City of Bryan

STRATEGIC TASK AND TECHNOLOGICAL ANALYSIS

Graduate Research Team from
Texas A&M University
Bush School of Government and Public Service

The **Bush School**
OF GOVERNMENT & PUBLIC SERVICE
TEXAS A&M UNIVERSITY

City of Bryan
Strategic Task & Technological Analysis

Produced 2019 - 2020
in collaboration with
The Bush School of Government and Public Service
Texas A&M University

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Abbreviations and Acronyms

AAPRA	American Academy for Park and Recreation Administration
AD	Active Directory
AI	Artificial Intelligence
APN	American Park Network
AICP	American Institute of Certified Planners
AR	Augmented Reality
AUDREY	Assistant for Understanding Data through Reasoning, Extraction, and Synthesis
CAD	Computer-Aided Dispatch
CAPRA	Commission for Accreditation of Park and Recreation Agencies
CCTV	Closed-Circuit Television
CIO	Chief Information Officer
DNS	Domain Name System
DHS	Department of Homeland Security
EMS	Emergency Medical Services
FD	Fire Department
HDMI	High Definition Multimedia Interface
ICT	Information and Communication Technology
ILS	Integrated Library System
IoT	Internet of Things
IT	Information Technology
GIS	Geographic Information System
GPS	Global Positioning System
JPL	Jet Propulsion Laboratory
LCD	Liquid Crystal Display
MCP	Mobile Command Post
MDM	Mobile Device Management
NAHS	National Association of Home Builders
NIST	National Institute of Standards and Technology
NG911	Next Generation 911
NRPA	National Recreation and Park Association
OCR	Optical Character Recognition
PA	Public Address
PC	Personal Computer
PPE	Personal Protective Equipment
RF	Radio Frequency
RFID	Radio-frequency Identification
S&T	Science and Technology
SAPL	San Antonio Public Library
SMA	Systems Management Appliance
SMS	Short Message Service
TAGITM	Texas Association of Government Information Technology

TIC	Thermal Imaging Camera
TNA	Technological Needs Assessment
TRM	Technology Road mapping
VR	Virtual Reality
WST	Wearable Safety Technology

PART I: Executive Summary

INTRODUCTION

The Bush School of Government and Public Service partnered with the City of Bryan for the 2019-2020 academic year to perform an analysis of five city departments and to identify opportunities to improve departmental effectiveness, efficiency, and equity through technology. This analysis was conducted by a group of ten Bush School students, advised by Dr. Justin Bullock, as part of their Graduate Capstone Project. The research team is divided into five sub-teams that worked directly with the following departments: Development and Planning Services, Fire Department, Information Technology, Library Services, and Parks and Recreation.

From August 2019 to April 2020, the research team conducted two distinct project phases that allowed the team to identify potential opportunities and provide technological recommendations. During Phase I (August 2019 – December 2019) the team conducted a Technological Needs Assessment (TNA) of the five departments. The TNA sought to identify what technological opportunities exist within each department to improve effectiveness, efficiency, and equity. During Phase II (January 2020 - April 2020) the team conducted research to identify available technology that could be adopted to take advantage of opportunities identified by the TNA.

Project Overview
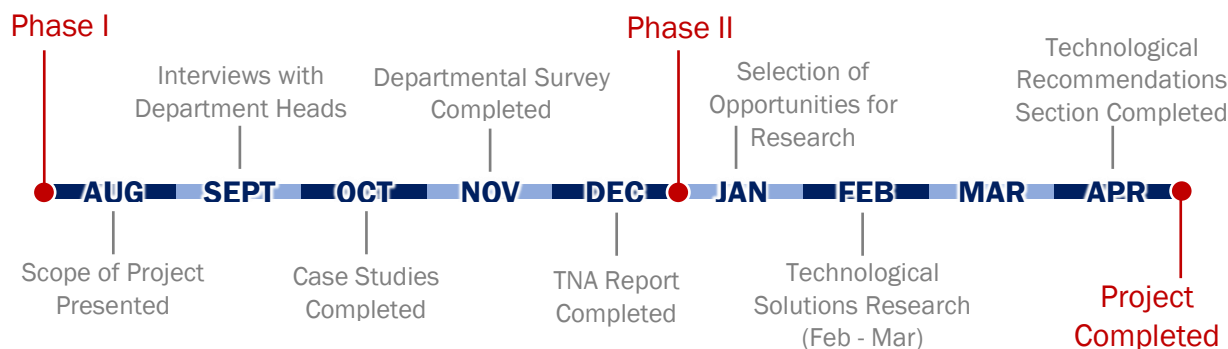
Phase I — Phase II

Interviews with Department Heads
Departmental Survey Completed
Selection of Opportunities for Research
Technological Recommendations Section Completed

AUG — SEPT — OCT — NOV — DEC — JAN — FEB — MAR — APR

Scope of Project Presented
Case Studies Completed
TNA Report Completed
Technological Solutions Research (Feb - Mar)
Project Completed

Departments Selected for Analysis:
- Development Services
- Fire Department
- Information Technology
- Library Services
- Parks and Recreation

Total Project Hours: 2,017
Phase I Hours: 1,162
Phase II Hours: 855

TECHNOLOGICAL NEEDS ASSESSMENT

The Technological Needs Assessment sought to accomplish the following three goals:

1. *Identifying best practices and challenges by reviewing current literature and conducting case studies of other local governments.*

2. *Identifying opportunities (specifically tasks and processes) to enhance effectiveness and efficiency within the five departments.*

3. *Identifying potential options for technology adoption that could produce gains in effectiveness and efficiency within the five departments.*

To accomplish these goals, the five research teams conducted an analysis of their respective departments using the following methods:

- **Academic and Professional Literature Review:** Teams conducted a review of academic and professional literature to identify common challenges and best practices regarding the use of technology for overcoming those challenges.

- **Case Studies:** Teams developed case studies of departments in other local governments to identify how other municipalities were using technology to overcome challenges.

- **Department Head Interviews:** Teams conducted interviews with department heads to gain a better understanding of each department's roles and responsibilities, strengths and weaknesses, and opportunities to adopt technology.

- **On-site Field Visits and Staff Interviews:** Similar to the department head interview, each team conducted on-site field visits and staff interviews to gain a better understanding of the department. These field visits and interviews were used to inform each team's analysis of potential opportunities for technology adoption.

- **Departmental Survey:** The survey sought to gather information related to departmental roles and responsibilities, current technology use, challenges to adopting new technology, and potential opportunities to apply technology to enhance effectiveness and efficiency.

Based on the information gathered and the subsequent analysis of the data, teams were able to identify potential challenges, best practices, key roles and responsibilities, and potential opportunities for technology adoption.

Development Services

Development Services determined their department needs an online portal with features that allow customers to track permitting status, make payments, and submit applications. The sub-team discovered the utilization of an online portal is essential in providing and maintaining adequate customer services. Additionally, the department would benefit from implementing heightened standards for performance measures, as current practices are somewhat limited. Case study cities for this department consisted of Austin, Denton, and College Station, Texas.

Fire Department

The Fire Department provides services that are vital for protecting citizens and property within the city. The sub-team found the department would benefit from employing technologies such as data-integration systems, drones and robots, EMS technologies, synchronized workflow platforms, simulation and mapping software, and recording technologies. Additionally, the sub-team gathered information from Santa Clara, California's fire department to better understand how to utilize these technologies. Moving forward, the team will work with the department to determine which of these technologies are the most feasible for the city to acquire.
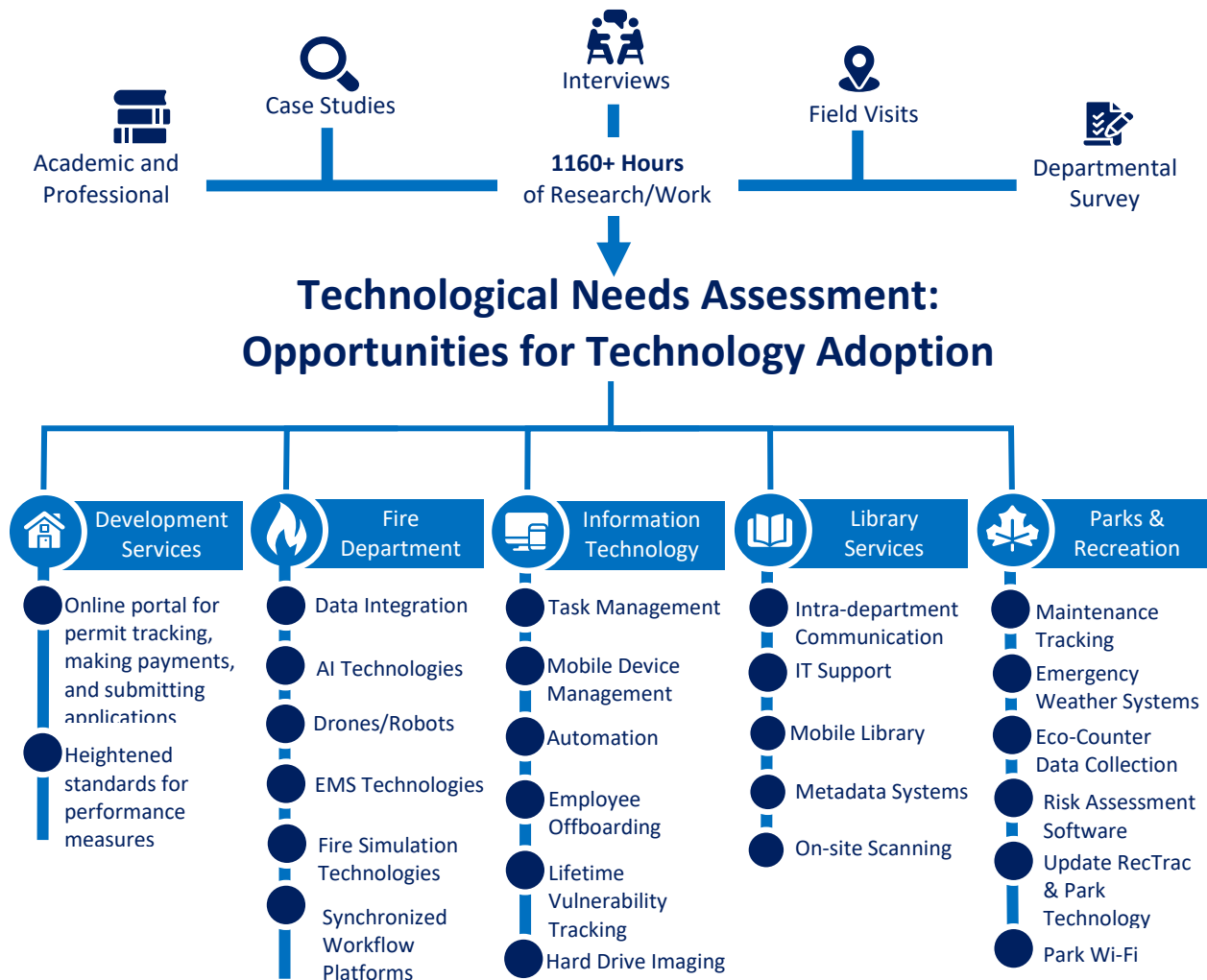
Information Technology

The Information Technology (IT) Department is focused on providing exceptional customer support and security for the various departments within the City of Bryan. To assist the department with these objectives, the IT sub-team conducted research that found that key challenges and best practices for local government IT departments can include poor technology implementation processes, limited financial and human resources, and security. Best practices include fostering innovation and technology awareness, automation of tasks, e-government through cloud computing, and effective security management. Case study cities examined by the sub-team included New Braunfels and Frisco, Texas. Additional research through interviews and surveys found that opportunities to enhance the effectiveness and efficiency of the IT department as it carries out its customer support and security role include task management, mobile device management, automation, employee offboarding, lifetime vulnerability tracking, and hard drive imaging.

Library Services

Overseeing three different libraries within both College Station and Bryan, Library Services provides access to technologies and informational resources to the community. The sub-team found that technologies that would improve the department's intra-department communication, IT support systems, and metadata systems, as well as basic technology such as on-site scanning, would be beneficial for staff and patrons. Additionally, the sub-team's knowledge for best practices for the department was influenced by using San Antonio, Texas as their case study city.

Parks and Recreation

The Parks and Recreation sub-team concluded adopting software programs for maintenance risk assessments, data collection, and park WiFi implementation are among some of the solutions that could increase effectiveness and efficiency within the department. Additionally, calling attention to different forms of revenue generation (eSports and tourism) and environmental technologies (irrigation systems) could be of large benefit to the community. Case study cities for this department include Plymouth, Minnesota along with Allen and Plano, Texas.

Academic and Professional — Case Studies — Interviews — Field Visits — Departmental Survey

1160+ Hours of Research/Work

Technological Needs Assessment: Opportunities for Technology Adoption

Development Services	Fire Department	Information Technology	Library Services	Parks & Recreation
Online portal for permit tracking, making payments, and submitting applications	Data Integration	Task Management	Intra-department Communication	Maintenance Tracking
Heightened standards for performance measures	AI Technologies	Mobile Device Management	IT Support	Emergency Weather Systems
	Drones/Robots	Automation	Mobile Library	Eco-Counter Data Collection
	EMS Technologies	Employee Offboarding	Metadata Systems	Risk Assessment Software
	Fire Simulation Technologies	Lifetime Vulnerability Tracking	On-site Scanning	Update RecTrac & Park Technology
	Synchronized Workflow Platforms	Hard Drive Imaging		Park Wi-Fi

TECHNOLOGICAL RECOMMENDATIONS

Following the completion of the TNA, our team met with departmental leadership to recap our findings and discuss potential opportunities in which to focus further research efforts. The team researched various technological solutions, contacted companies, and identified constraints in implementing the recommended technologies. We propose the following technological recommendations for each of the five departments.

Development Services

Through their research, the Development Services sub-team identified two key challenges within the department: the lack of an online tracking and permitting system and the need to enhance performance measures. To overcome these challenges, the team recommends that the department (1) continue working with CentralSquare to implement an online system and (2) utilize current technologies to allow for in-office customer-satisfaction surveys.

Fire Department

The Fire Department sub-team identified technologically driven solutions for an updated computer-assisted dispatch system (CAD), an improved workflow platform, and new thermal imaging cameras (TICs). These will enhance emergency response time and coordination, workflow processes, and firefighter safety. The team's primary recommendations for overcoming these challenges include (1) prioritizing the purchasing of TICs and (2) using Laserfiche to improve workflow processes.

