8-17-2023

Municipal Pathways towards Digital Government: Ontario's Municipal Modernization Program and the Determinants of Technology Adoption

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MPA Research Report

Submitted to
The Local Government Program
Department of Political Science
The University of Western Ontario

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July 2023

Abstract: Ontario’s municipalities exist at various stages of e-government adoption. Municipalities are faced with the challenge of adopting new technologies to meet expanding services demands. Both municipalities and the Provincial government face the challenge of developing policies to support information and communication technologies (ICT) adoption. Understanding the unique determinants of technology adoption can assist with this policy making. The study answers how organizational factors affect ICT adoption in small and rural municipalities; and how Ontario’s municipal modernization funding interacts with these determinants. The study examines the determinants of ICT adoption for ICT policies, online services, and electronic records management systems. Focusing on both organizational factors and grant engagement, a total population study was conducted on the CAO, Clerk, and Treasurer’s for the municipalities which received 2019 Provincial modernization grant funding. Findings suggest centralization is negatively associated with each ICT adoption investigated. Centralization, work routineness, and personal constraints negatively impact risk tolerance, with risk tolerance being positively associated with the adoption of online services. Finally, the study suggest grant engagement is positively related to ICT policy and online adoption. In summary, this study’s primary contributions are to explore American research findings within Ontario’s context, and to suggest Ontario’s municipal modernization funding successfully aligned with the municipal determinants of ICT adoption.

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Section 1: Introduction

The Ontario government has released over $200 million dollars in funding to support municipal modernization in over four hundred municipalities since 2019. These funds have been expended in a variety of manners; Ontario's municipalities are a diverse collection of municipal governments, each with unique challenges and service demands. Despite these differences, previous research has suggested municipalities share a common process of modernization, innovation, and information technology integration. The effects of intergovernmental grants on information and communication technology (ICT) adoption, and ICT adoption within the municipalities of Ontario specifically, has not been explored in previous research.

This study explores the municipalities of Ontario's use of the provincial modernization funds, and the determinants of ICT adoption within small and medium sized Ontario municipalities. The study provides insights on how organizational factors affect ICT adoption in small and rural municipalities; and how Ontario's municipal modernization funding interacts with these determinants. The paper evaluates multiple hypotheses based on existing literature on ICT adoption. Municipal staff from Ontario's municipalities with a population size up to 100,000 were surveyed on their organization and its ICT adoption. The survey format was an amended version from previous studies regarding the determinant factors of ICT adoption. Quantitative analysis, as well as path multivariant regression analysis, were used to analyze the survey data.

This paper offers a detailed accounting of the research and its findings. To achieve this, the paper is divided into five sections. The first section introduces and justifies the research question; this section includes an introduction to the technical offerings of "modernization" and the global push towards digital government. The

second section is a literature review discussing intergovernmental incentives, best practices, and the determinants of ICT adoption. This section outlines how multiple hypotheses were developed for testing with the survey. A breakdown of each hypothesis is provided using previous literature.

The third section outlines the research methodology in detail. This section details the positivist theoretical framework underlying the survey of 1212 municipal staff members from 404 Ontario municipalities. The design of the survey, case selection, its limitations, and its operationalization of the underlying concept is explored in detail.

The fourth section provides analysis of the data collected in the survey. This section explains how the data was systematically analyzed using a variety of statistical tools, including path analysis and generalized linear models. The section introduces the key results needed to interpret the statistical analysis and draw conclusions.

The fifth and final section discusses the major findings of the paper. This section outlines the limitations of the data, explores key findings, and provides direction to future research to continue examining the topic. There are three major findings explored in this section: first, centralization negatively influences the adoption of ICT policies, online services, and new electronic records management system. Second, risk tolerance is positively associated with the adoption of online services; the negative effect of work routineness, personal constraints, and partial centralization are best understood to impact ICT adoption through their relationship with risk tolerance. Finally, there is a positive relationship between grant engagement and ICT adoption, which suggests Ontario’s municipal modernization funding is well designed to support further

ICT adoption. This paper is organized using headers and can be navigated using the table of contents above.

Background and Research Question

Discussion of ICT adoption in local government is nested within definitions of digital government and e-government. Digital government refers to the use of digital technologies in current and future government processes. As an area of study, it emphasizes the digitalization of all functions of government, including: service provision, administration, civic engagement, accountability, and governance (Sanina, 2023, p. 87). Digital government is expansive and encompassing of the future possibilities of digital technology in government. E-government as a concept is nested within digital government. E-government refers to the deployment of technology in government services, primarily through the internet, social media, and computer-based applications. As a nested concept, discussions of e-government can be understood as a component of digital government.

ICT adoption is a component of both digital government and e-government; ICT adoption expands beyond the realm of government and encompasses the adoption of ICT within the private sector. For the purposes of government, this literature exists within the grander vision of digital government, or the gradual digitization and reinvention of government in a digital age (Sanina, 2023, p. 88). Similarly, where ICT adoption is used to mirror traditional services within the digital space, it is also an example of e-government. Within the definition of information and communication technologies, or ICT, there is a wide range of tangible, non conceptual, real-world tools. At the most basic level in the current world, there is computer word processing, the internet, websites, social media, electronic storage of information, and data

management. At the bleeding edge of current ICT, we have generative AI for language and media, deep data mining, and blockchain.

Each different form of ICT has varied capabilities and implications for government and specific government services (Giulio, 2021, p. 133). Discussion of adoption, capabilities, and implications for government is the focus of both digital government and e-government literature. This study contributes to the literature of digital government and e-government by exploring ICT adoption within the municipal setting.

To understand the importance of the research question, Ontario's municipal modernization program must be understood within the global context of governments prioritizing digital government and associated ICT adoptions. Internationally, the leading voice on digital government is the Organisation for Economic Co-operation and Development (OECD). In their 2019 publication, *Strengthening Digital Government*, the OECD addresses the need for rapid integration of technology within government; they suggest failing to transform with technology would be a breach of the social contract (p. 1). This idea suggests that technology is transforming all social interactions and that governments will need to reshape the way they interact with individuals and businesses. The e-government movements of the early 2000s prioritized technology adoption as a pathway towards a more efficient public service (Dunleavy, 2006, p. 494); today, the concept of digital governments focuses more on citizen driven adoption. Adoption of technology can be seen as serving more ends than simply efficiency. “Usability, accessibility, friendliness, convenience, and effectiveness” are all key factors to add into

discussions of technology adoption beyond traditional discussions of efficiency according to the OECD (p. 3).

Key amongst the OECD recommendations are providing government incentives for digital initiatives, service design overhauls, and overall developments of digital government strategy. The Government of Ontario has developed a digital service strategy to support its own services. Their approach to modernization has relevance to municipal governments as service partners to the province; initiatives like digital identity and accessibility compliance have direct implications on municipalities. As creatures of the province, municipalities may be subject to regulation on digital government initiatives from the province in the future. For example, Ontario Regulation 191/11: Integrated Accessibility Standards under Accessibility for Ontarians with Disabilities Acts (AODA/O. Reg. 191/11) requires municipalities to undertake extensive reviews of their own services and particularly reform their approaches to presenting information online. The current approach of providing modernization funding presents municipalities with the opportunity to guide their own digital pathway.

Ontario's municipalities recognize the value of digital government initiatives. In a 2017 report, the Association of Municipalities of Ontario argued digital government offers multiple benefits in terms of efficiency and customer service improvements. Significant service improvements are available in the development of internal workflows, cloud computing municipal websites, online-services, and digital public engagement (AMO, 2017, p. 8).

The AMO offered recommendations to enable digital transformation within Ontario's municipalities. First, they suggested it was necessary to recognize that

municipal governments are at various stages of digital maturation, meaning municipal governments have various levels of existing information technology integration; municipal governments also have different local realities, and local needs creating demands for different information technology decisions and solutions. The AMO suggested in 2017 that the provincial government should provide digital initiatives with supports to overcome obstacles, including funding and human resourcing (AMO, 2017, p. 29). The AMO called for further direct intergovernmental collaboration. Their final recommendation was that the provincial government support the expansion of broadband and cellular services to ensure that all municipalities have the infrastructure to support digital services. With a commitment of $4 billion to deliver high speed internet to all of Ontario[1], the provincial government has already been making high speed Internet access a priority and many municipalities are working together towards the expansion of Internet services[2]. With consideration of the municipal modernization funding program, provincial actions in the municipal modernization policy area have been consistent with the AMO's recommendations.

The AMO report included results of a survey of Clerks and CAOs meant to assess various levels of digital government initiatives. The survey included three questions; the first question asked whether municipalities are undertaking any level of digital government initiatives specifically referencing online tools or online applications. Respondents were asked to provide descriptions of the initiatives they were undertaking. Data from the survey and specifically the written responses is useful for

[1] Defined as 50Mbps download and 10Mbps upload speeds. See https://www.ontario.ca/page/ontario-connects-making-high-speed-internet-accessible-in-every-community for progress map.
[2] Numerous investments, example SWIFT initiative or ICON

understanding the wide variety of projects being undertaken within Ontario's 400 plus municipalities. Projects range from GIS open data initiatives to online job application systems, to public Wi-Fi and electronic document management's systems, and more. As suggested by the data, municipalities exist at various stages of digitalization.

AMO offered general observations that municipalities intend to digitalise all service processes where possible and that all new projects should consider digital integrations (AMO, 2017, p. 22). Responses suggests the municipalities intends to digitalise all interactions with the public or at least allow for residents to interact with the municipality digitally. Asked about barriers to implementations, responses varied with most respondents indicating that financial resources were the primary barrier followed by staff issues, change management, insufficient Internet access, and IT issues. Notably only one respondent indicated cyber security and privacy as barrier to implementation. With financial resources identified as the primary barrier, Ontario's municipal modernization program seems well positioned to have an impact on digital initiatives.

This paper asks what the determinants of ICT adoption in small and rural Ontario municipalities are and how should the context of Ontario's municipal modernization program be anticipated to interact with those determinants. This question is significant because the Government of Ontario has provided a substantial external incentive to modernize, innovate, and adopt new ICT since 2019. If intergovernmental incentive programs are to be successful, it should be found to align with the determinants of ICT adoption within small and rural municipalities. If this is the case, further

intergovernmental programming on ICT adoption may be desirable. To explore this idea, the municipal modernization program needs explanation.

The municipal modernization program is a structured grant funding program provided by the Government of Ontario's to help municipalities make their services more efficient and modern. Before the program officially began, 405 small and rural municipalities were provided unconditional grants to support modernization efforts, totalling over $200 million in March 2019[3]. As an unconditional grant, municipalities had significant discretion in determining which projects were funded using the modernization funds. Following the release of the unconditional funds, the program formally adopted the name of the "municipal modernization program" and initiated a multi-phase approach to releasing additional funds with conditions. Intake one followed shortly after the 2019 unconditional funding; the first intake offered municipalities funds to complete a service delivery review meant to identify efficiencies which the municipality could then address.

Intake two of the program began in early 2021. This program featured two streams of funding: first the review stream which provided funding for municipalities looking to undertake reviews of their services, particularly municipal service delivery reviews or reviews of administrative expenditures.[4] The second implementation stream of funding was meant to support projects either recommended by previous reviews or supported by evidence-based reporting; the municipality and province would be cost

[3] See: https://www.ontario.ca/page/service-modernization-funding-small-and-rural-communities
[4] This information was collected from the provincial governments funding portal which is not publicly available. Intake guidelines and applications were reviewed for each intake of the MMP.

sharing on these projects with the intention of the municipality finding new efficiencies through technology implementation.

Review stream funding required municipalities to undertake independent third-party reviews to find savings and efficiencies. Municipalities had discretion in the form of review undertaken; options included line by line review of the municipal budget, or review of services or administrative processes. Each of these reviews would be undertaken with the intention of discovering efficiencies or cost reductions. Grants were distributed with priority to projects which focused on digital modernization, services integration, streamline development approvals, or shared services/alternative service delivery model proposals. Other requirements for the stream included: that report goals did not include increases to revenues, nor reductions in staffing levels; that the report would be published publicly and available on the municipal website; that the report would focus on topics beyond accountability; and that the report was not overlapping with Ontario's asset management regulations requirements.

Implementation stream funding offered between 75% and 65% project cost sharing by the provincial government depending on the size of the municipality. The provincial share of a project's cost was anticipated to be between $20,000 and $250,000, with projects being approved on a case-by-case basis.[5] The program required projects to have evidence supporting cost savings; be scheduled to begin within eight months; include a high-level plan and implementation timelines; include a plan to produce a final report forecasting savings over three years; and include a

[5] This information was collected from the provincial governments funding portal which is not publicly available. Intake guidelines and applications were reviewed for each intake of the MMP.

commitment to reporting within one year of project completion the actual savings over the course of the year and revised savings over the following two years. As with the review stream, application selection by the provincial government prioritized projects focused on digital modernization, service integration, streamlined development approvals, and shared service/alternative service delivery models. Municipalities under five thousand in population were eligible for 75% cost covered by the provincial grant, where municipalities over five thousand population were eligible for 65%.[6] Once again, projects which sought to reduce frontline staff, or which were not linked to efficiencies or cost savings, were ineligible. Additionally, municipalities would need to cover any ongoing maintenance charges. Major capital expenses, regular budget expenses, and regular employee salaries were all ineligible costs; however, expenses like temporary hiring (internships), fee for service providers (consultants), software licensing, system development, and training were all eligible. It is anticipated that the municipal modernization program will have another two phases of funding releases[7], with $125 million is set to be released later in 2023.

Each wave of funding has been linked to information technology adoption. The first unconditional grant provided municipalities a significant amount of discretion in what they spent the funds on. These funds were distributed with the instruction that they would be used for modernization and efficiency finding efforts. Qualification for funding in the future phases only required the municipalities to have spent the 2019 funding,

[6] This information was collected from the provincial governments funding portal which is not publicly available. Intake guidelines and applications were reviewed for each intake of the MMP.
[7] See: https://news.ontario.ca/en/release/1000446/ontario-supports-modernization-of-small-and-rural-municipalities

municipalities had no specific requirements to report back on how the funds were specifically used. Around half of these municipalities have applied and received for conditional funding through the future phases to pursue either service reviews or projects approved by the provincial government[8]. Requiring proposals to be linked to digital modernization, service integration, streamlined development approvals, and shared service/alternative service delivery models connected the funding to technology adoption. The provincial government has published a list of these projects and there is a great deal of variety in the projects being undertaken in the implementation stream. Reviewing the approved implementation projects, all approved projects relate to some form of information and communication technology (ICT) adoption[9].

Section 2: Literature Review

Intergovernmental Influence

The municipal modernization program represents one tool available to the Ontario government to encourage municipalities to adopt digital government reforms and ICT. These tools project power and control in different manners; in its early implementation, the municipal modernization program, with its unconditional grants, offered municipalities the capability to direct their own modernization. The addition of conditions for future grants tightens provincial control over modernization efforts. Intergovernmental programs can be classified on a scale of intergovernmental centralization. Literature on outcome oriented intergovernmental programs provides two performance regime archetypes: intelligence regime and compliance regimes. Applying

[8] Phase 1: https://s3.amazonaws.com/files.news.ontario.ca/mma/en/learnmore/ontario_supports_modernization_of_municipal_services/List_of_municipal_service_delivery_and_efficiency_projects.pdf
[9] Phase 2: https://news.ontario.ca/assets/files/20210630/20bede9439cff70fffb5ad235aa731c6.pdf

a scale, intelligence regimes reflect low intergovernmental centralization and compliance regimes high intergovernmental centralization. The municipal modernization program would be classified as an information regime, which encourages municipalities to take desirable actions without the use of compliance tools.

Charbonneau (2018) evaluates Ontario's municipal performance measurement program with the intention of testing theories of intelligence regimes providing compliance, accountability, and learning benefits to municipalities. Compliance is encouraged when non-compliance is punished. For example, Ontario's performance measurement program does not influence a municipality's ability to apply for grants or provincial funding, whereas successful submission of the municipal financial information return is a prerequisite for grant applications (Charbonneau, 2016, p. 1463). Intelligence regimes do not include any form of non-compliance punishment, performance comparison, ranking, or evaluation between municipalities. Instead, the regimes rely on the initiative of municipal managers to make use of the information required in the reporting program (Charbonneau, 2016, p. 1452). Hood (2012), examining English municipal governments, theorizes that intelligence regimes could have benefits beyond performance and ranking regimes. The intelligence regimes would encourage the sharing of information and the gaining of knowledge between municipalities. Related to the unique ICT position of municipalities, intelligence regimes do "not imply prior judgments about what should be maximized or what the desirable floor or ceiling level of activity should be, in contrast with both targets and rankings which you require and rests on explicit judgments about what really matters" (Hood, 2012, p. 88). Hood argues that intelligence regimes can provide the learning, accountability, and compliance benefits of

performance regimes, without the central governments imposing targets on a municipality which do not match local realities (p. 88).

Charbonneau finds that the theoretical benefits of intelligence regimes are not evident in a qualitative analysis of Ontario's performance measurement program (p. 1470). The study relies on a variety of qualitative sources including minutes from the program committee as well as data of surveys from municipal staff. Intelligence regimes do not feature tools to encourage compliance. He suggests learning is only likely to take place in intelligence regimes when the central administrator is providing feedback and interpretation to each participant on their individual performance (p. 1451). Without adequate comparisons, managers are unlikely to make use of the information. This is suggested in the qualitative data with public managers reporting that they make limited use of the performance measurement program data. These systems do not adhere to the concept of routineness of use, that is having managers routinely use their performance data. Routineness of use is seen as a prerequisite for legitimate learning and required for organizational bodies to benefit from performance data (Charbonneau, 2016, p. 1453).

Charbonneau suggest compliance regimes to be a more effective tool for provincial governments seeking to encourage certain behaviors (p. 1455). Compliance theory offers useful concepts for provincial direction of municipal modernization efforts. Notably compliance theory suggests that compliance will increase as units are detected for noncompliance and others observe their punishment. As the social unacceptability of noncompliance increases, more units will be brought into compliance with the program. This can be observed in the financial information return which Ontario conducts every

year, where 100% compliance rate is achieved as noncompliant organizations are punished with ineligibility for grant funding (Charbonneau, 2016, p. 1471).

The AODA and its associated regulations present a similar compliance system within Ontario, which could be replicated in the digital government space. There is currently no research conducted on municipal compliance with the requirements of the AODA. Research on similar legislation in Europe demonstrates that regulations designed to improve the accessibility of municipal websites had significant effects on compliance; over one year in Slovenia, the introduction of European Union accessibility standards resulted in municipal websites moving from zero percent compliance to 33% compliance (Kous, 2020, p. 595). In the Ontario context, some research suggests municipalities resist provincially imposed policy requirements (Alcantara, 2012, p. 114). Applications of a compliance system in the realm of digital government could be controversial given that municipalities are currently at widely distinct stages on the path towards digital government; however, for the purposes of evaluating the municipal modernization programs, it is necessary to be aware of alternative governments approaches to digital government reform.

