lighter note: A high-ranking government official once said to me, and I'll summarize here: "I know that my reports are not correct, but they have consistently been incorrect for the last number of years, so I do not bother checking out the problematic data anymore.")

An example is the discount you get from requesting a bus or train pass. In Flanders, Belgium, the bus company provides a discount on subscriptions based on your family situation. Depending on the number of children you have and their age, you get a certain discount. To get this family data, the bus company has an agreement to be allowed to search the master databases of the Flemish Government. The answer contains only those fields necessary to feed into the discount formula. As such, the bus company can provide a personalized offer that fits the family situation — without the citizen needing to supply that information. This method guarantees full privacy of the family's/citizens' data.

A far larger amount of data is needed to personalize the citizen experience in general — data about each citizen's agency interaction history, behavior, location, preferences and more. This data will come from different sources and channels, like social media or mobile apps. The value of personalized services is based on analysis of all of these sources, not only on the operational data that the citizen uses on your website. When you move toward becoming a data-driven organization, it is essential to capture, store and analyze data from different sources to personalize the experience.

Based on the "4R Personalization Framework" (Accenture, 2019), we can define the following opportunities for an organization to improve services and provide personalized value:

- **Recognize** — identify citizens and potential new audiences for your service
- **Remember** — use previous activity to anticipate future needs
- **Recommend** — present the most relevant content, services and products
- **Relevance** — consider the context to propose certain services (e.g., family situation)

Engaging in this analysis of the data means that the organization does not need to sit and wait for a service request to come in. In a truly transformed and data-driven organization, the data can be proactively searched for services needed or desired by citizens. So, the value of being *proactive* is enhanced when using data to *personalize* the experience.

Becoming a data-driven organization brings value by way of the **experiences** offered to citizens. By better understanding citizen behavior, engaging with citizens in meaningful interactions and delivering outstanding service, you deliver a positive citizen experience — which has never been more important than it is today. The standard set by the business/commercial world for retaining clients is becoming a necessity at the government level as citizens demand to see personalized and proactive services. Understanding citizens holistically requires combining digital, behavioral, sentiment, and predictive analytics. This knowledge needs to be applied to each citizen as an individual, based on their recent actions and unique relationship with your organization or other government organizations.

In addition to the benefits to citizens, becoming a data-driven organization also brings internal value to the organization. There is **efficiency** value, as the organization can improve resource utilization by shifting "case expert" capabilities toward data scientists to interpret the data. It also brings **innovation**, as analysis of the data can generate new ideas, processes or services to improve the current and/or future way of working.

Important considerations

Becoming a data-driven government organization also poses some risks to consider when plotting out the journey. Based on literature research, we have found some concerns, as follows:

- **Speed of transformation.** A Gartner survey found that (business/industry) organizations are slow to advance in data and analytics. The report showed that 91 percent of organizations have not yet reached a "transformational" level of maturity in data and analytics, despite this area being a No. 1 investment priority for CIOs in recent years. Gartner also states that organizations at transformational levels of maturity enjoy increased agility, better integration with partners and suppliers, and easier use of advanced predictive and prescriptive forms of analytics (Rob vander Meulen and Thomas McCall, Gartner, 2018).

  One of the researchers gives advice that is fully aligned with our starting position in this paper — that this transformation process is not about technology: *"First, focus on improving how people and processes are coordinated inside the organization, and then look at how you enhance your practices with external partners."*

- **Legitimacy.** Data has become a commodity, and the way that people — or companies — use it even shapes our own behavior. We all realize that large companies like to collect a lot of data about us as an individual to provide us with personalized experiences or perhaps even sell our profile to, for example, an insurer or healthcare provider.

  The question is: Can we or should we expect or allow our government organizations to collect data from our behavior, as well?

  The introduction of automated decision making into the business process, made possible by AI and machine learning (ML) technology, must be transparent to keep the trust of citizens. When an organization relies solely on algorithms that act upon large amounts of data (through sometimes complex statistical analysis and calculations), it is unclear to both civil servants and citizens how the algorithm has come to a decision. This can then decrease citizens' trust in government.

  Government officials tend to be cautious in allowing usage of large amounts of data from various sources to address societal problems. Even though government agencies have been using statistics and publishing open data for a long time to better understand the needs of citizens and companies, IT vendors are developing tools and services faster and more precisely than governments are currently equipped to use or even want to use. (Note: Open data is the process or means by which government agencies make information that is not private (or privacy related) available to the world as a machine-readable data set, for various practical purposes).

- **Trust.** The processes by which government agencies collect, handle, use and manage the data should comply with all applicable legislative regulations. The government must ensure that its agencies analyze the data in a lawful and meaningful manner.

- **Quality and accessibility of data.** Whatever algorithm is applied to data, it is necessary that the underlying data be of good quality, be reliable and be accessible to the technology.

- **Talent and skills.** Working with large amounts of data of different formats, sizes and velocity requires different skills than the ones used for operational reporting. Organizations will have to think hard how to attract professionals with these skills into their organization and let these people work with the internal business teams.
- **Communicate widely about the value of data.** Any transformation to a data-driven organization will require good communication with the internal business teams about what this will deliver to them and why they need to change their operating model.