Information Technology

The IT sub-team focused on the challenges associated with onboarding, offboarding, transfers and promotions (collectively called employee management processes) along with hard drive imaging. The primary challenges are inefficient communication in the employee management processes and a lack of time, space, and hardware capability for hard drive imaging. To overcome these challenges, primary recommendations include the following: (1) use Laserfiche to develop an automated system of forms and (2) purchase Symantec Ghost for hard drive imaging.
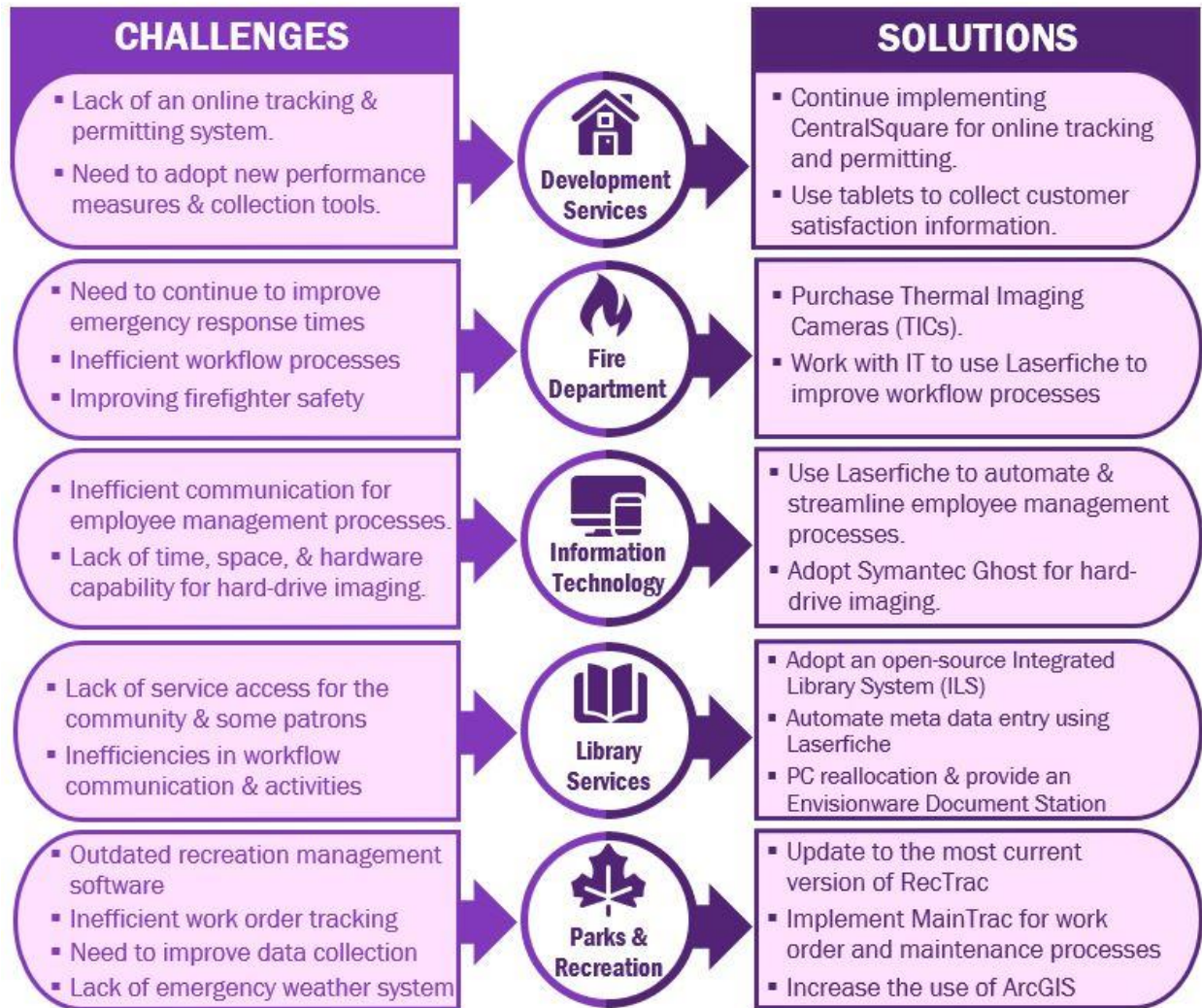
Library Services

The Library sub-team focused on efforts to enhance mobility and outreach capabilities, improve patron experience, and streamline work processes. The team's primary recommendation is a three-year plan that seeks to: (1) migrate from the current Polaris Integrated Library System (ILS) to an open-source ILS in year one, (2) implement an inter-library chat system for all library branches and automate metadata entry using Laserfiche in year 2, and (3) provide for an Envisionware Document Station and the reallocation of PCs at the Mounce Library into Public Access Catalogs, disability access, and low-vision PCs. By implementing the primary recommendation the team expects the department to see significant cost savings, an improvement to workflow processes, and an enhanced experience for patrons.

Parks and Recreation

The Parks and Recreation sub-team has focused on updating current recreation management software, streamlining assessment and work order tracking, increasing data collection, installing an emergency weather system, and expanding the use of GIS technology. The team's primary recommendation includes (1) updating current recreation management software to the most current version of RecTrac, (2) implementing MainTrac to improve the tracking of work orders, maintenance requests, and service delivery, and (3) increasing the use of ArcGIS in the department.

RECOMMENDED TECHNOLOGICAL SOLUTIONS

CHALLENGES

Development Services
- Lack of an online tracking & permitting system.
- Need to adopt new performance measures & collection tools.

Fire Department
- Need to continue to improve emergency response times
- Inefficient workflow processes
- Improving firefighter safety

Information Technology
- Inefficient communication for employee management processes.
- Lack of time, space, & hardware capability for hard-drive imaging.

Library Services
- Lack of service access for the community & some patrons
- Inefficiencies in workflow communication & activities

Parks & Recreation
- Outdated recreation management software
- Inefficient work order tracking
- Need to improve data collection
- Lack of emergency weather system

SOLUTIONS

Development Services
- Continue implementing CentralSquare for online tracking and permitting.
- Use tablets to collect customer satisfaction information.

Fire Department
- Purchase Thermal Imaging Cameras (TICs).
- Work with IT to use Laserfiche to improve workflow processes

Information Technology
- Use Laserfiche to automate & streamline employee management processes.
- Adopt Symantec Ghost for hard-drive imaging.

Library Services
- Adopt an open-source Integrated Library System (ILS)
- Automate meta data entry using Laserfiche
- PC reallocation & provide an Envisionware Document Station

Parks & Recreation
- Update to the most current version of RecTrac
- Implement MainTrac for work order and maintenance processes
- Increase the use of ArcGIS

CONCLUSION

Moving forward, it is intended that the City will utilize the findings and recommendations from this report in the implementation of new technologies. Departmental leadership and staff should consider holding inter-departmental discussions to identify ways to adopt the recommendations pertaining to their departments. Additional discussions may need to be held across departments to converse on potential synergies. We believe our recommended solutions identify opportunities for inter-departmental cooperation, increased productivity, and an atmosphere conducive to enhancing services provided to the general public.

PART II:
Technological
Needs Assessment

INTRODUCTION

A unique aspect of local government is that, for good or for bad, the decisions made by municipal employees, managers, and departments has the potential to directly affect the lives of citizens. As such, finding opportunities to improve efficiency, effectiveness, and equity regarding decision making and task fulfillment is crucial to a successful and functioning city. The City of Bryan recognizes the need for departments to effectively and efficiently fulfill their departmental roles and responsibilities in a way that allows the City to deliver exceptional and equitable community services to citizens. This belief is demonstrated by the organization's mission statement, "The City of Bryan is committed to providing financially efficient municipal services to improve the quality of life and develop a community where all citizens are proud to live" (City of Bryan, 2019). For the City of Bryan and its employees, efficiently delivering services that will ensure a high quality of life for its citizens its crucial to fulfilling their mission. One way to work towards ensuring the effective delivery of community services is by seeking to identify opportunities for improving the effectiveness, efficiency, and equity of decision making, task fulfillment, and service delivery through the application of technological tools. To accomplish this, our team has conducted a technological needs assessment (TNA) of each of the five departments participating in this study.

Technological Needs Assessment Goals

To identify and take advantage of potential opportunities to enhance task effectiveness and efficiency through technology, the City of Bryan has partnered with a ten-student graduate research team, advised by Dr. Justin Bullock, from the Bush School of Government at Texas A&M University. From August to December of 2019, this team conducted a technological needs assessment of the following five departments: Development Services, the Fire Department, Information Technology, Library Services, and Parks and Recreation. The goals for this Technological Needs Assessment included:

1. *Identifying best practices and challenges by reviewing current literature and conducting case studies of other local governments.*

2. *Identifying opportunities (specifically tasks and processes) to enhance effectiveness and efficiency within the five departments.*

3. *Identifying potential options for technology adoption that could produce gains in effectiveness and efficiency within the five departments.*

Based on these goals, the research team conducted a successful analysis that analyzed current technology use and needs within each department. The result is this Technological Needs Assessment

Departments Selected for Analysis

- Development Services
- Fire Department
- Information Technology
- Library Services
- Parks & Recreation

(TNA) that identifies potential opportunities for technology adoption that could assist with enhancing departmental effectiveness and efficiency.

Research and Analysis Processes

The ten-student research team was split into teams of two, with each sub-team assigned to perform a technological needs assessment of one of the five departments. Students devoted over 1,160 hours to performing this assessment. Key tasks related to research and analysis included:

- **Literature Review:** each sub-team conducted a review of current academic and professional literature related to their respective departments. The literature review sought to identify some of the key challenges and best practices that could affect decision making, task fulfillment, and service delivery within each department.

- **Case Studies:** sub-teams conducted case studies of other local government organizations to identify how other cities are overcoming challenges and improving their departments through the adoption of technology.

- **Department Head Interview:** to gain a better understanding of each department's roles and responsibilities, strengths and weaknesses, and opportunities to adopt technology to enhance departmental efficiency and effectiveness, each sub-team interviewed the department head of the department they were assigned to. Interviews consisted of seven to eleven questions, with the first seven questions of each interview being the same for each department head. Department head interview questions can be found in Appendix A.

- **On-site Field Visits and Staff Interviews:** similar to the department head interview, each team conducted on-site field visits and staff interviews to gain a better understanding of the department. These field visits and interviews were used to inform each teams analysis of potential opportunities for technology adoption.

- **Departmental Survey:** the survey sought to gather information related to departmental roles and responsibilities, current technology use, challenges to adopting new technology, and potential opportunities to apply technology to enhance effectiveness and efficiency. Departmental surveys consisted of eight to eleven questions with the first eight questions of each survey being the same for each department. Students then conducted a descriptive analysis of this data.

Through the use of these tools and processes, the research team was able to successfully accomplish the three TNA goals stated in the prior section. As will be demonstrated by the remaining sections of the TNA the research team successfully identified a number of potential opportunities to apply technology in an effort to enhance effectiveness, efficiency, and equity within each of the five departments.

SUMMARY OF NEEDS ASSESSMENT

The Development Services Department within the City of Bryan is responsible for promoting development within the city through excellent customer services. The purpose of this document is to provide a framework that will guide the city in adopting and implementing new technologies within the department. A plethora of information was gathered through academic and professional literature reviews, department-head interviews, field visits, and departmental surveys. The case study cities analyzed in this work are Austin, Denton, and College Station, Texas. From our research, we gathered that the city needs an online portal system that will aid in the tracking, permitting, and payment processes of the city. Additionally, the department would benefit from establishing and adhering to a set of performance measures that are indicative of the quantity and quality of the department's services. Moving forward, our team will focus on analyzing the various types of online systems available for municipal governments. As well, we will work with the department to determine what goals are ideal, so as to implement adequate performance measures.

INTRODUCTION

About the Development Services Department

The purpose of this technological needs assessment is to provide the City of Bryan's Development Services Department with a framework for implementing and utilizing new forms of technology. This assessment is composed of information gathered from academic and professional literature, along with survey data and departmental interviews. The case study cities studied for this assessment are Austin, Denton, and College Station, Texas. These cities were chosen primarily because of their population sizes and their current use of technology.

The Development Services department in the City of Bryan, which includes Planning and Building Services, is primarily tasked with providing quality customer services and working to promote development (Planning and Development Services, n.d.). The department consists of 24 full-time employees, split equally between Planning Services and Building Services, and operates at an annual budget of around $2.3 million (Planning and Development Services, n.d.; City of Bryan, Texas, 2019). The Planning Department has been continuously awarded for its work by being chosen as a recipient of the Certificate of Achievement for Planning Excellence from the Texas Chapter of the American Planning Association in the years 2016, 2017, 2018, and 2019 (Texas

Chapter Planning Awards, n.d.; Zimmermann, 2019). The department strives to encourage professional and community development, and their back-to-back awards attest for their excellence in increasing community awareness of planning and economic development.

On October 2nd, 2019, our sub-team interviewed Martin Zimmermann, AICP. Mr. Zimmermann is currently the Assistant Director for Planning and Development Services for Bryan. His responses, along with data collected through a departmental survey, create a consensus that the department needs an online portal that will aid in improving overall efficiency. Additionally, interviews with representatives from our case study cities have confirmed the importance of using online software in providing adequate services. Improving current performance measures is another goal of Mr. Zimmermann, and empirical research notes the importance of implementing adequate measures.

From this data, our team identified three main objectives to consider when determining our recommendations for the city. They are:

- Improve the means by which customer services are provided
- Decrease internal and external obstacles for implementing new technologies
- Increase awareness of alternative funding for acquiring new technologies

With a plethora of information from various sources, and the aforementioned objectives in mind, the following needs assessment gauges where we believe the city stands in comparison to others of similar structure. Additionally, we provide instruction regarding current best practices within the field.

Use of Current Technology

Tracking

The department relies on a software called HTE. This system is outdated, adding to the frustration of customers and employees. Paul Zucker, a consultant hired by the city, performed an assessment for the department in 2012. Zucker concluded HTE is in need of replacement and suggested adopting a new permitting software that would allow for online payments and permitting. Despite Zucker's suggestion, the city has still not adopted a new form of software and attempts to do so have been stalled.

HTE is also problematic because of the time it takes for new employees to become familiar with how it operates. That is, new employees spend a substantial amount of time (roughly 4-6 weeks) becoming acquainted with the system. Also, because customers cannot track the online status of their permits, front-desk staff noted that a majority of the calls they receive on a daily basis concern the status of inspections and permits. Staff indicated that roughly 70-80% of their calls are in regard to permit status.

Additionally, inspectors also face problems with the current software. Specifically, when they are in the field performing inspections, a lack of connectivity can prevent real-time updates to the

system. This creates problems for front-desk staff responsible for providing customers with requested information.

This is not to say that the department does not use other electronic databases or resources. Employees noted their use of ArcGIS, Laserfiche, BlueBeam, Cayenta, and Google Earth. However, they also expressed their desire for these programs to be updated to their newest versions.

Appliances

In terms of appliances, the department uses: iPads, iPhones, Toughbooks, laptops, desktop computers, scanners, printers, televisions, and projectors. It should be noted that some board and commission members request their documents be printed copies in binders for meetings. Despite having access to more beneficial technologies, there is a hesitancy from these members to incorporate them into use. This can make acquisition of new tools problematic, as time and budgetary resources could be potentially wasted. Despite these challenges, while the office is not completely digital, it has taken some steps to become paperless.

LITERATURE REVIEW

The literature review integrates professional and academic literature to examine what types of technologies are currently being used in municipal government across the country. The literature has revealed that many local governments are utilizing e-government and e-services, various forms of mobile technologies, and online surveys and data assimilation to produce performance measurements.