Best Practices in Modernization Initiatives

To evaluate and develop hypotheses on the effect of the municipal modernization program, it is necessary to establish that ICT adoption is not a mysterious or overly complex process. Best practices in ICT adoption are well established in both the public and private sector. The municipal modernization program encourages municipalities to undertake third party service reviews and follow the recommendation as part of their modernization efforts. These service reviews are compatible with industry best

practices. For example, Dawson's *A Roadmap for IT Modernization in Government* (2018) offers eight key principles for successful modernization initiatives.

Municipalities could follow the eight guidelines and continually improve their level of ICT integration. The first of these lessons is awareness of the drivers of modernization; this awareness will allow for staff with information technology responsibility to correctly position the organization for modernization. Understanding the drivers can allow for a strategy to be developed (Dawson, 2018, p. 26). The second lesson is that planning should be done on an enterprise or organizational level, rather than out of business unit level. This could come in the form of a central strategy, a leadership group, centralization of information technology purchasing, and a legislative mandate to promote centralized solutions to information technology modernization.

The next key is implementing change at the departmental level (Dawson, 2018, p. 29); at this level individual efforts can support organization wide change in a tangible and visible way. Taking advantage of low hanging fruit allows a snowballing effect on other modernization efforts. The fourth key is communicating the value of modernization efforts to stakeholders. Communicating value helps avoid modernization fatigue which could be a risk to future modernization. Reflecting Seigel's leadership role for the CAO, modernization successes need to be communicated up to Council and down to staff. Communication needs to highlight the business case for modernization; ideally communication should extend beyond information technology benefits and cost savings and should connect to the larger goals of the organization (Dawson, 2018, p. 29).

The fifth key is taking inventory of existing information technology and skills inventory (Dawson, 2018, p. 30). Modernization takes different pathways for different

organizations; each organization begins in a different place. By taking inventory organizations can fully leverage existing technology. For example, many municipalities have existing information management systems which may not be fully utilized. Furthermore, municipalities may have electronic records management systems or enterprise management systems which are unimplemented or underutilize (AMO, 2017, p. 11).

The sixth key is beginning with people before proceeding with processes and technology (Dawson, 2018, p. 30). This is a change management strategy driven by pragmatism; people need to be solved before technology problems. Modernization efforts should not simply speed up inefficient processes, they should target underlying problems. Modernization can be a lengthy process and people need to have the capabilities and willingness to support it. Closely related, the seventh key is leadership support; executives need to be willing to drive change through strategy development, communication, and oversight. Leadership needs to offer staff the flexibility and empowerment to make initiatives succeed (Dawson, 2018, p. 32).

The final and eighth key to modernization is acknowledgement and nurturing of the “long tail” effects of successes (Dawson, 2018, p. 33). Immediate efficiency gains are likely to be followed by many years of supplementary performance improvements based on the evolution of information technology. For example, a municipality which is digitizing its records and developing data driven solutions to service issues is more likely to benefit from technologies like artificial intelligence, cloud integrations, and platform expansions which improve with additional data. Acknowledgement and

recognition of new ICT opportunities encourages a virtuous cycle of technology adoption.

This roadmap for modernization paves a clear path for ICT adoption, modernization, and innovation. Alas, it is a reality that municipalities do not travel this path with ease (AMO, 2017, p. 6). Ontario's municipal modernization program is a response to a lagging municipal sector losing out on the benefits of digital government. For this reason, it is important to understand the determinants of ICT adoption within municipalities and to explore policy options to address them. The following section reviews literature on ICT adoption and develops hypothesis based on it.

Determinants of ICT Adoption and Hypotheses Development

Research has identified organizational and environmental factors which influence ICT adoption; those being organizational centralization, work routineness, personnel constraints, stakeholder influences, risk taking (Wang, 2016, p. 292). Wang and Feeney used these same four factors as the basis of their study of municipal sector ICT adoption within the United States. They examine a survey of cities in the United States with populations ranging from 25,000 to 250,000. The survey was sent to 2428 city managers across these cities and received a response rate of 34.8% (p. 300). Their study focused on perceptions of municipal culture as independent variables using Likert scales responses. Adopted ICT technology served as dependent variables, and multivariant, path regression was used to evaluate the survey data. They developed hypotheses on centralization, work routineness, personnel constraints, stakeholder influences, and risk taking, and evaluated them against the results of the survey.

Stakeholders include actors who impose external accountability onto government bodies and thus impact ICT adoption. Stakeholders can include both citizens, their

elected officials, businesses, and other levels of government. Incorporating stakeholder influence in discussions of innovation is a new area of research (Wang, 2016, p. 297). DeLeon and Denhardt (2000) observe that new public management discussions about innovation needed to consider external stakeholders (p. 96). ICT adoption is strongly associated with faster service delivery, greater convenience, improved communication, and a stronger platform for democracy; considered to be generally desirable by citizens, researchers found that ICT innovations were more likely to be adopted early by municipalities with wealthier citizens (Jun, 2011, p. 509). Other research has found that constituency pressure is a major factor in management and council views of information technology (West, 2001, p. 243).

Other government organizations also influence ICT adoption. This can include legal, political, professional, or intergovernmental influences. Legislation and judicial decisions may shape ICT decisions. For an example within Ontario, the *Accessibility for Ontarians with Disabilities Act, 2005, S.O. 2005, c. 11* (AODA) established a framework for municipal compliance with a variety of accessibility-oriented ICT innovations. Political pressure may also impact municipal ICT adoption. Ahn (2011) suggested that political competition and perceived demand increase municipalities willingness to adopt new communication platforms (p. 428). Professional influences and best practices have not been extensively explored within the literature, but it can be assumed that organizations like the AMO and the AMCTO influence ICT decisions made by municipalities by raising awareness of best practices; additionally exchange of employees between municipalities will lead to shared practices and technology preferences in the industry. Finally, intergovernmental influences would include

Ontario's municipal modernization program and associated grant funding. As noted earlier, there is limited research on the influence of grants.

In their 2016 study, Wang and Feeney found nongovernmental stakeholder influence to have a significant effect on the adoption of e-services and governmental stakeholder influence to have a significant effect on the adoption of intranet (p. 304). The findings were consistent with their hypothesis, and they suggested a link between the interests of external stakeholders and potential benefits derived from each system. Nongovernmental actors would benefit from e-government services, whereas governmental actors would be interested in the efficiency gains from an intranet system.

For the purposes of this paper, a similar hypothesis was adopted. The municipal modernization program suggests the Ontario government has a direct influence in all significant ICT adoptions which lead to service improvements; this position is consistent with the Ontario's digital service strategy (Building a Digital Ontario, 2021). Guidelines for the municipal modernization program applications prioritize digital modernization, service integration, and streamline development approvals. This research suggests tracking three ICT projects which fall within these guidelines: information technology policy and planning, website-accessible citizen services, and electronic records management systems. Compared to government actors, nongovernmental actors should have limited desire for non-public facing systems, and thus the following hypothesis do not suggest such an association:

Hypothesis 1 – Grant engagement is positively associated with:

a) Adoption of ICT policies and best practices
b) Adoption of website-accessible citizen services

c) Adoption of electronic records management systems

Hypothesis 2 – Government stakeholder influence is positively associated with:

a) Adoption of ICT policies and best practices

b) Adoption of website-accessible citizen services

c) Adoption of electronic records management systems

Hypothesis 3 – Non-government stakeholder influence is positively associated with:

b) Adoption of website-accessible citizen services

Work routineness or lack of variety in tasks has been negatively associated with the adoption of ICT. Early literature compared mechanistic verse organic business models. The research compared the models' aptitude for change and innovation; organic models were found to be more adaptable and likely to embrace innovation (DeHart-Davis, 2005, p. 134). Organic models were more likely to feature a diversity of tasks which promoted the sharing of knowledge and innovative practices throughout an organization (Wang, 2016, p. 296). Research from 2012 linked work routineness negatively with the adoption of ICT (Li, 2011, p. 75). Wang and Feeney found work routineness to not have a significant effect on the use of intranet, and only to have a partial effect on use of e-services. These findings were contradictory to most early research.

It must be noted that the environmental factor of the COVID-19 pandemic shifted patterns of work routineness in the three years proceeding this study; the ongoing effect of the pandemic on work routineness and ICT adoption is only in the initial process of being explored (Spicer, 2023, p. 177). Many municipalities have settled into a new normal with pandemic work-from-home arrangements becoming standard practice. This

research proceeded under the assumption that work routineness stabilized and decreased within most municipal organizations through 2022. As a result, Wang and Feeney's original hypothesis was retested in this study as follows:

Hypothesis 4 – Work routineness is negatively associated with:

a) Adoption of ICT policies and best practices
b) Adoption of website-accessible citizen services
c) Adoption of electronic records management systems

Centralization refers to the dispersal of power and decision-making capabilities within the organization. A highly centralized organization disperses control toward the top of the organizational hierarchy; a highly decentralized organization widely disperse control to all levels of the organization. Scholars have historically found varying effects of centralization as a factor influencing technology adoption. In 1965, Thompson found that innovative processes required the wide dispersion of power within an organization (as cited in Wang, 2016, p. 295). In 1978, Daft found that innovative administrative processes were more associated with highly centralized systems; this was explained by centralized systems providing central administrators a complete view of operational processes allowing for successful implementations (as cited in Wang, 2016, p. 295). E-services implementation was examined in 2011 and significant negative association was found with centralization (Jun, 2011, p. 509). Other recent research suggested a negative correlation between e-services and centralization (Li, 2011, p. 75). Research on governments implementing intranet also offers conflicting results with decentralized organizations being better able to implement intranet systems, while intranet systems have been found to better support centralized structures. Meta-analysis on the role of

centralization from the 1990s suggests a negative effect on innovation (Damanpour, 1991, p. 588). In 2016, Wang and Feeney found no significance direct effect of centralization on the adoption of e-services or intranet (p. 304).

Given the variety of findings on the effects of centralization, the study adopted the findings of Wang and Feeney. Research does not suggest a strong correlation between organizational centralization and ICT adoption. The hypotheses were proposed:

Hypothesis 5 – Organizational centralization will not be significantly associated with:

a) Adoption of ICT policies and best practices
b) Adoption of website-accessible citizen services
c) Adoption of electronic records management systems

Personnel constraints are a common feature amongst municipalities, which rely on systems like unions and personnel policy to ensure both accountability and security of the worker. Many researchers defend these constraints. Thompson (2006) argues bureaucratic rules and job protections maintain a system of accountability, protect subordinates and organizations from inappropriate directives from managers, and ensures personal interests do not interfere with public duty (p. 501). Moe and Gilmore (1995) suggest an entrepreneurial approach to government undermines the law; municipal governments exist in all functions as entities created by law, discouraging actions outside of their explicit legal purpose (p. 138). Despite these arguments in favor of personnel constraints, research has linked personnel constraints as an obstacle impeding improvements to organizational effectiveness and performance (Brewer, 2009, p. 240).

Wang and Feeney's study found a significant negative link between personnel constraints and intranet and e-service adoption. Wang and Feeney suggest that ICT adoption may require increased managerial discretion to adjust workloads, adjust work types, and make changes which alter the motivation of employees (p. 298). They suggested an inflexible approach to personnel negatively affects ICT adoption. For this study, Wang and Feeney's results were adopted as a hypothesis. As such, the hypothesis is as followed:

Hypothesis 6 – Personnel constraints are negatively associated with:

a) Adoption of ICT policies and best practices
b) Adoption of website-accessible citizen services
c) Adoption of electronic records management systems

Risk taking is an aspect of any ICT adoption project. Implementing new technology is an inherently disruptive process and the risks of negative consequences are always present. Literature and commentary on risk taking within government is closely related to debates about centralization and personnel constraints. Traditional bureaucracies are subject to critiques for fostering risk aversion due to cultures of strict accountability, limited autonomy, and the absence of competitive forces. Previous research has suggested that government ICT adoption can disrupt municipal power structures and work routines; incorrectly implemented, new ICT systems may discourage teamwork, alter hiring processes, or expose confidential data to the public among numerous possible risks (Wang, 2016, p. 298). Organizations with high levels of risk aversion and risk recognition should be less likely to pursue ICT innovations; similarly, organizations comfortable with risk taking should be more likely to adopt ICT

innovations. Wang and Feeney evaluated both the direct and indirect influence of risk tolerance. Personal constraints, centralization, and work routineness were all associated with significant reductions in risk tolerance. Risk tolerance was found to have a significant direct affect on intranet adoption and a significant indirect influence as a mediating variable for organizational factors (Wang, 2016, p. 306).

Hypothesis 7 – Risk Tolerance is positively associated with:

a) Adoption of ICT policies and best practices
b) Adoption of website-accessible citizen services
c) Adoption of electronic records management systems

Hypothesis 8 – Organizational factors (Centralization, routineness, personal constraint) are indirectly *negatively* associated, through the mediate variable of risk taking, with:

a) Adoption of ICT policies and best practices
b) Adoption of website-accessible citizen services
c) Adoption of electronic records management systems

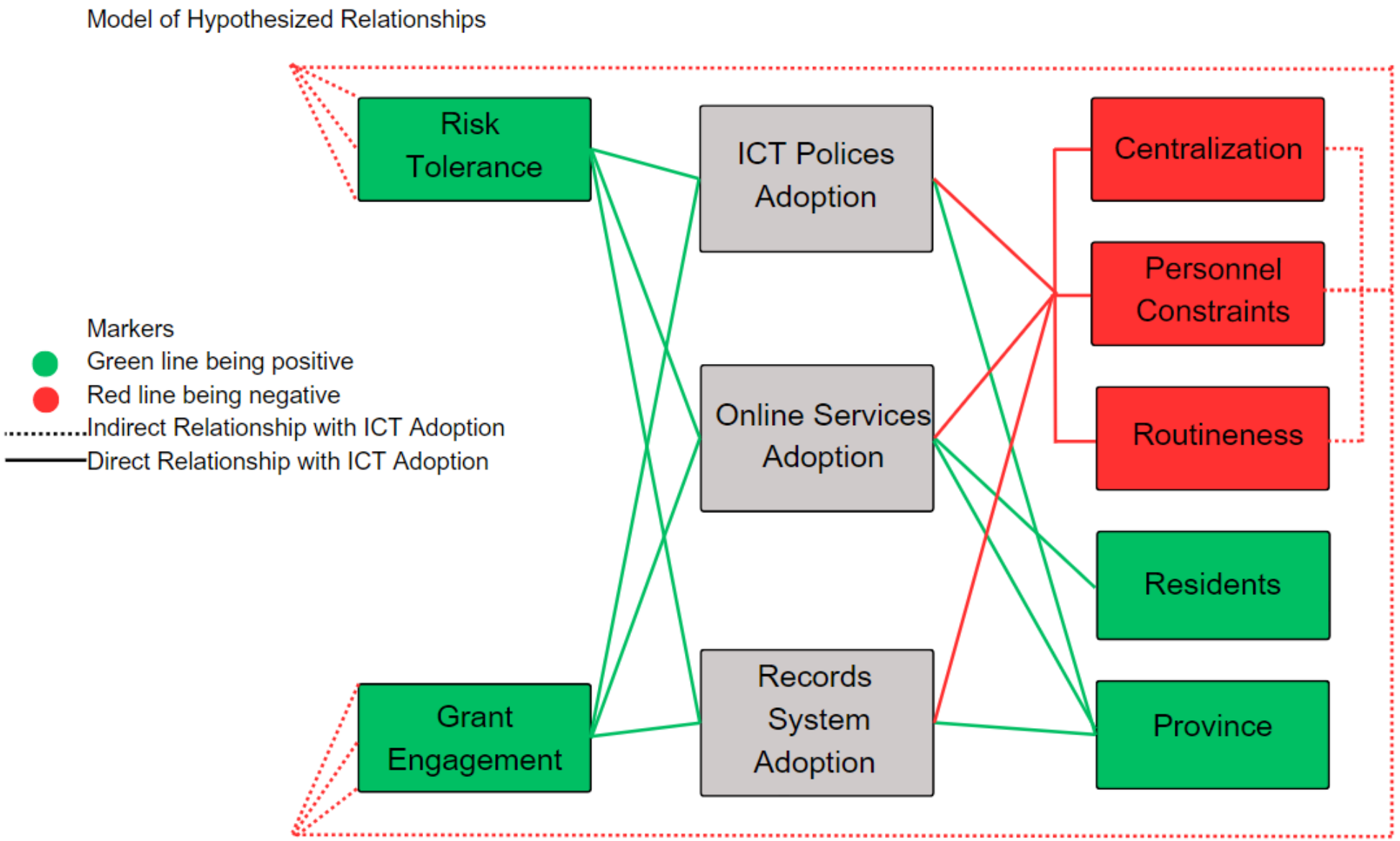
Developing a hypothesis on mediating factors allowed for evaluation of previous findings on risk taking and for a more in-depth analysis of the municipal modernization grant funding provided to municipalities. Mediating variables can be used to explain the relationship between two other variables. For example, the relationship between organizational factors and ICT adoption is significantly linked through the path of risk tolerance as suggested by Wang and Feeney. The logic here is that a more flexible organizations would be more open to risk taking and thus more likely to adopt ICT technology. This path of logic adds value to research findings as relationships between variables are more thoroughly understood (Wang, 2016, p. 306). While research on risk

taking was explored in the previous paragraph, there is no research on the effect or indirect affect of grants funding.

Conceptualising grants engagement as an indirect variable is more challenging than the direct effect proposed in hypothesis one. Testing grant funding as an indirect variable may offer additional insights into its relevance. Grant funding may encourage municipalities to rise above the limitations of centralization, personnel constraints, and work routineness; alternatively grant funding may be engaged in by municipalities already likely to undertake ICT adoptions. The following hypothesis tests the later concept and suggests centralization, routineness, personal constraint negatively influence grant engagement. Considering this, the following hypothesis is proposed: Hypothesis 9 – Organizational factors (Centralization, routineness, personal constraint) are indirectly *negatively* associated, through the mediate variable of grant funding, with:

a) Adoption of ICT policies and best practices
b) Adoption of website-accessible citizen services
c) Adoption of electronic records management systems

Figure 1:


Model of Hypothesized Relationships
Markers
Green line being positive
Red line being negative
Indirect Relationship with ICT Adoption
Direct Relationship with ICT Adoption
Risk Tolerance
Grant Engagement
ICT Polices Adoption
Online Services Adoption
Records System Adoption
Centralization
Personnel Constraints
Routineness
Residents
Province

Section 3: Research Methodology and Theoretical Framework

Theoretical Framework

Answering the research questions requires establishing both a theoretical framework of ICT implementation and a positivist research methodology to direct the inquiry. The unit of analysis for this study is the process of ICT implementation within municipalities. The analysis explores the determinantal organization factors of ICT adoption and establishes how the municipal modernization funding would have altered the process within Ontario. Generalizable results can inform provincial and municipal decision.

From an ontological perspective, this objective is best explored utilizing a conceptual model of ICT implementation. Scholars have developed tangible frameworks for ICT implementation and conducted research on determinant variables of ICT adoption. Adopting a positivist approach, these frameworks can be evaluated against the experiences of municipalities.

