Government as a Platform: Public Values in the Age of Big Data

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Abstract
The Dutch government is exploring the use of big data methods to help carry out their tasks in providing public good. Several Dutch agencies are taking their first steps, including the Dutch Tax Office, the Vehicle Authority and the National Police. This paper studies big data from a legal perspective: what is the relationship between using big data methods, specifically machine learning, and the principles of proper government that are part of the Dutch Administrative Law.

Big data has two central components. The first looks at the nature of the data and the second looks at the data analysis. This paper focuses on the latter: machine learning as a big data method to analyse data. Machine learning is a form of artificial intelligence: computer modeling of learning processes. The Centre for Internet and Human Rights has raised concerns that complex algorithms like machine learning are "often practically inscrutable to outside observers." Burrell (2016) and Pasquale (2014) have also pointed to the opaque, black box nature of machine learning algorithms. But there are also many potential advantages to big data. Big data can help develop self driving cars, diagnose diseases and predict and detect fraud while reducing costs.

This paper briefly looks at the application of big data in the context of the Netherlands Vehicle Authority (RDW). The RDW explored using big data to improve two business processes: periodical technical inspection (PTI) and import of vehicles. These cases were studied from the legal perspective of the Dutch principles of proper government and two principles were singled out: motivation and diligence. The big data applications proved to have a problematic relationship with these two principles of proper government.

The drivers for introducing big data are strong. Gains in efficiency and efficacy are most appealing in a time of constant pressure on government to cut spending while improving public services. But there is also pressure to comply with Dutch and international law. This paper draws attention to the legal questions that big data raises and looks at ways to move debate forward by embracing the notion of Government as a Platform.

Big data in the Netherlands
In the Netherlands, a growing number of government agencies have started exploring the application of big data solutions to their work. This paper addresses the challenge and opportunities big data poses to the way government is organised. Using big data methods in the public sector raises legal concerns, particularly with regard to Data Protection legislation and Administrative Law.

This paper will address the following research question: What is the nature of the relationship between big data applications and public values, enshrined in the Dutch Administrative Law and its

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This paper is based on a master thesis written by the author, while he was working for the Netherlands Vehicle Authority. He currently works for the Dutch Finance Ministry. Please find the thesis document here: https://vanhaastertblog.files.wordpress.com/2016/08/thesis-hugo-van-haastert.pdf

principles of proper government*?*

In order to answer the research question, this paper will look at the use of big data in the Dutch public sector, the definition of big data, the principles of proper government, two case studies with the Netherlands Vehicle Authority and the relationship between these case studies and the legal framework. Please note that this paper is a short (and revised) version of a master thesis at Erasmus University Rotterdam by the author.

A growing number of Dutch government agencies is exploring the use of big data. The National Police are involved in deploying predictive policing (Rienks, 2015). The Tax Office looks at risk profiles to track down tax evasion and fraud (Correspondent, 2015). The Telecom Agency uses big data to predict abuse of frequencies (Sogeti, 2013). Municipalities are exploring big data applications to improve their public service to their inhabitants, as part of their 'smart cities' agendas (Meijer & Bolivar, 2013). And the Vehicle Authority (*RDW in Dutch*) is exploring big data to better carry out their tasks in the field of vehicle admission, periodical testing of vehicles and import of vehicles.

MIT professors Brynjolfsson and McAfee (2014) have studied the way that big data and artificial intelligence can help replace cognitive labour. Their quote illustrates how they signal the emergence of technology that could improve lives and services:

"For years we have studied the impact of digital technologies like computers, software, and communications networks, and we thought we had a decent understanding of their capabilities and limitations. But over the past few years, they started surprising us. Computers started diagnosing diseases, listening and speaking to us, and writing high-quality prose, while robots started scurrying around warehouses and driving cars with minimal or no guidance. Digital technologies had been laughably bad at a lot of these things for a long time – then they suddenly got very good."

Big data and artificial intelligence are paving the way for smart computers to carry out an increasing number of tasks. Algorithms can learn how to drive a car, they can discover patterns in patient data to help diagnose diseases. They can predict fraud and illegal acts, helping governments supervise the market place and reduce risk in society at large.