Technology and E-Government

The World Bank defines e-government as "government-owned or operated systems of information and communications technologies (ICTs) that transform relations with citizens, the private sector and/or other government agencies so as to promote citizen empowerment, improve service delivery, strengthen accountability, increase transparency, or improve government efficiency" (World Bank, 2001). The idea of e-government was a product of technology road mapping (TRM). TRM is a strategic decision processing framework used by the private sector when determining which technological innovations to implement to increase a firm's competitive advantage. With the private sector's shift towards servitization, defined as the provision of services as supplements to their products, firms increased their use of technology. This led local governments to use TRM frameworks when determining which service-oriented technologies to adopt (Lee, Phaal, & Lee, 2013). As technology use in the public sector increased, local governments moved towards administering online transactions in the early phases, mirroring the private sector's innovation of e-commerce (D'Agostino et al., 2011). Specific to the development and planning services departments, many types of e-government include online portals for permits and inspection tracking, online payment technologies, and the use of social networking services.

Following the recession that ended in 2009, the National Association of Home Builders (NAHB) commissioned a report by Abt Associates. They found that the land development review and

approval process is a major component of the expense and risk of housing development projects. To improve the efficiency of this process, Abt Associates noted that local governments must work towards streamlining and consolidating the review process by: increasing their staff capacity, creating an independent process for expedited review, implementing online permitting software, creating greater accountability, and making the process and platforms more user friendly (Burnett & Morrill, 2015). Online permitting software is a convenient tool that can improve administrative performance. These systems allow customers to submit applications 24 hours a day, while also creating internal efficiencies by combining multiple databases used across various departments into one single system (Burnett & Morrill, 2015).

Some challenges with implementing e-government technologies at the local level include citizen adoption, employee and organizational characteristics, and various financial and logistical barriers (Manoharan & Ingrams, 2018). An online approach can allow employees to focus their attention on tasks that have greater impact on the community rather than trivial, time-consuming tasks. However, citizen adoption of this technology may not be universal. Additionally, while employee and organizational professionalism can be addressed at a managerial level, this does not account for the presence of generational gaps. In organizations with a generational divide, even the best-designed software will not produce the intended returns on its investment if some experienced employees view new technologies as useless or a threat to their job (Salkowitz, 2008). Finally, a lack of financial resources and time to research best technologies can deter local governments from adopting innovations that can increase their department's productivity and efficiency.

E-services, defined as the electronic delivery of services such as online payments for services, online job applications, and communication technologies, can increase the customer services provided to citizens (Li & Feeney, 2014). Despite the advantages of adopting innovative technologies, many local governments are slow to make these changes. The City Planning Department Technology Benchmark Survey of 2015 revealed that while 99% of city planning departments have a website and 83% of departments offer their zoning code online, only 10% of departments have department specific social media channels and only 21% of cities offer online permitting (Riggs, Chavan, & Steins, 2015). As both the private and public sectors have increasingly shifted towards electronic methods, the adoption of e-services and communication technologies should also increase. This is the result of governments becoming more cognizant of the need to enhance customer services (Nica, 2015).

Mobile Technology

Mobile technologies are defined as portable technology that allows tasks to be performed via tablets, cellular phones, laptops, vehicles, personal digital assistants, etc. (Greenberg, 2014). The adoption of different mobile technologies in the public sector can enable departments to expand their services, enhance communication, and aid with data collection efforts. Mobile technologies have the ability to reduce restrictions for local planning activities and can also provide an outlet for citizen engagement (Gordon, 2014). The primary types of applications that could benefit professional planning departments include (Gordon, 2014):

- *Informational* - spreading information to planning professionals

- *Transactional and Interactive* - applications for citizens to share their input and participate in local planning activities
- *Utility and Productivity* - project management platforms
- *Virtual Reality and Gaming* - simulation to make complex scenarios clearer
- *Wayfinding* - data collection of citizens' navigation habits

More cities are beginning to use mobile and digital technologies to improve customer services. These technologies increase the coordination across different departments in the city, foster greater citizen input, and profoundly change service delivery (Greenberg, 2014).

Performance Measures

Performance measurement is a tool used by organizations to gauge the relative success or failure of the services they are providing to markets and constituents (Amaratunga and Baldry, 2002). As the goals of these organizations differ based on contextual factors, such as the various actors and missions within institutions, implementing performance measures tends to be a subjective practice (Lebas, 1995). Ultimately, the idea is that effective performance measures will lead to efficient public management (Leroux, 2014). Given this information, it is imperative that organizations, specifically local governments, are aware of what measures work best for them and why those measures are fruitful. This is reflected in the literature in that, "ideal systems are characterized as being designer-built, comprising a small core of indicators, and timely so that information can guide action" (Palmer, 1993). Managers need to be aware, however, of the potential pitfalls that can come with performance measures. That is, at times, there can be instances when accountability programs foster a "performance paradox" where employees are so fixated on reaching the goal that the quality of the services they are providing become diminished (Leroux, 2014). Leroux also asserts that managers need to prioritize which measures will be intended to provide the best metrics for their organizations, as placing a premium on effectiveness could lead to tradeoffs that lead to the fragmentation of accountability (2014).

Kelly and Swindell (2002) establish a dichotomy of performance measures within organizations as being internal or external. Specifically, internal measures are those that can be measured as progress on service projects or other completed projects that can be examined by administrators. External measures, on the other hand, are those that come from the citizenry and other outside sources (2002). Citizen satisfaction surveys are at the upper-end of popular performance measures from external sources (Leroux, 2014; Kelly and Swindell, 2002). Another example of measurement that municipalities utilize could be benchmarking their performance with that of other cities (Kelly and Swindell, 2002). That is, external organizations such as the International City Management Association (ICMA) provide metrics that cities can use to compare their success with other cities that are similar in size and structure (Kelly and Swindell, 2002).

Ultimately, local governments should be cognizant of the measures they are implementing and how those measures are tailored to specifically benefit their organization. Lebas (1995) lists five questions that organizations should consider when thinking of effective performance measures.

They are:

- Where have we been?
- Where are we now?
- Where do we want to go?
- How are we going to get there?
- How will we know we got there?

Additionally, Palmer (1993) notes how past researchers have used the following concepts as "indicators" for success in organizations: consistency, comparability, clarity, controllability, contingency, comprehensiveness, boundedness, relevance, and feasibility. As aforementioned, these are not set objectives that managers must use in examining the effectiveness and efficiency of their services, but they are examples of what local governments could consider as important to their cause (1993).

Ultimately, the implementation of performance measures depends greatly on the municipality in question and the structure of its organization. Whether the locality has clear, organized goals and supportive leadership will be determinant factors in its success and how seriously it takes performance measures (Leroux, 2014). Having a consistent and sensible set of internal and external metrics, as posited by Kelly and Swindell (2002), can greatly benefit local governments and, more importantly, the citizenry.

BEST PRACTICES

Our team compiled information taken from both the literature review and research on other development services departments across the country to identify three best practices. The most common type of e-government technology being utilized in local governments is an online permitting and planning software. Additionally, many municipal governments are shifting towards mobile technology to enhance customer services, and electronic feedback mechanisms for enhanced performance measurements.

E-Government (E-Services)

Citizenserve, Accela, Central Square (previously known as eTRAKiT), and EnerGov are four types of online permitting and planning softwares that are popular among local governments across the country. Citizenserve offers an online permitting software configuration where citizens, businesses, and contractors can access the online portal 24/7. This program automates and streamlines the permitting process, while also allowing contractors to view their status information and pay online (Permitting, n.d.). Similarly, Accela is designed to cut turnaround times by also creating a digital permitting process. Features of this software include: an online citizen portal, electronic document review, data collection and reporting, geographic information systems (GIS) mapping, code enforcement, and mobile inspections (Accelerating Community Development, n.d.). Central Square, previously known as eTRAKiT, is a popular program that provides similar services as the other two systems. With eTRAKiT, customers can apply and pay for services, permits, and fees. As well, they can search for properties, schedule and cancel inspections, and renew licenses (City of College Station, n.d.). Mirroring the other software systems, EnerGov

allows users to create an account to submit, track, and pay for permits and schedule and search for inspections (EnerGov, n.d.).

Mobile Technology

One type of mobile technology gaining attention in municipal government are 3-1-1 services. 3-1-1 is a local phone number that allows citizens to access non-emergency municipal services such as reporting code violations and submitting service requests. Cities such as Austin, Boston, Philadelphia, and Washington D.C. have implemented 3-1-1 mobile applications that residents can use to report, map, photograph, and submit information on issues in their city (Greenberg, 2014). The goal of these types of applications are to allow citizens to have a more interactive role in monitoring and improving their city.

Performance Measures

Best practices vary by municipality. In 2012, Paul Zucker of Zucker Systems met with the City of Bryan to perform an evaluation of the city and how it could improve service delivery. He found that, in terms of performance measures, the city should use citizen satisfaction surveys, comment cards, secret shoppers, perform random phone calls, and have focus groups (Zucker, 2012). As the literature reveals, along with Zucker's recommendation, increasing the use of citizen satisfaction surveys can potentially increase accountability and transparency for the city. Additionally, the use of electronic comment cards would aid improving the services provided by the city and increasing the utility of citizens.

In his other work, *The ABZs of Planning Management*, Zucker (2007) states that the problem with performance measurements within local governments is their overall tendency to be ignored. While these mechanisms are vital for healthy organizations, there belies a certain skepticism among managers regarding numbers and statistics. However, Zucker also provides suggestions regarding what forms of measurement need to be considered to provide the most insight in regard to efficient and effective measures. In summary, he states standard systems should focus on: quality, quantity, cost, and time (Zucker, 2007). Measurement systems should also include:

- A standard level of performance that would like to be met
- A design that is based off of the organizational structure of the institution
- Comparisons of actual measures with the standards
- The performance being out into conformance with the standards

With this information it can be concluded that performance measures will vary across local governments depending on the organization. Zucker's suggestions provide a wealth of knowledge that the city could utilize in improving its current measures. Best practices within this area include finding standards that will consistently adhere to the organization's goals and missions.

CASE STUDIES

As part of our assessment, our team focused on three case study cities to provide supplementary insight on the best practices and different types of technologies used in other development services

departments in Texas. The selected cities include Denton, Austin, and College Station, Texas. The city of Denton was chosen due to it being of similar size to the city of Bryan, and for their unique mobile technology adoption, Engage Denton. The city of Austin was selected because of its large size and technological innovativeness, providing us with unique ideas of new technologies moving forward. Lastly, the city of College Station was chosen because of its spatial proximity and the overlap of developers between College Station and the city of Bryan.

College Station, TX
Uses eTrackIt Software

Austin, TX
Uses online payment and portal systems

Denton, TX
EngageDenton Mobile Application
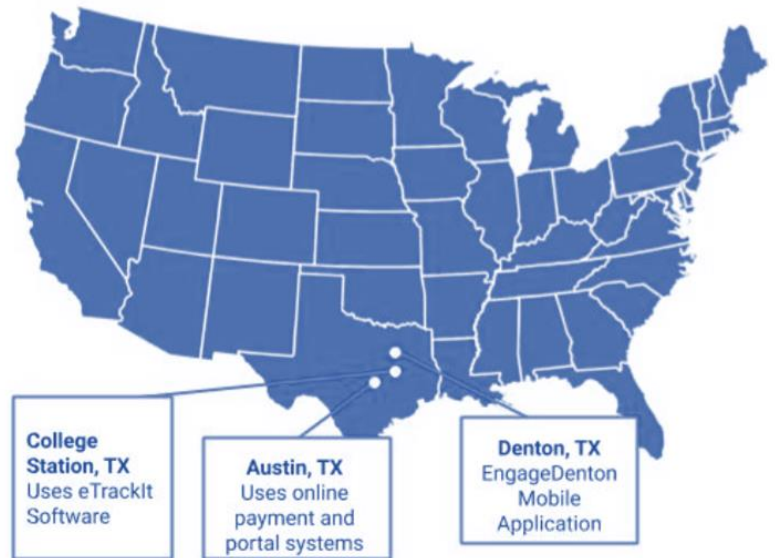
Case Study: Denton, Texas

E-Government

Denton's development services department uses a combination of eTRAKiT and ProjectDox softwares for online permitting, workflow management, and project planning review. Since 1999, both software systems have allowed the city's customers to easily make requests online, while also saving time with less face-to-face visits. eTRAKiT and ProjectDox are connected to several other departments within the city, so when customers submit plans on ProjectDox it is automatically sent to the other departments necessary for site review.

Mobile Technology

Denton recently adopted a new technology in the form of a mobile application. The app, Engage Denton, allows citizens to submit service requests to the city and monitor the status of said requests (Allen, 2018). Charles Rosendahl, the Business Services Manager of Denton, commented on the application by stating it has been successful and residents enjoy having the ability to engage electronically. Since 2018 there have been around 2,753 application downloads and 5,835 service requests submitted (Rosendahl, 2019). There are roughly 418 service requests a month, and the time it takes to close the case is at an average of 3.2 days.

Performance Measurements

The city of Denton uses multiple methods to collect performance measurements for its development services department. These methods include customer feedback methods via in-house surveys (SurveyMonkey surveys available on a tablet in their main lobby), survey signatures on their department staff's emails, and data available on the eTRAKiT system. Data obtained from the online permitting system includes the average time for plan review by permit type and total days from application to issuance for permits (Rosendahl, 2019).

Case Study: Austin, TX

E-Government

Austin Build + Connect (AB+C) is an online system where registered users can log-in to an online portal to find information about their permits, submit applications, schedule inspections, pay for their permits and fees, and chat with staff online for assistance (Austin Build + Connect, n.d.). An interview with the IT Program Manager for Development Services, Teri Pennington, revealed that the city has used the software company, Calytera, since 2006 for their AB+C program. Specifically, they work with the AMANDA Edition, which provides a modern user interface to automate workflow processes and online services for citizens through an online portal (Pennington, 2019). This software company was favored over others because of its flexibility. In particular, they favored the ability to customize the workflow to fit the needs of the city.

Austin also utilizes GIS mapping tools to provide a variety of options for citizens, contractors, and developers. The general public has the option to: search for specific properties, check an inspector territory map, search zoning for specific properties, view emerging projects, and sign up for permit alerts via the development tracker (Development Services Department, n.d.). When it comes to citizen interaction, Austin also uses an online appointment scheduling and queue management system, QLess. However, it should be noted that the city is looking to switch towards an appointment-based system (Pennington, 2019).

Mobile Technology

Austin 311 is a mobile application where citizens can report violations and request services. As well, it provides community feedback where residents can report issues related to construction, streets/signs, environmental services, noise/sound, and water problems (Austin 3-1-1, n.d.). The service can also be accessed online or by calling 3-1-1. The mobile application allows citizens to submit photographs, review reports that other users have submitted, and check the status of their request on their mobile phone. Austin 311 is powered by Motorola Solutions and serves to connect with citizens when they see something wrong. This application is limited within the development services department, because citizens cannot use the application to ask questions about their permit status. They are, however, able to use the chat option to inquire about their permit status (Pennington, 2019).

Performance Measurements

Austin uses their Success Metric Document to identify monthly target goals and performance measurements for the city's development services department. Their key success metrics include: in-house customer wait time, the percentage of timely closed service requests, the number of days taken to schedule appointments, and the amount of completed plan reviews (Key Success Metrics, 2019). The department uses MicroStrategy, an IBM business intelligence tool, and data retrieved from AMANDA to identify their success metrics. The city also gathers data from the annual citywide survey that the department is apart of, along with a department-specific survey where they meet with random stakeholders once a year to evaluate the department's performance (Pennington, 2019).