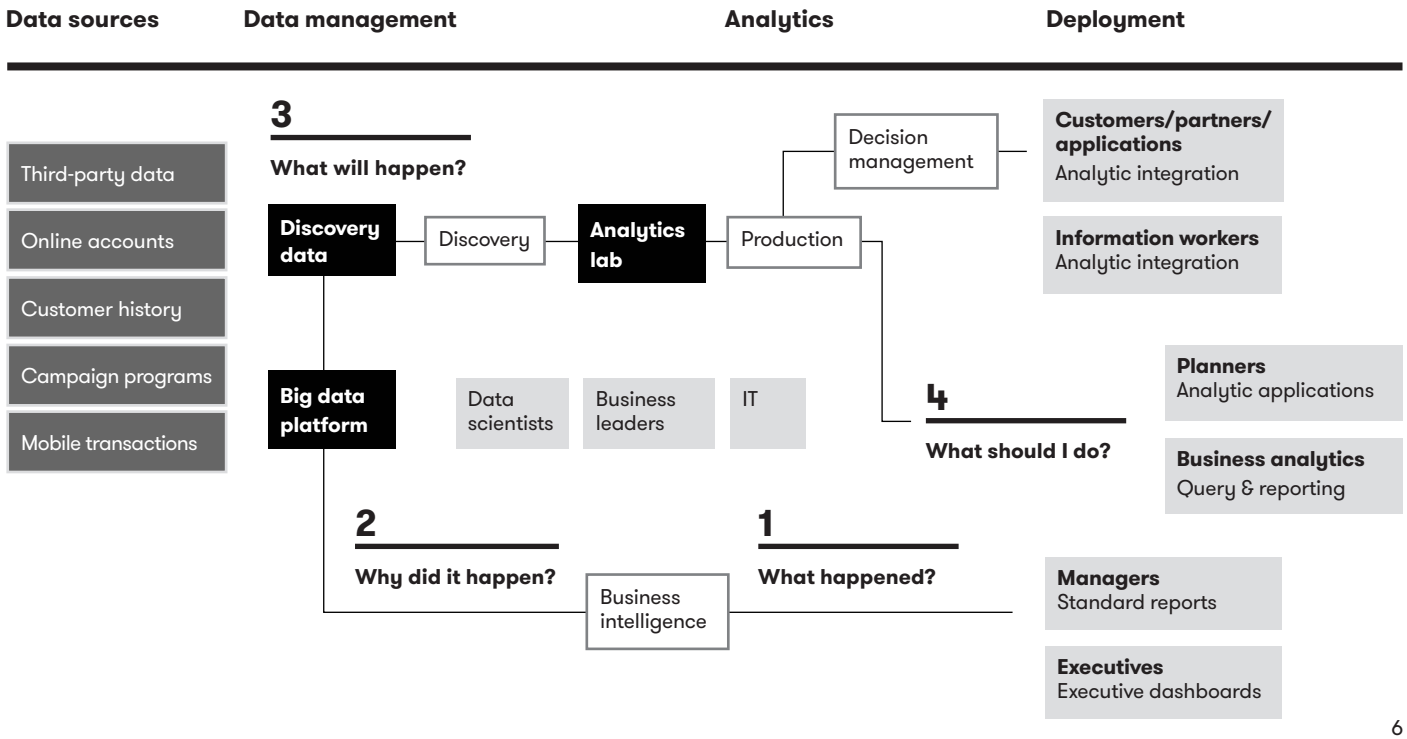
In conclusion, as long as the organization is fully **transparent** about what data it collects and uses, the benefits and value of a data-driven organization outweigh any drawbacks. And, all the more reason that any transformation must be carefully planned, tested and executed.

We must also repeat here that transforming is not about the usage of (new) technology, but should be focused on people and processes first. Our conclusions are aligned with those in an extensive study done by the European Union (EU) on use of big data and other innovative data-driven approaches for evidence-informed policy making (Technopolis Oxford, 2016).

Becoming data driven — four stages

In order to understand the **impact** of transforming to a data-driven organization, we posit four stages to explain the evolution from operational reporting to predictive analytics and AI-assisted decision making:

- Stage 1 — What happened?
- Stage 2 — Why did it happen?
- Stage 3 — What will happen (next)?
- Stage 4 — What should I do?



Each stage will have an increasing impact on several aspects of the service delivery and will require a more profound transformation of the operating model to achieve the maximum benefits.

Going through these four stages will impact the **people, process and technology** aspects of an organization. This means that every transformation journey will need to address the following questions:

- **People** (relates to all HR and cultural aspects of the transformation)
  - **Culture:** What is the impact on the organizational culture when transforming to a higher level of data-driven organization? Is the internal business willing to adapt and allow data to lead/drive decisions, even without human intervention, where possible?
  - **Change management:** What change management elements do you need to foresee to achieve this level?
  - **Capabilities:** What new capabilities do you need to introduce to make sure the new data techniques are being fully exploited and integrated in the way of working?
- **Process** (impact on operating model, way of working and way that data can influence decision making)
  - **Process:** What is the impact on the business process flow when new data techniques are being introduced, not only to support the existing business process but to eventually transform the way of working?
  - **Data governance and quality:** How to govern data from source to analytics. How to safeguard the quality of the data at all stages.
  - **Integrated data and information management:** How to make sure all data and reporting is consistent (e.g., agreed-upon definition of key terms, data modeling standards) across all stages.
- **Technology** (the ensemble of infrastructure, platforms and tools to use or introduce at this stage)
  - **Infrastructure:** What is the evolution in infrastructure when you move to a higher stage of being data driven?
  - **Platform and tools:** What is the impact on the tools you use when moving upward? Will the same tools still be usable? Do you need new ones?
  - **Advanced analytics:** What is the impact of introducing advanced analytics into the organization? Do you have the right capabilities? Will these resources be trained? Will you source data scientists from external sources? How do you link this to business process impact?
  - **Reporting and visualization:** Will you keep on using reporting and visualization as part of your future way of reporting? What is their place versus new tools? How do you keep this all consistent to the internal business users?

Let us now walk through the four stages and describe their increasing impact on the above-mentioned aspects.

Stage 1: What happened?

This is the area where operational reports provide information on "business" transactions from the past, which might also include near-real-time transactions. Typically, these reports are extracted from a data warehouse environment specifically designed to deliver these reports. Exploitation of the data goes through business intelligence tools that prepare reports or through end users who create reports. Basic analytical formulas are available to run across the selected data sets.

Impact on people, process and technology

- Impact on the **people** aspect

  Transformation at the business-process side is minimally invasive, as these types of reports typically state operational facts for business leaders. As such, few to no processes are to be changed to introducing data reporting.

  New capabilities are typically absorbed by the existing business through training and/or nominating key business users.

  Culture-wise, it is often the case that the internal **business** was promised that it could run its own data analysis, but usually delegates report creation to the IT department or trained key business users; this takes time to deliver. Considerations include requirements as to how the report should look before it is assembled. Business intelligence tools allow flexibility in changing the graph type or content.

  Data governance and data quality are usually handled by the IT team. Research has shown that there is still quite some room for improvement here. When we look at the state of open data (usually a direct copy of internal data sets), one can see that there is little attention to data quality. A recent study revealed that " *... We have found almost no evidence of quality control processes for the data before publication.*" (independent Open Data Barometer organization, part of World Wide Web Foundation) – 3rd edition 2016). This means that the source data is also not well governed.

- Impact on **process**

  Operational reports state how efficiently the business is handling the turnover of services. This data can be used to solve operational problems such as shifting workload to a different step in the process to work through a backlog. When problems keep arising, business leaders can justify changes in the operations or workflow.

- Impact on **technology**

  IT is highly involved in maintaining and enhancing the technical environment. Tools and technology are readily available and are mature. Often the majority of features are underused at the business, so there is always room for more efficient usage of the current technology. At the very least, the business should strive toward standardization of the reporting toolset and highly discourage separate initiatives (e.g., in Excel or other technologies).

Summary of impact

Most government organizations have experienced Stage 1, so we put the impact as "low to medium" — as features are well understood and implemented in the organization.

	People	Process	Technology
Impact	Low	Low to medium	Low to medium
Value	Medium to high	Medium to high	Medium to high

Stage 2: Why did it happen?

At Stage 2, **advanced analytics** tools and techniques are added to the mix as evolution of Stage 1 possibilities. These now allow the autonomous exploration of vast amounts of data from different sources and types, typically beyond what business intelligence systems provide. Velocity, variety and volume are more pronounced in the data sets used. This is better known as big data.

