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VALUE-BASED GUIDING PRINCIPLES FOR MANAGING COGNITIVE COMPUTING SYSTEMS IN THE PUBLIC SECTOR.

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Abstract

Cognitive Computing Systems (CCSs) are increasing in prominence in the public sector. This paper develops a framework drawing on public value and information technology service management literature to guide the management of CCSs in the public sector. We draw on academic literature, grey literature, legislation and government reports, and examples on CCS initiatives in the public sector to develop insights for research and practice. We then outline the themes and present the insights in the form of guiding principles and specific (detailed) recommendations. These include guiding principles and recommendations for establishing legitimacy, understanding the required capabilities, executing capabilities, creating and measuring public value.

Keywords: cognitive computing systems, public value, artificial intelligence, public service management, technology governance

Introduction

Public agencies are implementing cognitive computing systems (CCSs) for service delivery (Wirtz, Weyerer, & Geyer, 2019). CCSs are digital systems that support service delivery by automating data processing, contributing to making public service delivery more efficient and effective. They incorporate a cluster of technologies including artificial intelligence, machine learning, big data analytics, deep learning, neural networks, image processing, and natural language processing. Because of sensitivity of using CCSs in the public sector, successful design and deployment of CCSs require covering a range of considerations that on one hand are not limited to one of these enabling technologies (i.e. that do not overlook other related enabling technologies) and on the other hand are not too broad (i.e. that do not provide specific enough recommendations for practice).

The functioning of CCSs often involves opaqueness over how information is handled (Makadia, 2019). For example, CCSs' targeted profiling can lead to discriminatory tendencies, because these systems are prone to learn and magnify biases (for example racial or gender based influences) which can be hidden in data (Bass & Huet, 2017; Citron & Pasquale, 2014). To promote the successful implementation and use of CCSs in the public sector, there is therefore an urgent need to understand how the systems should contribute towards the creation of public value through public services. While there are many frameworks for service management, there is a dearth of theoretically grounded frameworks for managing CCSs and public value particularly. There is also a relative lack of empirical evidence, with only a relatively small, but growing body of academic studies of public sector cognitive computing implementations (Desouza, Dawson, & Chenok, 2020; Sun & Medaglia, 2019), and a somewhat larger corpus of evidence in the grey literature (Burton, 2016; Eidam, 2016; IBM

Corporation, 2016). We answer the question “how can CCSs in the public sector be managed to support creating public value?”.

In order to answer this question, we conducted the study in two major stages: first, we selected a comprehensive framework of public value management and explain it in the context of CCSs in the public sector. We used the framework as a lens to review academic literature, grey literature, legislation and government reports, and examples on CCS initiatives in public sector, and to derive insights on the management of CCSs for public value. Second, we integrate this framework with the Information Technology Infrastructure Library (ITIL), which is a widely used IT service management framework, in order to provide guiding principles for managing CCS to support creating public value in the public sector. ITIL has been developed based on best-practice insights to provide a quality management framework for digital services. The ITIL framework is appropriate for our study because it has a service delivery, rather than a technical focus, “*ITIL deemphasizes the management of IT assets and focuses on the provision of quality end-to-end IT services*” (Tan, Cater-Steel, Toleman, & Seaniger, 2007, p. 1).

In the rest of this paper, first we provide a brief background on the use of CCS for public services. Next, we discuss the concept of public value from the public administration domain and explain the selection of our framework. We conclude the literature review section with a discussion on the ITIL service framework. Following that, we present our public-value-based framework of managing CCS for public value, and then propose guiding principles based on the framework for how to manage CCSs in the public sector to create public value. Next, we integrate our framework with ITIL4 practices, and then use the combined framework to organize and propose specific recommendations for practice. The paper concludes with the discussion and conclusion sections.

Literature Review

Public services and CCSs

Public services cover a broad range of applications, from recreation, education, health, welfare and more, and range from the very simple (such as renewing a vehicle registration) to the very complex (such as identifying potential crime). We use two dimensions to broadly characterize public services: the level of volition, and an individual versus collective focus (Krishnamurthy, Desouza, Dawson, & Ho, 2018; Lipsky, 2010). Non-volitional refers to when we have no choice about whether we engage with a service or not. Non-volitional services are non-discretionary, involuntary official-citizen interaction. Others are voluntary, and there is a continuum in between of services that we are strongly incentivized to use. The other dimension we consider is an individual versus collective focus. An individual focus aims at identifying, targeting, and possibly making decisions about individuals – for example, as likely to have high needs for specific welfare, health or educational interventions or assistance, high risk of offending or reoffending (Tirias Research, 2018). A collective focus aims at large sectors of society, such as traffic control, defence, or crowd control at events (Lipsky, 2010). Once again, this can be a continuum, and sometimes a collective focus requires some level of individual profiling and targeting, and some collective services may not be aimed at the public at large but may target specific groups.

Considering recent examples, a network of smart surveillance cameras with built in neural networks to detect suspicious individuals, activity, or packages is considered a CCS for a collective and non-volitional service. Other examples are services that deal with irregularities in public facilities such as road congestions (The ASEAN Post Team, 2018) or public water

systems (Cowie, 2019) using data gathered from the collective use of the public resources. Facial recognition systems used by police departments to identify criminal suspects (Schuppe, 2019) and systems used to determine the likelihood of future criminal behavior would be considered CCS for non-volitional individually focused services (Northpointe, 2015). CCSs used in determining targeted service experience for individuals such as tax decisions (Burton, 2016) or individual welfare benefits (Fishman, Eggers, & Kishnani, 2017) also fall into this category. Volitional and individual services supported by CCS include AI-enabled chatbots, when citizens are not required to use them, but may select other channels (Reddick & Anthopoulos, 2014). Also in this category are CCSs that use voluntarily shared real time user data to personalize a service experience (IBM Newsroom, 2016). There are many instances which require people to agree to voluntarily share personal data (or personally collected data, such as photographs, or local climate information) to support larger scale collective AI analysis (SAP Brandvoice, 2019; Wirtz, Weyerer, & Rösch, 2018), for instance, citizen science initiatives. CCSs used to analyze information collectively shared voluntarily by individuals fall into the category of volitional collective services. These also include CCSs that analyze information shared by individuals on social media platforms (Eggers, Schatsky, & Viechnicki, 2017; Sullivan, 2018). All in all, cognitive computing systems present several opportunities that span across several public service sectors. These range from detection of fraudulent activities, improved decision making and service efficiency, optimising resource use and overall reduced service costs (Cooper, 2020).

Public value

Public agencies create public value through (among other things) designing and delivering public services (Moore, 1995). More recently Bryson, Crosby, and Bloomberg (2015) have extended Moore's (1995) framework by incorporating from subsequent scholars to include the

activities: establishing legitimacy; creating capabilities; executing capabilities; and evaluating public value. We select and adapt this framework because of its comprehensiveness and relevance to the context of our study. Figure 1 summarizes the key factors, and expresses questions to guide practice for the five activities of our framework.

[Insert Figure 1 Here]

Establishing legitimacy asks the question “what are we allowed to do”. CCSs should conform to the existent governance bodies that control the design of public service delivery. This requires operating within legal frameworks and also engaging in actions that satisfy the social norms of acceptable conduct. Legitimacy can be formal (granted through legislation) (Suddaby, Bitektine, & Haack, 2017) or informal (construed in societal groups) (Buhmann, 2016).