Next to the debate on the potential benefits of big data, there is also an ongoing debate about technology and ethics. The Dutch Scientific Council on Public Policy (*WRR in Dutch*) has warned that the introduction of an information government means that the relationship between citizens and government is changing (WRR 2011, p. 11). The WRR notes that there is growing enthusiasm in government and politics to embrace technology to solve problems, which leads to ambitious IT projects. All layers of government, from local to European government, are connecting their datasets (WRR, p. 12).

The WRR warns that employing IT fundamentally changes the primary process. Political enthusiasm for IT goes hand in hand with increasing efficiency and efficacy. The values of efficiency and efficacy seem to be more important than values such as transparency and accountability (WRR, p. 13). When IT is discussed in the public sphere, the WRR signals that the focus lies on technological aspects, rather than on the legal and social consequences of employing IT (WRR, p. 14). IT is no longer a supporting technology, but it has become an essential part of the primary process of government: IT is at the heart of government (Thaens, p. 15).

The WRR presented a study on big data in 2016 (WRR, 2016a). In their study, they stress the need for strengthening civil liberties in the light of big data developments. They recommend stronger regulation and oversight of big data in the public sector, through enhanced transparency of the data processing techniques. They voice concerns over what they call the privacy paradox: citizens are becoming more transparent, while companies and governments are becoming less transparent about their modus operandi. The WRR recommends reversing this trend. To achieve this, supervision should be strengthened and the ban on automated decision making (part of the European General Data Protection Directive) by government must be respected (WRR, 2016a).

The WRR contends that the power balance between citizens, government and business is shifting towards the latter two as a result of big data. The role of government is to strengthen the position of the citizen in this light by improving their information position. Only by being open about what is done with (personal) data and which consequences this has for the individual, can citizens counterbalance the growing power of government and business.

Defining big data

There are various definitions of big data. For the purposes of this paper, I will use the definition that is used by Beyer & Laney. They define big data as follows:

"Big data are the production and analysis of data that are characterized by large volume, rapid velocity (i.e., real-time or nearly real-time information), and sheer variety (i.e., formats that include text messages, images, readings from sensors, GPS signals, and more, and that originate from laptops, smart phones, tablets, and other devices), that require new forms of processing to enable enhanced decision making, insight discovery and process optimization" (Beyer and Laney, 2012).

This definition emphasizes two central components of big data: the production and analysis of data. The first aspect are the three V's: Volume, Velocity and Variety. This aspect of big data relates to the traits of the data itself. The second aspect of big data is the new form of processing: the analysis of the data which enables enhanced decision making, insight discovery and process optimization. The focus of this paper is limited to the method of data analysis known as machine learning. Machine learning is one way of processing data and there are many more.

Boyd and Crawford (2012) argue that big data is mostly about this second aspect of the definition, "a capacity to search, aggregate, and cross-reference large data sets". Data analyses are made using algorithms. White House big data report authors Podesta et al. (2014) describe algorithms as "a sequence of steps and instructions that can be applied to data. Algorithms generate categories for filtering information, operate on data, look for patterns and relationships, or generally assist in the analysis of information. […] So-called "learning algorithms" which underpin everything from recommendation engines to content filters evolve with the datasets that run through them, assigning different weights to each variable."

At the Global Conference on Cyberspace (GCCS) in The Hague, the Netherlands in April 2015, the German Centre for Internet and Human Rights (CIHR) published a research paper titled "The Ethics of Algorithms" (CIHR, 2015). In their paper, the authors signal the "advances in machine learning which allow artificial intelligence to perform tasks that were outside its reach just a few years ago." They draw attention to the fact that algorithms are increasingly making decisions for us, about us or with us.

The CIHR points out in their paper that complex algorithms "are often practically inscrutable to outside observers" (CIHR, p. 3). "They can even be hard for people to understand, even if the original source code was shared with competent observers. Algorithms perform complex calculations that follow many potential steps along the way and can consist of thousands or even millions of individual data points. Algorithms act in a way similar to living things: it is not easy to always understand or predict what they do, and how, even if we have a broad understanding of how they work".

"Through increasingly advanced machine learning systems, such algorithms can fine-tune themselves, learning over time what works and what does not in complex ways. Hence, a hiring algorithm requires large amounts of data from each hire, which are later matched with performance and turnover metrics. Such a machine learning system will not just be too complex to understand because the code is complicated, but it will also be doing things that the programmers did not program directly" (CIHR, p. 5).