This stage is characterized by new data processing and analyzing techniques such as drill-down, data discovery, data mining and correlations on large volumes of data. Gartner refers to this stage as **"Diagnostic"**.

Data can come from various sources, including social media, chat transcripts or even voice files. These allow new techniques like sentiment analysis to analyze the behavior of citizens and correlate this with the services requested or provided.

Stage 2 can be considered a big step up from Stage 1, as advanced techniques will necessitate the need for transforming people, process and usage of technology to a more analytical approach rather than taking operational actions on what the data reports state.

Impact on people, process and technology

- Impact on **people**

  We are now at a stage where the collaboration between IT and business becomes very close. As such, the need for good communication about the data and initiatives to move forward are crucial. This involves a **transformation** to a new way of working together.

  Projects are not linear, they do not always have a defined end in mind; rather, they are usually open and flexible, as new insights may lead to revised projects. There needs to be a certain degree of freedom for experimentation with the data or results. People will need to be coached through this mindset as most business leaders are problem (and solution) focused — whereas here, the discovery of new insights is the prime goal.

  This does not mean we forget about objectives or goals; it means that we need to focus on small projects and known business questions. A well-defined scope understood by the team is necessary. The outcome must be measurable, meaning that the analysis must result in a suggestion of concrete actions for changing the business process or way of working.

From a project perspective, people must have the ability to self-organize when needed. This may require different skills or capabilities to be injected into the project team. Various skills will come together in a multidisciplinary team, like data science, other technology, business expertise and management. Sometimes, the team will consist of members of different organizations, so having good stakeholder coordination and a shared understanding of the objectives are important.

Although we talk about multidisciplinary teams, at this stage, business is now in charge — and IT is here to support the business with its thinking.

- Impact on **process**

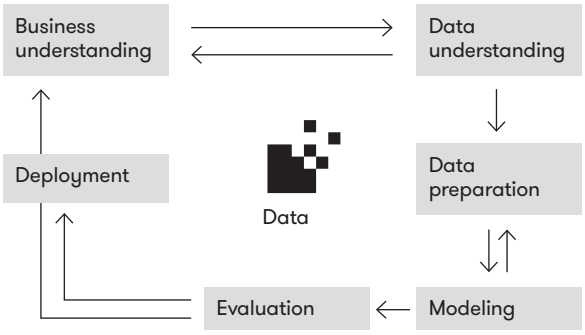
  There is quite some impact on the process or **governance** level. Obviously, people do not start experimenting just like that, without management buy-in. As such, these projects need to be anchored in a well-defined data strategy where the usage of the technologies is well aligned with the business objectives.

  There also needs to be a well-defined **organizational structure** where the people (business and IT) can work together as one team and produce insights. This is where the culture of being data driven is born. Typically, this is done in an agile way, which means defining short sprints and delivering upon these. Failure is also an option — as finding no correlation between the data is essentially also an acceptable finding.

  On the **data** front, data governance and data quality management now take center stage. As different formats of structured and unstructured data will be used, a strong data integration and security policy must be defined, in place and applied to all data needed.

  The need for a methodological approach at Stage 2 becomes a necessity. We suggest using the CRISP-DM methodology, which has been around for some time; it is one of the very few methods focusing on data mining (Shearer, C., 2000).

  This methodology states there are six phases to undertake, which are:



- Business understanding
- Data understanding
- Data preparation
- Modeling
- Evaluation
- Deployment

These phases help organizations understand the data mining process and provide a roadmap to follow while planning and carrying out a data mining project.

- Impact on **technology**

  This stage sees the introduction of new technology and tools, necessitating an investment in IT infrastructure or moving to an as-service model.

Additional funding (or investments) will be required to prepare, clean and process the data sources before the project starts. Next to *reporting technology*, extra *visualization technology* is needed.

The IT strategy must be well aligned with the data strategy to make the right investments and availability of experts to the business teams.

Example

In the catering department of the Flemish Government, food ordering by the cooks resulted in a lot of waste. So, we brought together a multitude of data sets into the mix — from cash register entries to weather, work schedules/holidays, cultural information, announced strikes, etc. The data scientist then discovered correlations among these data sets — allowing the cooks to predict food ordering much more accurately than ever before. The result was 30% less wasted food and a better forecasting mechanism in the dining area, achieved just by correlating data sets.

Summary of impact

	People	Process	Technology
Impact	High	Medium to high	High
Value	High	High	High

Stage 3: What will happen?

In Stage 3, we turn our attention to the future and emphasize the **predictive** nature of the data analysis.

CIO.com provides an excellent definition of this stage: *"Predictive analytics is a category of advanced data analytics focusing on making predictions about future outcomes based on historical data and analytics techniques such as statistical modeling and machine learning. The science of predictive analytics can generate future insights with a significant degree of precision. With the help of sophisticated predictive analytics tools and models, any organization can now use past and current data to reliably forecast trends and behaviors milliseconds, days or years into the future."* (Edwards, 2018, CIO.com)

At this stage, data discovery is typically done in a secure environment like an **analytics lab,** which starts with a working hypothesis to be validated through correlating data sets. The hypothesis is then either confirmed or unconfirmed by a percentage. It is then up to the business to validate this to be credible or not. After discovery of data, we move the model into production and have it run automatically and autonomously. That means we need to have a high degree of certainty that the model actually is correct and will remain functional when new data is fed into the model over time.

This is also the stage where machine learning and AI come into play, as you can now start training computers to work through the data and predict the outcome based on the model defined in the analytics lab. The results are usually a number of analytical applications that will continue to run and provide insights to the business. This can move toward automated decision making by the algorithms.

Impact on people, process and technology

- Impact on the **people** aspect

  Being open to what the data brings to the business is the most important characteristic to consider here. Although we are introducing a lot of new technology at this stage, this must be a business-driven stage, where business people aim to improve the services by predicting behavior or relevance. Within government, this will raise concerns about privacy, but by remaining transparent, this approach can lead to insights that are undiscovered in operational environments.

  Businesspeople must keep an **open mind** toward discovering new insights and must refrain from solutioning until the algorithm is well tuned. This is a different **culture** than one where an organization tries to solve one particular problem; here, we seek the bigger picture and then try to provide better services based on the new insights.

  As new **capabilities** are definitely needed for this approach, we advise being coached by external experts through the first analytics lab exercises. For most people, this is a new way of thinking, so it must be carefully introduced.

  Data governance and data quality are crucial, as you will base insights on the presented data. The data must be impeccable and relevant to the scenario you will be running in the lab. Per the analytics lab, a different set of data might be needed — so do take the time to prepare a lab. This means the business hypothesis must be made first, and then the lab can be used to exploit the data and find/see the patterns.

- Impact on **process**

  As noted, we advocate the installation of an **analytics labs** at Stage 3, a place where a multidisciplinary team can do controlled exercises with machine learning and other analytical algorithms. A standardized approach is necessary for bringing a case to the lab and for the expected results. The business needs to think carefully about what can be automated, and then algorithms can work through the data to make or propose a decision. This requires placing trust in data and algorithms to come together.