Case Study: College Station, TX

E-Government

College Station uses eTRAKiT. This system rolled out as a pilot program in April of 2015 and was permanently implemented a year later. In an interview with the department, our team learned that the city followed an alternative route and bought all of the modules, instead of the typical strategy of buying the permitting modules and upgrading as they go. The city had one full-time employee dedicated to eTRAKiT, which included a tedious debugging, customization, and learning process. This employee learned SQL and SSRS to make these functions work for the city, and since its implementation the employee now spends a little over half of her time working on eTRAKiT (George and Hitchcock, 2019). Since the program went live, the department indicated that customers are using eTRAKiT 95% of the time and their phone calls regarding permit statuses have significantly decreased.

Mobile Technology

College Station's eTRAKiT software is currently only operational through Internet Explorer. However, the city is in the process of updating to the newer version, which will include the option of a mobile application where citizens can make changes and access their permit status via their smartphone (George and Hitchcock, 2019).

College Station has also partnered with the third-party vendor, SeeClickFix, to provide a mobile phone application and online system for citizens to report code violations and other issues around the city (SeeClickFix, n.d.). The application (available on Android, Blackberry, and iPhone) allows users to submit photos of various issues, check the status of the complaint, and comment on other complaints. The main function of SeeClickFix is to aid with code enforcement in the city. However, in College Station, the code enforcement division is within the Community Services Division, whereas in Bryan, code enforcement works within the Development Services Department (City of College Station, n.d.; City of Bryan, Texas, n.d.).

Performance Measurements

College Station uses eight performance measures for their planning and development services department. In the proposed 2019-2020 budget, the city lists its goals and how they will be measured. Their three main goals are neighborhood integrity, core services and infrastructure, and financial stability. These goals are measured by: the number of neighborhood plans being implemented, the number of permits issued, number of inspections performed, number of development projects submitted, projected annual expenditures being at or below the budget, value of building permits, and value of projects reviewed by engineering and engineering inspectors (City of College Station, 2019). The city also utilizes customer feedback mechanisms including online surveys, random phone calls, and developers' breakfasts for qualitative measures (George and Hitchcock, 2019).

INTERVIEW FINDINGS

On October 2nd, 2019 our team conducted a department interview with Assistant Director of Planning and Development Services, Martin Zimmermann. The questions asked were created by the entire Bush School Strategic Task & Analysis Capstone Team during a joint team session. The purpose of the interview was to gain a managerial perspective, which would provide a framework for constructing the department's case study. During the interview, Mr. Zimmermann revealed the following information:

Objectives/Roles and Responsibilities

The primary objectives for the development and planning services for Bryan are to provide quality customer service and guidance through development processes. This includes ensuring that the department outlines clear expectations and can provide clear guidelines through each step of the development process. The department makes it a goal to be responsive to their customers, specifically during the site review processes, and also provide coordination between the engineering department and the building inspectors.

The overall roles and responsibilities of the department include:

- Providing timely customer service
- Developing code administration
- Providing current planning and development review
- Administering building plan reviews and permitting
- Performing building inspections
- Facilitating long-range planning
- Providing Board and Commission support
- Encouraging professional staff development
- Providing adequate information and communication
- Providing education outreach
- Overseeing historic preservation
- Transportation planning
- Code enforcement and substandard structure abatement.

Technological Strengths & Weaknesses

GIS is used frequently within their department and it is useful in providing accurate information such as zoning, utilities, and planning. The department also uses Smartboards for their meetings, along with excel spreadsheets and outlook calendar for keeping track of reports and scheduling. The major weakness identified in the department is the HTE system, which tracks permitting and inspections. This outdated program presents challenges for the department through its lack of ease and versatility. For instance, new employees devote a substantial amount of time learning how to use this software. As well, the inability for customers to track their permits online results in the department receiving multiple calls inquiring about this information.

Challenges/Opportunities

The department has not pursued any grants for new technologies because of limitations on time and resources. Zimmermann indicated that looking for grants has not been a priority for the department due to current practices not necessarily being inefficient. The outdated tracking software is the primary obstacle for employees.

Additionally, Zimmermann noted that a software with the ability to automatically reply to customers and run more satisfactory reports would be a technological asset for the department. The difficulty in easily acquiring statistics for year-end reports can cause complications for the department when obtaining valid numbers for their work, such as building inspector statistics. Reliable software would aid in collecting this data. There are also issues with performance measurements, mainly in that there is no accurate portrayal of the department's performance. Improving performance measures and implementing those that reflect and inspect the quality of services would be of benefit to the department.

Technological Priorities

The four top technological priorities that were mentioned are:

- A quicker way for inspections to be finalized
- Adopting an online portal for site review processes, payments, and inspection statuses
- Reducing the generational challenges in the adoption of new technologies
- Increasing the transparency of the department's functions

Zimmermann stated the use of more illustrative graphics, overcoming difficulties in training and licensing, and improving customer service would also be useful in fostering effectiveness and efficiency. This would imply adopting updated technologies and trying to sustain knowledge on these technologies.

Inter-departmental Coordination

Development and planning services works closely with other departments, which requires maintaining coordination in order to provide excellent customer service. For example, during the site review process the department has 10 business days for acquiring the first set of comments. This involves communicating and receiving feedback from multiple departments within the city on the site plan. Other departments development services works with on a weekly basis for the site review process are:

- Planning Services
- Engineering Services
- Transportation
- IT-GIS
- Building Services
- BTU-Electrical Engineering
- Parks & Recreation

- Police Services
- Streets & Drainage
- Solid Waste
- Water Services
- Environmental Services
- Fire Services
- Health Services
- Atmos Gas
- Verizon
- TxDOT
- Brazos County 911

The department also supports six Boards and Commissions including: the Planning and Zoning Commission, Historic Landmark Commission, Zoning Board of Adjustment, Board of Adjustment and Appeals, Building and Standards Commission, and Design Review Board.

Performance Measurement

As previously mentioned, Zimmermann indicated that the department struggles with using adequate performance measurements. Currently, they look at the number of reviews, number of meetings, hours spent on specific tasks, and the number of permits issued. Zimmermann indicated that the current methods of performance measurement are hard to track and it is difficult to monetize the value of their outcomes. Somewhat contradictory, there has not been a need to enhance performance measurement. Officials within the department feel the current system works as there are little to no complaints, and there are no collective incentives to adopt better measures.

SURVEY FINDINGS

The Development Services Survey was distributed on October 10th, 2019 to all 23 employees within the department. Data collection for the survey concluded on November 1st, 2019, and a total of eight responses were recorded. The following is a summarization of the responses, along with commentary regarding how those answers support or contradict information gathered from previous interviews and field visits. The variance in responses are likely due to the different divisions within the department. Development services is split into two categories, planning and building, with 11 full-time employees in each division. *Despite attempts to acquire responses from everyone within the department, our data is limited to surveys completed by eight employees, roughly 33% of the department's employees.*

Objectives/Roles and Responsibilities

Responses for this question were fairly consistent, with most employees stating the primary objective is to provide customers with adequate services and oversee the development of new structures and buildings within the city. Responsibilities respondents listed include: planning and managing projects with other departments, performing administrative and clerical duties, and inspecting new and existing buildings for compliance of safety standards.

Perspectives on Departmental Technology

Most of the department, 75% of respondents, believe the department stays updated on new forms of technology. All of the respondents agreed that the purpose of these technologies are to improve the overall effectiveness and efficiency of their department. Regarding technology training and development for employees, half of respondents noted the department did an adequate job of providing these opportunities. More than half of respondents also indicated that the department does a sufficient job of coordinating technology within development services and with other departments. Additionally, 63% of respondents answered the department fosters citizen engagement through the use of technology.

Challenges to New Technologies

Budgeting was shown to be the biggest obstacle in implementing new technologies. This is followed by citizen comfort, employee comfort, and awareness of alternative funding for these technologies. The following graph is illustrative of the other factors that pose as challenges for the department.

How Challenging are the Following to Technology Adoptiong & Implementation? (Median Response)
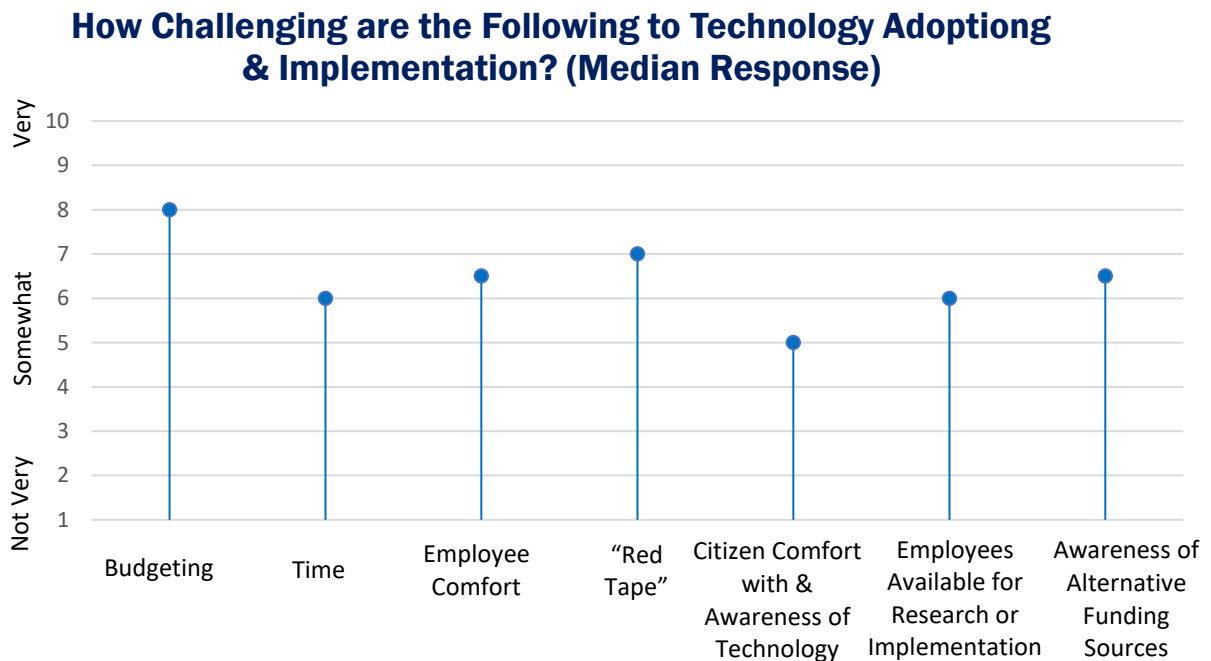
Current Device/Software Use

Employees use the following devices: iPhones, laptops, desktop computers, telephones, scanners, printers, and iPads. They also use the following software systems/programs: HTE, ArcMap, Microsoft Office Suite, BlueBeam, Laserfiche, Google Earth, Dropbox, Contract Assistant, and Cayenta.

Task Effectiveness and Efficiency

100% of respondents answered technology improves the effectiveness and efficiency of a variety of processes. Among these, technology was mentioned as an aid to: the development review process, sorting inspections, reporting building statistics, researching property information and performing data analysis, issuing permits and plan reviews, and having iPads available for board members rather than binders.

Priorities, Customer Service, Long-Term Goals

Respondents indicated they would place most of their priorities in case tracking, online permitting, and updating their current software. To improve customer service, employees note technology aids by making it easier for customers to access information and reducing the time it takes in solving problems. In achieving long-term goals, online portals and customer-friendly technologies would significantly help the department in providing its services

CONCLUSION OF NEEDS ASSESSMENT

The survey answers are consistent with what has already been learned from department head interviews, field visits, and case studies. The employees within the department have expressed frustration with the current tracking software, HTE, being used as it is archaic and inefficient. One example, in particular, of a major obstacle of this software would be that of building inspections.

Despite the demand for an online payment and permitting system, our team has recognized the budgetary and time constraints to adopting such a system. We recognize that this is a best practice that has been adopted in each of the case studies but may not feasible at this time for the City of Bryan.

Additionally, through the research our team has conducted, we have found areas for improvement in performance measurements and through the adoption of mobile applications. It was found in our case studies and literature review that cities have put a strong emphasis on customer feedback mechanisms to guide performance measurements. Many cities are also using mobile applications to engage citizens, which can encourage interdepartmental communication. Moving forward, our team will look into specific software and costs to determine which types of technologies will both benefit the development services department and the City of Bryan as a whole.

SUMMARY OF NEEDS ASSESSMENT

The Bryan Fire Department is responsible for protecting citizens and property and providing emergency medical services throughout the city. The purpose of this document is to provide a framework that will guide the city in adopting and implementing new technologies within the department. A plethora of information was gathered through academic and professional literature reviews, department-head interviews, field visits, and departmental surveys. From our research, we gathered that the department would benefit from improved recording technology and mapping software. Moving forward, our team will focus on analyzing the various types of recording systems as well as emerging software systems used by municipal fire departments. Additionally, we will work with the department to determine what goals are ideal, so as to implement adequate performance measures.

INTRODUCTION

Local government fire departments often face the struggle of increasing expectations in their service delivery with fewer resources. For local fire departments to be able to overcome this challenge, they must identify areas within their scope of work in which efficiency and effectiveness are not fully optimized. In this age of overwhelming technological advancements, technology offers the greatest opportunity to meet these rising expectations. With that in mind, it is the responsibility of local FDs across the country to identify and implement cost-effective technologies that can help boost their service delivery and task effectiveness and efficiency with limited resources.

The work that local FDs do for their respective cities can best be described as service delivery, with their service recipients being the city and any individual or property within their jurisdiction. The purpose of this project is to assist the Bryan Fire Department in fulfilling its responsibilities by:

1. *Identifying opportunities (specifically equipment and resources) to enhance effectiveness and efficiency within the FD as it relates to service delivery.*

2. *Identifying potential options for technology adoption that could produce gains in effectiveness and efficiency within the FD.*

With these goals in mind, this report seeks to identify opportunities by reviewing the technological landscape of the Bryan FD, providing an analysis of gathered data by reviewing academic and professional literature, exploring case studies of technologically savvy fire departments, interviewing departmental staff, and surveying the department. The end result is a technological needs assessment of the Bryan FD that highlights opportunities for technology adoption across the entire department that will increase effectiveness and efficiency.

About the Bryan Fire Station Department

The City of Bryan consists of around 85,000 residents and covers approximately 43.4 square miles (City of Bryan, 2019). Aside from servicing all of Bryan, the fire department assists the College Station fire department as well as providing EMS services to the northern half of Brazos County (City of Bryan, 2019; McGregor, 2019). The fire department operates with an annual budget of approximately $16 million (City of Bryan, 2019). This substantial operating budget has allowed Bryan's fire department to stay on the cutting edge of fire and emergency medical services (EMS) technology; going so far as placing the need for the best equipment and technology as one of the department's seven initiative goals within its strategic plan for 2017-2021 (*Bryan Fire Department Strategic Plan,* 2016). A well-trained staff and cooperative city government have allowed Bryan's fire department to become one of the most recognized departments within the state of Texas (McGregor, 2019).

The Bryan fire department consists of 144 full-time employees dispersed between five individual fire stations (City of Bryan, 2019). Those within the Bryan Fire Department have a shared understanding of what their primary objectives are: saving lives and protecting property (Bryan Fire Department Survey, 2019). Similarly, when asked about what they believed to be their primary roles and responsibilities within the fire department, the respondents answered with a shared understanding: being ready to provide fire and EMS at all times across their jurisdiction(Bryan Fire Department Survey, 2019). This shared understanding of their primary objectives as well as their roles and responsibilities allows for cohesive workflow and understanding within the department.