From an epistemological perspective, the determinant organizational factors of ICT implementation are primarily accessible through reported perceptions of municipal employees. As will be seen in the following section, the breadth of organizational factors included in the model could not be evaluated without relying on employee perception. This breadth is explored in the subsequent models of ICT implementation section. As such, the unit of observation is the municipal employee and data collected will reflect their views of their municipal culture, and their municipality's ICT implementation process. A survey is the most reasonable way to collect enough data to draw generalizable conclusions as desired.

Models of ICT Implementation

This section will outline a model of ICT implementation which accounts for contextual factors, internal processes, and final outcomes. The framework below (Figure 2) is a version of the framework presented by Kim (2020), which itself is an amended version of several other authors creation (Kim, 2020, p. 6). As technology advances rapidly, implementation frameworks for ICT adoption are useful conceptualizations of the ongoing and unceasing process. For this proposal, the impact of organizational factors and provincial modernization grants can only be measured by first placing it within the overall model of ICT implementation.

This model features a cyclical internal ICT process to support the concept of sustainability and continual improvement within the workplace (Kim, 2020, p. 7). In the initiation phase, organizations identify issues and seek out ICT solutions. Progressing to adoption, the organization must build support for the new technology and determine what investment will be made the organization must then adapt to the new technology, providing rules frameworks, and training to employees. At this stage, the technology is in full use and the organization proceeds to the acceptance stage with further encouragements to support full deployment. Once used regularly, comfort with ICT applications becomes routine and highly normalized. At the infusion stage, the ICT application is fully leveraged, usage is maximized, and the application becomes essential. The organization then advances to the intelligence stage where ICT implementations must be adapted to uncertainty; the flexibility and adaptability of the organization is evaluated as problems arise and new solutions are presented in different technology. This creates a virtuous cycle, where new technology is adopted when

required; the internal implementation process is influenced by external contextual factors which this study investigates.

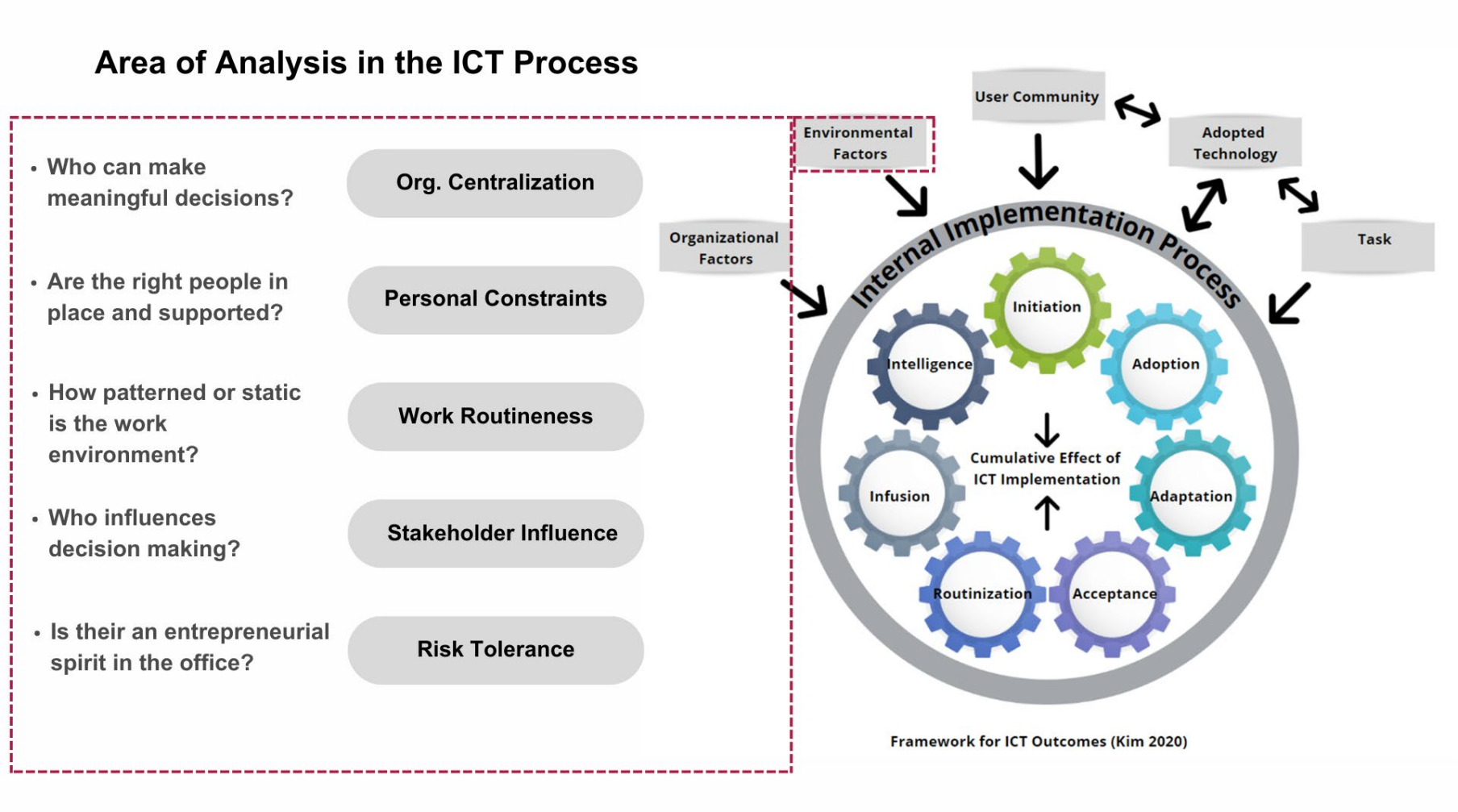
The model features five contextual factors which influence implementation including: organization, environment, user community, adopted technology, and tasks (Kim, 2020, p. 7). Organizational factors include centralization, formalization, specialization, personnel, financial resources, approaches to ICT implementation, organizational culture, size, and type. Environmental factors refer to the economy, the market, geographic location, governance frameworks, intergovernmental relations, intraorganizational dependencies, and generalized uncertainty. The user community refers to the users of ICT products and their generalized preferences, ability to use technology, access to technology, and resistance to change. This includes both internal users and public users when applicable. Previously adopted technologies have legacy impacts on both future implementations and user communities directly; they influence the ongoing completions of tasks. Adopted technology is the outcome of the previous ICT implementations and their design; ease of use also has repercussions for future implementations. The final external factor is tasks, which refers to the purpose of ICT applications or how the technology is meant to be applied.

This model provides an overview of the ICT implementation process in its entirety and provides a consistent system for understanding the proposed research question. Ontario's municipal modernization program should be viewed as a variable affecting organizational and environmental determinants of adoption. This theoretical framework is testable, and deductive research to test variables within the model has been completed in the past (Kim, 2020, p. 8). The model simplifies the complex process of

ICT implementation into a singular, cyclical process. See figure 2 for a visualization of this model, with the research of this paper contextualized within it.

The model could be applied at any stage of technological development within public administration with accuracy and usefulness. This universal applicability makes the model highly suitable for the breadth of stages of technology adoption municipalities exist at (AMO, 2017). The model may be critiqued for lacking empirical accuracy due to the multiple, varying processes and factors within it (Van Thiel, 2014, p. 40). Each individual ICT implementation is likely to have a different combination of influential factors requiring a model with wide applicability. With consideration that this is a generalized model of ICT implementation, the model is simple and parsimonious, being easily understood, while avoiding oversimplification (Van Thiel, 2014, p. 40). With consideration to this model, the following section operationalizes the hypotheses of the previous section.

Figure 2: A Model of ICT Implementation



Research Methodology

Case Selection

The study was conducted using a cross sectional and multi-case survey approach, emulating the design of Shu Wang and Mary Feeney's 2016 study titled *Determinants of Information and Communication Technology Adoption in Municipalities*. The cross-sectional approach was selected for practical reasons. First, this research was developed along the timelines for a four-to-six-month completion window; timelines for significant ICT adoption are often longer than such a window. A longitudinal approach would have been ideal to study the impacts of the grant program established in 2019, however that opportunity had passed and initiating another longitudinal study would not fit the timeline of this project. The snapshot approach of a cross sectional study allowed for a direct comparison of municipalities at a certain point in time; additionally, the cross-sectional approached matched previous research by Wang and Feeney (2016). The approach allowed for the research question to be answered, and for these reasons, it was selected and a survey was undertaken.

The survey used a total population, large N approach to selecting municipalities. Every municipality which received the 2019 unconditional modernization grant funding was surveyed.[10] This included 404 Ontario municipalities with populations ranging between 750 to 75,000.[11] This approach ensured that each municipality which received grant funding had the chance of being represented in the results. It was anticipated that response rates would be between 20% and 40%, so the survey was distributed to

[10] See Ontario original press release with the 404 municipalities listed here.
[11] The Town of Aylmer was excluded due to the employment of the researcher and personal connection to the responders at the Town.

multiple staff per municipality to improve the representativeness and significance of results.

This survey used nonprobability-based sampling, with a purposeful collection framework and a quota of “elites” from the 405 municipalities (Van Thiel, 2014, p. 46). The purposeful framework sought responses from the three officials with the highest level of theoretical exposure to information technology decision making. First among these positions was the chief administrative officer or the highest-ranking municipal official. This position has responsibility over the entire municipality and thus over the entire information technology system. The second channel was the municipal Clerk; this mandatory position is central to most administrative functions and has exposure to all major municipal decision-making processes. It was anticipated that over half of the respondents would have had the CAO and Clerk position combined into the CAO-Clerk role; in these cases, priority was given to the position of best fit for the administrative responsibilities of the Clerk. Finally, the third position was granted to the director level position with the highest estimated financial responsibility. The following priority order was used: Treasurer or director of finance, director of municipal operations (capital works responsibilities), municipal police chief or fire chief. This stratified approach to a total population survey ensured that all municipalities had three staff members to respond. For example, a municipality with a population of 950; under the quota approach, the CAO-Clerk, the administrative assistant, the Fire Chief were invited to complete the survey. Alternatively, a municipality with a population of 70,000 saw the Chief Administrative Officer, municipal Clerk, and Treasurer sent the survey. The use of nonprobability-based sampling is a key difference from Wang and Feeney’s 2016 study,

which used a sampling approach on all municipalities between 25,000 to 75,000 within the United States (p. 299). This difference was required to address the research question.

Distribution and Replicability

Collecting contact information for representatives from the 405 municipalities was a challenging undertaking. As mentioned in a previous section, three representatives from each municipality were invited to take the survey. AMCTO's distribution list of municipal officials was used. The list was expanded on to completely capture the 405 municipalities which received the modernization grant in 2019. Each contact was individually verified manually using the contact directory on the websites.

In terms of replicability, the survey format could be translated to any other study of municipal ICT adoption and reworked into the local context. Should such a study be repeated in the future or in a different context, the primary challenge would be creating the contact list for a total population sample. This study emulated the design of Wang and Feeney's 2016 study, which could be repeated in the context of any group of public sector organizations. Fortunately, the response rate to this study was comparable with Wang and Feeney's 2016 study.

Response Rate

The adjusted response rate to this study was 32.5% using the American Association of Public Opinion Research Response Rate Calculator, or 391 completed responses.[12] For an online survey, this response is strong and allows for the generation of statistically significant results as they relate to the total population (Sammut, 2021, 9).

[12] More information on this calculator is available here.

For the purposes of regression, path analysis, and mediation analysis found in this paper, the number of responses allowed for statistically significant results. Comparatively, Wang and Feeney's 2016 study received an adjusted response rate of 34.8% using the same adjusted response rate calculator (p. 300). For an Ontario specific comparison, AMO distributed a survey in 2017 to all Clerks and CAOs to assess municipal involvement in digital government initiatives; their survey only received 63 responses as noted in *Towards Digital Transformation and Opportunities for Ontario's Municipal Governments* (AMO). Whereas the AMO survey featured no incentive and open-ended questions, this study's survey was designed to encourage completion. Key design aspects to encourage completion were its simplicity, shortness, required completion time, an incentive to participate through optional entry in a draw, anonymity of responses, and a distribution strategy featuring two reminders (Sammut, 2021, 9).

Survey Design - Validity, reliability, replicability

The survey was designed with the use of Likert scale questions to measure key independent variables reflecting organizational culture. The Likert scale is a useful tool for measuring respondent's perceptions due to its reliability and validity (Van Thiel, 2012, p. 79). Likert scale questions were written to avoid ambiguity and multiple questions on the same subject are offered to encourage consistent responses. Questions were phrased negatively and positively to ensure respondents were responding intentionally. This design choice, along with the briefness of the overall survey, helped the respondents avoid developing answering tendencies; Qualtrics reported no issue with speeding or straight lining in the respondent's data. This improves the reliability and validity of the data (Van Thiel, 2014, p. 80).

A survey pilot was utilised to verify the clarity of the survey's questions and format. Evaluating a survey with a pilot is a useful exercise to ensure reliability and validity (Van Thiel, 2014, p. 82). The survey was circulated to five municipal staff within the targeted population who were asked to review it and provide feedback on the contents. Pilot participants were asked to verify the assumptions of the proposed survey, including their response time and their opinion of the dependent variable questions. The pilot participants provided useful feedback about the clarity of certain questions and verified the dependant variable's usefulness. Pilot participants were excluded from the final survey.

Sources of Bias and Issues with the Data

There are key differences between this survey and Wang and Feeney's 2016 study which have significance when accounting for possible biases in the data. Some key differences include: the addition of questions regarding grants, a reduction of total questions, and significantly different dependant variables. Each of these is addressed later, but the most significant difference is on that of respondent anonymity. Wang and Feeney's survey was not anonymous; they tracked the respondents and non-respondents which allowed them to account for statistically significant differences in city size, department type (e.g., job title), or city between respondents and non-respondents (Wang, 2016, p. 299). Additionally, tracking respondents allowed for the number of respondents from a single municipality to be weighted to equalize effects between municipalities. For purposes of ethics approval and to encourage participation, this study was conducted with respondents being completely anonymous. This introduces the concern for sampling bias in the form of self-selection bias, unweighted response

bias, non-response bias, social desirability bias, and bias caused by misrepresentation or unintended responses.

Self-Selection and Unweighted Response Bias

Sampling biases caused by anonymity have been accounted for in the design and analysis of this paper. First, self-selection bias, or the attraction of respondents with a particular interest in the topic, was accounted for with the individuals classifying their job title within a nominal job title of best fit. This allowed for the analysis to focus in on specific staff members (primarily Chief Administrative Officers), which share a similar outlook on technology adoption and grant funding based on their common responsibilities. Past research has linked the city manager position, being a CAO equivalent, as central to the innovative process at municipalities (de Vries, 2018, p. 260). Each CAO would be equally responsible for technology adoption, and all CAO's administer a municipality which received 2019 grant funding. Self-selection bias was addressed to the greatest extent possible in combination with a solution to unweighted response bias.

Unweighted response bias results from the respondent data being anonymous, and thus there being no means of weighting the responses from each municipality to present an equalized perspective from each of the respondent municipalities. For example, municipality A may have had all three respondents complete the survey, whereas municipality B had two respondents, and municipality C one respondent, etc. This results in certain municipalities being overrepresented in the results. A remedy for this issue was multi-group analysis relying on respondents self-declared job title of best fit response. Municipalities do not have multiple CAOs, Clerks, or Treasurers. Taking a multi-group analysis approach ensured that each municipality was equally represented

in the analysis. Additionally, this solution partially addressed the self-selection bias, as it ensures significant interest commonalities between the respondent groups. The sample sizes are not large enough to allow for meaningful results from a strict use of multigroup analysis; therefore, multigroup analysis, with a focus on CAOs responses, is used to verify total population findings. Neither form of bias can be fully eliminated with anonymous data, but this measure aimed to limit the effects on the conclusions.

Non-Response Bias

Non-response bias is addressed through a comparison of the respondent group with the total population based on their job title and population. Nonresponse can be a potential source of bias if those responding have different characteristics (Van Thiel, 2014, p. 83). This concern is addressed with an independent sample T-test (Table 1). There are no statistically significant differences between the job titles of the respondent group from the total population. Roughly an equal number of CAO, Clerks, and Treasurer/Managers responded. There was a statistically significant difference in population size between the respondent group and the total population. Staff from large municipalities were more likely to respond. The adjusted population figure below demonstrates that when municipalities with a population between 0 and 4999 are removed from the data set, there is no significant difference between the respondent group and the total population in terms of population size. Small municipalities often had staff in a combined role of CAO, Clerks, and Treasurer, and thus managerial equivalents were selected from areas like public works, or the fire service as described in the earlier section. Addressing these issues through the increased weighting of smaller municipalities would only compound the issues previously noted issues arising from the anonymity of responses. Similarly, the sample sizes are not large enough to

allow for meaningful results from a multigroup analysis. Instead, this study acknowledges the underrepresentation of smaller municipalities within the dataset and relies on two alleviating factors on theoretical grounds: first, municipal administrations of all sizes have similar demands in terms of services, and fewer respondents in smaller municipalities would have had the ability to complete some of the survey's questions.

Table 1 - Independent Samples T-Test

		Statistic	df	p
Position	Student's t	-1.47	1557	0.142
Population	Student's t	-4.83	1557	< .001
Adjusted Population**	Student's t	-1.91	867	< 0.059

Note. $H_a\ \mu_1 \neq \mu_2$

Group Descriptives

	Group	N	Mean	Median	SD	SE
Position	Total	1200	2.00	2.00	0.817	0.0236
	Respondents	359	2.07	2.00	0.833	0.0439
Population	Total	1200	2.91 *	3.00	1.497	0.0432
	Respondents	359	3.34 *	3.00	1.512	0.0798
Adjusted Population**	Total	638	4.06 *	4.00	1.072	0.0424
	Respondents	231	4.22 *	4.00	1.134	0.0746

Note. *Based on ordinal scale of municipal population. Under 999 (1), 1000-4,999 (2), 4,999 to 9,999 (3), 10,000 to 24,999 (4), 25,000 to 49,999 (5), 50,000 to 99,999 (6), Over 100,000 (7).
** Adjusted Population filters out

Other Sources of Bias

Consideration was given to other potential sources of bias. As a confidential survey, with results disassociated from municipal names, there was no risk of acquiescence or social desirability altering results for social acceptability (Van Thiel, 2014, p. 83). Respondents had no incentive in this format to deceive or provide false responses. No questions were likely to induce feelings of embarrassment or anxiety. Questions were logically grouped and ordered in such a way to avoid answers influencing other answers (Van Thiel, 2014, p. 81); for example, questions about perceptions of organizational innovative culture were all grouped together and proceed fact gathering questions about existing technology. Additionally, all questions related to independent variables were based on multiple previous studies of organizational culture (Wang & Feeny, 2016; Li & Feeney, 2012; Rainey et al., 1995; Aiken & Hage, 1971).

Questions and answers were worded in such a way to make selection clear. Double negatives were avoided with each statement having clear meaning. The five value Likert-type scale was standardized, providing predictability to the respondents on how to respond based on their perception of individual statements. The piloting process improved question clarity, reducing any bias threat developing from confusion about questions and answers; the determinant variable questions were revised based on feedback from municipal officials exposed to the survey in the pilot.