  Running an analytics lab requires a mandate from management, suitable budget and proper team setup that fits in with the overall data strategy and the transformation approach to a data-driven organization. This translates into having **dedicated project management** and a standard approach and team to prepare, run, follow up and clean the lab. This is to be seen as an investment into the organization, so all cases must be well prepared. We advocate either getting external help for facilitating this process or making it part of the investment portfolio to become a data-driven organization.

  You can use the analytics lab to test and validate new ways of working based on the insights from the data. This will lead to improving the services you offer today. But you can also use the lab to search for needs for new or adapted services. This way, you can optimize the existing set of services offered to citizens or predict the need for new ones. In the commercial/industry world, these labs are often part of the R&D department, and they research new products or enhancements.

Key success factors for an analytics lab are the following characteristics:

- **Multipurpose and multistakeholder.** Data is kept agnostic from business units and departments, and the tools used cannot be trapped in one silo. (In other words, a lab should try to collect as much data as possible — not filter it upfront. You load it all; if it does not fit today's project or stakeholder, it might fit tomorrow's. The lab should keep a pot of data available for all.)
- **Holistic view.** Business needs to take (and keep) a holistic view on where this is going. You are not in a lab to solve one case but to improve the portfolio of services; otherwise, decisions will only be partially right and not reach the potential of transforming the business.
- **Autonomy.** The analytics lab runs its own processes to prepare and execute a project. The cases are driven by business needs. The lab manager is responsible for ensuring consistency and reusability.
- **Measurability first.** All outcomes must be measurable, and the anticipated impact must be quantifiable. Since we are talking about statistics and algorithms, we need to be sure that the algorithm elicits enough trust to move it into production

A lab should be "owned" by a horizontal group that can provide the best facilities for all groups in the government organization to use. This will reduce the investments needed, and it will also increase efficiency by standardizing the approach. If that is not possible, consider using an external party to provide such a lab for you. DXC has Digital Transformation Centers around the globe to provide such services.

- Impact on **technology**

  This is the stage where machine learning steps in and where algorithms will predict the outcome, or even make the decision autonomously. There are numerous frameworks readily available as a service, but caution is to be exercised when making a choice. Using these frameworks will also be an experiment for the IT team and will require new skills to master the algorithms.

Example

The automotive industry is heavily investing in sensors to collect data about driver behavior (or of the software driving the car) and provide new services based on data insights, like automated braking when an accident is ahead or adapting to road conditions. Insurance companies have to develop new insurance services once it is software that is driving the car or vehicle. Based on data insights, these companies can predict what services would be useful and start testing them in real life.

In Belgium, the Agency for Employment Services (aka VDAB) has set up an innovation lab to experiment with data on matching, the core business process whereby demand and supply of an open position are matched. People open to being considered for a new job are matched to the offerings of the companies, and the agency then establishes a connection between the job candidate and company. Recently, the lab provided an algorithm (aka Jobnet) based on AI and machine learning to do automated matching. This proved to be very successful, and the algorithm is now in production and will augment existing tools and processes.

Summary of impact

	People	Process	Technology
Impact	High	High	Transformative
Value	High	Transformative	Transformative

Stage 3 is where most organizations will get in contact with transformative technologies such as machine learning and AI. Therefore, embracing these technologies must be well anchored in the overall data strategy and objectives of the business.

Stage 4: What should I do?

As we now have established an algorithm that can propose improvement to the business process or services, it is time to decide what to do with that insight. Given that we learned this in a lab environment, Stage 4: What should I do? will focus on how to institutionalize and operationalize the algorithm as a standalone, continuously running an application that supports the business.

Instead of discovering and learning, we now move the application into production and let the business workflow and decisions be influenced by the data and applications. Obviously, many government organizations are not used to allowing algorithms to make decisions. The main questions will be: Is the business ready to let the algorithm decide on its own? Or should the algorithm only provide recommendations and then be controlled?

So, we can use this stage to support the business in the decision supporting process, but also to automate decision making. This is where technology such as recommendation engines, neural networks, complex event processing and heuristics come into play. We emphasize again this must be a business-driven process, not a technology-driven one.

At present, this is the highest form of maturity for a data-driven organization. It is a state where the technology assists actively in the organization's planning and decision process. For mainstream processes like administering grants, licenses and inspections, this may seem like overkill; but for emergency situations, such as rescue operations, it might be highly likely to send in a drone that collects data and let the drone decide what the best immediate response would be.

Impact on people, process and technology

- Impact on **people** aspect

  The idea that algorithms can take over decision-making can be intimidating to the business, so the objectives need to be well established and communicated upfront. Automated decisions in government are subject to more rules than in the commercial/industry world, so we advise caution about how far you want to take this.

  At this stage, the **culture** is one such that the businesspeople trust the insights coming from the data and associated algorithms and turn these into decisions to change the business flow. The difference compared to the previous stage is that this is now an ongoing process, where the data algorithms are running 24×7 and continuously being fine-tuned by new lab projects. Change is a constant, so the algorithm will change over time as well, thereby giving more and better insights as more data is evaluated and the machine learns to make better decisions.

All of this **requires new capabilities,** as business workers are now case experts instead of case handlers. The workplace is transformed into one where people specialize in turning the insights into actions, or letting the algorithm decide on its own, for certain easy cases. Business and IT have now become very close partners as IT people are constantly helping to fine-tune the algorithms with emerging technology that is likely to be in-sourced as a service. Data scientists are now a part of the business team, constantly looking for data to feed into the labs to find better insights. **Data governance and data quality** are now a management priority and constantly maintained at the highest level. The data is now an instrument in the decision-making process of the organization.

- Impact on **process**

  This, Stage 4, is where the operating model of the organization is transformed based on the insights gained from the data. Business planners are authorized to change the way of working based on the results of the analytical applications. For example, the model can be tuned to process submissions automatically if they fall within well-defined parameters. Exceptions to these rules can be rerouted to an expert worker.

  It is not only data that can be shared, but also the insights derived from that data. Cross-organizational collaboration will enable even better government services overall.

  The investment in data scientists, labs, etc. pays off as the operational efficiency of the organization is now more automated and optimized.

- Impact on **technology**

  AI technology is still evolving at a high pace, so IT people will have to continuously monitor new possibilities to further optimize the labs and analytics applications.

Example

Simple government agency processes, like requesting a fishing permit, can be highly automated. The rules are clear, upfront and the fee can be calculated easily, so a civil servant does not need to intervene here. The algorithm can predict the outcome and decide to grant the fishing permit directly, making an entry in the logbook of decisions taken. This improves the citizen's experience and thus provides value to both the citizen and the organization. This process and other similar processes are currently being implemented in the UK (Government Digital Service, 2018).