Creating capabilities asks the question “what capabilities do we need”. For example, incorporating cognitive computing systems in public service delivery often requires extensive collaboration between public and private sectors, particularly large technology firms, and require a combination of skills that do not frequently occur together, such as training in ethical and privacy issues, data science and engineering knowledge (Cath, Wachter, Mittelstadt, Taddeo, & Floridi, 2018). Ensuring fairness in process and decision-making (procedural justice and procedural rationality) is also an important capability (Bryson, Sancino, Benington, & Sørensen, 2017).

Executing capabilities asks “how do we execute these [above] capabilities” in the way public services are designed, implemented, managed and evaluated (Osborne, Radnor, & Strokosch, 2016). This can include the strategic management of models, processes and decisions made within public organizations (Rosenberg Hansen & Ferlie, 2016), and also engaging in ongoing dialogue and consultation about ways to achieve public value (Bryson, 2018). Value dimensions can be observed and embedded in the performance of many activities. For example,

policy analysis design and evaluation can “clarify value [dimensions]...identify value complementarities, conflicts, contradictions and trade-offs” (Bryson et al., 2015, p. 17).

Creating public value asks two related questions: first “how do we achieve valued outcomes?” (Moore, 2007) in terms of the value experienced by each individual community member (Grant, Tan, Ryan, & Nesbitt, 2014). Second, we ask how we create value for those capabilities and processes involved in service delivery (S. Kavanagh, 2014).

Finally, *evaluating public value* asks “how do we measure public value”. Measuring public value can be controversial and different stakeholders may have different perceptions of what constitutes value. This requires drawing on numerous sources and perspectives using both normative (such as Moore (1995)) and non-normative (such as Meynhardt (2015)) approaches. Evaluating public value can also draw measures from experience of the success or failure of previous initiatives (Jørgensen & Bozeman, 2002).

The ITIL service management framework

The ITIL service management framework is a widely adopted and well-established framework in organizations that implement IT service management (Eikebrokk & Iden, 2017). The framework specifies a set of best practices for IT service management centred around an overall service quality management view, rather than a technical view (BMC, 2020). The ITIL 4 framework defines a service value system (SVS), a universal model consisting of 5 components: guiding principles; governance; the service value chain; management practices; and continual improvement. Table 1 provides a summarized description of each of these components.

[Insert Table 1 Here]

The components of the SVS serve to assure that value is continually managed for all the organizations' stakeholders through the use and management of services. The SVS guides the systematic and iterative process of translating opportunities into new and improved services – “through a joined-up effective and efficient operation (to) produce value” (BMC, 2020, p. 7). In this study, we concentrate on identifying ITIL-based management practices for managing CCS, specifically, general management practices and service management practices.

Approach

We adapt the approach employed by Rose et al. (2019) for deriving theory-based guiding principles, based on integrating insights from public value literature with ITIL management principles to formulate detailed recommendations for managing CCS. Rose's (2019) work is one of the few we were able to identify that applies an approach specifically to formulating guiding recommendations for innovative digital services such as CCS. Table 2 explains the four steps we followed, covering from formulating solution objectives (the first step) to refining and organizing elements as theory-based detailed recommendations (the fourth step).

[Insert Table 2 Here]

Formulate solution objectives: We formulate guiding principles for managing CCS in the public sector as the solution objectives, following the series of questions posed in our public value-based framework for managing CCS, Figure 1. Our guiding principles are developed and synthesized based on insights drawn from academic literature, grey literature, legislation and government reports, and examples on CCS initiatives in public sector, and experience. A detailed description of our approach to literature searching is included as Appendix 1.

Identify kernel theory: We reviewed several service management theories to identify the most appropriate framework to address our solution objectives. Considering digital service

management, we selected the ITIL 4 framework as being well-aligned with our overall goal. In addition, we use the public value framework we adapted from literature and the resulted public value dimensions – a practice that is commensurate with Rose’s (2019) recommendation that relevant knowledge from literature serves as kernel theory (justificatory knowledge) for proposing guidelines and recommendations for practice.

Derive normative and prescriptive elements: We next review the ITIL 4 framework and focus on the management practices. We draw on the 14 general management practices and the 17 service management practices, which we refer to in formulating our detailed recommendations. We specifically use these 31 practices because of their relevancy to the topic of our study.

Refine and organize the elements as detailed recommendations: In ITIL terms, we note that the abstract public value dimensions we identify from public policy literature need to be considered as “guiding principles” that will influence management practice. However, we can see that the guiding principles of service delivery in many public sector organizations are often already quite well-aligned with public value principles. For example, the Department of Human Affairs in Australia includes efficiency, accountability, transparency and other public value dimensions in its service commitment statement¹. The challenge is to operationalize these in a CCS context. We review the selected management practices mapping them across each of our guiding principles to formulate detailed recommendations. Rather than going into technical details, our detailed recommendations are expected to be recommendations for management practices related to managing CCS for creating public value in the public sector. We provide arguments in support of these activities and procedures based on the relevant ITIL 4 practices, which are selected from general management practices and service management practices.

¹¹ See <https://www.servicesaustralia.gov.au/organisations/about-us/our-agency/our-service-commitments>

Results

In this section, we first present our public-value-based framework and then propose guiding principles for how to manage CCSs in the public sector to create public value. Next, we integrate the public-value-based framework with ITIL4 practices, and then use the combined framework to organize detailed recommendations for managing CCSs in the public sector to create public value.

Establishing legitimacy

Internationally, the establishment of well-defined formal authority and governance structures for CCS often lag behind well established and fully legitimate structures for technical capabilities and applications of AI. Legislative frameworks governing CCSs may be nascent or non-existent (Brahmawar, 2017). Although many national administrations have published AI frameworks in the last few years, the European Union's General Data Protection Regulation GDPR is among the first major attempts to regulate the use of citizen data in CCSs (to establish the boundaries of legitimate authority) (Dutton, 2018). Strongly focussed on the rights of the individual, and aimed at reducing coercion and increasing the role of individual consent, its key principles include laying foundations for fairness and transparency of decisions; purpose limitation (using data solely for the purposes the subject has been advised on); data minimalization (only the data required should be collected); accuracy, including a rectification process if data is inaccurate; storage limitation, including a right for data to expire or be removed; and integrity and confidentiality in handling data; and accountability. A nuanced discussion by Mantelero (2018) notes "*These [The GDPR] principles...are general clauses that may be interpreted more or less broadly and require an implicit consideration of the interests underpinning data use*" (p. 762). Establishing legitimacy calls for public organizations to individually define the governance principles to interpret and operationalize such legislative

frameworks (Jouravlev et al., 2019). These interpretations can still be challenged legally, in a manner that affects the relationship of trust between the public organization and the public (Deephouse, Bundy, Tost, & Suchman, 2017). Consequently, the success and continued existence of services with increased levels of volition for the public, require increased flexibility in the approach of establishing legitimacy (Simmons, 2018). Hence, the interpretation and operationalization of legislative frameworks in practice is a continuous work-in-progress.

Guiding principle 1: The development and implementation of CCSs occurs in a context of nascent legislation requiring flexibility to emergent policies and regulations to ensure ongoing legitimacy.