A significant risk for any online survey was the potential for respondents to get bored or, in laziness, provide answers quickly to finish the survey (Van Thiel, 2014, p. 81). The survey was kept to twenty questions and within a completion time of approximately 10 minutes. Additionally, the questions were written to ensure elevated levels of engagement throughout the survey. The survey began with standard control

style questions which would be anticipated by any survey respondent. Questions in the middle of the survey asked respondents to reflect on their organizational culture; these questions were created to be thought provoking to most senior level municipal managers and should not have dissuaded them from completing the survey. The concluding section asked respondents to provide information about their services, and all the respondents should have had a general or expert level awareness of these-services. All sections were brief. Based on the cumulative effect of these measures, it was anticipated most respondent would complete the survey without issue. 359 of 409 responses were sufficiently completed to be included in the analysis. 31 submissions were completed, but key questions related to the dependent variables were omitted. 19 participants opened the survey and failed to complete the submission.

Operationalization

Independent Variables

To evaluate the hypotheses introduced earlier, nine concepts must be operationalized as measurable variables and placed inside appropriate questions for distribution. This section refers to the questions found within the survey, attached as appendix 1. Operationalization refers to the translation of concepts into measurable variables (Van Thiel, 2014, p. 4). This operationalization approach is borrowed from Wang and Feeney, who adapted the earlier work of earlier studies (Aiken & Hage 1969-70, Rainey 2010, Li 2012). Four variables are original operationalization to this study, including grant engagement and the three dependent variables representing technology adoption. Five variables borrowed the operationalization approach. Centralization, personnel constraints, work routineness, stakeholder influence, and risk tolerance are

reviewed in the following section, followed by a more detailed review of grant funding and the three ICT adoption dependent variables.

Independent variable data was the product of questions asking respondents to select their level of agreement with the statement. As noted earlier, Likert-type scale was used with five levels of agreement ranging from strongly disagree to strongly agree. The ordinal scale approach allows for individual perceptions to be captured. Each of these responses were coded from 1 to 5. Question framing alternated between positive and negative, and with responses negatively coded depending on the framing. Each of the primary independent variables had multiple questions associated with it.
Each independent variable was formed as a construct using the mean of associated question responses (Wang, 2016, p. 301). For example, there were two questions for the variable of risk tolerance. The first asked respondents to evaluate the statement "Most employees in this organization are not afraid to take risks" and the second asked "This organization is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks" (Wang, 2016, p. 301). A response of strongly disagree to both questions yielded the mean result of one, indicating a highly risk averse municipality as perceived by the respondent. All primary independent variables followed this design, except for stakeholder influence; both provincial and resident influence were reduced to a single question versus the implementation in previous studies, primarily to simplify and reduce the length of the survey.

For each of these independent variables, it was necessary to perform an internal reliability test to measure that the answers sufficiently related to one another to backup the construct of the variable. The key test was the Cronbach's alpha; Cronbach's alpha

is a measure of internal consistency and reliability; which assesses the extent to which items within a scale or measure are measuring the same underlying construct.[13] Ranging from 0 to 1, ideally, higher Cronbach's alpha scores indicate higher internal consistency. The reliability analysis results, and the Cronbach's alpha are available as appendix 6.

Both centralization and risk tolerance displayed high internal consistency. Centralization was measured using the Likert scale questions: "There can be little action taken here until a supervisor approves a decision"; "In general, a person who wants to make his or her own decisions would be quickly discouraged" and "Even small matters have to be referred to someone higher up for a final answer". The Cronbach's alpha value was 0.758, indicating an acceptable level of internal consistency for the measures of centralization. As noted earlier, risk tolerance was measured using the Likert scale questions: "Most employees in this organization are not afraid to take risks" and "This organization is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks. The Cronbach's alpha value was 0.740, indicating an acceptable level of internal consistency for the measures of risk tolerance. Routineness and personal constraints displayed lower internal consistency. Routineness was measured using the Likert scale questions: "People here do the same job in the same way every day"; "One thing people like around here is the variety of work" (negatively coded); and "Most jobs have something new happening every day" (negatively coded). Negatively coded questions have their Likert scale responses reversed to reflect the underlying construct. The Cronbach's alpha value was 0.582,

[13] Explanation of Cronbach's alpha as a measure of internal consistency is available here.

indicating a lower level of internal consistency for the measures of centralization. For the purposes of this study, the Cronbach's alpha was accepted and similarly reflected in Wang and Feeney's 2016 study (p. 301). Ultimately, internal consistency was being checked to validate the questions combination into a construct; even a low level of consistency was valid for the purposes of the study as inconsistent responses should yield a moderate average value. Exceptionally low Cronbach's alpha could, however, indicate respondent confusion with the question wording.

For example, personal constraints were measured using the Likert scale questions: "The formal pay structures and rules make it hard to reward a good employee with higher pay here"; "Even if a manager is a poor performer, formal rules make it hard to remove him or her from the organization"; and "Because of the rules here, promotions are based mainly on performance" (negatively coded). The Cronbach's alpha value was 0.167 indicating a very weak level of internal consistency; the third question appears to have confused participants, as the responses were inconsistent with the first two questions. Feedback from the pilot process suggested that the third question may not have been well suited to the Canadian municipal environment, having been designed in the American context; in hindsight, this feedback was likely correct. Unionization, strong employee protections, and the weak mayor system within the Ontario may be impacting responses to this question. In addition to the environmental concerning, the wording of the question and negative framing likely confused the respondents. To remedy this inconsistency, the third question was eliminated from the construct of personal constraints; Removing the question's responses improves the Cronbach's alpha value to an acceptable, if weak, .374.

This study introduced an original operationalization construct for the variable of grant engagement. Whereas a variable like centralization attempted to capture the culture of the organization, the variable of grant engagement captures the perceived usefulness of grants and the openness of municipalities to grant opportunities. The first question measures perceived grant utility. Using the Likert scale approach again, respondents were asked their perception of the statement “provincial modernization grants have been used to implement new technology or increase efficiency”. The second question was awareness with the statement “This organization closely follows and regularly applies to provincial grant opportunities”. Taking the mean of the two responses, organizations scoring one were perceived as finding low utility in grants, whereas a five would indicate high utility. The Cronbach's alpha value was 0.481, indicating a low, but acceptable level of internal consistency for the measures of grant engagement.

To provide further measurement of the validity of the construct measurement model used in the study, a confirmatory factor analysis was preformed using Jamovi. The results can be found in appendix 5. This analysis yielded similar results to that of Wang and Feeney’s 2016 results (p. 301). All items loaded significantly on their respective latent factors[14], meaning each of the question responses was shown to have a strong and meaningful relationship with their intended construct or factor. The fit indices result additionally suggest reasonable fit of the model to the observed data,

[14] This is observable in appendix 5 by examining the statistically significant estimate values for each of the factors in the Factor Loading table.

meaning the framework for organizational factors captures the underlying constructs adequately.

Dependent Variables – Stages of Digital Maturation

As discussed in the hypotheses section, three dependent variables were used. These variables were unique to this study, although they attempt to emulate the design of Wang and Feeney's 2016 dependent variables (p. 300). These three variables each displayed different stages of digital maturation. Information on these variables was collected from respondents through questions listing various applications of technology. For every selection the respondent made, the municipality was awarded one point towards the dependent variable with the total amount of points being the total amount of technology uses listed (Wang, 2016, p. 300).

For example, the adoption of website-accessible citizen services variable (Online Services in the tables) was evaluated with the question "Please select all of the following public submission processes which can be completed entirely on your municipal website or other online platforms – without requiring email submission". Respondents will have the option to select from the following list:

- Public Records (Agendas, Minutes, By-Laws) (1)
- Bids and Tenders (2)
- Delegation, deputation, or public hearings requests (3)
- Service Requests (4)
- Planning Applications (5)
- Licensing and Permitting Applications (6)
- By-Law Complaints (7)

- Tracking Applications or Requests (8)
- Tax Pre-Authorized Payment Applications (9)
- Public Feedback or Comments (10)
- Community Event Calendar (11)
- Freedom of Information Requests (12)
- Facilities Rentals Applications (13)
- Search for jobs with the municipality (14)
- Apply for jobs with the municipality (15)
- Payment of Taxes (16)
- Payment of User Fees (17)
- Participate Virtually in Council/Committee Meetings (18)
- Online Voting (19)
- Live Text Chat with a Customer Service Representative or Chatbot (20)"

This variable theoretically reflects the stages of digital maturation through the number of services provided online. More digitally mature municipalities provide more services online. Municipalities may score anywhere from a zero to twenty and this value will be an indicator of their level of adoption of website accessible citizen services. This approach to measuring levels of ICT adoption is consistent with previous studies (Wang, 2016, p. 300). See the summary statistics table for descriptive statistics on the responses. Notably, no municipality claimed to be providing all services; nor did any municipality claim to be providing *Live Text Chat with a Customer Service Representative or Chatbot.* This item was included to ensure honest responses; no municipality is currently providing this service as it is known to the researcher, so the

fact it was not selected suggests respondents were attempting to respond honestly and accurately. With the mean services provided as 10.5, the question appears to have provided a strong baseline for the relative development of online municipal services within the respondent's municipalities. Of the three dependent variables, online services provided the strongest results.

The second measure of digital maturation was ICT policy development. Respondents were asked to provide a response to the question: "Please select all of the following IT policy and management tools your municipality maintains? Select all applicable:

- Policy addressing Acceptable Use of Technology (1)
- Policy addressing IT Security (2)
- Policy addressing Third-Party Access or Data Management (3)
- Asset Lifecycle Management Plan for IT Hardware (4)
- Information Technology Strategic Plan or Master Plan (5)
- Business Continuity Plan or Disaster Recovery Strategy addressing Information Technology (6)
- Information Technology Steering Committee or equivalent (7)"

The variable theoretically reflects the stages of digital maturation within a municipality. The options were taken from the policies recommended by the Government of Ontario's Cyber Security Centre of Excellence. More digitally mature municipalities would be more likely to engage in IT planning, policy making, and cybersecurity precautions. Despite this, it is necessary to note some potential issues with the variable. Pilot feedback suggested this might have challenged some

respondents to check on their policies and verify they are in place. Thirty-five respondents chose not to respond to this question, suggesting the feedback from the pilot was correct; respondents may not have been aware of all these policies being in place, or they may have not been knowledgeable enough about their policies to answer the question. These issues suggest the variable may not have been an ideal indicator of digital maturation.

The final measure of digital maturation was the type of electronic information management systems. This variable was the combination of two questions: “Does your municipality have a system or systems for sharing and managing electronic records?” a yes or no questions, and a follow up question “Which of the following best describes the system(s)?:

- Cloud Based (3)
- Intranet or Hosted (2)
- File Explorer Based (Shared Drive) (1) (Reverse coded)

Answering no to the first question resulted in a zero as the response to the second question. These responses valued zero to four form the scale of digital maturation reflected in the system used for sharing and managing electronic records. The connection between the type of system in use and the level of digital maturation is grounded in both firsthand experiences of the municipal information management systems and the chronological historical releases of each system. The variable captures municipalities digital maturation from no electronic information management system to a file explorer-based system, to an Intranet or Hosted, to a cloud-based system. Each

successive step along this spectrum reflects a higher level of digital maturity under this study's theoretical construct.

Control Variables

Several control variables were included in the study. These were included primarily to evaluate for any biases in the results, or discrepancies in responses; the variables are used to control for known effects on ICT adoption (Van Thiel, 2014, p. 81). These include the position of the respondent, the population of the municipality, the tier of municipality, and the type of IT services available to the municipality. The relevance of IT Provider being external or internal was noted in previous research as significant by both multiple studies (Jun & Weare, 2011; Welch & Pandey, 2011; Wang & Feeney 2016). These sources suggest the IT provider is a powerful actor in the ICT adoption process. Internal providers have generally been associated with increased adoption. Population size has similarly been found to correlate with increased technology adoption and use (Jun & Weare, 2011; Wang & Feeney 2016).

Two tables have been included to offer an overview of the responses collected in the survey. Table 2 provides descriptive statistics for the key variables and constructs (see appendix 7 for a full descriptive table). Table 3 provides a correlation matrix demonstrating the relationships between variables primary variables. The key statistics in this table are Pearson's r which represents the strength and direction of the linear relationship between two variables; note the legend for statistical significance.

Table 2 - Summary Statistics of Individual Survey Items

Descriptives

	N	Missing	Mean	Median	SD	Minimum	Maximum
MunicipalPop	359	0	3.34	3	1.512	1	7
Position	359	0	2.23	2	1.106	1	5
PositionTransformed	359	0	2.07	2	0.833	1	3
Tier	359	0	2.20	2	0.558	1	3
Years	359	0	4.25	4	1.530	1	6
ITProv	359	0	1.60	2	0.491	1	2
CentralizationK	359	0	2.42	2.33	0.884	1.00	5.00
RoutinenessK	358	1	2.24	2.00	0.709	1.00	5.00
PersonalContraintsK	359	0	3.52	3.50	0.933	1.00	5.00
RiskToleranceK	359	0	2.76	3.00	0.907	1.00	5.00
Grant Engagement	359	0	4.38	4.50	0.690	1.00	5.00
DVPolicies	324	35	3.76	4.00	1.764	1	7
DVInformationSystemTypeK	359	0	1.77	2	0.998	0	3
DVOnlineServices1	359	0	10.50	11	4.522	1	19

Table 3 - Correlation Matrix of the Study Variables.

Correlation Matrix

		DVOnlineServices1	DVInformationSystemTypeK	DVPolicies	CentralizationK	RoutinenessK	PersonalContraintsK	RiskToleranceK	Grant Engagement	Province1	Community1	Position	Tier	ITProv	MunicipalPop	Years
DVOnlineServices1	Pearson's r	—														
	df	—														
	p-value	—														
DVInformationSystemTypeK	Pearson's r	0.204***	—													
	df	357	—													
	p-value	< .001	—													
DVPolicies	Pearson's r	0.317***	0.180**	—												
	df	322	322	—												
	p-value	< .001	0.001	—												
CentralizationK	Pearson's r	−0.182***	−0.197***	−0.247***	—											
	df	357	357	322	—											
	p-value	< .001	< .001	< .001	—											
RoutinenessK	Pearson's r	−0.176***	−0.084	−0.141*	0.313***	—										
	df	356	356	322	356	—										
	p-value	< .001	0.112	0.011	< .001	—										
PersonalContraintsK	Pearson's r	−0.109*	−0.030	−0.198***	0.276***	0.145**	—									
	df	357	357	322	357	356	—									
	p-value	0.038	0.568	< .001	< .001	0.006	—									
RiskToleranceK	Pearson's r	0.233***	0.097	0.162**	−0.280***	−0.295***	−0.276***	—								
	df	357	357	322	357	356	357	—								
	p-value	< .001	0.067	0.003	< .001	< .001	< .001	—								
Grant Engagement	Pearson's r	0.281***	0.105*	0.243***	−0.132*	−0.126*	−0.072	0.112*	—							
	df	357	357	322	357	356	357	357	—							
	p-value	< .001	0.048	< .001	0.013	0.017	0.176	0.034	—							
Province1	Pearson's r	0.044	0.008	−0.059	−0.012	−0.134*	0.078	−0.054	0.085	—						
	df	356	356	321	356	355	356	356	356	—						
	p-value	0.409	0.873	0.292	0.823	0.011	0.142	0.310	0.107	—						
Community1	Pearson's r	−0.116*	0.037	−0.105	0.048	0.076	0.052	−0.077	0.010	0.284***	—					
	df	356	356	321	356	355	356	356	356	356	—					
	p-value	0.029	0.482	0.059	0.361	0.153	0.323	0.146	0.847	< .001	—					
Position	Pearson's r	−0.100	−0.072	−0.036	0.157**	0.121*	0.064	−0.111*	−0.092	0.044	0.000	—				
	df	357	357	322	357	356	357	357	357	356	356	—				
	p-value	0.060	0.176	0.516	0.003	0.022	0.228	0.035	0.083	0.407	0.993	—				
Tier	Pearson's r	−0.136*	−0.159**	−0.252***	0.068	0.068	−0.001	−0.069	−0.010	−0.072	−0.043	0.088	—			
	df	357	357	322	357	356	357	357	357	356	356	357	—			
	p-value	0.010	0.002	< .001	0.197	0.202	0.983	0.190	0.851	0.174	0.412	0.098	—			
ITProv	Pearson's r	−0.218***	−0.021	−0.473***	0.174***	−0.013	0.021	0.024	0.005	0.084	0.112*	0.039	0.204***	—		
	df	357	357	322	357	356	357	357	357	356	356	357	357	—		
	p-value	< .001	0.689	< .001	< .001	0.813	0.693	0.648	0.922	0.114	0.034	0.465	< .001	—		
MunicipalPop	Pearson's r	0.297***	0.107*	0.510***	−0.190***	−0.045	−0.083	0.034	0.061	−0.048	−0.140**	−0.071	−0.502***	−0.648***	—	
	df	357	357	322	357	356	357	357	357	356	356	357	357	357	—	
	p-value	< .001	0.043	< .001	< .001	0.400	0.117	0.518	0.250	0.369	0.008	0.180	< .001	< .001	—	
Years	Pearson's r	0.274***	0.038	0.267***	−0.112*	−0.126*	−0.056	0.111*	0.176***	0.062	−0.036	−0.250***	−0.149**	−0.213***	0.305***	—
	df	357	357	322	357	356	357	357	357	356	356	357	357	357	357	—
	p-value	< .001	0.471	< .001	0.034	0.017	0.291	0.035	< .001	0.244	0.495	< .001	0.005	< .001	< .001	—

Note. * p < .05, ** p < .01, *** p < .001

Section 4: Results and Findings

This section uses path analysis to evaluate the nine-hypothesis presented earlier. Path analysis allows for the simultaneous examination of multiple directs and indirect relationships between variables in a structural model.[15] By employing path analysis, the study assesses the direct and indirect effects of independent variables on each of the three dependent variables. Path analysis allows for the exploration of potential indirect mediating effects, which reveal underlying mechanisms through which the independent variables influence the dependent variables. This approach to analysis is consistent with Wang and Feeney's 2016 study (p. 304). The three dependent variables were evaluated separately, each using individual path analysis models. For simplicity, this section is divided into four sections: discussion of the model's fit, direct evaluation of the nine hypotheses, a breakdown of the statistically significant results related to the hypotheses, and evaluation of the control variables. The full path analyses are included as appendix 5.1, 5.2, and 5.3. In summary, these analyses offer a more nuanced understanding of the factors influencing ICT adoption.

Path Analysis and Model Fit

The three path analysis models were evaluated for their fit to the data using various fit indices. Overall, all three models demonstrated good fit. The chi-square test statistics for the user models were not significant, indicating reasonable fits compared to the baseline models. The AIC, BIC, and adjusted BIC values were relatively low for all models, suggesting better fits. The SRMR values were small, indicating good fits. The

[15] Explanation of path analysis as a tool to evaluate explanatory model using multivariant regression is available here.