Another practical example: The algorithm is used to identify suspected fraud. Based on a risk-scoring method, the algorithm can decide which cases are to be subject to further inspection, before automatically granting the service.

An advanced but emerging application here is **digital twins,** whereby a virtual reality copy of the real world is created. In that virtual world, simulations can be run to see what the impact of certain measures would be. For example, the impact on air quality in cities can be simulated for when traffic is redirected or new legislation on exhaust levels becomes effective. This is also where data from sensors from different sources such as cars and the weather is taken into consideration for real-time impact and analysis.

Summary of impact

	People	Process	Technology
Impact	Transformative	Transformative	Transformative
Value	Transformative	Transformative	Transformative

Transformative across the board means that Stage 4 will fundamentally alter the way of working, the operating model, the trust in allowing algorithms to make semi-autonomous decisions, new capabilities and new technology, while maintaining trust and transparency to ensure privacy per GDPR and other legislative frameworks.

These four stages prescribe a typical path toward becoming a data-driven organization. Often, these stages overlap.

Remember: Introducing these technologies can only add value if the business is also changing its operating model or traditional business processes.

Based on these four stages, we define the transformation to a data-driven organization as the journey the agency will undertake to move to at least Stage 3 in this model, and preferably to Stage 4. Note that Stage 4 is not and will never be the end state to being a perfect data-driven organization. As new insights arise, so must the strategy of the organization constantly be monitored and fine tuned. This will impact people, processes and technology and make them move to another level — in a continuous improvement cycle.

Now, let's go one step deeper and translate all these insights into a data strategy.

Data strategy: Five steps toward a data-driven transformation program

Here is a five-step approach for defining your transformation journey to become a data-driven organization.

Step 1: Accept that this is a transformation of your business operating model

Step 2: Create a data strategy aligned with the goal of becoming data driven

Step 3: Set up a data transformation program

Step 4: Innovate via a (business-driven) data discovery lab

Step 5: Implement improvements in small steps

This approach will not provide a single magical answer, but it should help to make clear the type of transformation journey that is best for a particular organization.

The steps are to be taken in a sequential order. First, management must decide that being more data driven will benefit business operations and help make work processes and workloads more efficient. Then, like with any major undertaking, it is essential to realize that undertaking a transformation program without a plan means that it will not happen. A data-driven transformation program will require careful planning, sufficient budget and followup — as well as a broad communication effort to convince government employees that while their role will change, automated decision making will allow them more time for advanced-level work.

Even for a government organization, the journey is one where business and technology will be highly interlinked. Data processing technology has advanced a lot, and we are not seeing the end of investments of large IT suppliers in new features and options, often delivered as a service. This transformation thus also becomes driven by the overwhelming number of tools and techniques that are finding their way to the market and to government organizations.

This will also drive a new way of working, whereby data plays a more central role in analyzing, preventing or predicting when relevant services should be pushed or made available to citizens. Becoming proactive in delivery services means accepting that data will drive decisions, without losing transparency, of course.

We also advocate the installation of a chief data officer (CDO) to keep the focus on data governance for quality and also on the collection and processing of internal and external data, in whichever format (we will shortly discuss the CDO's role in greater detail in this paper). Given that new forms of data are continually becoming available, a good data strategy is key to supporting business transformation.

This will not be a linear transformation. It is a journey that can be taken in many small steps with room for experimenting and tuning the roadmap. But once the journey is started, giving up is not an option. In a sense, it is very similar to the overarching strategy of many organizations to execute a digital transformation. Any data-driven transformation should fit into the broader picture or strategy of a digital transformation.

Step 1: Accept that this is a transformation of your business operating model

According to CXO Transform, *"Transformation is about creating a new future, without the constraints of the past. … [Change] improves the past, while transformation creates the future."* (Llewellyn, 2016)

Becoming a data-driven organization is by default a transformation of the current operating model to a future version of it, based on a high confidence in data. Organizations will have to strategize the future target operating model, and this will undoubtedly result in introducing new (data) capabilities in the organization. This in itself will require new people, processes and technologies to be used to improve the services.

The first question to be answered is "what" to transform, not "how", as that will come later. A data-driven mindset considers new ways to transform business models, how they can deliver better value and experiences to citizens, operations and the workforce. The mindset calls for new ways of operating within the organization and with its workforce, citizens, partners and external talent.

It might be necessary to first spend some time educating and aligning leadership. Typically, there will be positive and negative reactions, so the CEO needs to get everyone aligned to move forward. This can only be done by focusing on the added value the transformation will bring.

One may think that this journey needs to be plotted over a longer period of, let's say, 3 to 5 years. Research has shown that charting the roadmap for just the next 12 to 18 months is best, as beyond that — given the rapid pace of change and disruption in technology and also on a political level — you will need to revisit this journey anyway. So, becoming a data-driven organization is an ongoing process, not a one-off project.

You first need to assess the current level of transformation readiness of the following readiness factors: Culture, governance, innovation capabilities, digital capabilities, transformation management capabilities, organizational structure, and any transformation barriers that might compromise the transformation in any way.

At this stage, it is important to create the business case for the transformation. The business case will contain the following elements:

- Vision
- Anticipated value
- Roadmap for how and how much service delivery efficiency will increase
- Indications of how the service quality will improve — i.e., how this may lead to new or proactive services for citizens, how this will lower the risk of failures due to human errors, how this will solve known workload problems, etc. *The whole case is to be based on optimizing the experience of the citizen and improving the services accordingly.*

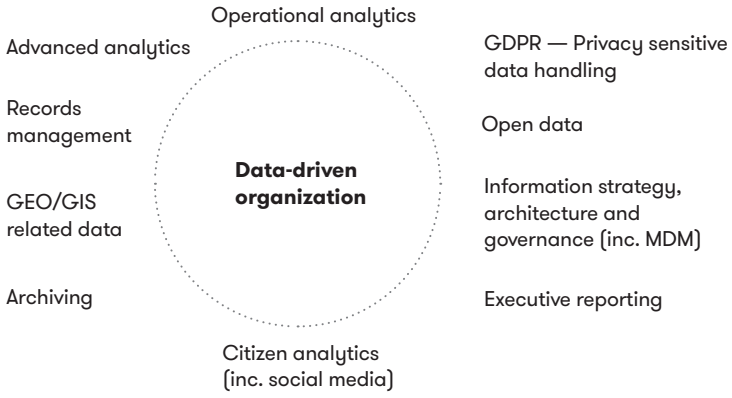
Small experiments or data use cases can help make the benefits clear to the organization's directors, but avoid letting the experiments move into production without a proper plan or strategy. It is wise to document the data use cases so they can later be included in the transformation journey.

As with any transformation, this process will bring immense change to the organization. We therefore advocate addressing the human element of business transformation. You will have to deal with the people who have to change their ways of working. This involves setting up a foundation for effective change management with respect to governance and assessing organizational change readiness. Establishing and implementing stakeholder communication and performance management strategies, and continuously receiving feedback to make improvements, are critical. ADKAR is a good method to consider for this; see https://www.prosci.com/adkar

Step 2: Create a data strategy aligned with the goal of becoming data driven

(May include creating the role of a chief data officer.)