Facilitating data sharing requires establishing legitimate procedures to assure legitimate public service operations. Citizens share large quantities of data with various public agencies through CCSs. Cities across the globe are leveraging on various forms of data collected from the public using sensors installed in public spaces (such as security surveillance cameras, intelligent traffic systems, city services monitoring) to transform into smart cities (Money & Cohen, 2019). There are opportunities for the public to individually participate in collective and volitional services by agreeing to share with data they have already made available to public agencies, to share in the wealth created by data (Barry, 2017). CCS analyze data in a more subjective manner. Hence, for services that involve collection of identifiable data, CCSs should uphold the relevant data sharing principles to establish legitimacy through transparency of operations.

Guiding principle 2: Developing formal mechanisms to promote the voluntary sharing and consented use of data that is already digitized is necessary to provide valuable resources for services.

The concept of “social licence” is necessary to account for the broad stakeholder support of granting legitimacy and authority of procedures. It requires transparency in communicating how CCSs collaborate with humans agents to deliver services. Some past big data public initiatives have been legal but unpopular, and it is likely that CCSs will attract similar controversy (Carney, 2019). Experience suggests that even for relatively trusted agencies, legislated authority does not confer social licence (Leonard, 2018). For example, an individual, non-volitional data matching program in Australia aimed at recovering overpayments of welfare benefits was the subject of two separate investigations by the Office of the Ombudsman (McLean, 2018). This has eroded public confidence and trust and is expected to make the implementation of future CCSs more challenging.

Guiding principle 3: Implementation of CCSs requires investment in development of social license as well as legislated authority through transparency in communicating their role in service delivery.

Creating capability

Implementing CCSs requires a combination of skills including legal knowledge, ethical and privacy training, data science, software engineering, and in some cases, robotics (Cath et al., 2018). Targeted service interactions or offerings are enabled by sophisticated customer profiles which may include personal information (such as age and marital status), life events (such as job loss, physical injury), circumstances (such as becoming a single parent) and prior service interactions. These need to be built into contextually aware and dynamically growing customer profiles (Domingos, 2012). In addition, both historical data (such as prior service interactions) and real-time data need to be made actionable by collecting, normalising and integrating with the data the organization obtains from separate channels (such as the organization’s website, mobile app and call centres), user’s connected devices, and other scattered silos of interaction

data (Davenport & Ronanki, 2018). Recently, in Australia, several government departments piloted AI-based digital agents (chatbots) as part of their front-line customer support. However, some of these (for example, Nadia – a chatbot designed to assist people with a disability to negotiate a service offering) have been withdrawn after initial trials amid fear of public backlash (Probyn, 2017), indicating that development of technological capability, particularly in individual focused service contexts with increased levels of volition, needs to proceed in tandem with dialogue, and development of policy and governance frameworks to win public confidence and stakeholder support (Jouravlev et al., 2019). Investing in boundary spanning staff who can understand the strengths and limitations of CCS and are also domain experts to provide proper training data for CCS and to verify the effective incorporation of necessary rules and practices facilitates meeting the procedural rationality and justice and the overall quality expectations (Wilson, Daugherty, & Bianzino, 2017).

Guiding principle 4: Developing and integrating CCSs with service processes requires a multi-disciplinary team approach that includes representatives of the experts who will directly collaborate with the system.

CCSs can help mitigate unconscious bias (Bloomberg, 2018). This can be helpful in (for example) recruiting, by using consistent criteria to evaluate all candidates. On the other hand, there is a growing body of evidence that bias is introduced and can be amplified by CCSs (Botelho, 2018). One source is the training data. Groups that are under-represented in training datasets may receive unreliable and inconsistent results. For example, face recognition systems have been challenged for misidentifying people of colour, women, and young people at high rates, because they are less well represented in the training data (Klare, Burge, Klontz, Bruegge, & Jain, 2012). The next source of bias is the algorithms that are applied to the data. Algorithms have been described as opinions, embedded in code (O'neil, 2016). For example, COMPAS,

an individually focussed, non-volitional crime recidivism risk algorithm used in the USA, calculates a score indicating the likelihood of a defendant re-offending which is used to inform judges' decisions. It was found that the algorithm produced true positive rate that was equal for black and white defendants. The false positive rate, however, was twice as high for black defendants. *“The problem was that the judges and parole officers relying on the results of the algorithm had little appreciation that this particular notion of fairness was being used. The problem was also that the private sector data scientists who built the algorithm weren't conscious of the fact that they were building certain normative views into their algorithm (Filer, 2018, p. 1).* The public's right to equitable treatment implies the expectations of eliminating bias tendencies especially in non-volitional services with an individual focus. Explainable AI is a recent advancement in adding the capability of explaining the reason for a decision to the capabilities of CCSs, resulting in more transparent and minimized biased decisions (Gunning, 2017), and therefore supporting procedural justice (Lago & Trueman, 2019). High reliance on outsourcing to technology organizations, and a lack of specialized in-house skills can place the successful development and incorporation of CCSs into the organization's practice at risk (Eckhoff & Wagner, 2017). Engaging an independent standards body to verify the accuracy of the systems in addition to the inhouse testing is necessary to ensure equal representativeness of all public stakeholders.

Guiding principle 5: Developing capabilities to independently verify the complete representativeness of the CCS training data and auditing the performance of associated algorithms eliminates bias tendencies.

CCSs that have a collective focus is the need to be evaluated from a perspective of social as well as individual consequences (Mantelero, 2018). In the past, stakeholder collectives that have been (arguably) subjected to discrimination have frequently been aware of, and mobilized

around their collective interests (Lipsky, 2010). With the introduction of CCSs, “*algorithms create groups or clusters of people based on different and more varied characteristics (such as habits, lifestyle, online and offline behavior, network of personal relationships etc.)* [than groups such as disabled people or ethnic minorities that are already recognized as minority categories who may have specific public service needs]. *For this reason, the wide application of predictive technologies based on these new categories and their use in decision-making processes suggests a broader notion of discrimination*” (Mantelero, 2018, p. 763). Unlike groups that have traditionally experienced discrimination, people assigned to groups by algorithms may not be aware of their membership to these groups, and may not be aware of their collective interests. Continuous review of patterns emerging from use of CCS in public service with a collective focus enables identification of new and emerging collectives that can potentially become discriminatory.

Guiding principle 6: Continuous engagement with new and changing collectives enables the establishment of procedural justice in CCSs.

Executing capabilities

The implementation of CCSs may exacerbate many existing institutional and strategic challenges in the public sector. These include internal culture and processes of government agencies; such as short term budgetary, planning and political cycles; risk aversion; lack of incentive to change; and entrenched organizational cultures (Bason, 2018; Bekkers, 2009). Further, public institutions are not necessarily guided by a single, homogenous value system. Incompatible value dimensions frequently arise between policy-makers and the internal functioning of public agencies, where impediments to joined up government include departmentalism (where a department concentrates on its own responsibilities rather than on service outcomes) (D. Kavanagh & Richards, 2001) and the problem that “strategic priorities

only partly determine the way departments work” (Ling, 2002, p. 620). Multiple competing value dimensions may also exist within organizations and even within teams (Reay & Hinings, 2009). There is no reason to believe that these issues will be any different with CCSs, particularly when CCSs tend to facilitate solving complex problems. For example, the use of the Education Value Added Assessment System (EVAAS) which led to the firing of several Houston teachers for underperforming was contested on legal and ethical grounds resulting in the decisions being overturned in the courts (Webb & Harden, 2017). The fact that clear strategic intent, policy, and governance guidelines are still emerging is likely to exacerbate risk aversion. Managing steps to assure ethical, legal procedural and public considerations as part of the life cycle of CCSs (including outsourced development) facilitates creating public value. For this reason, small, local initiatives that can be evaluated and subsequently scaled may be more successful than “big bang” projects that are incompatible with existing strategy and institutional design.