Current Technologies of Bryan Fire Department

Tracking Monitor

Following discussions with the Bryan Fire Marshal and Fire Chief as well as a field visit to Fire Station 1 and Fire Station 2, the fire department sub-team has identified some of the key technology that the fire department uses. One of the newest pieces of technology implemented has been a tracking monitor in Station 1. This monitor allows for all recent and current calls, as well as all vehicles within the fire department to be tracked and displayed. This monitoring system is soon to be implemented in the other four stations (McGregor, 2019). These monitors will have a substantial impact on efficiency regarding the communicating and tracking of calls and the overall coordination of the fire department (McGregor, 2019).

Virtual Training

The Bryan Fire Station Department provides recorded virtual training sessions for firefighters. Virtual training sessions positively impact the efficiency of the fire department. These computer-assisted class lectures allow the lecturer to hold one class from whichever station they are at as opposed to having to travel to two different stations to give the lecture (McGregor, 2019). This saves time, money, and effort on the part of the lecturer and the squads they are teaching (McGregor, 2019). This additionally impacts the efficiency of response times for firefighters that are in the lecture as they can stay at their station and respond to calls as needed without having to travel from another station (McGregor, 2019). These sessions are also recorded allowing for firefighters to go back and review any missed or confusing information (McGregor, 2019).

Drones for Firefighting

Currently, the Bryan Fire Department has six drones in its fleet: two Phantom 3's, one Phantom 2, two Inspire 1's, and a Menace 210 (McGregor, 2019). These drones are used exclusively for data collection and are brought to the scene to gather information to increase situational awareness for all first responders on the scene. Each drone is equipped with multiple cameras that allow for different types of intelligence gathering from thermal pictures to firefighter location identification (McGregor, 2019). There are five trained drone pilots in the department with five additional pilots in the IT department. These pilots have regular training to ensure their piloting skills stay sharp (McGregor, 2019). One of the drones is always stationed on the Battalion Chief's vehicle and brought to almost every incident (McGregor, 2019). The other drones are stationed at different fire stations or the Mobile Command Post and used as needed (McGregor, 2019).

Mobile Command Post

The Mobile Command Post (MCP) is the peak of technology implemented by the Bryan Fire Department. The MCP allows for the department to run a full operation as if they were back at a fire station. Emergency and non-emergency situations that have required the use of the MCP in the past include but are not limited to: large scale structure and chemical fires, police standoffs, missing person searches, wildland fires, severe weather events, the Brazos County Fair, and certain large-scale Texas A&M events. The MCP houses an incredible amount of technology that includes but is not limited to seven independent work stations with computers, wired phones, printers, and scanners, a SMART Board, internet access through three independent systems, multiple TV monitors with satellite DISH DVRs, and 23 radios. This abundance of technology allows for the fire department to utilize the MCP as a highly equipped and operational base for any needed emergency. The MCP has additional technological capabilities such as its own GIS and weather tracking systems and the ability to link into any camera feed close to its proximity (McGregor, 2019).

The wealth of technology on the MCP requires it to not only be kept in excellent condition but also be handled by trained experts. The exceptional working relationship between the Bryan Fire Department and IT Department is exemplified in their shared work with the MCP. Once a month, the MCP is brought to the IT department for a full diagnostic checkup and cleaning. Additionally, all hardware on the MCP is upgraded every five years to ensure peak efficiency and output (McGregor, 2019). Aside from maintaining the MCP, three IT staff members are sent to any events

that require the MCP. This support team is present to ensure that the primary functions of the MCP, that being its GIS, radios, and overall systems, stay running at peak levels and to ensure that any problems that arise are dealt with swiftly (McGregor, 2019).

LITERATURE REVIEW

The literature review incorporates academic and professional literature to identify emerging technology in EMS and firefighting. Similarly, best practices regarding occupational health in firefighting and fire suppression are identified. Some new technologies in firefighting such as rapid response EMS devices, drones, and AI systems are discussed in detail. Additionally, challenges associated with implementing emerging technologies such as the high cost and necessary training time will be described.

The conducted survey displayed an overwhelming majority of respondents' support, over 75%, of the use of technology such as data integration, AI systems, and EMS technology as tools to increase efficiency and effectiveness with service delivery.

Emerging and Current Technology

EMS Field Technology

An August 2017 article of EMS World focuses on new and emerging technology in the field of EMS. The technologies that were identified are as follows: LifeFlow Rapid Infuser, Compensatory Reserve Index Monitor, CARDIOHELP, and the SAM Junctional Tourniquet (Gates, MAEd, & NRP, 2017). The Lifeflow Rapid Infuser is a squirt gun-shaped device that allows EMS providers to deliver up to a liter of fluid to a patient in five minutes as opposed to the 15-20 minutes it takes to deliver one liter of fluid using standard pressure bags (Gates, MAEd, & NRP, 2017). The Compensatory Reserve Index Monitor allows EMS providers to more quickly and accurately read a patient compensatory reserve index which is used to measure if a patient has entered shock, and how deep into it they might be (Gates, MAEd, & NRP, 2017). CARDIOHELP is a handheld heart-lung machine that allows EMS providers to give both extracorporeal life support or extracorporeal membrane oxygenation to patients (Gates, MAEd, & NRP, 2017). This allows EMS to begin recitation and other life-saving processes to a patient that may not be able to wait until they arrive at a hospital. The SAM Junctional Tourniquet is designed to combat hemorrhaging from limb loss or amputations.

Drones and Firefighting

A Goldman Sachs study estimates that an $881 million market between now and 2020 for firefighting (Goldman Sachs, 2019). The current landscape of drone technology in firefighting includes but is not limited to: (1) thermal cameras to identify fire sources and hot spots, (2) Infrared cameras that detect humans and animals, (3) extinguishing agent takes, including powder, foam, water, or specialized liquids, (4) mist distributors that spray a cooling mist to let drones and firefighters get closer to a fire, and (5) high-definition cameras that can help identify products and codes on packaging to determine potentially dangerous and flammable goods (Schaft, 2018).

Type of Drones in the Market

During the firefighting at the historic cathedral of Notre Dame, a water cannon-manned robot, Colossus, was used by firefighters to extinguish the fire (Johnson, 2019). The DJI Zenmuse XT drone provides thermal imaging from the air with pinpoint precision over a large area for transmitting and analysis purposes (DJI, 2019). Typhoon H is another drone with advanced aerial photography and videography for a large area (YUNEEC, 2019). Based out of Latvia, Aerones has developed a firefighter drone prototype that can climb 984 feet, nearly300 meters in six minutes (Schaft, 2018). This not only exceeds the reach of normal ladders, which are typically no longer than 100 feet or 29 meters but also exceeds the speed of ascent of a human firefighter. The Aerones drone has the following specifications: (1) 20 minutes of air time, which can be extended through a tethered power supply or in-air recharging, (2) can achieve close proximity to a fire, about 98 feet (30 meters), (3) spray a special chemical mix to maximize spray weight and pressure of fire suppression systems, and (4) has an optional chemical mix of foam to further improve fire suppression (Schaft, 2018). Finally, a new drone invented by researchers at Örebro University in Sweden can see through heavy smoke to detect humans and toxic fumes, includes stereo infrared heat cameras, a 3D radar camera, a lidar unit, a laser scanner, and gas sensors (Örebro University, 2018).

Data Integration and Firefighting

In 2016, the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) has partnered with the NASA Jet Propulsion Laboratory (JPL) to apply JPL's state-of-the-art human-like reasoning system, Assistant for Understanding Data through Reasoning, Extraction, and Synthesis (AUDREY), to perform data fusion and provide tailored situational awareness information to first responders (DHS, 2016). AUDREY will connect with sensors on the first responder's personal protective equipment (PPE) and information provided by the Internet of Things (IoT) through a suite of plugin tools will intelligently consider the situation of each first responder and extract key information as it pertains to their needs (DHS). Rather than simply forwarding this information and risk distracting the first responder, AUDREY will synthesize high-level actionable information and provide it to the first responder when appropriate (DHS, 2016). In the case of the first responder, IoT can supply highly valuable information about everything from infrastructure status to demographic reports to public social media postings (DHS, 2016). AUDREY can deliver this advanced situational awareness by seeking out information that is relevant to a given first responder's immediate situation. One of the key benefits of AUDREY is its ability to sift through vast amounts of data and intelligently use only the most appropriate information to optimally deliver the relevant and actionable knowledge to the end-user (DHS, 2016).

Emerging Artificial Intelligence Technologies

In a recent paper, researchers propose an early fire detection framework using fine-tuned convolutional neural networks for CCTV surveillance cameras, which can detect fire in varying indoor and outdoor environments (Muhammad, Ahmad, & Baik, 2018). To ensure the autonomous response, the authors propose an adaptive prioritization mechanism for cameras in the surveillance system. They propose a dynamic channel selection algorithm for cameras based on cognitive radio

networks ensuring reliable data dissemination. Experimental results verify the higher accuracy of the author's fire detection scheme compared to state-of-the-art methods and validate the applicability of their framework for effective fire disaster management(Muhammad, Ahmad, & Baik, 2018).

Communication Technologies

Next Generation 911 (NG911) is a software program that can be utilized by 911 call centers across the country. NG911 provides a plethora of advantages compared to standard call center software including the ability to receive videos, images, and texts from civilians (National 911 Program, n.d.). It has improved GPS tracking that allows for an improved caller location accuracy tracing. The system also connects calls faster, thus reducing the time a civilian must wait before a 911 operator can answer them (National 911 Program, n.d.). Aside from improving the interface between civilians and call centers, NG911 additionally improves communication between 911 call centers by allowing call centers to send and receive information to each other quicker (National 911 Program, n.d.). Additionally, if a call center that utilizes NG911 is backed up on operators, the system can instantaneously re-route the call to the closest available call center (National 911 Program, n.d.).

Firefighter Training

Having firefighters who are prepared to deal with the dangers and ever-changing situation of firefighting is key. Due to this, utilizing well-developed firefighter training and adapting it as the profession changes is imperative. Due to the differing nature of fires, different best practices linked to specific types of fires have been established. For example, best practices for exterior firefighting includes familiarization with incident management principles, building construction in relation to fire service operations, and arson awareness (Homeland Security and Emergency Services, 2015). Best practices regarding interior firefighting include familiarization with fire extinguisher operations, familiarization with structure fire search and rescue operations, and familiarization with salvage and property conservation techniques (Homeland Security and Emergency Services, 2015). To facilitate more realistic training so that firefighters are better prepared for the hardships of working in the field, augmented and virtual reality training has begun to be used. Augmented and virtual reality firefighting training allows for a safe training environment, improved retention of learned skills, and often a reduction in training costs (Target Solutions, 2018). An example of this is a publicly available program called Smoke Reading (Target Solutions, 2018). Smoke Reading allows for firefighters to train their ability to make quick decisions regarding fire location, size, and strength-based upon virtual smoke leaving real buildings (Target Solutions, 2018). The augmentation allows for smoke to be displayed leaving real buildings simulating different types of fires in buildings that firefighters may have to fight actual fires in one day (Target Solutions, 2018). The Bryan Fire Department has already taken steps to ensure that the training of its firefighters is done as efficiently as possible through the utilization of virtual classroom lectures (McGregor, 2019). Steps like these are vital to take in the proper training of the next generation of firefighting.

Challenges

Municipal fire departments face the issue of increased service demand with decreased resources. This is where new technology comes into play that increases the efficiency and effectiveness of the fire department's ability to provide the intended services. Advancements over the past few decades in firefighting technology have pushed scholars to coin the term "smart firefighting" to describe the current landscape of the profession as it is combined with technology such as robots, drones, AI, and new GIS, among others (Wu, Dunne, Zhang, Shi, 2017). The use of technology as the primary apparatus to facilitate this increase in service delivery is a double-edged sword. While it does allow for the improvements to efficiency and effectiveness across a department to be substantial, it simultaneously opens the door for new problems to arise that could explicitly inhibit a department's ability to be efficient or effective. This is due to the two needs associated with smart firefighting, those being the timeliness of technology implementation, and the accuracy of data gathered from the technology (Wu, Dunne, Zhang, Shi, 2017). If a department is to utilize technology and trust the lives of its firefighters to that technology, any error in specific timelines or data collection can be fatal. Furthermore, the availability of precise information in real-time plays a crucial factor in the guidance and success of rescue missions or general fire fighting (Liu, Yu, Cang, Vladareanu, 2016). This exemplifies the need for proper training and understanding of newly implemented technologies as miscommunication or misunderstanding regarding technology could be fatal. Though it will be discussed more in-depth later in this report, this facet of technology implementation is especially concerning regarding Bryan's FD, as lack of time for training and implementation of new technology was identified multiple times as a key limiter within their department (FD Survey, 2019).

CASE STUDIES

Santa Clara, California: Overview

The Fire Department of Santa Clara, California was chosen as our primary case study due to their comparable size to Bryan as well as their implementation of new technology. The city of Santa Clara has an approximate population of 129,000 and their fire department has 167 full-time employees (*Santa Clara Fire Department Strategic Plan,* 2016). Additionally, both Bryan and Santa Clara's fire departments are highly accredited and awarded within their respective states (*Santa Clara Fire Department Strategic Plan,* 2016; *Bryan Fire Department Strategic Plan,* 2016). Regarding the new technology implemented by the Santa Clara Fire Department, they all serve the purpose of increasing the efficiency and effectiveness of service distribution. This includes easier connections between citizens and fire and EMS, a reduction in the response time for fire and EMS, and improved records keeping to increase informational flow efficiency. The proximity to Silicon Valley aids in the flow of new technologies reaching the department.

Regarding the implementation of new technology, Santa Clara has been able to do so across multiple facets of firefighting and EMS. Though not tied exclusively to Santa Clara's fire department, across the county of Santa Clara residents are now able to text 911 as opposed to just calling them (County of Santa Clara, 2019). Though the County did not clarify which system it is utilizing to achieve this, it is likely NG911 which has emerged as a national leader in

revolutionizing how 911 calls are handled (National 911 Program, n.d.). Additionally, in 2018 both the fire and police departments received an upgraded CAD system (Santa Clara Fire department 2018 Annual Report, 2018; City of Santa Clara News, 2018). The new software is from Hexagon Safety and Infrastructure and allows for more accurate call and event placement in the field (City of Santa Clara News, 2018). In addition to the upgraded CAD system, in the fall of 2019, the fire and police departments will be receiving an upgraded records management system allowing for a more streamlined approach regarding call information and reporting (City of Santa Clara News, 2018).

Santa Clara, California: Concerns

Though Santa Clara and Bryan share relatively similar size in population and staff of the fire department, there are disparities between the two. The largest of these disparities are the available funds of each department. The Bryan Fire Department operates with a $16 million annual budget while the Santa Clara Fire Department operates with a nearly $47.5 annual budget (*Santa Clara Fire Department Strategic Plan,* 2016; *Bryan Fire Department Strategic Plan,* 2016). This roughly $30 million gap in department operating budgets allows for Santa Clara to purchase and implement more technologies and also more expensive, and likely newer, technologies. In addition, though the City of Santa Clara's Fire Department has received numerous technological upgrades, the County Fire Department has received more funding to implement new technologies. The presence of a bigger and better-funded fire department looming over that of Santa Clara City's somewhat limits the flow of new technology.