Becoming a data-driven organization is highly dependent on the data and its quality, as the data will be the enabler for making sound decisions.



Governments have quite some experience already in exposing data as open data to the world. Valuable lessons on data governance and quality can be derived from such programs, and now taken a step further internally.

With the emergence of new forms of data produced by many devices connected to the internet (i.e., IoT), the government should also envisage these data streams to be part of the data strategy. As such, there are several dimensions of data to be handled in a data strategy.

Gartner states that there are three kinds of trajectories for using data, and all three need to be part of your strategy (White, 2019). These tend to focus on:

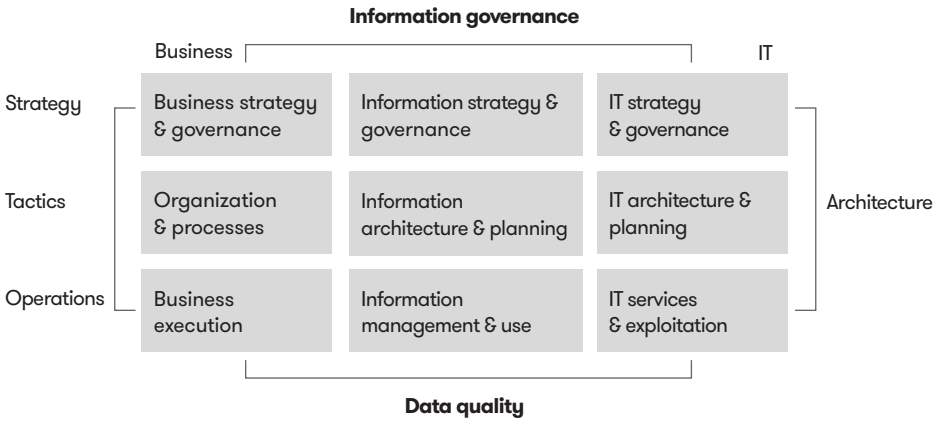
- **Data and analytics as a utility —** A generic capability, this should be available to everybody for myriad requirements and for all kinds of intended business value.
- **Data and analytics as an enabler —** Always targeted toward a specific business goal, the secondary value should come from reusing the data and analytics for other business purposes.
- **Data and analytics as a driver —** A means to achieving new business goals, new tools can uncover new insights, and new data types can lead to new business questions; both drive new business ideas and revenue sources.

KPMG provided a nice model in the report. "*Better data, better government*" (KPMG, 2016) that makes the case that effective use of data and analytics can help governments at all levels deliver improved citizen services and outcomes.

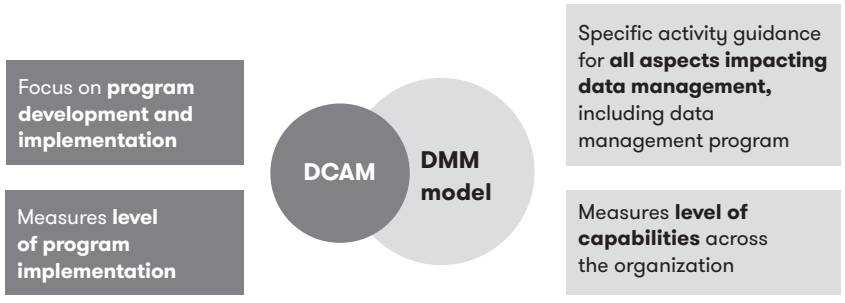
Strategy

Organization	**Data**	**Technology**	**Analytics**
Culture & change management	Governance and quality	Infrastructure	Advanced analytics
Capabilities & process	Integrated data & information management	Platforms & tools	Reporting & visualization

Any data strategy should encompass all of the above-mentioned elements — and we must repeat here that a data strategy is much broader than merely selecting the right technologies.



We also find guidance on how to create an overall data strategy in the Amsterdam Information Management model (AIM), which is based on the Generic Framework of Information Management model (Maes, 2003). The AIM enhances the model by focusing on putting information right in the center of any "business – IT" alignment model.



DCAM

Designed to measure progress toward full implementation of a data management program

DMM model

Designed to provide detailed guidance via a ladder of increased capabilities across all activities

Finally, there are good frameworks out there like DAMA DMBOK (DAMA.org, 2013), DMM (CMMI Institute, 2019) and DCAM (EDM, 2019) that provide a more detailed approach to data governance and quality as cornerstones of a data strategy. Each offers a slightly different focus, so depending on where you are today, you may prefer one or the other.

The chief data officer (CDO)

As we mentioned a moment ago, to make sure the data strategy is fully owned inside a government organization, we see a new executive role emerging, namely that of the **chief data officer (CDO).** Over the last few years, a number of cities and states in the United States have created a CDO to lead their efforts toward data-driven government.

There is wide variation in the responsibilities of CDOs. Some focus solely on open data programs, while others focus on applying geographic information systems (GIS) tools to streamline these publications; some supervise performance management, and still others are taking on advanced data analytics projects as their primary focus. According to one paper on this topic: Regardless of the scope of their responsibilities or size of their team, CDOs share a common goal: *to increase capacity for making data-driven decisions in government* (Wiseman, 2017.)

Where the tasks of data strategy, governance and quality measurement were (or are) typically executed by the CIO, the duties are shifting to give more focus on data. The paper mentioned above provides an overview of the differences.

Operations vs. strategy: Key differences between CIO and CDO roles

Role	Key data responsibilities	Key external partner responsibilities
CIO	Build and maintain enterprise data systems that produce large volumes of data	• Run procurement process and select vendors • Manage vendor relationships • Identify and develop external pro bono partnerships
CDO	Use data in describing, mapping and modeling to identify patterns to derive business value and policy insight	• Work with contracted vendors • Identify, develop and sustain external partnerships by working collaboratively on analytics projects. Partners can include civic tech community, business partners for pro bono work and academic partners

The same paper also suggests how a CDO should operate in a government context:

The impact of a CDO can be significant and lasting — they have the power to foster a culture of data use across organizations and create more impact in using data. In moving their government toward data-driven decision making, the CDO faces the classic trade-off between doing the work for organizations and "teaching them to fish." In many cases, the CDO has no choice but to build distributed capacity.