Guiding principle 7: Strategic alignment of CCS initiatives with the institutional context is necessary. In this regard, small, local initiatives that can be evaluated and subsequently scaled may be more successful (than “big bang” projects), as it is more practical to manage incompatible value dimensions that can arise between policy-makers and the internal functioning of public agencies.

The need for consultation and stakeholder engagement around CCSs has been widely recognized and can take place with varying degrees of public involvement (Le Pira et al., 2017; Ubaldi et al., 2019). This overlaps with the previous section on developing capabilities to ensure procedural legitimacy, justice and rationality. In New Zealand, an independent, but government funded “Data Futures Partnership” was established with the goal of engaging with citizens and stakeholders across public, private and non-government sectors, and to manage

change associated with the use of data (Bhunia, 2017). The partnership has a clear public value focus and recognizes the importance of establishing trust in the data sharing necessary for CCSs. This group carried out an extensive public consultation process with individuals and groups using a range of data sharing scenarios representing varying degrees of risk and reward for different stakeholders to obtain insights into the perceptions of the New Zealand public. The extent and nature of consultation expresses the degree to which public agencies are committed to developing a social licence and a consensus around public value. Consultation processes typically recognize the need for a cross-sector approach, particularly when some stakeholder groups have limited opportunities to participate.

Guiding principle 8: Developing processes and forums for engagement with individuals and public stakeholder groups enables building social license around CCSs.

Creating public value

While achieving public value from public services is much broader than just achieving efficiency, it has often been expressed in terms of this public value dimension (Andrews, 2018). This often happens because public agencies do not clearly outline the public value dimensions that are intended to be achieved when introducing a CCS into the service system. Another reason is that efficiency of service delivery is often associated with productivity, saving time and budget which is interesting for public agencies. Moreover, a public value aspect can take form differently in different contexts. For example, with regards to effectiveness and in the case of surveillance cameras used for crowd monitoring, creating public value takes the form of the systems effectiveness in promoting public safety and security (Ashby, 2017). With regards to the same public value dimension (effectiveness), there can be other instances where for example a CCS assists human service agents with decision making through providing relevant and contextual information about individuals, resulting in a service outcome that

matches an individual's life circumstances. The Australian Tax Office uses a CCS for advanced analytics purposes towards providing more accurate tax administration decisions based on previous tax outcomes and life circumstances of an individual (Burton, 2016). A clear outline of the intentions when introducing CCSs into the service system enables organizations to account for the anticipated public value contributions from these initiatives to all public stakeholders.

Guiding principle 9: CCSs require clearly defined intentions for their introduction and clearly established outline of the public value dimensions that are intended to be achieved from their usage to be well communicated.

Frequently, when a CCS is introduced into a public service to contribute towards promoting a particular public value dimension, there is an unintended negative impact on one (or many) public value dimension(s) that need to be mitigated to ensure that creation of the intended public value remains viable. For example, using CCS in the form of face recognition technologies to identify crime suspects promotes the overall safety of the public. However it also comes with concerns around the privacy of individuals as all have to forego the liberty of privacy to some degree to ensure the effectiveness of the system (Prabhakar, Pankanti, & Jain, 2003). When a CCS is designed to facilitate the creation of any particular (or a set of) prime value(s), developing a holistic perspective of the instrumental and other public value dimensions that are important in the public sector promotes the creation of public value from all stakeholder perspectives.

Guiding principle 10: Creating public value through CCSs requires a holistic approach that considers all the public value dimensions to assure that the intended outcomes are realized without forgoing other public value dimensions.

Evaluating public value

Measurable outputs and outcomes need to be defined when introducing CCS initiatives in public service delivery. These can take several different perspectives. One major measure is based on what officials decide public value to be (Chohan & Jacobs, 2018). However, as we have established in our preceding discussion, this arises from many sources, and can be implicit or explicit; may not be unanimous within and between organizations; and can be difficult to establish when legitimacy and governing policies are still being established. The Australian data matching system that produced cost savings but was met with poor public reception indicate that what officials decide is “public value” may not always align with the views of wider stakeholders, and a narrow focus on cost saving is unlikely to be adequate (Carney, 2019; Whyte, 2018). The perception of fairness, openness and transparency can be improved through employing inclusive decision-making practices that is supported by the viewpoints of citizens and other involved stakeholders, and by gaining insight from objectively obtained data from stakeholders, particularly customers (Page, Stone, Bryson, & Crosby, 2015). However, managers and staff in public agencies may end up implementing CCSs while governance structures to ensure fairness, accuracy, accountability and transparency are still a work-in-progress. When the public have a choice to make between using or not using a CCS, it is necessary to include the public’s expectations in terms of the system’s contributions towards public value.

Guiding principle 11: Public value measures for CCSs should be drawn in consultation with a wide variety of stakeholder perspectives including both the direct (public agents or human experts) and indirect beneficiaries (citizens or service consumers) of its use.

Experience of public value successes and failures can also shape how public value is understood for CCS. Since national administrations around the world are grappling with similar

issues (Eggers et al., 2017; OECD, 2018), case studies and sharing experience about best practice are important in creating a consensus view. For example, key lessons on evaluating public value measures can be drawn particularly from the failed cognitive computing initiatives (for example COMPAS, EVAAS), which may uncover the important public value criteria that are easily overlooked during deployment of CCS in public service contexts.

Guiding principle 12: Understanding of the public value of CCSs of all kinds can be improved by learning from direct experience, case studies, and international examples.

Detailed recommendations for CCSs

We provide arguments in support of these activities and procedures based on the relevant ITIL 4 practices, which are selected from general management practices and service management practices, including: relationship management; service design; service validation and testing; service configuration management; knowledge management; information security management; supplier management; workforce and talent management; service catalogue management; monitoring and event management; problem management; continual improvement; change control; incident management; release management; capacity and performance management; service level management; service continuity management; availability management. Table 3 summarizes our findings.

[Insert Table 3 Here]

Discussion

Discussion on the guiding principles related to the different types of CCS

We proposed guiding principles on managing CCS within the public sector according to the variations in the nature of public services across the two dimensions of individual-collective and volition-non-volition. Public services exhibit at varying levels across these dimensions, which are not necessarily exclusive of each other. Certain levels of individualism may be required in delivering a collective public service, and some level of coercion might be necessary when delivering volitional services. While all our guiding principles are generally applicable to the design of all CCS in public service, our analysis and review shows how these vary in terms of relevance across these dimensions. Figure 2 below shows the positioning of our guiding principles according to the nature of public service.