INTERVIEWS, FIELD VISITS, AND SURVEY FINDINGS

Methodology

To obtain a deeper understanding of Bryan's Fire Department, the fire department sub-team conducted two field visits to two different fire stations, one interview with Chief McGregor, and one survey from the fire department employees.

Field Visits

Two field visits conducted by the team to examine the current application of technology in the Fire Department of Bryan. The field visits were accompanied by the Fire Marshall Chief McGregor, firefighters, and IT department staff. During the field visits, the team fully examined the current technologies used by the Fire Department.

Interviews

One structured interview was conducted with the fire chief, Randy McGregor, and involved a series of nine questions that sought to ascertain the roles and responsibilities of the fire department, uses of technology, challenges, priorities, and potential opportunities to apply technology to improve efficiency and effectiveness. While all questions were designed and selected prior to the interview, seven of these questions were provided to each department head by each sub-team

involved in this project, with the two additional questions being determined by members of the fire department sub-team. A list of interview questions can be found in Appendix A.

Survey Methodology

A survey was conducted from the firefighters and fire department employees. The survey consisted of 11 questions and was sent to Chief McGregor to collect the department's responses. In total, we received a 32.6% response rate with 47 employees from the department responding to the survey questions.

Survey questions were focused on seven main areas: (1) primary objectives of the Fire Department, (2) applications of technology in the department, (3) challenges in adopting technologies, (4) potential areas of technology application, (5) importance of data integration, (6) importance of artificially intelligent technologies in firefighting, and (7) importance evacuation and preparedness modeling in firefighting.

Findings

Interview Findings

The meeting with Chief McGregor gave an insight into the environment of the Bryan Fire Department; he described an environment of cooperation and excellence. He identified multiple times the great working relationship the fire department has with the other departments in the city as well as other fire departments in the area (McGregor, 2019). Chief McGregor additionally pointed out how well off the fire department is regarding technology stating, "Our city supports us very well and I would even say we pretty much have any technology that any other department would have, maybe even a little bit of extra stuff". Through answers like this, the understanding of Bryan's Fire Department as a well operated, equipped, and funded department, allows for a proper starting point for subsequent technology-based research and recommendations.

Survey Findings

The Bryan Firefighters Have a Consistent Understanding of the Primary Objectives of the Department

The survey findings demonstrate that public servants in the Fire Department of Bryan have a consistent understanding of the primary objectives of the department. The main objectives of the Fire Department described by respondents as (1) protection of lives and properties by around 50% of respondents, (2) public safety by
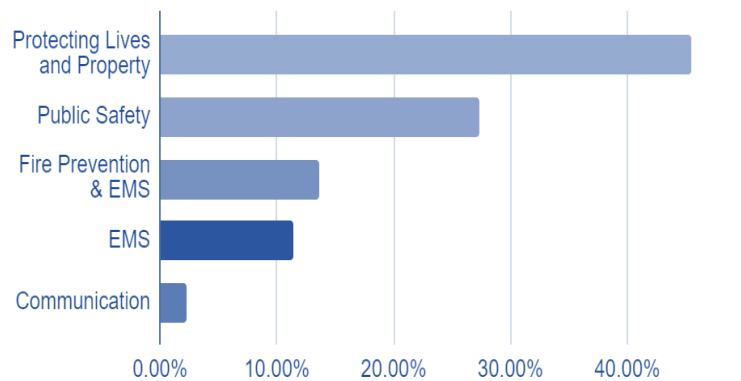
over 25% of respondents, (3) fire prevention & EMS by over 10% of respondents and communicating with other departments as being the primary objectives of the Fire Department.

Fire Department Stays Up-to-date

On average, 65% of respondents believe that the Bryan Fire Station Department stays up to date with technology. On the other hand, around 20% of respondents believe that their department does not up to date with technology. Also, some of the respondents, around 15%, remain neutral on the issue.

My Department Stays Up-to-Date with New Technology

stay
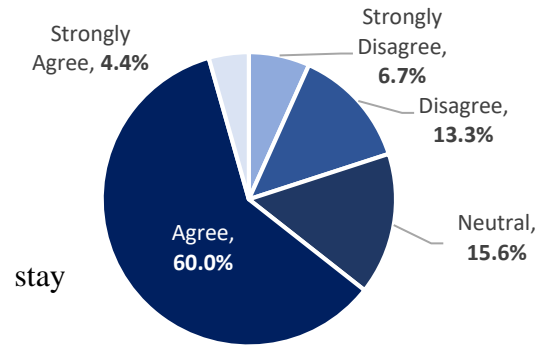
Training has Room for Improvement

Training is one of the issues that has room for improvement. While around 45% of respondents perceive that the Fire Department provides training opportunities for them, 42% of respondents remain neutral on providing training by the Fire Department.

Additionally, 75% of the respondents say that they never used computer-based simulation and modeling of evacuation or firefighting in their training.

Department Provides Technology Related Development/Training Opportunities
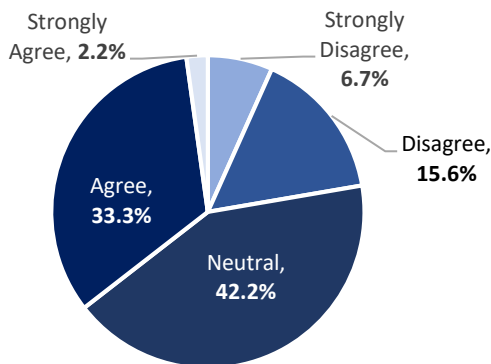
How Often Do Employees Use Fire Modeling Technologies?
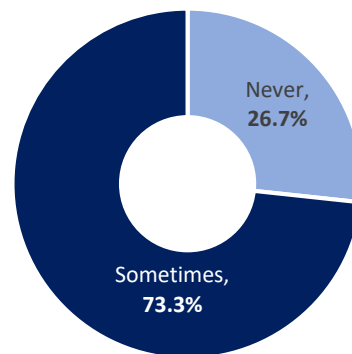
Red Tape and Budgeting are Important Challenges

Red Tape and budgeting are the most important challenges for technology adoption. Overall, most of the respondents perceive "red tape" as the most important challenge in technology adoption. Whereas citizen awareness of technology is perceived as the least challenge of technology adoption in the Fire Department.

How Challenging are the Following to Adopting & Implementing New Technology? (Average Response)

	Value
Budgeting	6.6
Time	6.02
Employee Comfort	6
"Red Tape"	5.2
Citizen Comfort with & Awareness of Technology	7.2
Employees Available for Research or Implementation	6
Awareness of Alternative Funding Sources	5.9
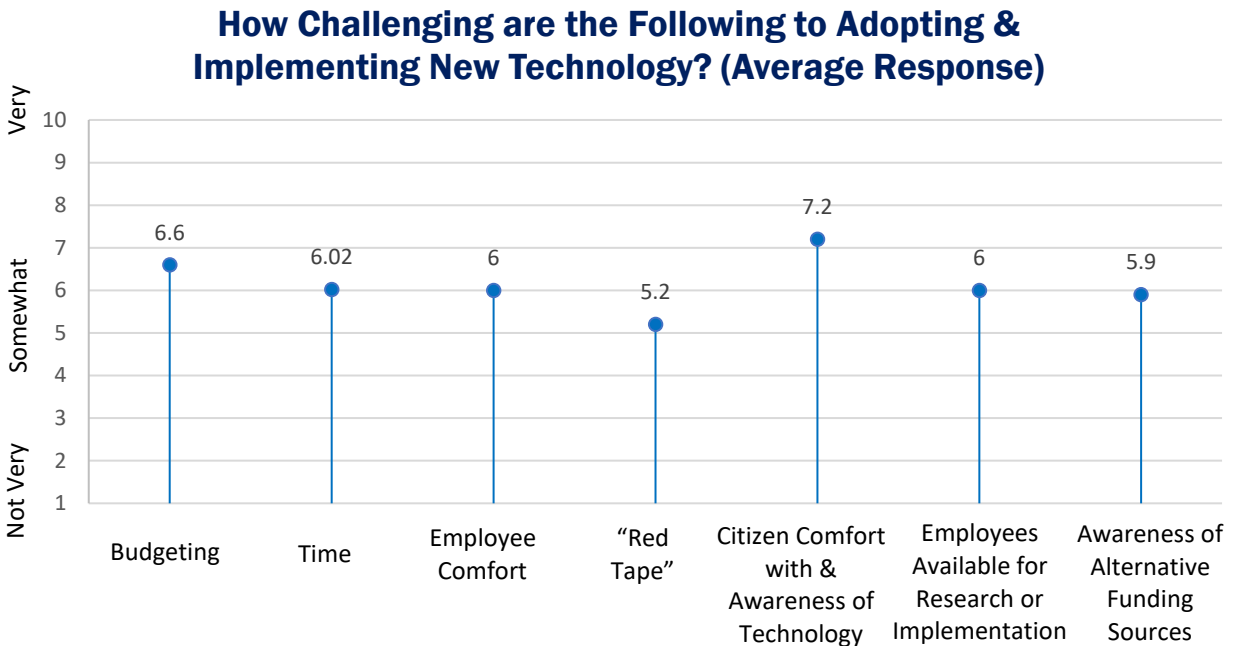
Artificial Intelligence Technologies

Artificial Intelligence and artificially intelligent technologies are effective for firefighting. More than 75% of respondents scored the effectiveness of data integration and artificial intelligence for firefighting above 6 on a scale of 1 to 10.

Importance of Artificial Intelligence and Data Integration Technologies for Firefighting

Artificial Intelligence Technologies

Data Integration Technologies

1 (Not Important)   2   3   4   5 (Somewhat Important)   6   7   8   9   10 (Very Important)
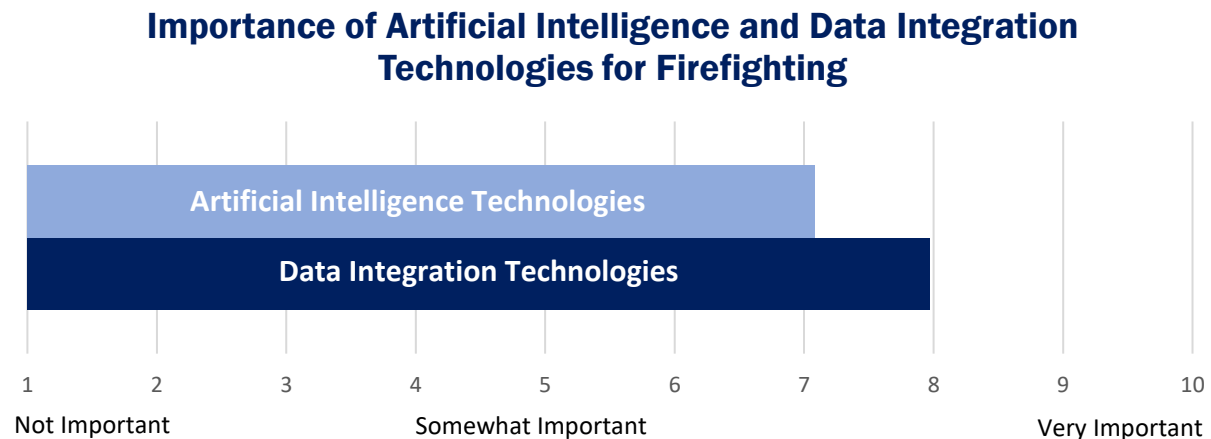
CONCLUSION OF NEEDS ASSESSMENT

The City of Bryan's Fire Department is one that through good intergovernmental relations, well-trained staff, and passionate public servants has become one of the most prominent in the state of Texas (McGregor, 2019). A relevant case study and literature review of technologies that could improve efficiency and effectiveness within the department has found different technologies that could be implemented within the city. Furthermore, field visits, interviews, and a department-wide survey allow for a deeper understanding of the inner workings of the Fire Department as well as what the staff views as their top priorities and needs. Though hindrances such as economic constraints and governmental red tape have been identified, the Bryan Fire Department has the potential to take the next step in high-tech service provision leading to safer citizens, safer firefighters, and a safer city.

SUMMARY OF NEEDS ASSESSMENT

The City of Bryan IT Department is recognized within the state of Texas as an effective local government IT department. The department is divided into five sub-teams that seek to provide exceptional customer support to the City. To assist the department in its customer support role, our team was tasked with performing a technological needs assessment of the department that identifies challenges, best practices, and opportunities to improve efficiency and effectiveness within the department through technological tools.

To conduct this assessment our team gathered information through a review of current professional and academic literature, conducting case studies of other local government IT departments, a department wide survey, and a series of interviews with IT staff. Through this process our team found that potential challenges that local IT departments face include having an effective implementation process for adopting new technology, limited resources (financial and human), and ensuring the security of the system and network. Identified best practices from our research include innovation and technology awareness, automation, e-government through cloud computing, and effective security management.

As part of the technological needs assessment our team also examined two other local government IT departments; the City of New Braunfels and the City of Frisco. We found that both cities experienced challenges related to limited financial and human resources, improving the organization's security posture, finding and hiring experienced talent, and the coordination tasks between department sub-teams. To overcome these challenges and to institute best practices, these organizations adopted technologies that assisted their departments with task management, employee coordination, and improving the organization's security.

In addition to examining current literature and other local governments our research also incorporated interviews and a survey. The purpose for these interviews and the survey were to identify department roles and responsibilities, how the organization utilizes technology, and opportunities to enhance effectiveness and efficiency. Key findings from interviews and the survey included the belief among department employees that customer support and security for the City of Bryan were primary objectives and that opportunities for improved effectiveness and efficiency include task management, mobile device management, automation of certain tasks, employee offboarding, lifetime vulnerability tracking, and improved tools for hard drive imaging.

INTRODUCTION

Purpose of the Technological Needs Assessment

For the City of Bryan and local governments everywhere, having an effective and efficient department of information and technology (IT) has become a requirement for good local governance in the 21st century. The National Institute of Standards and Technology (NIST) describes IT as "the art and applied sciences that deal with data and information" which includes the capturing, representation, processing, security, transfer, interchange, presentation, management, organization, storage, and retrieval of data and information (NIST, 2015). Simply put, local government IT departments are in the business of assisting their organizations with processing, managing, using, and protecting organizational data and information.

The work that local IT departments do for their respective cities can best be described as customer support, with their customers being city departments and residents. The purpose of this project is to identify opportunities to assist the Bryan IT Department in supporting its customers by:

4. *Identifying opportunities (specifically tasks and processes) to enhance effectiveness and efficiency within the IT department.*

5. *Identifying potential options for technology adoption that could produce gains in effectiveness and efficiency within the IT department.*

With these goals in mind, this report will seek to identify opportunities by reviewing and analyzing data gathered from academic and professional literature, exploring case studies of selected cities, interviewing departmental staff, and surveying the department. Based on the research conducted, potential opportunities for enhanced effectiveness and efficiency that are both needed and feasible include task management, employee offboarding, lifetime vulnerability tracking, and hard drive imaging. The technological needs assessment will address these and other findings in an effort to highlight potential opportunities for technology adoption in areas that will produce gains in effectiveness and efficiency.