RMSEA values were very low with narrow confidence intervals, further supporting good fits. Additionally, the CFI, TLI, RNI, GFI, adj. GFI, and pars. GFI values were all close to 1 across the models, indicating good fits.[16] In combination with the theoretical grounding discussed earlier, these findings suggest that all three path analysis models fit the data well, providing support for the relationships between the dependent variables (ICT adoption level) and the independent variables (ICT determinants) under investigation. Introducing the multigroup analysis factor of job position undermines the fit of this model; a version of the path analysis utilizing multigroup analysis factor is used exclusively to confirm significant findings with the submissions from CAOs. While the fit of the overall model breaks down due to the low sample size, the regression analysis of the CAO's data remains valid.

Hypothesis Evaluation

Assessing of path analysis results requires interpretation of the parameter estimates; these tables reveal the estimated values of the relationships between predictor variables and outcome variables. The tables are organized by the relationships between variables. The estimate value represents the strength and direction of the relationship. For example, see the example relationship between the predictor work routineness and depend variable online services. In this example, the estimate value of -.5 suggests a negative relationship between work routineness and online services. The p value of 0.003 suggests the result is statistically significant, with results up to 0.01 being acceptable. Applying the estimates to variables design, a one point move in work routineness would be related to 5% increase in online services.

[16] Explanation of path analysis fit indices is available here.

Example:

Dep	Pred	Estimate	p
Online Services	Work Routineness	-0.5000	0.003

Applying this evaluation method yields the following results:

Hypothesis 1 – Grant engagement is positively associated with:

d) Adoption of ICT policies and best practices

This hypothesis was **supported** by the data. There was an estimated effect of 0.2938 with an associated P value of 0.019. This suggests a one-point increase in grant engagement would be associated with a 2.9% increase in ICT policies adopted.

e) Adoption of website-accessible citizen services

This hypothesis was **supported** by the data. There was an estimated effect of 0.76501 with an associated P value of 0.014. This suggests a one-point increase in grant engagement would be associated with a 7.6% increase in website-accessible citizen services adopted.

f) Adoption of electronic records management systems

This hypothesis was **not supported** by the data.

Hypothesis 2 – Government stakeholder influence is positively associated with:

d) Adoption of ICT policies and best practices

This hypothesis was **not supported** by the data.

e) Adoption of website-accessible citizen services

This hypothesis was **not supported** by the data.

f) Adoption of electronic records management systems

This hypothesis was **not supported** by the data.

Hypothesis 3 – Non-government stakeholder influence is positively associated with:

g) Adoption of website-accessible citizen services

This hypothesis was **not supported** by the data. A statistically significant **opposite effect** was discovered which is explored in the discussion section. There was an estimated effect of -0.6122 with an associated P value of 0.023. This suggests a one-point increase in non-government stakeholder influence would be associated with a 6% decrease in website-accessible citizen services adopted. This was further confirmed by the multi-group test, with the Clerk data group suggesting an estimated effect of -1.2597 with an associated P value of 0.005.

Hypothesis 4 – Work routineness is negatively associated with:

d) Adoption of ICT policies and best practices

This hypothesis was **not supported** by the data.

e) Adoption of website-accessible citizen services

This hypothesis was **not supported** by the data. The effect of work routineness is significantly mediated by risk tolerance.

f) Adoption of electronic records management systems

This hypothesis was **not supported** by the data.

Hypothesis 5 – Organizational centralization will not be significantly associated with:

d) Adoption of ICT policies and best practices

This hypothesis was **not supported** by the data. Organizational centralization was significantly associated with a negative effect. There was an estimated effect of -0.3564 with an associated P value of 0.002. The CAO data group suggested an estimated effect of -0.68912 with an associated P value of 0.009. This suggests a one-point increase in organizational centralization would be associated with a 3.5% decrease in ICT policies adopted.

e) Adoption of website-accessible citizen services

This hypothesis was **not supported** by the data. Organizational centralization was significantly associated with a negative effect. There was an estimated effect of -0.4876 with an associated P value of 0.084. This suggests a one-point increase in organizational centralization would be associated with a 4.8% decrease in ICT

policies adopted. The CAO data group suggested an estimated effect of -1.21 with an associated P value of 0.065.

f) Adoption of electronic records management systems

This hypothesis was **not supported** by the data. Organizational centralization was significantly associated with a negative effect. There was an estimated effect of -0.20730 with an associated P value of 0.001. This suggests a one-point increase in organizational centralization would be associated with a 2% decrease in ICT policies adopted. The CAO data group suggested an estimated effect of -0.5222 with an associated P value of 0.001.

Hypothesis 6 – Personnel constraints are negatively associated with:

d) Adoption of ICT policies and best practices

This hypothesis was **supported** by the data. There was an estimated effect of -0.2463 with an associated P value of 0.024. This suggests a one-point increase in personnel constraints perspective would be associated with a 2.9% increase in ICT policies adopted.

e) Adoption of website-accessible citizen services

This hypothesis was **not supported** by the data. The effect of personnel constraints is significantly mediated by risk tolerance.

f) Adoption of electronic records management systems

This hypothesis was **not supported** by the data.

Hypothesis 7 – Risk Tolerance is positively associated with:

d) Adoption of ICT policies and best practices

This hypothesis was **not supported** by the data.

e) Adoption of website-accessible citizen services

This hypothesis was **supported** by the data. There was an estimated effect of 0.81435 with an associated P value of 0.003. This suggests a one-point increase in risk would be associated with a 8% decrease in the ICT policies adopted. The CAO data group suggested an estimated effect of 0.9893 with an associated P value of 0.045.

f) Adoption of electronic records management systems

This hypothesis was **not supported** by the data.

Hypothesis 8 – Organizational factors (Centralization, routineness, personal constraint) are indirectly *negatively* associated, through the mediate variable of risk tolerance, with:

d) Adoption of ICT policies and best practices

This hypothesis was **not supported** by the data.

e) Adoption of website-accessible citizen services

This hypothesis was **supported** by the data. Centralization, routineness, personal constraint is each indirectly negatively associated with online services. Risk tolerance significantly mediates the direct effect.

f) Adoption of electronic records management systems

This hypothesis was **not supported** by the data.

Hypothesis 9 – Organizational factors (Centralization, routineness, personal constraint) are indirectly *negatively* associated, through the mediate variable of grant funding, with:

d) Adoption of ICT policies and best practices

This hypothesis was **not supported** by the data.

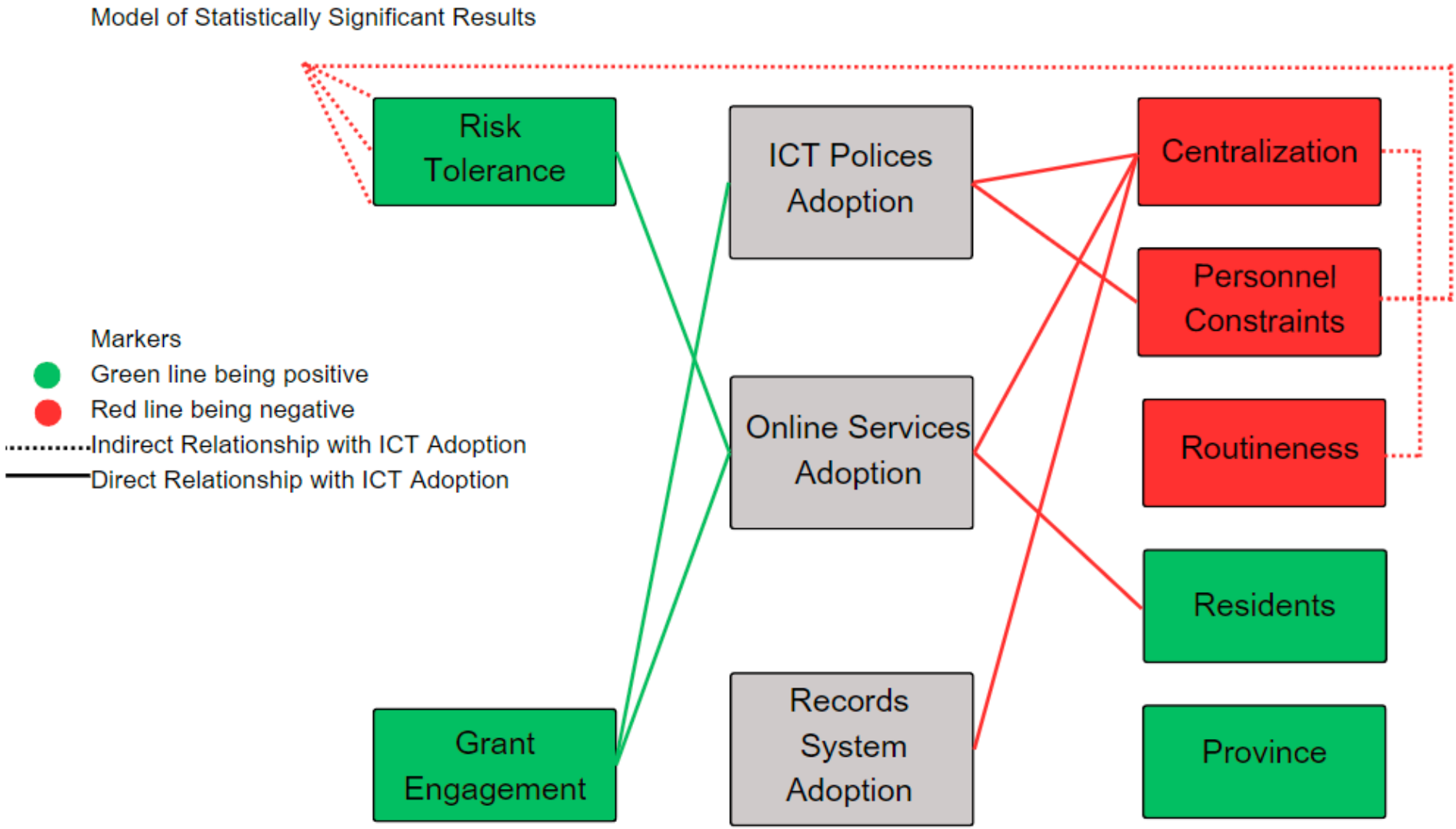
e) Adoption of website-accessible citizen services

This hypothesis was **not supported** by the data.

f) Adoption of electronic records management systems

This hypothesis was **not supported** by the data.

Figure 3


Model of Statistically Significant Results
Risk Tolerance
Grant Engagement
ICT Polices Adoption
Online Services Adoption
Records System Adoption
Centralization
Personnel Constraints
Routineness
Residents
Province
Markers
Green line being positive
Red line being negative
Indirect Relationship with ICT Adoption
Direct Relationship with ICT Adoption

Effects of Control Variables

The relative effects of the effects of control variables are measured using a separate generalized linear model, using poisson distribution, which is suitable for count data.[17] These results are available as Appendix 6. Notable in these results is that the municipal population size is associated with a statistically significant increase in the number of online services and a more advance form of electronic document management system; population size does not appear to affect the number of IT policies in place. This finding is consistent with results from both Jun & Weare in 2011 and Wang & Feeney in 2016. Years of service is associated with a statistically significant increase in the number of online services, but it is not associated with policy adoption or electronic information management system adoption. This result is consistent with findings of Wang & Feeney in 2016 (p. 206). Finally, the provision of IT services by an external provider was only significantly associated with a decrease in the number of IT policies; this relationship makes intuitive sense as municipalities with external IT providers are likely relying on the external provider to keep up to date IT policies separate from the municipality. While past research has associated external IT provider with slow technology adoption in municipalities (Jun, 2011, p. 509), surprisingly, external IT providers were not associated with a significant decrease in the number of online services, or the type of information management system implemented. In summary, the controls provided confirmation of many of the known effects on ICT

[17] https://www.theanalysisfactor.com/poisson-regression-analysis-for-count-data/

adoption, with inconclusive data on the differences between internal and external IT support.

Section 5: Discussion

Limitations

This study has four limitations which should be noted before discussing the results. First, as addressed in the earlier methodology section, this study is limited by the anonymity of the data. Primary results reflect the unweighted responses of all municipalities to the survey; each significant finding has been tested again within the responses from CAO and noted with the result if observed. Second, any clausal claims about ICT adoption are weakened by the cross-sectional nature of this data (Wang, 2016, p. 307); the findings are primarily association base, reflecting correlation between certain organizational perceptions and ICT adoption. The third limitation is the reliability of the data set with dependent variables being self-reported accounting of ICT adoptions, and independent variables being based on individual perceptions. These measures may be subject to errors, biases, or misrepresentations by the respondents. Additionally, the survey's distribution title of "Municipal Modernization and Technology Adoption Study" may have influence respondents due to the similarity to Ontario's municipal modernization funding; the similarity may have disposed respondents to overly supportive responses to grant effectiveness and grant engagement related questions. Finally, this study is limited to the Ontario municipal context and results reflect municipalities with a population size up to 100,000.

This study set out to answer how organizational factors and grant funding affect ICT adoption in small and rural municipalities; findings would inform on Ontario's municipal modernization funding interaction with the determinants. This study found

mixed results. First, centralization emerged from the research as a statistically significant negatively associated variable influencing policy adoption, website services adoption, and electronic records management system adoption. Second, risk tolerance can be understood to mediate the influence of centralization, work routineness, and personnel constraints in terms of adoption of online services adoption; increased levels of work routineness, and personnel constraints suggest decreased levels of risk tolerance, and an associated decrease in online services adopted. Finally, an organization's level of grant engagement positively associated with increased levels of both IT policy adoption and online services adoption; these three findings are explored in brief with comparison to results in other studies in this section following a discussion of the failed hypotheses.

Organizational Factors

Stakeholder influence has previously been found to have a more significant positive impact on organizational IT innovations than internal factors (Jun, 2011; Wang, 2016). While this study hypothesized this relationship, all hypotheses failed and neither provincial nor resident influence was found to have a significant influence on IT policy, online services, and electronic records system adoptions. The exception to this was the statistically significant negative relationship found between resident influence and ICT adoption; increase reported influence of residents was correlated with less ICT adoptions for online services. This finding was additionally confirmed in a multi-group analysis, eliminating the factor of unweighted results. This finding contradicts both the hypotheses and previous findings of Wang and Feeney; they found resident influence increased ICT adoption. They attributed this finding as an indicator of success of the New Public Management movement (Wang, 2016, p. 307). Online services should

theoretically benefit residents, and thus be positively associated with their influence; the opposite finding demands a brief examination of the dependant variable. The primary benefactor from each of the online services may not be residents, but staff themselves. For example, online applications offer at-home convenience to the few residents which engage with them; however, these processes can represent role defining convenience to staff by ensuring completeness of applications, automated tracking, and automated follow-up. Online services were increasingly associated with work-from-home staffing approaches, which could also suggest the pursuit of online services to be primarily a result of environmental factors and concern for staff safety. These interpretations suggested that resident influence may force staff away from the implementation of online services which they would otherwise pursue, consistent with democratic values and accountable government.

Centralization emerges from this study as the most notable organizational factor for its consistent negative association with IT policy, online services, electronic records system adoptions. Centralization of administrative decision making is associated with lower levels of ICT adoption within Ontario's municipalities up to a population size of 100,000. Previous research on centralization's effect on ICT adoption is mixed, but the findings of this study correspond with both some recent research (Feeney, 2012) and meta-analysis from the 1990s (Damanpour, 1991, p. 588). Unlike work routineness and personnel constraints, centralization's effect on ICT adoption is only partially mediated by risk tolerance, as a statistically significant direct relationship with online services exists within the model. These results were found in both the total population analysis and the multigroup analysis of CAO data for each dependent variable.

This result suggests that organizations with decentralized decision-making power structures are better able to engage in the internal implementation process of ICT adoption. ICT implementation requires a systematic process of initiation, adaptation, acceptance, and infusion which each requires a series of micro-decisions to support the cumulative effect and success of the process (Kim, 2020, p. 7). Decentralized organizations, with program managers empowered to make decisions, are likely better able to responsively navigate this implementation process (Wang, 2016, p. 295). This finding would be strengthened through additional research with alternative methods; for example, case studies of technology implementation could examine ICT adoptions for the number of individuals involved in making decisions and the significance of those decision. With collaborative findings, researchers may be able to offer recommendations to municipalities on leadership's role, decision making structures, and desirable competencies for program manager each to encourage ICT adoptions.

Results suggest that risk tolerance is positively associated with the adoption of citizen accessible online services. Further, the organizational factors of centralization, work routineness, and personnel constraints were each significantly negatively correlated with risk tolerance. This finding confirms the 2016 finding of Wang and Feeney, where they observed the same relationship (p. 305). Understanding this relationship can offer policy makers potential high-level levers to coordinate and influence the adoption of ICT at an organizational level. ICT adoptions and innovations could be pursued indirectly by decentralizing decision making, introducing breaks to routines, and addressing personnel limitation and pursued directly by improve organizational risk tolerance. Government organizations will always need to balance

pursuits of efficiency, innovation, and entrepreneurialism against their fundamental rules-based structures, stressing accountability, democratic influence, and institutional legitimacy (Wang, 2016, p. 305). While it could be argued that risk aversion is a safeguard of these structural value (Bozeman, 1998), the possible benefits of modern digital government call all administration and policy makers to reexamine their innovative capacity and consider potential organizational changes.

Grant Funding for Modernization

Combining these findings about organization culture offers insights into the potential situational effectiveness of Ontario's municipal modernization funding. Risk tolerance is addressed by grant funding through the removal of direct financial risk. Whereas a risk averse municipality may be reluctant to spend for new online services or services delivery reviews, the grant funding removes the disincentive of initial cost and shifts the opportunity cost spectrum towards new ICT adoptions. This connection between grant funding and risk tolerance is clear, but a more speculative connection with centralization is also possible. Ontario's municipal modernization funding challenges municipalities to make use of the available resources. Returning to the model of ICT implementation outcomes discussed earlier, the process of ICT implementation requires the involvement of numerous staff and managers (Kim, 2020, p. 7). Centralized municipalities taking full advantage of the grant program will be pressured to diffuse decision making power as part of the ICT implementation process. These connections between grant funding and the organizational determinants of ICT adoption could be explored further with future research using case studies of actual implementations supported by Ontario's municipal modernization.

Provincial policy makers have found a solution to promote digital government and ICT adoption with their municipal modernization funding program. Results from this study suggest that grant engagement attitudes are positively associated with the adoption of ICT policies and citizen accessible online services. Municipalities which perceive value in the provincial modernization grants and are diligent in their efforts to follow provincial grants are more likely to have implemented more fundamental digital government features in ICT policies and online services. For municipalities within Ontario, this result suggests that increasing focus on pursuing grants can support the expansion of e-government and ICT adoptions.