The rise in learning algorithms and artificial intelligence comes together in the concept of machine learning. Michalski et al. (1985) place machine learning in the context of artificial intelligence. "Since the inception of the computer era, researchers have been striving to implant learning capabilities in computers. Solving this problem has been, and remains, a most challenging and fascinating long-range goal in artificial intelligence (AI). The study and computer modeling of learning processes in their multiple manifestations constitutes the subject matter of machine learning" (Michalski et al., p. 3). Arthur Samuel defines machine learning as a "field of study that gives computers the ability to learn without being explicitly programmed" (Simon, p. 89). Both definitions place machine learning in the tradition of artificial intelligence: computers that can learn and hence become smarter and more intelligent.

Professor Burrell (2016) points to the role of machine learning in socially consequential mechanisms of classification and ranking, such as fraud detection, insurance or loan qualification and credit scoring. These mechanisms rely on algorithms, which are in many cases machine learning algorithms. A given machine learning algorithm, Burrell explains, generally includes two parallel operations: a classifier and a learner. Classifiers take input and produce an output. As an example, if you want to diagnose diseases, you may take input as blood test results and produce a diagnosis as output. Machine learning algorithms called learners must first train on test data. The learner looks at a set of (historic) data, learns from this and recognises certain patterns, which can then be used to draw conclusions on a new set of (present-day) data. This second type, the learner, is what is used by the Vehicle Authority in the cases that will be elaborated upon in the following sections.

Perspectives on big data

We are building a new digital society, and the values we build or fail to build into our new digital structures will define us. Critically, if we fail to balance the human values that we care about, like privacy, confidentiality, transparency, identity and free choice with the compelling uses of Big Data, our Big Data Society risks abandoning these values for the sake of innovation and expediency. (Richards & King, 2014)

There are numerous advantages and disadvantages to big data. The White House study on big data mentions many potential benefits, including 'opportunities for big data to grow the economy, improve health and education, national safety and energy efficiency.' Big data also contains potential 'solutions that can enhance accountability, privacy, and the rights of citizens' (Podesta,

2014). The big data promise of greater efficiency and efficacy is also appealing to the European Commission, which has published a Digital Agenda towards a Data Driven Economy (European Commission, 2014).

The Dutch Rathenau Institute also signals the potential benefits of high-resolution or precision management. With the growing availability of data from sensors, camera's and other Internet of Things devices, the data streams can be analysed real-time using big data techniques. This would make it possible for governments or businesses to exert very high levels of control over various subjects: machines, workers and citizens. Through precision management organisations could strive to end waste and inefficiencies on a massive scale (Van Est & Kool, p. 56). Similarly, the case studies of the RDW big data applications demonstrate large potential gains in efficiency.

Concerns over big data

A growing number of publications also focus on the risks and disadvantages of using big data. Boyd and Crawford (2012) reject the blind trust in numbers and data, the claims to objectivity and accuracy and the assumption that mining data because it is available is always ethical. They also warn for a growing digital divide that is created by a small number of multinationals owning a lot of data and the dependence of scientists and citizens on this small group of companies. Barocas and Selbst (2015) agree with the critique that algorithmic techniques are neutral nor objective. They warn that patterns found in big data could simply reproduce 'preexisting societal patterns of inequality and exclusion'. The White House report on Big Data voices similar concerns that algorithms could discriminate (Podesta et al., p. 7).

Evgeny Morozov (2014) has concerns over technological solutionism and this quote illustrates his objections:

"Imperfection, ambiguity, opacity, disorder and the opportunity to err, to sin, to do the wrong thing: all of these are constitutive of human freedom, and any concentrated attempt to root them out will root out that freedom as well" (Morozov, p. xiv)

Professor Andrej Zwitter from the University of Groningen specialises in Law and International Relations, but has also developed a keen interest in big data. Zwitter sees a fundamental problem with big data algorithms making government decisions. "Before government can make a decision, the recipient has a right to a legal explanation; i.e. reference to the law and reasons why the decision applies to that law. If you have an algorithm making that decision, you do not know what the evidence base is. It's a question of legal certainty and transparency. It shakes the fundamentals of rule of law. The only legally viable option will be to accept that eventually it still has to be the human person that writes the decision. The principle of rule of law is that you have the right to face your accuser. You can't face an algorithm. So I think the only consequence is machine-supported decision making rather than machine decision making."