About the Information Technology Department

The City of Bryan IT Department is recognized within the state of Texas as an exceptional local government IT unit that continues to contribute to the success of its City. As identified by Bryan Chief Information Officer (CIO) Bernie Acre and the department's mission statement, Bryan IT aims to serve as a customer support department for the City by "providing strategic, innovative, secure, and cost-effective technologies…[to] improve all levels of cybersecurity, communication, and efficiency" within the city (Acre, 2019; City of Bryan, 2019). In 2019 Bryan IT had a number of achievements that demonstrated the department's ability to provide exceptional customer support. These achievements included being awarded the TAGITM (Texas Association of Government Information Technology Managers) Award for its cybersecurity enhancing Cyber Warriors program, replacing over 215 devices, conducting global and community outreach, improving email security, managing the City's future recurring costs through cloud technology,

working with the Council of Governments to complete eleven miles of underground fiber, finishing a major utility billing software upgrade, and expanding the fiber infrastructure (City of Bryan, 2019).

To accomplish these objectives the Bryan IT department employs roughly forty employees who are led by the City of Bryan CIO, Bernie Acre. These employees are divided into sub-teams within the department and use hundreds of different technological tools, applications, and assets to accomplish their specific roles, tasks, and responsibilities within the department (examples of current technology from each department is included in Appendix C). Departmental sub-teams include:
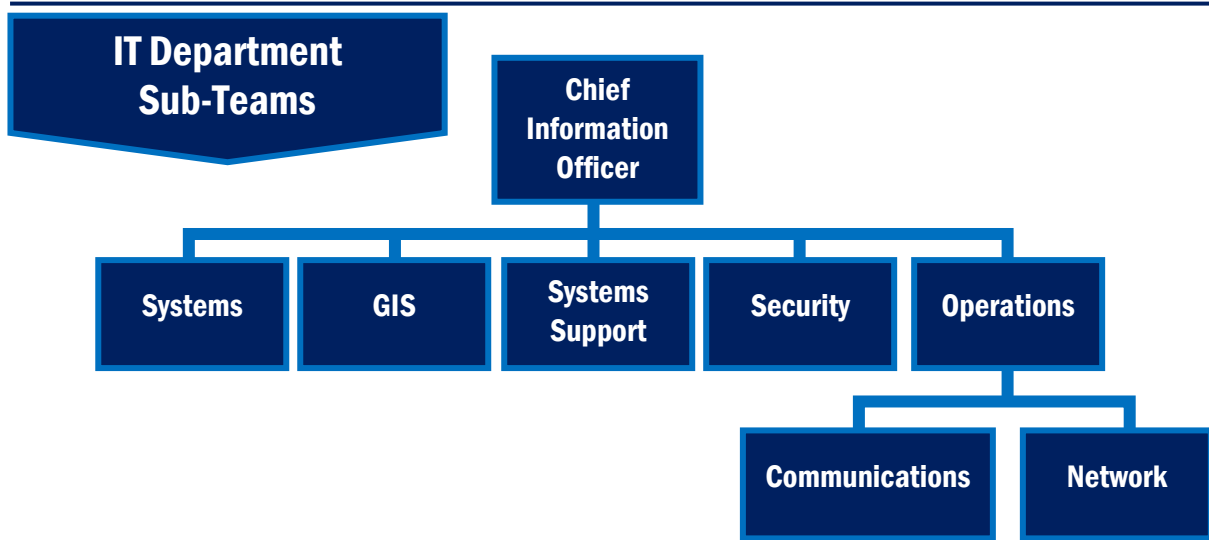
- **GIS:** supports the city in a variety of ways including gathering, storing, and managing GIS data and map layers, sharing data, assisting with the mobile command post, and operating the City's drone fleet.

- **Operations:** the operations sub-team has two additional sub-teams that takes on the responsibilities related to telecommunication and network management.

  - **Communications:** responsible for ensuring the smooth operation of two-way communication (i.e., radios, telecommunication towers, fiber optics, etc.) for city departments and third-party vendors by maintaining, monitoring, managing, updating and installing equipment.

  - **Network:** Responsibilities include ensuring that both wired and wireless networks are functional, maintaining switches, routers, and wireless access points, updating and patching the network, assisting with employee phones, and troubleshooting other related problems for end-users. This team also provides services related to network infrastructure design and support.

- **Security:** has primary responsibility for the security of the City of Bryan's networks and systems. The security sub-team assists with providing network and system security by seeking to prevent, detect, and respond to attacks, ensuring compliance with state and federal regulations, monitoring systems and networks, gathering data, training employees, and promoting a cybersecurity culture within the organization.

- **Systems Support:** also known as the IT Help Desk, this team acts as the frontline subteam in the department's efforts to provide exceptional customer support. This team's key responsibilities include providing technical support for city assets, troubleshooting problems, and assisting with purchasing, inventorying deploying, and updating equipment.

- **Systems:** assists with supporting city-wide systems by solving technical issues, updating and patching equipment, and helping end-users to adopt new systems and modify current systems to improve the efficiency and effectiveness of other departments within the city.

The five sub-teams of the IT department listed above play a key role in helping the department to accomplish its customer support role. By having a dedicated team of skilled employees and by dividing these employees among the various sub-teams, the IT department is able to effectively distribute roles and responsibilities in a way that ensures that critical tasks are accomplished in support of the City.

LITERATURE REVIEW

The literature review incorporates academic and professional literature to identify the challenges and best practices of local IT departments. Some of the challenges include adopting and implementing new processes and technology, limited resources, and security. Identified best practices include innovation and technology awareness, automation, e-government and cloud computing, and security.

Challenges

Academic and professional literature identifies several challenges facing IT departments in local governments. One common challenge is adopting and implementing new processes and technology. Literature suggests that this challenge can be the result of sluggish implementation processes, poor planning and time management, leadership and administrative issues, communication failures, and overcoming an employee's unwillingness to change and adopt new technology. (Beaumaster, 2002; Bowen, 2019).

A second common challenge found in the literature is limited resources. Limited resources refer to constraints on financial and human resources, such as the lack of available funds, staff, or time for the implementation of new technology. It is not uncommon for local governments to lack the resources needed for implementing new technologies and providing the associated training and development that will ensure effective implementation and use. Additionally, competition among

city departments for limited resources further exacerbates the problem (Beaumaster, 2002). As a result, IT departments may often lack the needed resources to implement the newest and best technologies or to offer competitive salaries, which in turn affects available human resources (Beaumaster, 2002; Norris, Mateczun, Joshi, and Finn, 2018). The challenge presented by limited resources is echoed by Bryan's CIO who observed that a key factor impacting local government IT effectiveness can include available financial and human resources (Acre, 2019).

A third common challenge addressed in the literature is network and cybersecurity. The threat to local governments security has been on the rise in recent years as governments create additional risks, vulnerabilities, and system accesses points through their expanded the use of internet of things devices (e.g., computing devices, such as computers, phones, or even sensors that are connected to and send data via the internet) (Tittle, 2014). Dale Bowen, an IT professional and deputy director at the Public Technology Institute (PTI), polled local

Challenges from the Literature

Ineffective Implementation Processes

Limited Resources

Security

government IT executives and found that cyber and network security were some of the most challenging aspects of IT governance (2019). This finding is supported by a recent nationwide survey of cities, which found that local governments are facing an increasing number of attacks but are failing to effectively combat these threats due to a lack of adequate funding, experienced public sector security officials, and effective security policies (Norris et al., 2018). The challenges of providing adequate security, overcoming limited resources, and navigating poor implementation processes presents a difficult task for IT departments who must find a balance between efficiency, effectiveness, and security when it comes to adopting new technology.

Best Practices

Innovation and Technology Awareness

Innovation and technology awareness refers to the impact that employees can have by improving products, processes, or effectiveness and that provides increased value for customers (NIST, 2019). Within local government IT, innovation and technology awareness can be practiced by identifying new ways to adapt or adopt current and new technology that overcomes challenges in order to provide exceptional customer support. A survey of local IT government executives by the Public Technology Institute found that key factors for public sector IT success include working to foster a culture of innovation and awareness of current and emerging technology (Bowen, 2019). Expanding on this topic of innovation and technology awareness, IT executives suggested that a culture of innovation and awareness must include an emphasis on customer service, teamwork, and creates a wholesome and fulfilling work environment that recognizes employee contributions.

Best Practices from the Literature

Innovation & Technology Awareness

Automation

E-Government & Cloud Computing

Security Management

Additionally, IT executives have found that innovation and technology awareness is developed within an organization by encouraging opportunities for employee development through professional and informal cross-training in areas outside their expertise, as well as helping employees understand the business management, change management, and project management aspects of the organization (Bowen, 2019). A final key to fostering innovation is information gathering. Academic literature highlights the need for gathering external information on technology and effective processes from other organizations as a critical part of IT innovation (Trantopoulos, Von Krogh, Wallin, and Woeter, 2017). For local government IT departments this means seeking to share information about best practices and technology use between cities and other groups that deal with public information technology. By combining research with an organizational culture that promotes innovation and technology awareness, local IT departments can find new and inventive ways to apply technology.

Automation

Automation refers to "technology and its application in order to control and monitor the production and delivery of various goods and services" (Technopedia, n.d.). Automation saves time and money, reduces errors, increases employee participation by freeing up employees from time-consuming tasks, and improves the overall satisfaction of the customer. One advantage of automated systems is that they are self-service systems that automate tedious, day-to-day tasks. Eliminating the need for employees to handle these tasks frees up time for staff to focus on tasks that require more expertise and judgment, such as fostering innovation. A 2019 Vanson Bourne survey of IT managers across Europe found that only 11% of their infrastructure is highly automated This lack of automation has led to IT teams spending more than half their time on operations maintenance, and fixing problems. (Branscombe, 2019). Branscombe (2019) notes that multiple areas within IT can be automated, including help desks, employee training and onboarding, cybersecurity, project administration, along with others. The automation of these tasks has the potential to improve the effectiveness of these tasks by eliminating human error and allowing employees to focus on other responsibilities. Further, automation can also be useful in making more complex tasks, such as risk assessment and recruiting, automated (Branscombe, 2019).

Further, automation can be useful through cloud-based services, such as DropBox and OneDrive, which can be used to store unlimited file storage that can be accessed from any mobile device. These cloud-based services can be easily secured by allowing certain people access to some or all government files. Further, supervisors can see who accessed the files and what changes they made.

Once an employee leaves, they can be removed from the account and all copies of the files can be deleted from their devices.

Automation can also be useful for device provisioning, such as device deployment and configuration. Further, automated systems can be set up with automatic password resets to protect the confidentiality of the department and on-premise and cloud-based management programs that can improve security by locking devices where it detects suspicious behavior (Comcast, 2017). Cloud-service tools, such as System Center and Intune, that allow IT to track devices when deployed. For example, the Windows 10 Autopilot feature can assist with first-time device setup and management by automating the process through the Azure Active Directory. (Branscombe, 2019). The cloud is one of the useful ways to fight against cybercrime because cloud-services provide protection platforms that protect sensitive data no matter where the data is (Comcast, 2017). Lastly, testing automation, allows you to test programs and devices to ensure that they can endure cyberattacks. This starts with creating test environments that are isolated and that are easily disposable (Comcast, 2017).

E-Government and Cloud Computing

Electronic government (E-government) refers to "the application of Information and Communication Technologies (ICTs) to government functions and procedures with the purpose of increasing efficiency, transparency, and citizen participation" (Organization of American States, 2010). One of the critical elements in government is to reduce the time spent on the processes and to increase the time spent interacting with citizens through efficient and effective services. Effective e-government can provide better services to citizens by providing them with increased access to information that enables them to participate in their community, provide feedback, and interact with government employees. Additional examples of effective e-governance include such processes as digitizing government records, automating tax collection, gathering community feedback, sharing information, and managing elections through modern technology (Hashemi, Monfaredi, Masdari, 2013). The use of technology to create e-governments that manage the various process of governing can lead to increased efficiency, effectiveness, and the available and available time for government employees to interact with citizens.

One way that e-governance can be accomplished is through the integration of cloud computing into local government. Cloud computing refers to "the delivery of computing services, including servers, storage, databases, networking, software, analytics, and intelligence, over the Internet ("the cloud") to offer faster innovation, flexible resources, and economies of scales" (Microsoft Azure, 2019). This technology can provide a safe environment and cost-efficient platform for computing, communication, and storage needs. One of the benefits of using cloud computing and other service-oriented computing services is that cloud computing allows a large quantity of data to be processed through the use of clusters of computers which can solve high-volume computational problems in an efficient manner. Cloud computing allows easy access to computing facilities, such as the server, network, and storage systems (Hashemi, Monfaredi, Masdari, 2013). These can include cloud storage platforms, such as Box and OneDrive.

Another benefit is that cloud computing reduces the operating cost by providing alternative means of managing systems that require professional employees to constantly manage and maintain the

systems. Costs can be further reduced because of the ability of cloud computing service providers to update software and provide any technical support automatically (Hashemi, Monfaredi, Masdari, 2013). Cloud computing also allows governments, especially small governments, to solve problems more efficiently because it saves money and time, requires less training for personnel to use the technology, and increases efficiency by allowing governments to profile data of the various services provided by the government (Hashemi, Monfaredi, Masdari, 2013).

Lastly, cloud computing is useful for disaster recovery and security. Cloud computing allows organizations to restore information that is lost quickly and effectively that saves the organization recovery cost and time. Organizations can use the cloud as a backup of the server and third-party storage service providers can store the cloud servicer off-site in a different location (Hashemi, Monfaredi, Masdari, 2013). Cloud computing also provides system security through the use of auditing processes and security audits, which should be performed periodically. Cloud computing can sort through large volumes of data to detect any fraud and enhance security by building up defense mechanisms (Hashemi, Monfaredi, Masdari, 2013). As demonstrated through professional and academic literature, e-government and cloud computing go hand-in-hand. By implementing practices related to cloud computing, cities can improve their processes and citizen services and allow government employees to spend more time interacting with and responding to citizens.

Security Management

Over the last several decades, local governments have become more reliant on technology and internet of things devices (e.g., computing devices, such as computers, phones, or even sensors that are connected to and send data via the internet) to accomplish their work. While the implementation of technology has allowed local governments to improve their citizen services it has also created additional access points for malicious actors who wish to gain access to sensitive information, critical infrastructure and citizen services assets, and/or financial resources. This observation is supported by a 2018 nationwide survey that found that local governments are under constant or near-constant attack (Norris et al., 2018) As a result, local government IT departments have been tasked with finding ways to promote cyber and network security so as to reduce potential risks and vulnerabilities.

To assist with cyber and network security on the local level, literature on the subject has emphasized the need to develop a culture of security within local government. Doing so can be accomplished by instituting industry-approved security practices, frameworks, and policies, as well as providing training for employees. Examples of where to find best practices, frameworks, and policies for security managers are published by organizations such as the National Institute of Standards and Technology (NIST) for cybersecurity, the Department of Homeland Security (DHS) cyber security strategy documents, and material from the International Standards Organization on information security management (Norris et al., 2018). In addition to national and international organizations that offer guides for implementing best practices, there also exist state level institutions, such as the Texas Department of Information Resources that also provide guidance. These frameworks often focus on how organizations can minimize risk, reduce threats, and eliminate vulnerabilities by making cyber and network security a part of the business management process. For example, NIST's *Framework for Improving Critical Infrastructure* provides guidelines for activities and outcomes that will assist in prioritizing and organizing an entity's

security needs (National Institute of Standards and Technology, 2016). By instituting industry best practices public organizations can better secure their networks and systems.