[Insert Figure 2 Here]

We observe that guiding principles 7, 9, 10 and 12 are critical for all CCS deployed in any public service context. When introducing CCS, it is important to clearly define the intended outcomes from its use and how that contributes towards public value. Measurement processes and frameworks that facilitate dialogue and the surfacing of issues, assumptions and conflicts have a very important role to play. Many CCS initiatives fail, and the reason why they fail often relates to a lack of social licence; formal and informal challenges to the initiative; controversies; or widespread opting out (where this is an option), rather than for technical reasons. This suggests that agencies should expect controversy and challenges, and be prepared to develop forums and processes for carrying out wide dialogue with stakeholders. A wide range of measurement approaches and perspectives should be adopted. In all cases, evaluating the success or failure of CCS initiatives provides insights to inform initiatives for improvement

and future projects. Ongoing learning is essential, both from direct experience and from international best practice and case studies. Many CCSs take government agencies, citizens, stakeholder groups, and the various relationships and mechanisms that bind them together, into unknown territory. “When it comes to human decision making, we have, over time...built...mechanisms which allow us to scrutinize the value judgments behind a decision, appeal against it and have it changed... We need those same mechanisms for Artificial Intelligence systems in government. Unless we build these controls and unless we do it in a way that is seen as legitimate by citizens, the great promise of AI in government will go unfulfilled.” (Filer, 2018, p. 1).

Guiding principles 1 and 11 are critical for CCS deployed in all volitional public service contexts. In a volitional service context, the public will only embrace the CCS when the benefits of using the system outweigh the costs of an alternative service channel. Legal frameworks are nascent and evolving, meaning that the legality and formal legitimacy of cognitive computing projects can be expected to be contested. Ensuring ongoing legitimacy while continually evaluating the performance of the CCS based on measures inclusive of all public stakeholders enables the CCS to continually satisfy the public needs. Guiding principle 4 is more critical in volitional public services with an individual focus, which relates to adopting a holistic approach that accounts for establishing all necessary capabilities to support individual interactions (for all stakeholder groups) with the CCS. Best practice in public CCSs is multi-disciplinary. Legal, ethical, public policy, and technical questions are all relevant, and boundary spanning staff are required. On the other hand, guiding principle 2 is more critical to volitional services within a collective context. Legitimacy established through transparent procedures enhances the likelihood of CCS embrace. When CCS use publicly shared data to generate outcomes, the public ought to be informed beforehand that their individual information will be used for services rendered on a collective scale.

Guiding principles 3 and 8 are more critical in all non-volitional public service contexts. CCS deployed in non-volitional service contexts pose a threat of presenting authoritativeness in how the public engage with the systems. Non-volitional services, even when legal, can attract enormous controversy and erode trust between citizens and public agencies if social licence is not established. This means that forums and ongoing processes for consultation are required, and stakeholder groups need to be reassured about the procedural legitimacy, justice and rationality of services. Given that the public have limited choice in terms of engaging the CCS, establishing social license in order to build the public's trust and confidence in the initiative becomes highly important. Guiding principle 5 is particularly important for non-volitional services with an individual focus. Deploying CCS in public service contexts requires strategic alignment with the overall service goals to eliminate bias that could lead to unfairness in terms of the generated outcomes. Appropriate levels of strategic alignment can be realized by ensuring the training data used for the CCS is a complete representation of the possible service circumstances that could present. On the other hand, guiding principle 6 alludes more to CCS deployed in public services with a collective focus. CCS algorithms are optimized to learn new patterns from service encounters, implying that new and emerging collectives will be continually generated. This calls for the need to investigate these new and emerging collectives to ensure fair service procedures for the public.

For each of these guiding principles, we defined a set of more detailed recommendations (*see* Table 3) formulated based on the general management and service management practices explained in the ITIL 4 framework. These recommendations should be viewed as a way to operationalize the guiding principles for managing CCSs in the public sector.

Implications for research and service management

The main contribution of our paper to theory is that our study is one of the very few studies (if not the only study) in the area of CCS for public service delivery that propose a Type V theory (theory for design and action) (Gregor, 2006). Such a theory uses kernel theory (our public value framework we adapted from an existing theory as well as the ITIL framework) to propose novel theory- and literature-based guiding principles and specific recommendations. We also hope that our study contributes to research by being a how-to example of theory-based research that connects abstract value dimensions to management practices.

As noted previously, there is an increasing convergence between “IT service management” and service management in general, as customer-facing services are increasingly digital and supported by new technologies such as AI. The ITIL framework has been steadily extended to include strategic guiding principles and general management practices as well as more technology-focussed practices. Our study reinforces the importance of taking a holistic view of managing public services that utilize new technologies. As we show in Table 3, the majority of service management and service design practices are affected by consideration of the public value implications of CCS. In particular, we note that relationship management practices are greatly affected. High-profile scandals and failures can erode public trust in services utilizing cognitive computing. Two-way channels of transparent communication, trust building, the ability to mediate disputes and the development social licence are all important practices (associated with principles 1, 2, 3, 6, 7, 8) and inform the ITIL practice of relationship management. ITIL service management practices such as configuration management that might have been previously considered as relating to more technical factors are affected. Service configuration changes need to consider their potential impact on public value (for example, if a CCS is implemented behind the scenes to make recommendations about service

eligibility, this configuration change needs to be communicated to stakeholders) as we see in principles 2, 3, 5, 10, and 11. Different ITIL workforce and talent management practices may be required. Managing CCS services requires a multi-disciplinary team which includes skills such as ethical and legal specialists (principles 3, 4 and 5). The ITIL practice of monitoring and event management needs to consider not only the technical performance of the service, but needs to also monitor and audit the ethical and legal performance of the CCS, including identifying any potential biases that are present or may creep in over time (principles 4, 5, 9, 12). Overall, consideration of public value in the management of CCS has far-reaching implications for information technology service management, as practiced through frameworks such as ITIL. Our guidelines direct management attention to areas of impact, and suggest practices that will ensure that issues of public value can be managed appropriately.

Conclusion

At present, public agencies are still trying to get to grips how to create and preserve public value when designing, developing, and deploying CCSs. CCS-enabled services of various sorts are being trialled in many contexts. As these services are becoming more capable, more psychologically aware, and (in some cases) able to express (the appearance of) empathy, people will require assurance about the public value created by these services. We expect the issues we discuss will continue and amplify. While many public agencies have high-level service value dimensions and service delivery promises (guiding principles in ITIL terms) that embody key public value there is a dearth of guidance that connects these abstract value dimensions to management practices in the design and delivery of CCS. Service management frameworks such as ITIL already aim to provide an integrated view of IT service management from the strategic to the technical levels. The introduction of new technologies such as CCS into public services, makes this even more pressing. For volitional CCS, the public need to be convinced

of the value and benefits. For non-volitional CCS, the public need to be reassured that the service does not represent creeping authoritarianism and institutionalized biases. For this to happen, consideration of public value needs to be embedded in the practice of IT service management. Our guidelines offer a roadmap of how this might be achieved. These guidelines are valuable in themselves, and can also be developed further in the future to anchor the management of public value firmly into the service value chain. Our study is limited to an extensive literature review for developing theory-based guiding principles and recommendations. Future researchers may want to empirically examine our guiding principles and recommendations in specific domains of public sector (such as health or education). Future research may also want to deploy our findings to advise researchers and managers on how to transform CCS projects from an ad-hoc status to experimentation and then to an advanced status that uses an enterprise-wide strategy.