For the province, this result suggests their municipal modernization program structure aligns with the relationship between municipalities and ICT adoption. Ontario's municipal modernization program has provided both financial supports and structured pathways toward modernization. With both unconditional funding and guided funding structured being offered, the program can adequately address the breadth of e-government development levels seen across Ontario. However, the alignment between the municipal grant engagement attitudes and ICT adoption may suggest a widening gap between municipalities in the e-government space. Returning to the concepts of intergovernmental policy influence, the program can be interpreted as information regime guiding municipalities toward e-government (Charbonneau, 2014, 1470). The policy relies on the initiative of municipal managers to make use of programing funding and support pathways. Municipalities already predisposed to ICT adoption may be the primary benefactors of the funding program; this would lead to a widening of the gap between municipalities in terms of ICT implications. If the Province is interested in

closing the gap in e-government services between different municipalities, they may need to consider moving from an information regime towards a compliance regime, like the AODA. This paper has suggested centralization at the municipal level reduced ICT adoption; it is unknown if intergovernmental centralization would hurt modernization efforts. Moving towards a compliance system would require more research on benefits of modernization in terms of efficiency, accountability, and citizen utility. Some current research suggests significant benefits in terms of socio-economic efficiency to digital government initiatives (Sanina, 2023, p. 94). These benefits would need to be weighed against the negatives of provincial centralization and municipal discontentment with imposed modernization.

Longitudinal research on intergovernmental incentives for modernization would be beneficial for the development of future provincial policy. For example, the AODA represents a compliance regime within the scope of digital government which has been largely unexamined for its compliance effect. It is currently unknown how a compliance system like the AODA has been received or preformed; such findings would have relevance in the municipal modernization space. Similarly, future waves of modernization funding should be examined both quantitatively and qualitatively to confirm the findings of this study. Multiyear surveys like the American National Study of Technology Use in Government could provide valuable information about municipal government in the Ontario and Canadian context (Feeney, 2020, p. 823). Similarly, case studies of specific projects funded by Ontario's municipal modernization program could offer valuable information to policy makers. Ideally, research should confirm the casual relationship between grant funding and the adoption of digital government services.

Research could additionally expand on the interaction between the organizational determinants of ICT adoption and grant funding.

Section 6: Conclusion

This study has examined the determinants of ICT adoption and Ontario's municipal modernization funding within Ontario's small and rural municipalities. This literature review covered intergovernmental inventive program, ICT adoption strategies, determinant of ICT adoption, and models of ICT adoption. Results of the study are based on a total population survey of all Ontario municipalities which received 2019 modernization grant funding from the Province of Ontario. The results suggest three major conclusions: first, centralization negatively influences the adoption of ICT policies, online services, and new electronic records management system. Second, risk tolerance is positively associated with the adoption of online services; the negative effect of work routineness, personal constraints, and partially centralization are best understood to impact ICT adoption through their relationship with risk tolerance. Finally, there is a positive relationship between grant engagement and ICT adoption, which suggests Ontario's municipal modernization funding is well designed to support further ICT adoption.

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Appendix

Appendix 1: Survey

Municipal Modernization and Technology Adoption Study

Start of Block: Default Question Block

Q1 **Municipal Modernization and Technology Adoption Study**
Letter of Information and Consent
Primary Investigator:
Joseph Lyons, PhD, Local Government Program, jlyons7@uwo.ca
Research Team:
Kate Graham, PhD, Local Government Program, kgraha@uwo.ca
Owen Jaggard, Local Government Program, ojaggard@uwo.ca
Dear CAOs, Clerks, Treasures, and equivalent senior administrators, You are invited to participate in this survey exploring trends in information and communication technology (ICT) within Ontario. Your participation is important as it will provide valuable insights into the factors that influence ICT adoption in municipal governments. The survey will take approximately 10 minutes to complete, and your responses will be kept anonymous.
Why are you invited to participate? Three participants from 405 Ontario Municipalities which received service modernization grant funding are being invited to complete the survey. Those serving in the role of Chief Administrative Officers, Treasurers, Clerks, and equivalent senior administrator positions are being asked to participate.
Why is this survey being done? The study will explore the impact of intergovernmental grants and workplace culture on information and communication technology (ICT) adoption within small and medium sized Ontario municipalities.
How long will this survey take? You will need approximately 10 minutes to complete the survey.
What are the survey procedures? The survey is administered online via Western Qualtrics. Participants will be asked to respond to the survey from May 10th to June 7th. Participation in the survey is voluntary and anonymous.
The survey consists of 20 questions aimed at gathering information about your municipality's organization culture, information technology implementation, and grant history.
The data collected from the participants will only be used for research purposes, and no other purposes. Quantitative analysis and multivariant regression will be used to analyze the survey data. The data will be analyzed and reported in combined form and no individual participant's information will be inferred. The findings of the research may be published or presented. **What are the risks and harms of participating in this study?** If you complete this survey, no adverse consequences should be directed at you. You will not be asked to provide personal

identifying information and your responses will be anonymous. Your participation is voluntary, and you will not be obliged to answer any question which you do not feel comfortable with. You may terminate or withdraw from the electronic survey at any point without consequence. Your responses will be anonymous and presented anonymously in all cases.

What are the benefits of participating in this study? Participating in this study provides an opportunity to contribute to important research that aims to better understand the effects of intergovernmental grants on information and communication technology (ICT) adoption. The findings from this study may inform policies and programs aimed at promoting ICT adoption in small and medium-sized Ontario municipalities. Additionally, by participating in the survey, municipal staff members have the opportunity to reflect on their organization's ICT adoption and potentially identify areas for improvement.

Can participants choose to leave the study? You may withdraw from the survey at any point without consequence by closing your internet browser, closing your internet browser tab, or navigating to a different website. Due to the anonymous nature of your data, once your survey responses have been submitted, the researchers will be unable to withdraw your data.

How will participants' information be kept anonymous? You will not be asked to provide personal identifying information. Your response will be anonymous. The survey does request that you identify your job title, your experience level, and general questions about your municipalities, such as approximate population size, level of government, and IT service provider status. The survey is being widely distributed which will significantly reduce the chance that you could be personally identified by your responses.

The anonymous data collected from the participants will be securely stored in the Qualtrics platform, which is encrypted, password-protected, and hosted in Ireland. Data will be accessible remotely for the study team members and authorized researchers from the broader scientific community granted access to the data. Delegated institutional representatives of Western University and its Non-Medical Research Ethics may require access to your study-related records to monitor the conduct of the research in accordance with regulatory requirements. After the survey is closed, the data will be downloaded from Qualtrics and stored on password-protected non-cloud-based device.

Are participants compensated to be in this study? The survey will provide an incentive for you to complete it. You will have the opportunity to complete a separate Qualtrics survey to receive a copy of the final report and be entered to win one of eight Tim Horton's card. For any draw, the odds of winning a prize depend on how many people are entered in the draw. As we do not know how many people will participate in this study and related draw, we cannot predict what will be the odds of winning a prize.

You will be directed to this survey upon completion Municipal Modernization and Technology Adoption study. Participants will be prompted to enter their email address to receive a copy of the final report and enter a draw for one of eight $50 Tim Hortons cards. This incentive aims to show appreciation for your time and effort in completing the survey and to encourage your participation. Email addresses are stored separately from study data.

The draw will be conducted in June 2023 with winners being notified by email. **What are the rights of participants?** Your participation in this study is voluntary. You may decide not to be in this study. Even if you consent to participate you have the right to not answer individual questions or to withdraw from the study at any time. If you choose not to participate or to leave

the study at any time it will have no consequence.

When selecting whether to complete the survey, you have the right to ask questions regarding the research, including its goal, procedures, risks, and benefits, and to have their questions addressed.

You have the right to privacy and confidentiality, which includes the right to have your personal information and all correspondence with researchers treated confidentially, and your data anonymized in all instances.

You have the right to assume that the study will be completed ethically and professionally, with any potential risks avoided to the greatest extent possible. The Study Team will take all necessary precautions to protect these rights during the study.

If you have any questions about your rights as a research participant or the conduct of this study, you may contact The Office of Human Research Ethics (519) 661-3036, 1-844- 720-9816, email: ethics@uwo.ca. This office oversees the ethical conduct of research studies and is not part of the study team. Everything that you discuss will be kept confidential. **Whom do participants contact for questions?** Please contact Owen Jaggard with any questions about the survey, the research, or this Letter of Information and Consent.

Owen Jaggard
Local Government Program
Study Team Member
E-mail: ojaggard@uwo.ca

Download Link: Letter of Information and Consent Consent *Submitting the survey is indication of your consent to participate.*

Page Break

Q1 What is the population of your municipality? Please select the range of best fit

- ○ Under 999 (1)
- ○ 1000-4,999 (2)
- ○ 4,999 to 9,999 (3)
- ○ 10,000 to 24,999 (4)
- ○ 25,000 to 49,999 (5)
- ○ 50,000 to 99,999 (6)
- ○ Over 100,000 (7)

Page Break

Q3 What is your position? Select the title of best fit.

- ○ Chief Administrative Officer or equivilent (1)
- ○ Municipal Clerk or equivalent (2)
- ○ Treasurer or equivalent (3)
- ○ Manager or equivalent (4)
- ○ Other (5)
- ○ Prefer not to say (6)

Q4 What tier is your municipality?

- ○ Upper Tier (1)
- ○ Lower Tier (2)
- ○ Single Tier (3)

Q5 How many years have you worked in local government?

- ○ Less than 1 years (1)
- ○ 1-5 years (2)
- ○ 6-10 years (3)
- ○ 11-15 years (4)
- ○ 16-20 years (5)
- ○ 20+ years (6)

Q6 Does your organization use primarily in-house (staff) IT support or an external IT provider?

- ○ In-House (1)
- ○ External (2)

Page Break

Q42 Please reflect on your municipal workplace and answer the following questions:

Q7 There can be little action taken here until a supervisor approves a decision

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q8 In general, a person who wants to make his or her own decisions would be quickly discouraged

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Page Break

Q9 Even small matters have to be referred to someone higher up for a final answer

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q10 People here do the same job in the same way every day

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q11 One thing people like around here is the variety of work

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Page Break

Q12 Most jobs have something new happening every day

- ○ Strongly Disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Q13 The formal pay structures and rules make it hard to reward a good employee with higher pay here

- ○ Strongly Disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Q14 Even if a manager is a poor performer, formal rules make it hard to remove him or her from the organization

- ○ Strongly Disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Page Break

Q15 Because of the rules here, promotions are based mainly on performance

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q16 Most employees in this organization are not afraid to take risks

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q17 This organization is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Page Break

Q18 Provincial modernization grants have been used to implement new technology or increase efficiency

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q19 This organization closely follows and regularly applies to provincial grant opportunities

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q20 This organization has a clear strategy for adopting new technology

- Strongly Disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Q21 Council is not willing to invest in technology unless absolutely necessary

- ○ Strongly Disagree (1)
- ○ Somewhat disagree (2)
- ○ Neither agree nor disagree (3)
- ○ Somewhat agree (4)
- ○ Strongly agree (5)

Page Break

Q40 Please indicate the level of influence the Province of Ontario exerts over your management area:

- ○ No Influence (1)
- ○ Weak Influence (2)
- ○ Medium Influence (3)
- ○ Strong Influence (4)
- ○ Very Strong Influence (5)

Q42 Please indicate the level of influence your residents and community stakeholders exerts over your management area:

- ○ No Influence (1)
- ○ Mild Influence (2)
- ○ Medium Influence (3)
- ○ Strong Influence (4)
- ○ Very Strong Influence (5)

Page Break

Q23 Please select all of the following IT policy and management tools your municipality maintains? Select all applicable:

- [ ] Policy addressing Acceptable Use of Technology (1)
- [ ] Policy addressing IT Security (2)
- [ ] Policy addressing Third-Party Access or Data Management (3)
- [ ] Asset Lifecycle Management Plan for IT Hardware (4)
- [ ] Information Technology Strategic Plan or Master Plan (5)
- [ ] Business Continuity Plan or Disaster Recovery Strategy addressing Information Technology (6)
- [ ] Information Technology Steering Committee or equivalent (7)

Q24 Please select all of the following customer services processes which can be completed on your municipal website or other online platforms - without requiring email submission or paper forms:

- [ ] Public Records (Agendas, Minutes, By-Laws) (1)
- [ ] Bids and Tenders (2)
- [ ] Delegation, deputation, or public hearings requests (3)
- [ ] Service Requests (4)
- [ ] Planning Applications (5)
- [ ] Licensing and Permitting Applications (6)
- [ ] By-Law Complaints (7)
- [ ] Tracking Applications or Requests (8)
- [ ] Tax Pre-Authorized Payment Applications (9)
- [ ] Public Feedback or Comments (10)
- [ ] Community Event Calendar (11)
- [ ] Freedom of Information Requests (12)
- [ ] Facilities Rentals Applications (13)
- [ ] Search for jobs with the municipality (14)
- [ ] Apply for jobs with the municipality (15)
- [ ] Payment of Taxes (16)
- [ ] Payment of User Fees (17)
- [ ] Participate Virtually in Council/Committee Meetings (18)
- [ ] Online Voting (19)
- [ ] Live Text Chat with a Customer Service Representative or Chatbot (20)

Q25 Does you municipality have a system or systems for sharing and managing electronic records?

- Yes (1)
- No (2)

Q26 Which of the following best describes the system(s)?

- Cloud Based (1)
- Intranet or Hosted (2)
- File Explorer Based (Shared Drive) (3)

End of Block: Default Question Block

Appendix 2: NMRED Approval

Western Research

Date: 3 May 2023

To: Joseph Lyons

Project ID: 122899

Study Title: Municipal Modernization and Technology Adoption Study

Short Title: Municipal Modernization Study

Application Type: NMREB Initial Application

Review Type: Delegated

Full Board Reporting Date: 02/Jun/2023

Date Approval Issued: 03/May/2023 11:45

REB Approval Expiry Date: 03/May/2024

Dear Joseph Lyons

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the WREM application form for the above mentioned study, as of the date noted above. NMREB approval for this study remains valid until the expiry date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

This research study is to be conducted by the investigator noted above. **All other required institutional approvals and mandated training must also be obtained prior to the conduct of the study.**

Documents Approved:

Document Name	Document Type	Document Date	Document Version
Print Survey - Municipal Modernization and Technology Adoption Study v3	Online Survey	03/Apr/2023	3
Letter of Information and Consent (LOI-C) - Municipal Modernization Survey v2	Implied Consent/Assent	11/Apr/2023	2
Municipal Modernization Study - Email Template V3	Recruitment Materials	30/Apr/2023	3
Municipal Modernization Study - Research Protocol V3	Protocol	30/Apr/2023	3

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario. Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Ms. Zoë Levi, Research Ethics Officer on behalf of Dr. Randal Graham, NMREB Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

Appendix 3.1: Path Analysis (Online Services)

Models Info

Estimation Method	ML	.
Number of observations	357	
Free parameters	23	
Converged	TRUE	
Loglikelihood user model	-1855.571	
Loglikelihood unrestricted model	-1855.186	
Model	RiskToleranceK ~ CentralizationK + RoutinenessK + PersonalContraintsK + Province1 + Community1 DVOnlineServices1 ~ CentralizationK + RoutinenessK + PersonalContraintsK + Province1 + Community1 + RiskToleranceK + GrantEngagement1 GrantEngagement1 ~ CentralizationK + RoutinenessK + PersonalContraintsK + Province1 + Community1	

Overall Tests

Model Tests

Label	X^2	df	p
User Model	0.768	1	0.381
Baseline Model	113.337	18	< .001

Fit Indices

					RMSEA 95% CI		
AIC	BIC	adj. BIC	SRMR	RMSEA	Lower	Upper	RMSEA p
3757	3846	3773	0.006	0.000	0.000	0.133	0.561

Fit Indices

CFI	TLI	RNI	GFI	adj. GFI	pars. GFI
1.000	1.044	1.002	1.000	0.998	0.023

Estimates

R-squared

		95% Confidence Intervals	
Variable	R^2	Lower	Upper
RiskToleranceK	0.1699	0.104	0.245

R-squared

		95% Confidence Intervals	
Variable	R^2	Lower	Upper
DVOnlineServices1	0.1037	0.051	0.170
GrantEngagement1	0.0177	0.001	0.055

Parameter Estimates

				95% Confidence Intervals				
Dep	Pred	Estimate	SE	Lower	Upper	β	z	p
RiskToleranceK	CentralizationK	-0.16114	0.0538	-0.2666	-0.0556	-0.15663	-2.994	0.003
RiskToleranceK	RoutinenessK	-0.28805	0.0661	-0.4177	-0.1584	-0.22526	-4.355	< .001
RiskToleranceK	PersonalContraintsK	-0.19052	0.0492	-0.2869	-0.0941	-0.19541	-3.875	< .001
RiskToleranceK	Province1	-0.06237	0.0503	-0.1609	0.0362	-0.06350	-1.241	0.215
RiskToleranceK	Community1	-0.02433	0.0521	-0.1265	0.0778	-0.02366	-0.467	0.641
DVOnlineServices1	CentralizationK	-0.48760	0.2821	-1.0405	0.0653	-0.09525	-1.728	0.084
DVOnlineServices1	RoutinenessK	-0.40483	0.3518	-1.0943	0.2846	-0.06362	-1.151	0.250

Parameter Estimates

				95% Confidence Intervals				
Dep	Pred	Estimate	SE	Lower	Upper	β	z	p
DVOnlineServices1	PersonalContraintsK	-0.14023	0.2595	-0.6489	0.3685	-0.02890	-0.540	0.589
DVOnlineServices1	Province1	0.34783	0.2608	-0.1632	0.8589	0.07117	1.334	0.182
DVOnlineServices1	Community1	-0.61222	0.2699	-1.1412	-0.0833	-0.11964	-2.268	0.023
DVOnlineServices1	RiskToleranceK	0.81435	0.2737	0.2780	1.3507	0.16366	2.976	0.003
DVOnlineServices1	GrantEngagement1	0.76501	0.3118	0.1539	1.3761	0.12403	2.454	0.014
GrantEngagement1	CentralizationK	-0.04498	0.0472	-0.1376	0.0476	-0.05420	-0.952	0.341
GrantEngagement1	RoutinenessK	-0.07524	0.0581	-0.1890	0.0385	-0.07293	-1.296	0.195
GrantEngagement1	PersonalContraintsK	-0.00690	0.0432	-0.0915	0.0777	-0.00878	-0.160	0.873
GrantEngagement1	Province1	0.03531	0.0441	-0.0512	0.1218	0.04456	0.800	0.424
GrantEngagement1	Community1	0.04635	0.0457	-0.0433	0.1360	0.05587	1.014	0.311

Variances and Covariances

				95% Confidence Intervals						
Variable 1	Variable 2	Estimate	SE	Lower	Upper	β	z	p	Method	Type
RiskToleranceK	RiskToleranceK	0.68312	0.0511	0.58290	0.78333	0.8301	13.4	< .001	Estim	Residuals
DVOnlineServices1	DVOnlineServices1	18.26325	1.3670	15.58404	20.94246	0.8963	13.4	< .001	Estim	Residuals
GrantEngagement1	GrantEngagement1	0.52620	0.0394	0.44900	0.60339	0.9823	13.4	< .001	Estim	Residuals
CentralizationK	CentralizationK	0.77756	0.0000	0.77756	0.77756	1.0000			Sample	Variables
CentralizationK	RoutinenessK	0.19616	0.0000	0.19616	0.19616	0.3136			Sample	Variables
CentralizationK	PersonalContraintsK	0.22228	0.0000	0.22228	0.22228	0.2709			Sample	Variables
CentralizationK	Province1	-0.00908	0.0000	-0.00908	-0.00908	-0.0111			Sample	Variables
CentralizationK	Community1	0.03821	0.0000	0.03821	0.03821	0.0491			Sample	Variables
RoutinenessK	RoutinenessK	0.50330	0.0000	0.50330	0.50330	1.0000			Sample	Variables
RoutinenessK	PersonalContraintsK	0.09576	0.0000	0.09576	0.09576	0.1451			Sample	Variables