Opaque nature of machine learning

Another concern regarding big data is raised by professor Burrell (2016). She considers machine learning to be a socially consequential mechanism of classification and ranking which is opaque. Machine learning has real consequences for the ability of people to get a loan at the bank or access to health insurance. But the way companies decide who gets access to certain products at what fee is done through opaque machine learning algorithms. "Algorithms use data as input and produce an output: a classification. They are opaque because if one is a recipient of the output of the algorithm, rarely does one have any concrete sense of how or why a particular classification

has been arrived at from inputs."

Burrell points out that machine learning is only part of the algorithmic ecosystem. "Machine learning do not encompass all of the algorithms of interest to scholars now studying what might be placed under the banner of the politics of algorithms." There are certain companies that avoid using machine learning. The Fair Credit Reporting Act, for instance, requires companies to provide reasons when denying consumers credit. That reasoning can't be supplied when using machine learning to determine access to credit. The same development is taking place in the development of self-driving cars: some scientists developing self-driving car algorithms refuse to work with machine learning because "You don't know what it learns (Both, 2014)."

In the United States, Law professor Pasquale (2014) criticizes machine learning algorithms in his book 'The Black Box Society' because of the secrecy and lack of transparency surrounding algorithms. His concerns echo those of Burrell. In his book, Pasquale argues for the use of auditors who have access to the code to assess whether the consequences of algorithmic decision-making are not discriminatory.

Public values

In essence, the proponents and opponents of big data and machine learning algorithms are concerned about the effect that big data will have on producing public value. The proponents point to advantages of efficiency. Big data could make government better at carrying out their tasks of keeping our streets safe and promoting a fair society, all at a lower cost. Artificial intelligence would simply be very effective at solving complex problems in our modern age. Opponents voice concerns over the objectivity of big data and the risk of restricting autonomy and accountability, while giving away essential decision-making powers to opaque artificial intelligence mechanisms.

These concerns fit well in the public values framework developed by professor Colin Talbot. Talbot (2008) distinguished four competing public value clusters. The introduction of big data is driven mostly by the need for lower costs and efficiency, while there are concerns over the consequences for collectivity, autonomy and personal utility. These values will have to be balanced if the application of big data is to enhance trust and legitimacy.