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Appendix 1: Approach to literature searching

With regards to our search for academic literature, we followed the Templier and Paré (2015) framework for conducting literature reviews, which informs the strategic integration of literature from diverse data sources. Towards our primary goal to establish value-laden principles for designing CCSs for the public sector, first we searched for peer reviewed journal

articles and conference papers that discuss CCSs in public service delivery within research areas including: public administration, public policy, information systems and electronic government. The databases we used included multidisciplinary databases including: Web of Science, AIS Electronic Library, ProQuest Computing, SpringerLink, and Scopus. We also used keyword search via Google Scholar for journal and conference papers that have been published in the last ten years. The keywords we used for our database and Google Scholar search include: ‘cognitive computing system’, ‘cognitive system’, ‘cognitive intelligence’ in combination with the term ‘public’. After three rounds of refining articles based on their title, abstract and introduction, a total of 17 articles were retained. Next, through backward and forward citation, we identified an additional 5 relevant peer reviewed publications. After reading each of these 22 papers in detail, we conducted a search of grey literature including legislation and government reports from the top two ranked countries in terms of AI readiness (2019), in the regions including Asia (Singapore and Japan); Americas (US and Canada); Europe (Germany and UK); and Oceania (Australia and New Zealand). We also drew on examples of CCS initiatives in the public sector within these selected countries.

TABLES

Table 1

ITIL component	Description
<i>Guiding principles</i>	Outlines that before introducing any forms of automation, it is necessary to: (1)create value for the service consumer, (2)promote collaboration and implement holistic and organization-wide improvement initiatives, (3)maintain lean operating procedures and enhance service effectiveness, (4)build upon existing service procedures and implement service improvement iteratively.
<i>Governance</i>	Outlines the expectations of an organization’s governing body to continuously ensure alignment with the internal priorities and objectives as well as providing a clear set of shared principles and objectives with all stakeholders.
<i>Service value chain</i>	Outlines the key activities required to act on opportunities or demand to facilitate creating value through services and service management, in accordance with an organization’s standards and principles.
<i>Management practices</i>	Outlines a set of resources viewed as capabilities needed by a service providing organization to execute service procedures and create value for stakeholders. The framework defines a total of 34 management practices classified in three categories: (1) General management practices; Service management practices; and (3) Technical management practices.
<i>Continual improvement</i>	Outlines how implementing improvements within the organization follows an iterative approach that separates improvement initiatives into manageable parts throughout the organization and at both strategic and operational levels. This requires the willingness of all stakeholders involved in service provision to continuously look for improvement opportunities in the service procedures.

Table 1: Description of ITIL 4 components: Adapted from BMC (2020) and Jouravlev et al. (2019)

Table 2

Step	Research practice	Research output
Formulate solution objectives	Define the overall goal of managing CCS initiatives to create public value and decompose into well-defined solution objectives.	Guiding framework (consisting guiding principles) to manage for public value from CCS initiatives in the public sector.
Identify Kernel theory (also called justificatory/guiding knowledge)	Determine an optimal branch of theory aligned with solution objectives to the guiding framework and identify well-aligned contributions.	The public value framework we adapted from literature; public value dimensions; and selection of ITIL 4 service management framework
Derive normative and prescriptive elements	Extract relevant elements, consider <i>characteristics, procedures</i> and linking <i>arguments</i> , adapt to CCS context and express as prescriptions.	14 general management practices and 17 service management practices derived from the ITIL 4 framework.
Refine and organize the elements as detailed recommendations	Synthesize in an economical set of necessary and sufficient guiding principles.	A set of 36 recommendations for CCS. (Table 3).

Table 2: The process of deriving theory-based recommendations; adapted from (Rose et al., 2019)

Table 3

Guiding principles	Operational recommendations	Justification of recommendations <i>According to the ITIL practice:</i>	Purpose/description of Practice
(1)	Establish multi-disciplinary teams of expert representatives from diverse public stakeholder groups (for example citizens, public servants, service designers and academics) during the design of all CCS governance policies.	<i>Relationship management:</i> this enables appropriate understanding and prioritization of legislative policies and needs of all internal and external public stakeholders.	<i>Relationship management practice</i> facilitates establishing and nurturing links between an organization and its stakeholders at both strategic and tactical levels.
	Continuously monitor and	<i>Service design and relationship management:</i>	(1) <i>Service design practice</i> facilitates designing the right

	communicate (discuss) policy and legislation developments from the various contributing service sectors.	these enable a systematic approach to (re-)design services that fit within the ecosystem promoting the existing stakeholder relationships, observe, analyze and record any changes in the service procedures.	services for the appropriate purpose that an organization can deliver within its ecosystem. (2) <i>Relationship management practice</i> facilitates establishing and nurturing links between an organization and its stakeholders at both strategic and tactical levels.
	Continuously update CCS governing policies in accordance with policy and legislative changes affecting relevant public sectors in a timely manner.	<i>Service validation and testing</i> : this enables timely integration of new and updated governance policies	<i>Service validation and testing practice</i> facilitates meeting the defined requirements in both new and changed services.
(2)	Communicate the benefits of public data sharing in a comprehensive manner to all stakeholder groups.	<i>Service configuration management</i> : this enables a clear understanding of the contributions, relationships and dependencies of all stakeholders towards public value.	<i>Service configuration management practice</i> facilitates the availability of information that is accurate and reliable concerning the configuration of all services.
	Establish a common consensus with the public stakeholder groups on the use (and limit of use) of publicly shared data.	<i>Relationship management and Knowledge management</i> : these enable transparent use of data with public consent.	(1) <i>Relationship management practice</i> facilitates establishing and nurturing links between an organization and its stakeholders at both strategic and tactical levels. (2) <i>Knowledge management practice</i> facilitates improving, and maintaining high standards of effective, efficient and convenient information and knowledge use across an organization.
	Devise and incorporate formal mandates for encouraging secure use of voluntarily shared public data.	<i>Information security management</i> : this enables preserving the confidentiality of stakeholder information.	<i>Information security management practice</i> facilitates the protection of an organization through understanding and managing risks associated to integrity, confidentiality and availability of information.
(3)	Create dialogue platforms (for	<i>Relationship management and supplier management</i> :	(1) <i>Relationship management practice</i> facilitates establishing and nurturing links between an

	<p>example community level dialogues, citizens' jury, fishbowls, expert panels and conferences) with diverse public representative group members during discussions towards the designing of CCS.</p>	<p>these enable appropriate mediation of stakeholder requirements that may be conflicting at times.</p>	<p>organization and its stakeholders at both strategic and tactical levels.</p> <p>(2) <i>Supplier management practice</i> facilitates observing and appropriately managing the performance levels of an organization's suppliers to continually support of quality services.</p>
	<p>Engage diverse public representative group members for testing the performance of the CCS.</p>	<p><i>Workforce and talent management</i>: this enables documenting comprehensive performance expectations from all public stakeholder perspectives.</p>	<p><i>Workforce and talent management practice</i> facilitates keeping the right people with the relevant skills and knowledge in appropriate roles that support the service objectives.</p>
	<p>Communicate information updates on the performance benefits of using the CCS for service delivery.</p>	<p><i>Service configuration management</i> and <i>service catalogue management</i>: these enable a clear and consistent understanding of the contributions, relationships and dependencies of all stakeholders towards creating public value.</p>	<p>(1) <i>Service configuration management practice</i> facilitates the availability of information that is accurate and reliable concerning the configuration of all services.</p> <p>(2) <i>Service catalogue management practice</i> facilitates the availability of consistent information about all services (from a single source) to the relevant stakeholders.</p>
(4)	<p>Establish equal representation of technical, legal and ethical expertise in CCS design teams to support a holistic approach.</p>	<p><i>Workforce and talent management</i>: this enables appropriate levels of equal representation of the diverse stakeholders contributing towards different elements of public value.</p>	<p><i>Workforce and talent management practice</i> facilitates keeping the right people with the relevant skills and knowledge in appropriate roles that support the service objectives.</p>
	<p>Engage technical, legal and ethical representatives for testing the performance of the CCS.</p>	<p><i>Service validation and testing</i>: this enables the established service procedures to maximize creation of public value for diverse public service stakeholders.</p>	<p><i>Service validation and testing practice</i> facilitates meeting the defined requirements in both new and changed services.</p>