Variances and Covariances

				95% Confidence Intervals						
Variable 1	Variable 2	Estimate	SE	Lower	Upper	β	z	p	Method	Type
RoutinenessK	Province1	-0.08801	0.0000	-0.08801	-0.08801	-0.1343			Sample	Variables
RoutinenessK	Community1	0.04744	0.0000	0.04744	0.04744	0.0758			Sample	Variables
PersonalContraintsK	PersonalContraintsK	0.86581	0.0000	0.86581	0.86581	1.0000			Sample	Variables
PersonalContraintsK	Province1	0.06784	0.0000	0.06784	0.06784	0.0789			Sample	Variables
PersonalContraintsK	Community1	0.04369	0.0000	0.04369	0.04369	0.0532			Sample	Variables
Province1	Province1	0.85316	0.0000	0.85316	0.85316	1.0000			Sample	Variables
Province1	Community1	0.23152	0.0000	0.23152	0.23152	0.2841			Sample	Variables
Community1	Community1	0.77821	0.0000	0.77821	0.77821	1.0000			Sample	Variables

Intercepts

			95% Confidence Intervals			
Variable	Intercept	SE	Lower	Upper	z	p
RiskToleranceK	4.735	0.280	4.186	5.284	16.917	0.000
DVOnlineServices1	8.181	2.403	3.471	12.892	3.404	0.001
GrantEngagement1	4.538	0.246	4.057	5.020	18.474	0.000
CentralizationK	2.419	0.000	2.419	2.419		
RoutinenessK	2.242	0.000	2.242	2.242		
PersonalContraintsK	3.521	0.000	3.521	3.521		
Province1	3.171	0.000	3.171	3.171		
Community1	3.120	0.000	3.120	3.120		

Defined Parameters

					95% Confidence Intervals				
Label	Description	Parameter	Estimate	SE	Lower	Upper	β	z	p
IE1	CentralizationK ⇒ RiskToleranceK ⇒ DVOnlineServices1	p1*p11	-0.131	0.062	-0.253	-0.009	-0.026	-2.111	0.035
IE2	CentralizationK ⇒ GrantEngagement1 ⇒ DVOnlineServices1	p13*p12	-0.034	0.039	-0.110	0.042	-0.007	-0.888	0.375

Defined Parameters

Label	Description	Parameter	Estimate	SE	95% Confidence Intervals		β	z	p
					Lower	Upper			
IE3	RoutinenessK ⇒ RiskToleranceK ⇒ DVOnlineServices1	p2*p11	-0.235	0.095	-0.422	-0.047	-0.037	-2.457	0.014
IE4	RoutinenessK ⇒ GrantEngagement1 ⇒ DVOnlineServices1	p14*p12	-0.058	0.050	-0.156	0.041	-0.009	-1.146	0.252
IE5	PersonalContraintsK ⇒ RiskToleranceK ⇒ DVOnlineServices1	p3*p11	-0.155	0.066	-0.284	-0.026	-0.032	-2.360	0.018
IE6	PersonalContraintsK ⇒ GrantEngagement1 ⇒ DVOnlineServices1	p15*p12	-0.005	0.033	-0.070	0.060	-0.001	-0.160	0.873
IE7	Province1 ⇒ RiskToleranceK ⇒ DVOnlineServices1	p4*p11	-0.051	0.044	-0.138	0.036	-0.010	-1.145	0.252
IE8	Province1 ⇒ GrantEngagement1 ⇒ DVOnlineServices1	p16*p12	0.027	0.036	-0.043	0.097	0.006	0.761	0.447
IE9	Community1 ⇒ RiskToleranceK ⇒ DVOnlineServices1	p5*p11	-0.020	0.043	-0.104	0.064	-0.004	-0.461	0.645
IE10	Community1 ⇒ GrantEngagement1 ⇒ DVOnlineServices1	p17*p12	0.035	0.038	-0.039	0.110	0.007	0.937	0.349

Appendix 3.2: Path Analysis (Policies Adopted)

Models Info

Estimation Method	ML
Number of observations	323
Free parameters	23
Converged	TRUE
Loglikelihood user model	-1375.89
Loglikelihood unrestricted model	-1375.513
Model	RiskToleranceK ~ CentralizationK + RoutinenessK + PersonalContraintsK + Province1 + Community1 GrantEngagement1 ~ CentralizationK + RoutinenessK + PersonalContraintsK + Province1 + Community1 DVPolicies ~ GrantEngagement1 + RiskToleranceK + Community1 + Province1 + PersonalContraintsK + RoutinenessK + CentralizationK

Overall Tests

Model Tests

Label	X^2	df	p
User Model	0.754	1	0.385
Baseline Model	111.780	18	< .001

Fit Indices

					RMSEA 95% CI		
AIC	BIC	adj. BIC	SRMR	RMSEA	Lower	Upper	RMSEA p
2798	2885	2812	0.007	0.000	0.000	0.140	0.551

Fit Indices

CFI	TLI	RNI	GFI	adj. GFI	pars. GFI
1.000	1.047	1.003	1.000	0.998	0.023

Estimates

R-squared

		95% Confidence Intervals	
Variable	R^2	Lower	Upper
RiskToleranceK	0.1899	0.118	0.271

R-squared

		95% Confidence Intervals	
Variable	R^2	Lower	Upper
GrantEngagement1	0.0166	0.000	0.055
DVPolicies	0.1095	0.053	0.180

Parameter Estimates

				95% Confidence Intervals				
Dep	Pred	Estimate	SE	Lower	Upper	β	z	p
RiskToleranceK	CentralizationK	-0.1753	0.0563	-0.2857	-0.0649	-0.1673	-3.112	0.002
RiskToleranceK	RoutinenessK	-0.2892	0.0682	-0.4229	-0.1555	-0.2277	-4.240	< .001
RiskToleranceK	PersonalContraintsK	-0.2212	0.0504	-0.3200	-0.1224	-0.2266	-4.390	< .001
RiskToleranceK	Province1	-0.0486	0.0514	-0.1494	0.0522	-0.0502	-0.945	0.345
RiskToleranceK	Community1	-0.0342	0.0536	-0.1393	0.0709	-0.0336	-0.638	0.524
GrantEngagement1	CentralizationK	-0.0570	0.0514	-0.1578	0.0437	-0.0657	-1.110	0.267
GrantEngagement1	RoutinenessK	-0.0609	0.0622	-0.1829	0.0610	-0.0579	-0.979	0.328

Parameter Estimates

				95% Confidence Intervals				
Dep	Pred	Estimate	SE	Lower	Upper	β	z	p
GrantEngagement1	PersonalContraintsK	-0.0162	0.0460	-0.1063	0.0739	-0.0200	-0.352	0.725
GrantEngagement1	Province1	0.0290	0.0469	-0.0629	0.1210	0.0362	0.618	0.536
GrantEngagement1	Community1	0.0496	0.0489	-0.0463	0.1455	0.0588	1.014	0.311
DVPolicies	GrantEngagement1	0.2938	0.1248	0.0492	0.5383	0.1247	2.355	0.019
DVPolicies	RiskToleranceK	0.0748	0.1138	-0.1483	0.2979	0.0384	0.657	0.511
DVPolicies	Community1	-0.1398	0.1099	-0.3553	0.0757	-0.0704	-1.272	0.203
DVPolicies	Province1	-0.0876	0.1054	-0.2942	0.1190	-0.0464	-0.831	0.406
DVPolicies	PersonalContraintsK	-0.2463	0.1061	-0.4544	-0.0383	-0.1293	-2.321	0.020
DVPolicies	RoutinenessK	-0.1270	0.1436	-0.4083	0.1544	-0.0512	-0.884	0.377
DVPolicies	CentralizationK	-0.3564	0.1172	-0.5861	-0.1268	-0.1743	-3.042	0.002

Variances and Covariances

				95% Confidence Intervals						
Variable 1	Variable 2	Estimate	SE	Lower	Upper	β	z	p	Method	Type
RiskToleranceK	RiskToleranceK	0.66101	0.0520	0.55906	0.76295	0.8101	12.7	< .001	Estim	Residuals
GrantEngagement1	GrantEngagement1	0.55011	0.0433	0.46527	0.63495	0.9834	12.7	< .001	Estim	Residuals
DVPolicies	DVPolicies	2.76609	0.2177	2.33949	3.19270	0.8905	12.7	< .001	Estim	Residuals
CentralizationK	CentralizationK	0.74304	0.0000	0.74304	0.74304	1.0000			Sample	Variables
CentralizationK	RoutinenessK	0.19051	0.0000	0.19051	0.19051	0.3107			Sample	Variables
CentralizationK	PersonalContraintsK	0.17567	0.0000	0.17567	0.17567	0.2203			Sample	Variables
CentralizationK	Province1	-0.00937	0.0000	-0.00937	-0.00937	-0.0116			Sample	Variables
CentralizationK	Community1	0.06099	0.0000	0.06099	0.06099	0.0798			Sample	Variables
RoutinenessK	RoutinenessK	0.50590	0.0000	0.50590	0.50590	1.0000			Sample	Variables
RoutinenessK	PersonalContraintsK	0.08264	0.0000	0.08264	0.08264	0.1256			Sample	Variables

Variances and Covariances

				95% Confidence Intervals						
Variable 1	Variable 2	Estimate	SE	Lower	Upper	β	z	p	Method	Type
RoutinenessK	Province1	-0.09893	0.0000	-0.09893	-0.09893	-0.1490			Sample	Variables
RoutinenessK	Community1	0.04487	0.0000	0.04487	0.04487	0.0711			Sample	Variables
PersonalContraintsK	PersonalContraintsK	0.85600	0.0000	0.85600	0.85600	1.0000			Sample	Variables
PersonalContraintsK	Province1	0.05628	0.0000	0.05628	0.05628	0.0651			Sample	Variables
PersonalContraintsK	Community1	0.05194	0.0000	0.05194	0.05194	0.0633			Sample	Variables
Province1	Province1	0.87191	0.0000	0.87191	0.87191	1.0000			Sample	Variables
Province1	Community1	0.23283	0.0000	0.23283	0.23283	0.2812			Sample	Variables
Community1	Community1	0.78634	0.0000	0.78634	0.78634	1.0000			Sample	Variables

Intercepts

			95% Confidence Intervals			
Variable	Intercept	SE	Lower	Upper	z	p
RiskToleranceK	4.869	0.291	4.298	5.439	16.723	0.000
GrantEngagement1	4.569	0.266	4.048	5.089	17.201	0.000
DVPolicies	4.938	0.993	2.991	6.885	4.971	0.000
CentralizationK	2.379	0.000	2.379	2.379		
RoutinenessK	2.236	0.000	2.236	2.236		
PersonalContraintsK	3.506	0.000	3.506	3.506		
Province1	3.161	0.000	3.161	3.161		
Community1	3.111	0.000	3.111	3.111		

Defined Parameters

					95% Confidence Intervals				
Label	Description	Parameter	Estimate	SE	Lower	Upper	β	z	p
IE1	CentralizationK ⇒ RiskToleranceK ⇒ DVPolicies	p1*p12	-0.013	0.020	-0.053	0.027	-0.006	-0.643	0.520
IE2	CentralizationK ⇒ GrantEngagement1 ⇒ DVPolicies	p6*p11	-0.017	0.017	-0.049	0.016	-0.008	-1.004	0.316

Defined Parameters

					95% Confidence Intervals				
Label	Description	Parameter	Estimate	SE	Lower	Upper	β	z	p
IE3	RoutinenessK ⇒ RiskToleranceK ⇒ DVPolicies	p2*p12	-0.022	0.033	-0.087	0.044	-0.009	-0.650	0.516
IE4	RoutinenessK ⇒ GrantEngagement1 ⇒ DVPolicies	p7*p11	-0.018	0.020	-0.057	0.021	-0.007	-0.904	0.366
IE5	PersonalContraintsK ⇒ RiskToleranceK ⇒ DVPolicies	p3*p12	-0.017	0.025	-0.066	0.033	-0.009	-0.650	0.516
IE6	PersonalContraintsK ⇒ GrantEngagement1 ⇒ DVPolicies	p8*p11	-0.005	0.014	-0.032	0.022	-0.002	-0.348	0.728
IE7	Province1 ⇒ RiskToleranceK ⇒ DVPolicies	p4*p12	-0.004	0.007	-0.017	0.010	-0.002	-0.540	0.589
IE8	Province1 ⇒ GrantEngagement1 ⇒ DVPolicies	p9*p11	0.009	0.014	-0.019	0.036	0.005	0.598	0.550
IE9	Community1 ⇒ RiskToleranceK ⇒ DVPolicies	p5*p12	-0.003	0.006	-0.014	0.008	-0.001	-0.458	0.647
IE10	Community1 ⇒ GrantEngagement1 ⇒ DVPolicies	p10*p11	0.015	0.016	-0.016	0.045	0.007	0.931	0.352

Appendix 3.3: Path Analysis (Information System Type)

Models Info

Estimation Method	ML
Number of observations	357
Free parameters	23
Converged	TRUE
Loglikelihood user model	-1327.386
Loglikelihood unrestricted model	-1327.002
Model	RiskToleranceK ~ CentralizationK + RoutinenessK + PersonalContraintsK + Province1 + Community1 GrantEngagement1 ~ CentralizationK + RoutinenessK + PersonalContraintsK + Province1 + Community1 DVInformationSystemTypeK ~ CentralizationK + RoutinenessK + PersonalContraintsK + Province1 + Community1 + RiskToleranceK + GrantEngagement1

Overall Tests

Model Tests

Label	X^2	df	p
User Model	0.768	1	0.381
Baseline Model	89.456	18	< .001

Fit Indices

					RMSEA 95% CI		
AIC	BIC	adj. BIC	SRMR	RMSEA	Lower	Upper	RMSEA p
2701	2790	2717	0.006	0.000	0.000	0.133	0.561

Fit Indices

CFI	TLI	RNI	GFI	adj. GFI	pars. GFI
1.000	1.058	1.003	1.000	0.998	0.023

Estimates

R-squared

		95% Confidence Intervals	
Variable	R^2	Lower	Upper
RiskToleranceK	0.1699	0.104	0.245

R-squared

		95% Confidence Intervals	
Variable	R^2	Lower	Upper
GrantEngagement1	0.0177	0.001	0.055
DVInformationSystemTypeK	0.0434	0.011	0.093

Parameter Estimates

				95% Confidence Intervals				
Dep	Pred	Estimate	SE	Lower	Upper	β	z	p
RiskToleranceK	CentralizationK	-0.16114	0.0538	-0.2666	-0.0556	-0.15663	-2.994	0.003
RiskToleranceK	RoutinenessK	-0.28805	0.0661	-0.4177	-0.1584	-0.22526	-4.355	< .001
RiskToleranceK	PersonalContraintsK	-0.19052	0.0492	-0.2869	-0.0941	-0.19541	-3.875	< .001
RiskToleranceK	Province1	-0.06237	0.0503	-0.1609	0.0362	-0.06350	-1.241	0.215
RiskToleranceK	Community1	-0.02433	0.0521	-0.1265	0.0778	-0.02366	-0.467	0.641

Parameter Estimates

				95% Confidence Intervals				
Dep	Pred	Estimate	SE	Lower	Upper	β	z	p
GrantEngagement1	CentralizationK	-0.04498	0.0472	-0.1376	0.0476	-0.05420	-0.952	0.341
GrantEngagement1	RoutinenessK	-0.07524	0.0581	-0.1890	0.0385	-0.07293	-1.296	0.195
GrantEngagement1	PersonalContraintsK	-0.00690	0.0432	-0.0915	0.0777	-0.00878	-0.160	0.873
GrantEngagement1	Province1	0.03531	0.0441	-0.0512	0.1218	0.04456	0.800	0.424
GrantEngagement1	Community1	0.04635	0.0457	-0.0433	0.1360	0.05587	1.014	0.311
DVInformationSystemTypeK	CentralizationK	-0.20730	0.0643	-0.3332	-0.0814	-0.18369	-3.226	0.001
DVInformationSystemTypeK	RoutinenessK	-0.03243	0.0801	-0.1894	0.1246	-0.02312	-0.405	0.686
DVInformationSystemTypeK	PersonalContraintsK	0.04742	0.0591	-0.0684	0.1633	0.04433	0.802	0.422

Parameter Estimates

Dep	Pred	Estimate	SE	95% Confidence Intervals		β	z	p
				Lower	Upper			
DVInformationSystemTypeK	Province1	-0.01352	0.0594	-0.1299	0.1029	-0.01254	-0.228	0.820
DVInformationSystemTypeK	Community1	0.06054	0.0615	-0.0599	0.1810	0.05366	0.985	0.325
DVInformationSystemTypeK	RiskToleranceK	0.06171	0.0623	-0.0604	0.1839	0.05626	0.990	0.322
DVInformationSystemTypeK	GrantEngagement1	-0.01400	0.0710	-0.1532	0.1252	-0.01029	-0.197	0.844

Variances and Covariances

Variable 1	Variable 2	Estimate	SE	95% Confidence Intervals		β	z	p	Method	Type
				Lower	Upper					
RiskToleranceK	RiskToleranceK	0.68312	0.0511	0.58290	0.78333	0.8301	13.4	< .001	Estim	Residuals

Variances and Covariances

				95% Confidence Intervals						
Variable 1	Variable 2	Estimate	SE	Lower	Upper	β	z	p	Method	Type
GrantEngagement1	GrantEngagement1	0.52620	0.0394	0.44900	0.60339	0.9823	13.4	< .001	Estim	Residuals
DVInformationSystemTypeK	DVInformationSystemTypeK	0.94731	0.0709	0.80834	1.08628	0.9566	13.4	< .001	Estim	Residuals
CentralizationK	CentralizationK	0.77756	0.0000	0.77756	0.77756	1.0000			Sample	Variables
CentralizationK	RoutinenessK	0.19616	0.0000	0.19616	0.19616	0.3136			Sample	Variables
CentralizationK	PersonalContraintsK	0.22228	0.0000	0.22228	0.22228	0.2709			Sample	Variables
CentralizationK	Province1	-0.00908	0.0000	-0.00908	-0.00908	-0.0111			Sample	Variables
CentralizationK	Community1	0.03821	0.0000	0.03821	0.03821	0.0491			Sample	Variables
RoutinenessK	RoutinenessK	0.50330	0.0000	0.50330	0.50330	1.0000			Sample	Variables
RoutinenessK	PersonalContraintsK	0.09576	0.0000	0.09576	0.09576	0.1451			Sample	Variables
RoutinenessK	Province1	-0.08801	0.0000	-0.08801	-0.08801	-0.1343			Sample	Variables