CDOs are becoming culture change agents in moving their government organizations toward data-driven decision making. The article "Better data, better government" (KPMG, 2016) also makes the case for a chief data officer, stating that their responsibilities typically include:

- Acting as a data and analytics evangelist and champion
- Promoting data sharing both internally and externally; facilitating data-sharing agreements
- Managing open data policies and developing guidelines to help agencies and departments identify and prioritize meaningful information and data sets
- Coordinating cross-department/agency data and analytics initiatives
- Facilitating standardization of enterprise data and analytics assets; promoting data and analytics standards in departments and agencies
- Enabling enterprise data governance
- Developing data as a service; providing transparent, easy access to all consumers of data independent of data location, format or platform
- Leading the development of an enterprise data strategy and plan

Some government organizations have established and published their data strategy. Examples of these include the following:

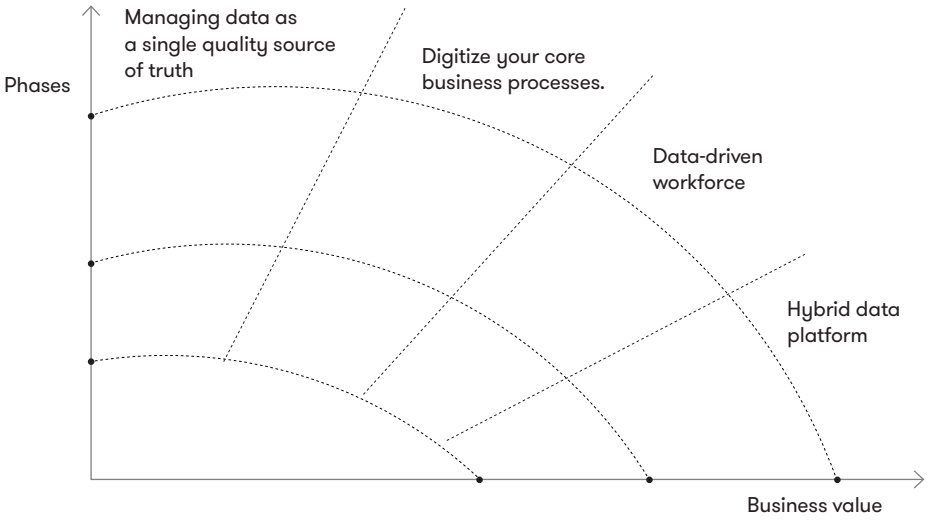
- **UK:** Today, few countries or governments have a national data strategy. The UK has started an initiative to deliver such a national approach in 2020; see https://www.gov.uk/guidance/national-data-strategy
- **Dubai** has an ambitious and far-reaching "smart city" strategy that aims for Dubai to be the world's best-connected, smartest and happiest geographic area. This vision is underpinned by the Dubai Data Initiative, which aims to open or share 100 percent of public sector data by 2021. The Dubai Data Law is supported by a clear set of published policies, setting out the strategic objectives and principles that drive work on Dubai Data; see http://dubaidata.ae/dubai-data-strategy.html
- **Singapore:** Another good example can be found in the Singapore Government strategy. To quote their words, *"Data will be an increasingly important source of comparative advantage, and we need to improve our ability to use it productively in the economy."* (Singapore, 2017)

Step 3: Set up a data transformation program

All right: Now that we have executive alignment and have drafted a strategy and a business case, it is time to convert all this into a transformation program.

We advocate bringing onboard the necessary transformation management capabilities. This is no different than for other programs. Roles include an overall transformation manager, one who preferably reports to the executive leadership; this can be the CDO or another person. Further, we will need qualified project managers — and do not forget to include operational change managers, certainly necessary when we start changing the operating model or the business processes. No business process should be changed "just like that" but always well fitted in the journey and only after appropriate business case validation.

The next step is to translate the strategy into an actionable roadmap that links the initiatives to measurable business objectives. It helps to visualize this via a graphical image:



When an organization is not yet ready to commit to a full transformation journey, it is advisable that they set up a data discovery lab to experiment first with what the use cases for data transformation might be. We will discuss this shortly.

Communicate broadly and get people's buy-in to the idea that this transformation will improve service delivery and that every person's role is important but at the same time, will change.

Step 4: Innovate via a (business-driven) data discovery lab

The government organization must realize that without having innovation capabilities as part of the transformation, many of the projects or use cases will focus on doing the same things but just with new technology added.

Being innovative is not just a matter of asking people to be more innovative. You need to foster a culture that thinks about removing barriers to changing the operating model, which may include thinking about removing legal restrictions. The primary goal of the transformation is still to aim for business model innovation — instead of merely service innovation — because that is where the most efficiency gains will be.

The next part of the equation is to make sure the IT department is fully on board with the plan. Here as well, there will be a need for new capabilities in emerging data processing technologies, including machine learning and AI. It is likely that these capabilities are not yet mature enough, relative to traditional IT capabilities, to support the operational needs of the organization.

This may sound like a lot of preconditions. We can, however, bring these elements together in the creation of a **data discovery lab.** Discovery labs are intended to enable organizations to reach the level of innovation required for new or improved data-driven projects. Such a lab will help to create a bridge between business and IT. Business and IT teams can work well together, but both professions use different tools and practices and have different expectations. An IT person may prioritize efficient functionality over usability, while their more business-minded colleague may focus on comprehensive reporting via a lean and efficient architecture. If these differences are not addressed, it can create misunderstandings that may hamper productivity. Moving toward having mixed "business and IT" teams helps mitigate this and fosters insight and understanding of the other's view.

An engagement in the lab is basically a project with a defined approach in which business and IT people come together in a short cycle of 6 – 8 weeks to validate a data use case. It always starts with the formulation of a business data use case. Then the IT team will have to spend some time collecting and preparing the data and setting up the technology to process the data. Often, in the beginning, these labs are facilitated by external resources, certainly for the technology part or to bring in certain capabilities like that of a data scientist. And note that these lab engagements are never marathons but are to be executed in many small sprints.

A data discovery lab is also a great way to get your business people acquainted with the possibilities of advanced analytics. It will be a learning environment, as it is an experiment, and it should avoid being threatening. It requires an open and innovative mind, as this is all about participation.

These labs should focus on engagements that are based on a reproducible workflow, from raw data through the different processes such as cleaning, enriching, modeling and uploading the data in the available technical environment. The workflow must be reproducible in the future, as needed. This will keep the use case relevant when new insights are learned. Additionally, data discovery labs must be able to quickly test findings during production without having to go back to square one. A good approach is the CRISP-DM (Shearer, 2000) methodology, mentioned earlier in this paper.

Remember that a data discovery lab is not the end result; rather, it is the start of discovering new insights that can move into production. Engagements do not always produce results — not discovering a pattern might be a good insight, too. The possibility of this risk can make the business side of the government organization reluctant to incur the time and cost to execute the lab — and that is why leadership support and good communication are essential, i.e., that such a lab is part of the transformation experience.

When the organization becomes more mature and experienced, the data discovery lab can be an ongoing part of the transformation where data use cases are validated and tested before moving to production.

Step 5: Implement improvements in small steps

Gartner coined the term "bimodal approach" for IT, whereby we recognize different models for creating and/or maintaining systems of record vs. systems of engagement or innovation. We now see the term "bimodal analytics" emerging as well; this term acknowledges the same principles for analytics applications. It recognizes that both operational reporting and advanced analytics will coexist in an organization but with a different support model or life cycle; both will have their own cycle of development and operate independently (but remain interrelated).