Figure 8 Competing Public Values

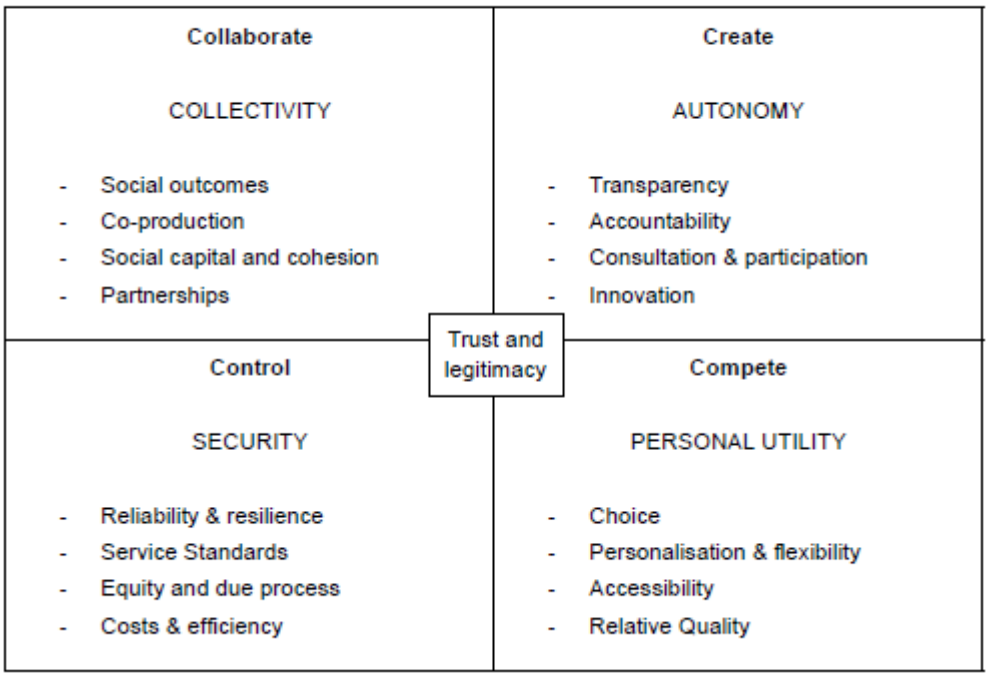

Figure 1: Public Values framework

Legal perspective

When developing big data applications in the Dutch public sector context, a number of laws are relevant. In this paper, the focus lies on the Dutch Administrative Law. There are other relevant laws in the Netherlands and other countries. For a brief overview of an international comparison, please read the WRR study 'International and comparative legal study on Big Data' (WRR, 2016b). Below the Dutch Administrative Law will be elaborated upon, while the new EU General Data Protection Regulation (GDPR) will also briefly be discussed.

Principles of Proper Government

The Dutch Administrative Law has a number of Principles of Proper Government (*Dutch: Algemene beginselen van behoorlijk bestuur*) that outline what conditions need to be met by government agencies when they take decisions that affect citizens or businesses. The Administrative Law is there to protect citizens and business from government, because without restraints the government might abuse their powers.

The Principles of Proper Government include diligence, uniform preparation, publication and motivation. This paper looks closely at the principles of diligence and motivation.

Diligence: "When preparing a decision, the government agency collects the necessary information and knowledge pertaining to the relevant facts and the weighing of different interests." If government wants to make just decisions, it will have to know the circumstances and the context of that decision. If the government neglects to consider a specific interest or if it bases its decisions on incorrect information, a judge may rule the decision null and void.

Motivation: "A decision needs to be based on a decent motivation." This motivation needs to be mentioned when a decision is made. Parties that are affected by a government decision can request a motivation for that decision.

These two principles will be used to ascertain whether the introduction of big data in government decision making within the Netherlands Vehicle Authority can be reconciled with the Dutch Administrative Law.

European data protection
The European Union has recently adopted their General Data Protection Regulation (GDPR, Regulation 2016/679), which intends to strengthen data protection for EU citizens. It enters into force in May 2018. The regulation applies to processing of personal data, including automated and semi-automated processing. The regulation does not apply to the security and justice domains.

The GDPR stipulates that processing of data should be lawful, fair and transparent to those affected. Organisations that process personal data must prove that they adhere to the principles of the GDPR. Citizens will see their information position strengthened as a result of the GDPR. Relevant to the introduction of big data is the stipulation that organisations have to be transparent about the existence of automated decision making, profiling and the logic behind it.

Article 22 of the GDPR specifies that citizens have the right not to be subjected to decisions with legal consequences made through automated processing of data and profiling. This rule does not apply if national law specifies otherwise or if citizens accept the decision. National law can exclude certain domains from the scope of these rules, such as in the field of security, defense, fiscal rules, the judiciary and supervision.

In general terms, the GDPR seeks to defend legal principles such as legal certainty, the presumption of innocence and the rule of law. Some contend that these fundamental legal principles are being threatened by the introduction of artificial intelligence algorithms.

Case study: Netherlands Vehicle Authority
The Netherlands Vehicle Authority (*Dutch: Rijksdienst Wegverkeer (RDW)*) has explored the use of big data in carrying out their public tasks. These tasks include enforcing vehicle safety standards, regulating import and export of vehicles, allowing new vehicle types on the European market and registering vehicles. For these purposes the RDW has 16 inspection stations across the Netherlands and a large test track. These tasks, including supervision of the periodical technical inspections (PTI's) process and the import of vehicles, could be carried out with far greater efficiency when enhanced with big data technology.

The RDW already works with a lot of information provided by customers, businesses and collected by the government. Much of the RDW services are provided online, which is part of the Dutch government initiative to provide all public services digitally per 2017. Given that the major tasks of the RDW are already carried out using large amounts of data, there is a keen interest in exploring how the RDW could benefit further from making the organization more data-driven.

In this section, the two cases of big data applications within the RDW are briefly presented. For a more detailed description, please consult the original research document.

Case 1: Periodical Technical Inspections
The RDW is responsible for supervising the Periodical Technical Inspections that take place in the Netherlands. These inspections are carried out by private sector garages. Almost all vehicles have to be inspected annually and RDW oversees legal compliance.