	Establish a multidisciplinary team of technical, legal and ethical experts for continuous monitoring of CCS performance.	<i>Monitoring and Event Management</i> : this enables continued identification and logging of emerging issues and improvement opportunities.	<i>Monitoring and event management practice</i> facilitates the systematic observation of services and components of services, including capturing and reporting changes in state.
(5)	Designate a team of internal and external data experts to analyze, clean and verify the accuracy and complete representativeness of the CCS training data.	<i>Service configuration management and workforce and management practice</i> : these enable a clear understanding of the levels of contributions, relationships and dependencies of all stakeholders towards public value.	(1) <i>Service configuration management practice</i> facilitates the availability of information that is accurate and reliable concerning the configuration of all services. (2) <i>Workforce and talent management practice</i> facilitates keeping the right people with the relevant skills and knowledge in appropriate roles that support the service objectives.
	Engage independent data auditors to analyze and identify any biases in the CCS training data.	<i>Monitoring and event management</i> : this enables a systematic approach to observe, analyze and record any changes in the service procedures.	<i>Monitoring and event management practice</i> facilitates the systematic observation of services and components of services, including capturing and reporting changes in state.
	Engage independent data auditors to analyze the performance of the CCS at regular intervals.	<i>Monitoring and event management and problem management</i> : these enable timely interventions to reduce unintentional errors.	(1) <i>Monitoring and event management practice</i> facilitates the systematic observation of services and components of services, including capturing and reporting changes in state. (2) <i>Problem management practice</i> facilitates identification of potential causes of incidents to reduce the impact and likelihood of incidents and known errors.

(6)	Establish feedback channels and platforms to listen to and promote continuous engagement with all public stakeholder groups.	<i>Relationship management and continual improvement</i> : this enables effective articulation of new or changed services that align with the public's priorities.	(1) <i>Relationship management practice</i> facilitates establishing and nurturing links between an organization and its stakeholders at both strategic and tactical levels. (2) <i>Continual improvement practice</i> facilitates the ongoing identification and improvement of all service elements to align with changing stakeholder needs.
	Establish mechanisms to detect emergent patterns of collectives from the service procedures.	<i>Change control and incident management</i> : these enable reducing the risk of unexpected occurrences by adding, modifying or removing elements that could have a direct or indirect effect on the service.	(1) <i>Change control practice</i> facilitates proper risks assessment and managing of changes to optimize successful service changes. (2) <i>Incident management practice</i> facilitates the swift restoration of normal service operations to minimize the impact of incidents.
	Review and analyze emergent patterns of collectives to eliminate discriminatory tendencies.	<i>Problem management</i> : this enables minimizing the likelihood of incidents that may be introduced unconsciously.	<i>Problem management practice</i> facilitates identification of potential causes of incidents to reduce the impact and likelihood of incidents and known errors.
(7)	Involve public service system expert designers during the designing phase of CCS to ensure consistency with norms.	<i>Relationship management</i> : this enables value creation for public stakeholders that is aligned with established strategies and priorities.	<i>Relationship management practice</i> facilitates establishing and nurturing links between an organization and its stakeholders at both strategic and tactical levels.
	Minimize the disruption to the public ecosystem with the introduction of CCS.	<i>Release management and change control</i> : these enables continued delivery of public value with minimal negative impact.	(1) <i>Change control practice</i> facilitates proper risks assessment and managing of changes to optimize successful service changes. (2) <i>Release management practice</i> facilitates rendering the changed services available for use.
	Continuously monitor how the CCS fits within the public ecosystem.	<i>Service design</i> : this enables minimum disruption in terms of creating public value within the public ecosystem.	<i>Service design practice</i> facilitates designing the right services for the appropriate purpose that an organization can deliver within its ecosystem.

(8)	Establish platforms and forums to engage individuals and stakeholder groups to discuss the contributions of the CCS.	<i>Capacity and performance management</i> : this enables determining the expected performance and public value contributions.	<i>Capacity and performance management practice</i> facilitates cost-effectively achieving the expected service performance levels to satisfy both current and future service demand.
	Engage individuals and stakeholder groups in continuous dialogue.	<i>Relationship management</i> : this enables a continued understanding of the diverse stakeholder needs.	<i>Relationship management practice</i> facilitates establishing and nurturing links between an organization and its stakeholders at both strategic and tactical levels.
	Use the knowledge from the diverse stakeholders of the CCS to drive continuous redesigning cycles of all aspects of the system.	<i>Continual improvement</i> : this enables aligning the service procedures with changing and emergent public requirements.	<i>Continual improvement practice</i> facilitates the ongoing identification and improvement of all service elements to align with changing stakeholder needs.
(9)	Establish well defined goals to be achieved by implementing the CCS.	<i>Service catalogue management</i> : this enables clear documentation of the activities and their contributions towards public value.	<i>Service catalogue management practice</i> facilitates the availability of consistent information about all services (from a single source) to the relevant stakeholders.
	Communicate the CCS goals with all stakeholders involved in the development of the CCS.	<i>Service level management</i> : this enables transparency in terms of the expected public value contributions.	<i>Service level management practice</i> facilitates setting service performance targets to properly monitor, assess and manage the delivery of a service.
	Continuously monitor the extent to which the CCS facilitates the intended goals and re-align the goals according to any changes in the public system.	<i>Monitoring and event management</i> : this enables identifying the need for initiating changes or other practices to the service procedures.	<i>Monitoring and event management practice</i> facilitates the systematic observation of services and components of services, including capturing and reporting changes in state.

(10)	Understand the positioning of the intended goals of the CCS in terms of how this relates to other public value dimensions.	<i>Service level management:</i> this enables the service to achieve the agreed and expected performance that satisfies the current and future public value demand.	<i>Service level management practice</i> facilitates setting service performance targets to properly monitor, assess and manage the delivery of a service.
	Ensure that all stakeholders involved in the development of the CCS have a good understanding of all public value dimensions implicated by the system.	<i>Service configuration management:</i> this enables a clear understanding of the contributions, relationships and dependencies of all stakeholders towards public value.	<i>Service configuration management practice</i> facilitates the availability of information that is accurate and reliable concerning the configuration of all services.
	Continuously evaluate the performance of the CCS in relation to both the intended goals and all other implicated public value dimensions.	<i>Service continuity management:</i> this enables maintaining sufficient levels of service performance in changing environmental conditions.	<i>Service continuity management practice</i> facilitates maintaining sufficient levels of service availability and service performance in the event of unexpected occurrences.
(11)	Discuss expectations of CCS public value contributions with individual public stakeholder groups.	<i>Availability management:</i> this enables a service to deliver the expected outcome levels that meet the needs of the public.	<i>Availability management practice</i> facilitates agreed levels of service availability in accordance with the service customer needs.
	Establish public value measures based on the consensual expectations of all public stakeholders.	<i>Service configuration management:</i> this enables a clear understanding of the contributions, relationships and dependencies of all stakeholders towards public value.	<i>Service configuration management practice</i> facilitates the availability of information that is accurate and reliable concerning the configuration of all services.
	Continuously propel feedback on the public value contributions of the CCS.	<i>Continual improvement:</i> this enables aligning the service procedures with changing and emergent public requirements.	<i>Continual improvement practice</i> facilitates the ongoing identification and improvement of all service elements to align with changing stakeholder needs.