Variances and Covariances

Variable 1	Variable 2	Estimate	SE	95% Confidence Intervals		β	z	p	Method	Type
				Lower	Upper					
RoutinenessK	Community1	0.04744	0.0000	0.04744	0.04744	0.0758			Sample	Variables
PersonalContraintsK	PersonalContraintsK	0.86581	0.0000	0.86581	0.86581	1.0000			Sample	Variables
PersonalContraintsK	Province1	0.06784	0.0000	0.06784	0.06784	0.0789			Sample	Variables
PersonalContraintsK	Community1	0.04369	0.0000	0.04369	0.04369	0.0532			Sample	Variables
Province1	Province1	0.85316	0.0000	0.85316	0.85316	1.0000			Sample	Variables
Province1	Community1	0.23152	0.0000	0.23152	0.23152	0.2841			Sample	Variables
Community1	Community1	0.77821	0.0000	0.77821	0.77821	1.0000			Sample	Variables

Intercepts

Variable	Intercept	SE	95% Confidence Intervals		z	p
			Lower	Upper		
RiskToleranceK	4.735	0.280	4.186	5.284	16.917	0.000

Intercepts

			95% Confidence Intervals			
Variable	Intercept	SE	Lower	Upper	z	p
GrantEngagement1	4.538	0.246	4.057	5.020	18.474	0.000
DVInformationSystemTypeK	2.933	0.547	1.860	4.006	5.358	0.000
CentralizationK	2.419	0.000	2.419	2.419		
RoutinenessK	2.242	0.000	2.242	2.242		
PersonalContraintsK	3.521	0.000	3.521	3.521		
Province1	3.171	0.000	3.171	3.171		
Community1	3.120	0.000	3.120	3.120		

Defined Parameters

					95% Confidence Intervals				
Label	Description	Parameter	Estimate	SE	Lower	Upper	β	z	p
IE1	CentralizationK ⇒ RiskToleranceK ⇒ DVInformationSystemTypeK	p1*p16	-0.010	0.011	-0.031	0.011	-0.009	-0.940	0.347
IE2	CentralizationK ⇒ GrantEngagement1 ⇒ DVInformationSystemTypeK	p6*p17	0.001	0.003	-0.006	0.007	0.001	0.193	0.847
IE3	RoutinenessK ⇒ RiskToleranceK ⇒ DVInformationSystemTypeK	p2*p16	-0.018	0.018	-0.054	0.018	-0.013	-0.965	0.334

Defined Parameters

Label	Description	Parameter	Estimate	SE	95% Confidence Intervals		β	z	p
					Lower	Upper			
IE4	RoutinenessK ⇒ GrantEngagement1 ⇒ DVInformationSystemTypeK	p7*p17	0.001	0.005	-0.010	0.012	0.001	0.195	0.846
IE5	PersonalContraintsK ⇒ RiskToleranceK ⇒ DVInformationSystemTypeK	p3*p16	-0.012	0.012	-0.036	0.012	-0.011	-0.959	0.337
IE6	PersonalContraintsK ⇒ GrantEngagement1 ⇒ DVInformationSystemTypeK	p8*p17	0.000	0.001	-0.001	0.002	0.000	0.124	0.901
IE7	Province1 ⇒ RiskToleranceK ⇒ DVInformationSystemTypeK	p4*p16	-0.004	0.005	-0.014	0.006	-0.004	-0.774	0.439
IE8	Province1 ⇒ GrantEngagement1 ⇒ DVInformationSystemTypeK	p9*p17	-0.000	0.003	-0.006	0.005	-0.000	-0.191	0.848
IE9	Community1 ⇒ RiskToleranceK ⇒ DVInformationSystemTypeK	p5*p16	-0.002	0.004	-0.008	0.005	-0.001	-0.422	0.673
IE10	Community1 ⇒ GrantEngagement1 ⇒ DVInformationSystemTypeK	p10*p17	-0.001	0.003	-0.007	0.006	-0.001	-0.193	0.847

Appendix 4.1: Generalized Linear Models with Poisson Distribution for Control Variables (Online Services)

Model Info

Info	Value	Comment
Model Type	Poisson	Model for count data
Call	glm	DVOnlineServices1 ~ 1 + MunicipalPop + Position + PositionTransformed + Tier + Years + ITProv + CentralizationK + RoutinenessK + PersonalContraintsK + RiskToleranceK + `Grant Engagement`
Link function	log	Coefficients are in the log(y) scale
Distribution	Poisson	Model for count data
R-squared	0.204	Proportion of reduction of error
AIC	2097.072	Less is better
BIC	2143.639	Less is better
Deviance	612.131	Less is better
Residual DF	346	
Chi-squared/DF	1.636	Overdispersion indicator
Converged	yes	Whether the estimation found a solution

Model Results

Loglikelihood ratio tests

	X^2	df	p
MunicipalPop	9.64104	1	0.002
Position	7.25e-5	1	0.993

Loglikelihood ratio tests

	X^2	df	p
PositionTransformed	0.00173	1	0.967
Tier	0.10053	1	0.751
Years	10.95666	1	< .001
ITProv	2.20839	1	0.137
CentralizationK	0.28846	1	0.591
RoutinenessK	2.74932	1	0.097
PersonalContraintsK	0.10513	1	0.746
RiskToleranceK	13.66673	1	< .001
Grant Engagement	32.31067	1	< .001

Parameter Estimates

				95% Exp(B) Confidence Interval			
Names	Estimate	SE	exp(B)	Lower	Upper	z	p
(Intercept)	2.32862	0.0167	10.264	9.932	10.60	139.67881	< .001
MunicipalPop	0.05093	0.0164	1.052	1.019	1.09	3.10735	0.002
Position	3.31e-4	0.0389	1.000	0.926	1.08	0.00851	0.993
PositionTransformed	-0.00213	0.0511	0.998	0.903	1.10	-0.04163	0.967
Tier	0.01071	0.0337	1.011	0.946	1.08	0.31726	0.751
Years	0.03963	0.0120	1.040	1.016	1.07	3.30481	< .001
ITProv	-0.06600	0.0443	0.936	0.858	1.02	-1.48848	0.137

Parameter Estimates

				95% Exp(B) Confidence Interval			
Names	Estimate	SE	exp(B)	Lower	Upper	z	p
CentralizationK	-0.01161	0.0216	0.988	0.947	1.03	-0.53672	0.591
RoutinenessK	-0.04248	0.0257	0.958	0.911	1.01	-1.65490	0.098
PersonalContraintsK	-0.00611	0.0188	0.994	0.958	1.03	-0.32435	0.746
RiskToleranceK	0.07255	0.0197	1.075	1.035	1.12	3.68573	< .001
Grant Engagement	0.14788	0.0267	1.159	1.101	1.22	5.54318	< .001

Appendix 4.2: Generalized Linear Models with Poisson Distribution for Control Variables (Policies Adopted)

Model Info

Info	Value	Comment
Model Type	Poisson	Model for count data
Call	glm	DVInformationSystemTypeK ~ 1 + MunicipalPop + Position + PositionTransformed + Tier + Years + ITProv + CentralizationK + RoutinenessK + PersonalContraintsK + RiskToleranceK + `Grant Engagement`
Link function	log	Coefficients are in the log(y) scale
Distribution	Poisson	Model for count data
R-squared	0.0644	Proportion of reduction of error
AIC	1071.0590	Less is better
BIC	1117.6250	Less is better
Deviance	229.9000	Less is better

Model Info

Info	Value	Comment
Residual DF	346	
Chi-squared/DF	0.5401	Overdispersion indicator
Converged	yes	Whether the estimation found a solution

Model Results

Loglikelihood ratio tests

	X^2	df	p
MunicipalPop	0.2138	1	0.644
Position	0.8394	1	0.360
PositionTransformed	1.3806	1	0.240
Tier	2.6675	1	0.102
Years	0.0964	1	0.756
ITProv	0.4528	1	0.501
CentralizationK	3.9200	1	0.048
RoutinenessK	2.72e-4	1	0.987
PersonalContraintsK	0.3021	1	0.583
RiskToleranceK	0.1493	1	0.699
Grant Engagement	1.5106	1	0.219

Parameter Estimates

				95% Exp(B) Confidence Interval			
Names	Estimate	SE	exp(B)	Lower	Upper	z	p
(Intercept)	0.56377	0.0401	1.757	1.623	1.899	14.0539	< .001
MunicipalPop	0.01894	0.0409	1.019	0.940	1.104	0.4625	0.644
Position	0.08282	0.0892	1.086	0.907	1.288	0.9287	0.353
PositionTransformed	-0.14188	0.1201	0.868	0.687	1.101	-1.1815	0.237
Tier	-0.13879	0.0856	0.870	0.735	1.028	-1.6208	0.105
Years	-0.00893	0.0287	0.991	0.937	1.049	-0.3105	0.756
ITProv	0.07341	0.1093	1.076	0.870	1.335	0.6715	0.502
CentralizationK	-0.10397	0.0529	0.901	0.812	0.999	-1.9671	0.049
RoutinenessK	-0.00102	0.0618	0.999	0.884	1.127	-0.0165	0.987
PersonalContraintsK	0.02507	0.0457	1.025	0.938	1.122	0.5489	0.583
RiskToleranceK	0.01842	0.0477	1.019	0.928	1.119	0.3861	0.699
Grant Engagement	0.07526	0.0620	1.078	0.957	1.221	1.2135	0.225

Appendix 4.3: Generalized Linear Models with Poisson Distribution for Control Variables (Information Systems Adopted)

Model Info

Info	Value	Comment
Model Type	Poisson	Model for count data

Model Info

Info	Value	Comment
Call	glm	DVPolicies ~ 1 + MunicipalPop + Position + PositionTransformed + Tier + Years + ITProv + CentralizationK + RoutinenessK + PersonalContraintsK + RiskToleranceK + `Grant Engagement`
Link function	log	Coefficients are in the log(y) scale
Distribution	Poisson	Model for count data
R-squared	0.379	Proportion of reduction of error
AIC	1199.822	Less is better
BIC	1245.191	Less is better
Deviance	176.623	Less is better
Residual DF	312	
Chi-squared/DF	0.551	Overdispersion indicator
Converged	yes	Whether the estimation found a solution

Model Results

Loglikelihood ratio tests

	X^2	df	p
MunicipalPop	6.614	1	0.010
Position	1.590	1	0.207
PositionTransformed	0.977	1	0.323
Tier	0.541	1	0.462
Years	2.400	1	0.121

Loglikelihood ratio tests

	X^2	df	p
ITProv	11.927	1	< .001
CentralizationK	0.668	1	0.414
RoutinenessK	0.224	1	0.636
PersonalContraintsK	4.463	1	0.035
RiskToleranceK	0.447	1	0.504
Grant Engagement	11.753	1	< .001

Parameter Estimates

				95% Exp(B) Confidence Interval			
Names	Estimate	SE	exp(B)	Lower	Upper	z	p
(Intercept)	1.2801	0.0299	3.597	3.390	3.812	42.820	< .001
MunicipalPop	0.0722	0.0280	1.075	1.017	1.136	2.573	0.010
Position	0.0857	0.0670	1.089	0.953	1.239	1.279	0.201
PositionTransformed	-0.0881	0.0888	0.916	0.770	1.091	-0.992	0.321
Tier	-0.0420	0.0573	0.959	0.856	1.072	-0.733	0.463
Years	0.0335	0.0217	1.034	0.991	1.079	1.547	0.122
ITProv	-0.2687	0.0775	0.764	0.657	0.890	-3.466	< .001
CentralizationK	-0.0314	0.0385	0.969	0.898	1.045	-0.816	0.414
RoutinenessK	-0.0211	0.0446	0.979	0.897	1.068	-0.473	0.636
PersonalContraintsK	-0.0699	0.0330	0.932	0.874	0.995	-2.121	0.034

Parameter Estimates

				95% Exp(B) Confidence Interval			
Names	Estimate	SE	exp(B)	Lower	Upper	z	p
RiskToleranceK	0.0236	0.0354	1.024	0.955	1.098	0.668	0.504
Grant Engagement	0.1562	0.0469	1.169	1.068	1.284	3.331	< .001

Appendix 5 – Confirmatory Factor Analysis

Factor Loadings

Factor	Indicator	Estimate	SE	Z	p
Factor 1	Centralization	0.769	0.0617	12.46	< .001
	Centralization2	0.725	0.0518	13.99	< .001
	Centralization3	0.810	0.0575	14.09	< .001
Factor 2	Routiness1	0.771	0.0786	9.80	< .001
	Routiness2	0.475	0.0530	8.95	< .001
	Routiness3	0.405	0.0592	6.85	< .001
Factor 3	PersonelContraints1	0.364	0.0818	4.46	< .001
	PersonelContraints2	0.755	0.1517	4.98	< .001
	PersonelContraints3	-0.194	0.0871	-2.23	0.026
Factor 4	Risk1	0.707	0.0638	11.07	< .001
	Risk2	0.859	0.0726	11.82	< .001
Factor 5	GrantEngagement1	0.345	0.0850	4.06	< .001

Factor Loadings

Factor	Indicator	Estimate	SE	Z	p
	GrantEffectiveness1	0.661	0.1536	4.31	< .001
Factor 6	Province1	0.922	0.0345	26.76	< .001
Factor 7	Community1	0.881	0.0329	26.76	< .001

Model Fit

Test for Exact Fit

χ^2	df	p
117	71	< .001

Fit Measures

			RMSEA 90% CI	
CFI	TLI	RMSEA	Lower	Upper
0.943	0.915	0.0426	0.0283	0.0560

Appendix 6 – Reliability Analysis (Cronbach's Alpha)

Reliability Analysis - Centralization

Scale Reliability Statistics

	Mean	Cronbach's α
scale	2.42	0.758

Item Reliability Statistics

	Mean
Centralization	3.01
Centralization2	2.28
Centralization3	1.97

Reliability Analysis - Routineness

Scale Reliability Statistics

	Mean	Cronbach's α
scale	2.24	0.582

Item Reliability Statistics

	Mean
Routiness1	2.53
Routiness2	2.02
Routiness3	2.17

Reliability Analysis - Personal Constraints

Scale Reliability Statistics

	Mean	Cronbach's α
scale	3.52	0.374

Item Reliability Statistics

	Mean
PersonelContraints1	3.94
PersonelContraints2	3.11

Reliability Analysis - Risk Tolerance

Scale Reliability Statistics

	Mean	Cronbach's α
scale	2.76	0.740

Item Reliability Statistics

	Mean
Risk1	2.89
Risk2	2.63

Item Reliability Statistics

	Mean

Reliability Analysis – Grant Engagement

Scale Reliability Statistics

	Cronbach's α
scale	0.481

Item Reliability Statistics

	Mean
GrantEffectiveness1	4.26
GrantEngagement1	4.50

Appendix 7 - Summary Statistics of Individual Survey Items

Descriptives

	N	Missing	Mean	Median	SD	Minimum	Maximum
MunicipalPop	359	0	3.3426	3	1.512	1	7
Position	359	0	2.2312	2	1.106	1	5
PositionTransformed	359	0	2.0724	2	0.833	1	3
Tier	359	0	2.2006	2	0.558	1	3
Years	359	0	4.2451	4	1.530	1	6
ITProv	359	0	1.5961	2	0.491	1	2
Centralization	359	0	3.0056	3	1.158	1	5
Centralization2	359	0	2.2813	2	0.978	1	5
Centralization3	359	0	1.9749	2	1.087	1	5
CentralizationK	359	0	2.4206	2.33	0.884	1.00	5.00
Routiness1	358	1	2.5335	2.00	1.149	1	5
Routiness2	359	0	2.0167	2	0.808	1	5
Routiness3	359	0	2.1699	2	0.895	1	5
RoutinenessK	358	1	2.2421	2.00	0.709	1.00	5.00
PersonelContraints1	359	0	3.9387	4	1.081	1	5
PersonelContraints2	359	0	3.1086	3	1.289	1	5
PersonelContraints3	359	0	3.2507	3	1.072	1	5
PersonalContraintsK	359	0	3.5237	3.50	0.933	1.00	5.00
Risk1	359	0	2.8858	3	0.972	1	5
Risk2	359	0	2.6295	3	1.062	1	5
RiskToleranceK	359	0	2.7577	3.00	0.907	1.00	5.00
GrantEffectiveness1	359	0	4.2646	4	0.954	1	5
GrantEngagement1	359	0	4.4958	5	0.732	1	5
TechStrategy1	358	1	3.3045	4.00	1.167	1	5

Descriptives

	N	Missing	Mean	Median	SD	Minimum	Maximum
InvestmentWillingness1	359	0	2.5209	2	1.198	1	5
Province1	358	1	3.1704	3.00	0.924	1	5
Community1	358	1	3.1201	3.00	0.882	1	5
DVPolicies	324	35	3.7593	4.00	1.764	1	7
DVRecordsSystemType	358	1	1.8743	2.00	1.012	0	3
DVOnlineServices1	359	0	10.4958	11	4.522	1	19
PAcceptableUse	324	35	0.8920	1.00	0.311	0	1
PITSecurity	324	35	0.7284	1.00	0.445	0	1
PThirdParty	324	35	0.4784	0.00	0.500	0	1
P AssetLifecyclePlan	324	35	0.6265	1.00	0.484	0	1
PITPlan	324	35	0.2685	0.00	0.444	0	1
PDisasterRecovery	324	35	0.5648	1.00	0.497	0	1
PSteeringCommittee	324	35	0.2006	0.00	0.401	0	1
OSPublicRecords	359	0	0.9192	1	0.273	0	1
OSBidsaAndTenders	359	0	0.7382	1	0.440	0	1
OSMeetingReg	359	0	0.5265	1	0.500	0	1
OSServiceRequests	359	0	0.5710	1	0.496	0	1
OSPlanningApplications	359	0	0.4039	0	0.491	0	1
OSLicensing	359	0	0.5209	1	0.500	0	1
OSByLawComplaints	359	0	0.6212	1	0.486	0	1
OSTracking	359	0	0.1783	0	0.383	0	1
OSTaxPAPApp	359	0	0.4345	0	0.496	0	1
OSPublicFeedback	359	0	0.6880	1	0.464	0	1
OSCommunityCalendar	359	0	0.7716	1	0.420	0	1
OSFOI	359	0	0.3343	0	0.472	0	1

Descriptives

	N	Missing	Mean	Median	SD	Minimum	Maximum
OSFacilitiesRentals	359	0	0.3733	0	0.484	0	1
OSSearchForJobs	359	0	0.8552	1	0.352	0	1
OSApplyForJobs	359	0	0.4178	0	0.494	0	1
OSPayTaxes	359	0	0.5097	1	0.501	0	1
OSPayUserFees	359	0	0.4234	0	0.495	0	1
OSPartipateInMeetings	359	0	0.6852	1	0.465	0	1
OSOnlineVoting	359	0	0.4930	0	0.501	0	1
OSChatbot	359	0	0.0306	0	0.173	0	1
RecordsSystemYN	357	2	1.2325	1	0.423	1	2