RDW supervises PTI's by carrying out a select sample of 3% of all garage inspections. Garages inspect vehicles to determine their roadworthiness. In 2014, RDW carried out 217.193 such sample inspections. The decision that this paper focuses on is whether the RDW will send an inspector to the garage to determine the correctness of the PTI outcome.

Machine learning could predict whether a garage is falsely releasing a car back on the road. This way the effectiveness of the 3% select sample could become much larger, which could benefit the safety of all Dutch vehicles on the road. The decision however does not directly affect the car owner, because the ultimate decision on roadworthiness is still done by man: the RDW inspector in this case. Thus the big data decision would be about whether a PTI will fall within the 3% select sample.

Given that the RDW records all PTI data from all Dutch garages, including the select sample outcomes, the RDW has enough historic data to make predictions on legal compliance in future PTI cases. The accuracy of the machine learning predictions was 95%. This would greatly improve the effectiveness of the 3% inspections. The programme manager big data at RDW however also stated that the workings of the AI algorithms in machine learning could not be scrutinised, because these operate as a black box. How the probabilities are calculated is unknown.

Case 2: Import
The RDW inspects all vehicles that are brought into the Netherlands for import purposes. Roughly 200.000 vehicles were imported into the Netherlands in 2014. Only after successful inspection at an RDW inspection station can vehicles be issued a Dutch license plate. At present, 100% of all import vehicles undergo inspection. RDW inspectors look over the paperwork and perform a technical inspection. The decision to allow a vehicle to carry a Dutch license plate could be made more data-driven through big data risk assessment.

Using machine learning, the data on import vehicles could be analysed to assess which vehicles are likely to be compliant with vehicle regulations and which are not. Citizens and business could be asked to provide more relevant data on the vehicle they wish to import. Using machine learning risk assessment, predictions could help relatively safe vehicles go through a light inspection regime while relatively unsafe vehicles would undergo physical inspection. This could potentially cut the workload at RDW inspection stations drastically. In this case, decision making powers would shift away from inspectors and towards algorithms.

The project manager big data at the Import division still thinks the ultimate decisions need to be man-made. But it is hard to see how RDW civil servants can use machine learning probability scores to support their work when the question how the probability scores came about remains unanswered.

Motivated, diligent decisions
In both cases of PTI and Import, the use of machine learning algorithms proves problematic, given that the algorithms used would lack in transparency. This means that they would not meet the principles of diligence and motivation, which are essential conditions to Dutch government decisions. Mitigating the risk of violating these two principles could be explored using audit tools and increasing the transparency of the algorithms, such as through supervised machine learning.

Fundamentally, the question remains whether it is acceptable to have government decisions (partially) made by computers. Using data to assist in risk assessment could help RDW staff to

make better decisions, but (semi-)automated decisions are problematic if the motivation towards a decision lacks in transparency. Part of the decision would be made inside the 'black box' of the algorithm.

Ultimately, if government is to operate more as a platform, the platform would have to be opened up both with respect to the data and the processing of the data. Failure to do so might undermine trust and legitimacy of government.

Conclusion

The introduction of big data in government services provides for an exciting opportunity to improve efficiency and efficacy of the Dutch public sector. At the same time, there are other public values that will also have to be safeguarded to ensure a balance between competing public values.

The decision to use big data should not be just about providing more public service at a lower cost. Using complex, self-learning algorithms introduces risks to public values such as autonomy, transparency and accountability. These different public values need to be brought into balance to ensure trust and legitimacy amongst the Dutch population in government.

The possibilities of big data need to be reconciled with the new data protection legislation that is coming from national and European parliament. The decision to which level our society is prepared to accept (semi-)automated decision making should be made at the political level. Supervision of society using self-learning algorithms needs to be sophisticated enough to protect fundamental rights from being violated. This necessitates more knowledge and understanding of how complex algorithms work, both within government agencies and with (external) supervisors.

At present, the answer to the research question of this paper is that the relationship is problematic. In order to reconcile big data applications with public values and the principles of proper government, investments will have to be made to promote transparency in the data processing techniques to empower the autonomy of citizens. The current use of big data raises many questions and would seem to fail to comply with legal standards. The answers can be found by looking at the Government as a Platform, where citizens, business and government all have access to relevant data, data processing insights and audit findings. To ensure that public values are promoted equally, government will have to be open and transparent about the use of big data.

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