(12)	Identify potential public value measures through reviewing past CCS initiatives.	<i>Problem management:</i> This enables uncovering potential causes of incidents and potential strategies to avoid incidents.	<i>Problem management practice</i> facilitates identification of potential causes of incidents to reduce the impact and likelihood of incidents and known errors.
	Establish measures to track the performance of CCS over time.	<i>Monitoring and event management:</i> this enables identifying the service components that should be monitored and the monitoring strategy.	<i>Monitoring and event management practice</i> facilitates the systematic observation of services and components of services, including capturing and reporting changes in state.
	Review the impact of CCS across all the established measures of public value.	<i>Monitoring and event management:</i> this enables establishing and maintaining thresholds and other criteria for determining interventions.	<i>Monitoring and event management practice</i> facilitates the systematic observation of services and components of services, including capturing and reporting changes in state.

Table 3: Detailed recommendations for managing CCS in the public sector

FIGURES

Figure 1

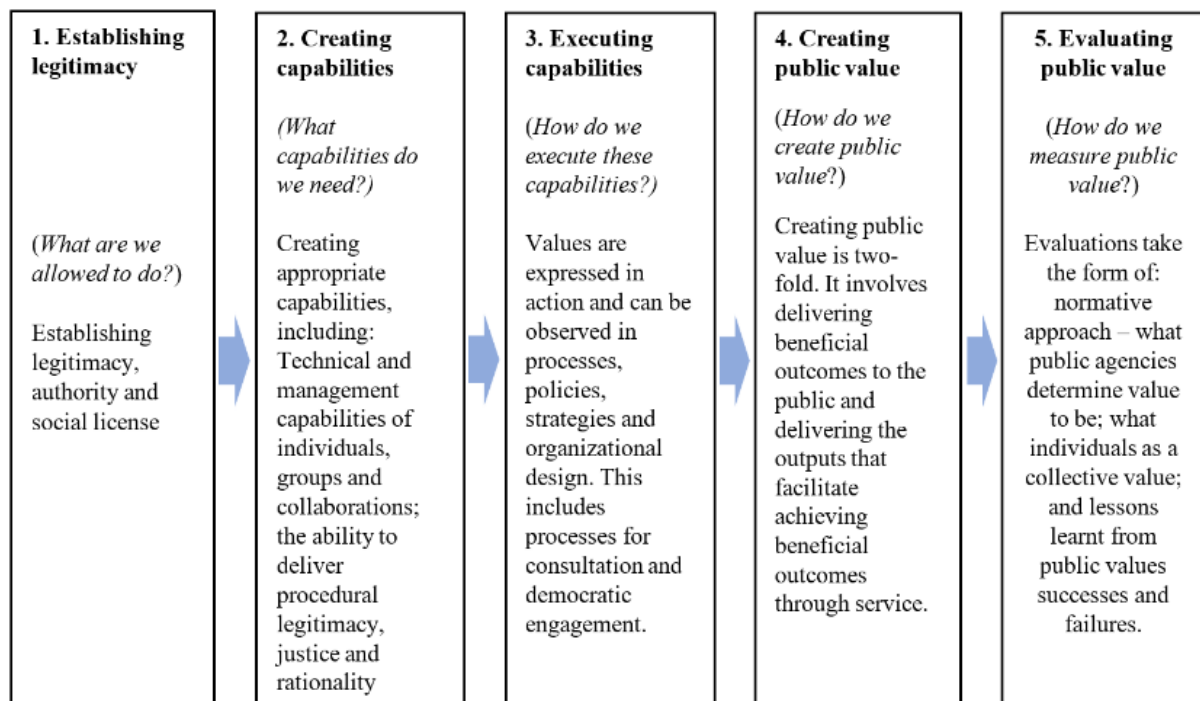


Figure 1: Public-value-based framework for managing CCSs

Figure 2

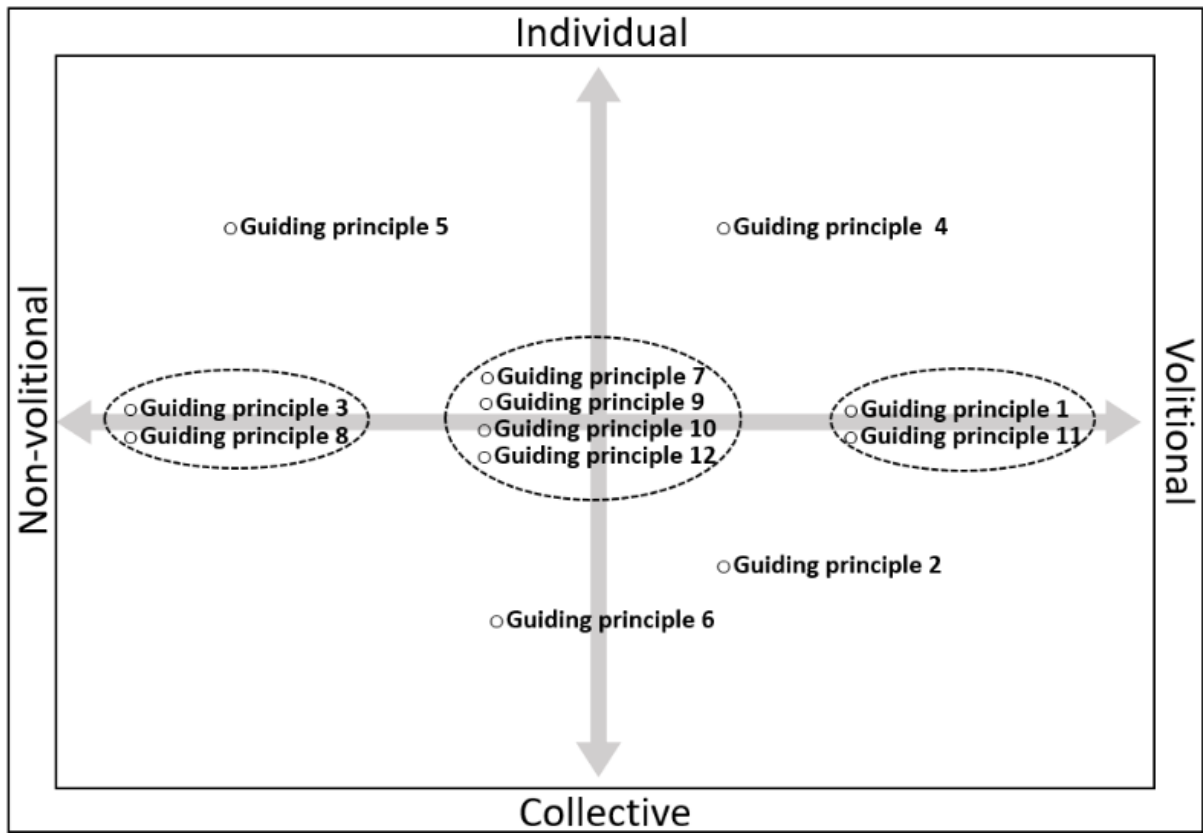


Figure 2: Positioning of the guiding principles in relation to the nature of the public service