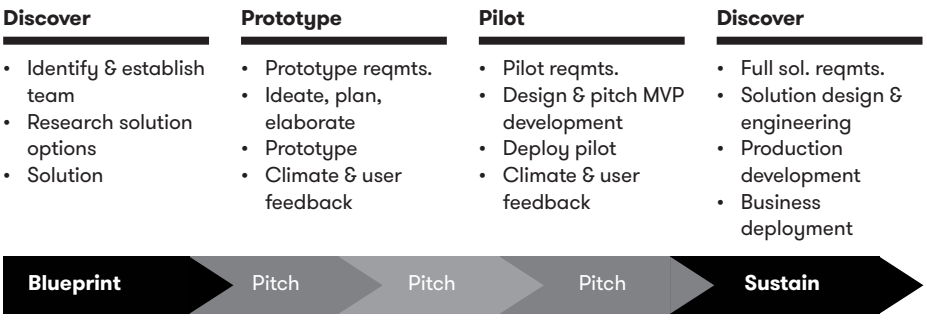
Gartner provides the following advice:

- Create separate working environments for Mode 1 and Mode 2 Analytics
- Launch Mode 2 Analytics projects to quickly build advanced analytics capabilities for innovation
- Define a change management process that aligns with business and IT stakeholders' requirements and expectations before deploying innovation projects
- Ensure a smooth deployment for handoffs

This advice is in line with the four stages toward transforming into a data-driven organization, which we described earlier. There will always be a Stage 1 where operational reports continue to provide value to the organization. Often built on traditional reporting tools, this environment will continue to be improved, and new reports will be developed over time. This is what Gartner describes as Mode 1 Analytics.

What we are advocating is to implement the Mode 2 Analytics right next to it. In our model, advanced analytics emerge in Stage 2 and do require a different approach; this is why we proposed the idea of creating a data discovery lab in Stage 3. This is what Gartner refers to as Mode 2 Analytics.

The dynamics of Mode 2 Analytics are different from Mode 1; in Mode 2, we will take many little steps forward instead of taking one big step ahead every year or so.



The figure shows the four different steps that work toward improving the service based on new data insights:

- In the **Discover** step, we create data use cases and do an early validation of what the value of these cases might be.
- In the **Prototype** step, we use the data discovery lab to work on the use case, after having collected the right data.

- In the **Pilot** step, we use the results or insights of the data discovery lab to create an analytics application that can run constantly and advise government officials/ civil servants on what to do.
- After the Pilot step, if the results are satisfactory, we can **scale** them out to production and obtain maximum value from the new analytics application.

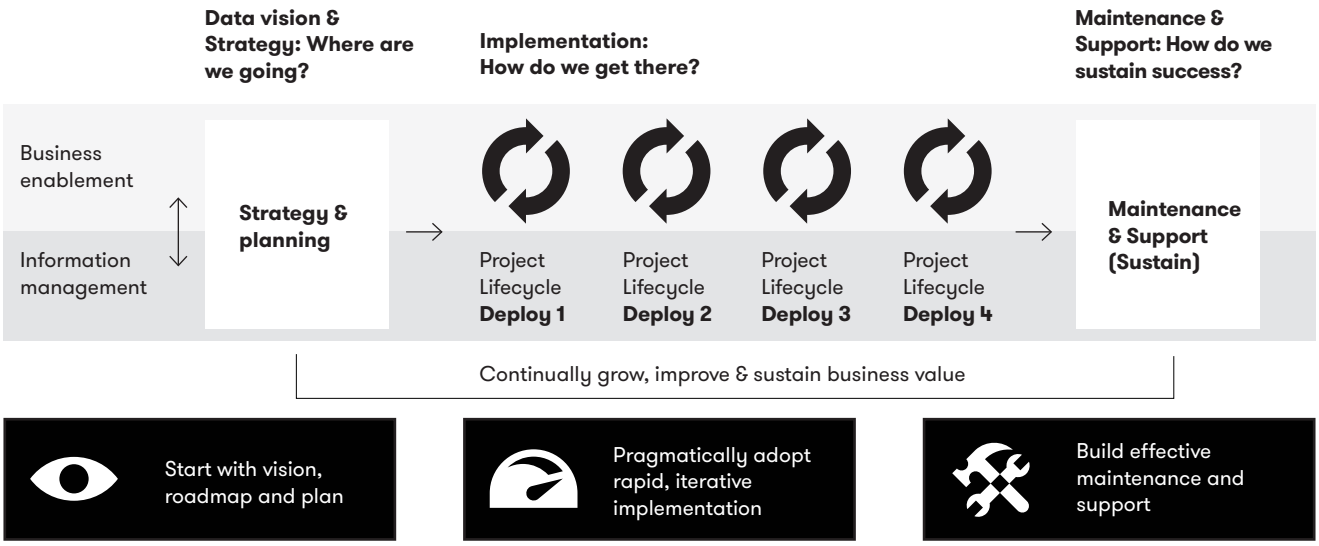
Although we have been focusing on data discovery labs, the same steps can be applied to application or services or redesign. In fact, the above approach fits any modern, agile way of working and incorporates new IT technology, or digital enablers for becoming a data-driven organization.

Closing summary

At this point, it should be clear that becoming a data-driven government organization requires a strong and clear vision supported by a good data strategy, and well governed and managed in execution.

Becoming a data-driven organization needs a thorough transformation mindset, and it will not happen overnight. Business and IT must be one team in mindset and culture, where the sole objective of all stakeholders is to use technology to improve the services or the experience of citizens (the end "consumers") and add value to the efficiency of the organization. The further you take this journey — based on the four stages that we have discussed in this paper — the more impact it will have on the operating model and capabilities needed.

When we put the five steps that have been described together in a visual model, we can see how they are interlinked and contribute to the success of a data-driven organization:



By now, it will be clear that this is not a linear process with one big implementation but an ongoing cycle that can deliver many small improvements.

Our final advice is to let yourself be inspired by other organizations, find your own way and do not copy what the others are doing. Every government's organization's journey is unique, and yours will have to find its own pace (and peace) with the many steps forward. Work with an external expert to develop a discovery lab, and see how insights can lead to value.

About the author

Yves Vanderbeken is the chief technologist for DXC Technology in Belgium. His focus is on delivering innovative approaches for digital services transformation, deriving public and business value from data, and helping governments at all levels realize benefits from consolidated platforms and shared services models associated with adoption of new digital strategies based on the principle of "Everything as a Service."

Yves has been a core team member of the Flemish Government's Open Data team since 2011. He coaches and advises government organizations on their (open) data strategy and overarching IT strategy. He graduated in 2018 from the Antwerp Management School with a master's degree in IT management; his thesis focused on how to create value with data in government organizations.

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City, ST 12345
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