In addition to creating a security culture through training and the institution of security policies and frameworks, local government organizations should also seek to adopt and implement technologies that will assist with cyber and network security by monitoring and managing technological assets and resources. One way to accomplish this is by taking advantage of internet of things (IoT) devices that can improve asset (i.e., desktops, laptops, mobile phones, radios, fiber optic cables, software applications, etc.) and threat monitoring by automating the processes of sensing, collecting, and sharing data regarding risks and vulnerabilities within the system (Tittle, 2019). As a result, public organizations that adopt and use IoT devices and applications for cyber and network security, as well as promoting a security culture, will be better prepared to protect assets and resources, identify and detect threats, mitigate risks, and respond to harmful security events.

CASE STUDIES

As part of the technological needs assessment, our team examined other local government IT departments to produce two case studies that provide additional insight into best practices, challenges, and technology adoption for local government IT. Local government IT departments where selected through consultation with IT managers at the City of Bryan who identified cities in Texas that they felt had exceptional IT departments. Selected cities include the City of New Braunfels and the City of Frisco. Both cities possess similarities to the City of Bryan that allow for relevant comparison. For example, the IT departments in the City of Bryan and New Braunfels both serve a similarly sized local population (City of Bryan, 2019; City of New Braunfels, 2019). In the case of the City of Frisco, both the City of Bryan and the City of Frisco must fulfill their IT roles with a similar staff size and budget (City of Bryan, 2019; City of Frisco, 2019). By examining these cities our research team was able to identify examples of best practices, challenges, and uses of technology by local government IT departments in Texas that may assist Bryan IT in carrying out its customer support role.

Case Study: New Braunfels, TX

Background

Established under a German charter in 1845, New Braunfels is a thriving city of around 85,000 that is governed by a seven-member city council (New Braunfels, n.d.; U.S. Census, 2019).

About New Braunfels

Established: 1845

Population: 85,566

IT Staff: 14 Full Time

FY20 IT Budget: $2.2 million

IT Director: Tony Gonzalez
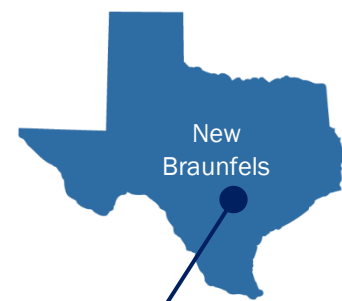

New Braunfels

Photo Source: (Reid, n.d.)

To meet the needs of its citizens, the city employs over 500 employees, 14 of which are full-time employees of the New Braunfels Information Technology Department (New Braunfels, n.d.; Gonzalez, 2019). Tony Gonzales, New Braunfels' Director of Information Technology, manages the department and is focused on achieving what he identifies as the key objectives of the department: (1) managing existing technology effectively and (2) bringing new technology to the City of New Braunfels (Gonzalez, 2019). Achieving these objectives requires that Mr. Gonzalez and his team overcome a number of challenges while implementing effective management practices that include ensuring the responsible use of city resources, documenting actions, and borrowing from existing professional IT frameworks to build a customize an effective system for IT management (Gonzalez, 2019).

Challenges

Key challenges affecting the New Braunfels IT department related to technology adoption include limited resources, security concerns, and staying aware of new technology. According to Mr. Gonzalez, ensuring that there are adequate financial and human resources can be problematic. "The challenge is that IT is not public-facing like Fire and Police," says Mr. Gonzalez, "so it doesn't often get first pick when it comes to resources" (2019). As a result, gathering the necessary resources to implement projects, overcome staffing limitations, and provide competitive salaries can be a challenge.

In addition, security is also a concern when adopting new technology within the City of New Braunfels. IT security refers to the implementation of processes, measures, and systems to secure and protect an organization's information (SANS Institute, 2019). As Mr. Gonzalez noted, he and his team "have to be right all the time, while a security threat only has to be right once". This need to always "be right" means that security is both a key challenge and a high priority when it comes to technology adoption.

A third challenge New Braunfels IT faces is staying aware of current technology. "Technology changes quickly and is doing so at a faster and faster pace," says Mr. Gonzalez, "what you were doing ten years ago is not what you are doing today, and what you are doing today is not what you will be doing in five years. We have to learn how to adapt and work with users to apply new technology" (2019). With this challenge in mind, Mr. Gonzalez and New Braunfels IT is always looking for opportunities to gather information and learn about new technology from various sources (conferences, training programs, online communities, etc.,) that the team can adapt and apply within the City of New Braunfels.

Findings Solutions through Technology

To overcome the various challenges the organization faces, New Braunfels IT has turned to technology as one method for improving the effectiveness and efficiency of the department. One area in which New Braunfels has found great success is project and task management. Effective project and task management can provide some relief for budget and staff limitations by ensuring that assignments are completed on time and efficiently. Mr. Gonzalez recounted that when he first arrived at New Braunfels that the department's project and task management process was not functioning adequately. "It was like fitting a square peg into a round hole," said Mr. Gonzalez. To

New Braunfels IT:
Challenges, Solutions, and Results

| Challenges | Limited Resources | Security | Technology Awareness |

Technology Solutions — KACE Systems Management, smartsheet

Results
- Improved task management
- More efficient use of resources and employee's time.
- Improved coordination.

solve this issue, Mr. Gonzalez and his team turned to two tools: Smartsheet and K1000. According to the company website, Smartsheet is described as an "end-to-end work execution platform" that allows for real-time collaboration, management, reporting, and automation of workflows and processes (Smartsheet, n.d.). K1000 provides access to the KACE Systems Management Appliance (SMA) software that assists with hardware and software management, network security, and improving service to end-users by automating administrative tasks and unifying endpoint management (Quest, n.d.).

By using these two technological tools, Mr. Gonzalez has found that he and his department are better able to manage tasks. Smartsheet has improved the IT department's ability to manage projects and tasks by allowing managers and team members to track project status, assignments, and actions, as well as allowing IT managers to share that information with any customers or vendors with which the team is collaborating. KACE SMA has helped with task management by assisting with and tracking incident management, service requests, and change management. Mr. Gonzalez has found that using both Smartsheet and K1000 has led to increased effectiveness and efficiency when it comes to project and task management. As a result, New Braunfels IT can make the most of its resources in its quest to fulfill its objectives.

Case Study: Frisco, TX

Background

Officially established as Frisco City in 1904, Frisco has grown from a population of a couple thousand to an estimated 190,000 plus today (City of Frisco, n.d.). This growth and changes in citizens' needs and technology have necessitated a larger municipal workforce in order to effectively serve citizens. Among the hundreds of employees at the City of Frisco, the city employs up to 50 individuals as part of their Information Technology Department. This department is led by Curt Balogh, the Director of Information Technology. As Director of Information Technology, Mr. Balogh has committed his department to helping all other City departments accomplish their missions by "ensuring reliability, availability, serviceability, and security of all computer and telecommunications related systems" (Balogh, 2019). To effectively carry out this goal, Frisco IT

has placed an emphasis on providing security, placing the business aspect of City of Frisco first and technology second, and building the credibility of the IT department.

Challenges

Like all local government IT departments, Frisco IT faces a unique set of challenges as it seeks to accomplish its objectives. One key challenge that Mr. Balogh identified is hiring experienced talent. Unlike other departments within the City of Frisco who can find and hire skilled employees from other cities, the expertise that Mr. Balogh and the IT department are seeking are often found in the private sector. "In my 17 ½ years here at Frisco I have literally hired technical talent from another local government agency a small handful of times," says Mr. Balogh, "the talent (often specialized) I am looking for is in the private sector". As a result, Frisco IT often finds itself competing with private sector organizations for talent. This competition between private entities and the City of Fisco can be challenging for two reasons: (1) Private organizations are often unwilling to share salary, wage, and benefits data that Frisco IT can compare to how it compensates employees and (2) budget restrictions can sometimes make it difficult to provide a competitive salary. These hiring challenges can make it difficult for IT departments to recruit skilled and experienced IT talent.

A second challenge that Frisco IT faces is improving its security posture. Security posture refers to the security status of an organization's "networks, information, and systems based on information assurance resources (e.g., hardware, software, policies) and capabilities in place to manage the defense of the enterprise and to react as the situation changes" (NIST, 2012). For Frisco IT this includes ensuring that systems, networks, and devices are secure and protected and that employees are involved in training that promotes a culture of security.

A third challenge identified by Mr. Balogh is keeping the various IT teams in sync with one another. The Frisco IT can consist of up to 50 employees who occupy several sub-teams, such as Infrastructure (responsible for servers, desktops, communications, etc.) or Information Services (manages the City's 200 applications). Each group in the Frisco IT department works on a number of projects and implement changes to the system every week. To avoid mistakes and conflict, it is crucial that each IT group is communicating and aware of what is going on in the department.

About
The City of Frisco

Established: 1902

Population: 192,261

IT Staff: 50 Employees

FY 20 IT Budget: $8.3 million

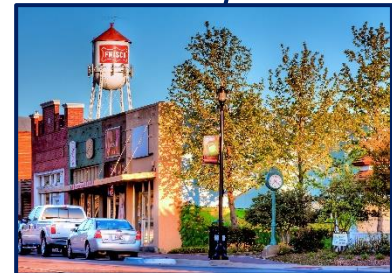**IT Director:** Curt Balogh

Frisco

Photo Source: (Vasel, 2017)

City of Frisco IT:
Challenges, Solutions, and Results

Challenges	Hiring Staff	Security Posture	Sub team Coordination
Technology Solutions	SharePoint	KnowBe4 Human error. Conquered.	
Results	▪ Improved coordination of tasks and change management. ▪ Improved security awareness and culture.		

Finding Solutions Through Technology

To overcome some of the challenges that Frisco IT faces, the department has taken advantage of different technological tools that offer solutions to its problems. One tool that the department uses is SharePoint. SharePoint is a tool from Microsoft that encourages teamwork and effective task management and operational workflows by allowing team members to quickly find and share information and data and collaborate across the organization (Microsoft, n.d.). Frisco IT has chosen to improve task management by customizing SharePoint to assist its change management process and coordinate the actions of various IT sub-teams and employees. Their customized platform allows the department to track changes, show the status of action items and projects in the change processes, certify changes, and provide notification of changes across sub-teams (Balogh, 2019). As a result, Frisco is better able to keep various IT sub-teams in sync.

Another tool that Frisco IT uses is KnowBe4. As mentioned previously, one of the challenges the department faces is improving its security posture. Part of improving an organization's security posture is promoting is providing training and promoting a security culture. Mr. Balogh and Frisco IT use KnowBe4 to overcome these challenges. KnowBe4 is a security awareness training and simulated phishing platform that assists organizations with fighting social engineering. Frisco IT has implemented KnowBe4's simulated phishing platform to train employees throughout the City of Frisco on how to avoid being caught in a phishing attempt that could place the organization and its information at risk.

Lessons from the Cases Studies

Key Challenges: Security and Limited Resources

Every local government IT department operates in a different environment that affects the type of challenges they might face. While there is variability in the challenges that IT departments face, security and limited resources were two challenges that each case study city shared. The fact that both case study cities have to deal with this challenge is reflective of what academic and professional literature also identified as key challenges. For both New Braunfels and Frisco, finding ways to improve and ensure security against internal and external threats is key when it comes to adopting and implementing the technology. Additionally, both cities deal with limited

resources. New Braunfels identified limited resources as having a potential impact on the carrying out of projects, while both cities highlighted the challenge that limited resources can have on hiring experienced staff.

Best Practices in Action

Innovation and Technology Awareness

Innovation and technology awareness center around encouraging a culture of creativity, training and professional development, and providing for new opportunities (Bowen, 2019). The end goal of fostering this culture in an IT department is to give management and staff the ability to find ways to apply and customize both new and currently used technology to overcome challenges (such as limited resources) and provide customer support to other city departments. For example, New Braunfels uses software called Smartsheets to not only improve task management within the department, but to also coordinate and share information with customers and vendors. New Braunfels has found that Smartsheets is a valuable tool that could be applied to solve issues for other departments, such as streamlining and improving the training request process for the Fire Department. Similarly, the City of Frisco adopted and customized the application SharePoint as a tool for improving coordination among sub-teams. By remaining aware of technology and finding innovative ways to apply technology both cities found solutions to some of the challenges they face.

Automation

Automation has the potential to increase departmental effectiveness by eliminating the need to perform redundant tasks or by eliminating human error. An example of this from the case studies is New Braunfels use of Smartsheet and the K1000 SMA. Smartsheet has allowed the department to automate tasks both within the IT and other city departments. Returning to the example of the Fire Department, New Braunfels IT has used Smartsheets to automate the flow of training requests so that information is received and dealt with in a timely manner. It is a simple automation process that can be applied in a variety of ways to improve effectiveness and efficiency by automating the workflow processes in an organization. Additionally, another example of automation technology is the K1000 SMA which allows for the automation of administrative tasks, such as hardware or software management, so that employees can focus their attention on more pressing matters.

Security

As identified by academic and professional literature, system and network security have become a paramount objective for IT departments everywhere. For example, one of the best practices that the City of Frisco implements is using KnowBe4 to improve the security posture of the organization. Frisco uses KnowBe4 to improve its security posture by operating a simulated phishing campaign that assists with training employees on how to identify, avoid, and report threats related to email.

Additional Themes

Improving Task Management

A common theme found between the two case studies is that both cities attempted to find opportunities to improve their task management and coordination between sub-teams. To solve this issue, Frisco IT has chosen to use SharePoint to coordinate with employees, sub-teams, and even other city departments. This program allows the department to collaborate during the change management processes, to track changes, display status of actions, and provide information across sub-teams. New Braunfels IT has sought to improve its task management and coordination through the use of Smartsheets and K1000. Like Frisco IT, these programs have allowed the department to better track changes, the status of tasks, and to share that information with team members, involved vendors, and customers.

Lack of Formal Offboarding

While employee offboarding was not discussed in the written case studies, our interviews with the two cities found that both lack a formal offboarding process. This finding reflects professional literature on the subject which indicates that most organizations do not have a formal offboarding process (Cushing, 2016). The IT director for the City of New Braunfels mentioned that while IT is involved in the offboarding processes (closing accounts, removing access, securing information, etc.), it lacks a clearly defined process. As a result, the offboarding process tends to be different for each department and the individual employee. The IT department for the City of Frisco has a slightly more formal process. It was mentioned in the interviews that their offboarding processes was reliant on having a general knowledge of what was happening in the city. The processes, as it was explained in the interview, involves the department head or Human Resources notifying the IT department of a pending departure, which then leads to the creation of a work order request to justify the closing of the account.

Conclusion to the Cases Studies

Information gathered from the case studies of the City of New Braunfels and the City of Frisco help to highlight additional best practices, challenges, and technology for local government IT departments. Additional best practices identified by studying the two cities include responsible resource management, staying aware of current and emerging technology, documenting work, building the department's credibility, focusing on security, and, above all else, providing support to their respective cities. Key challenges that the two cities faced include limited financial and human resources, staying up-to-date with current technology, improving the organization's security posture, finding and hiring experienced talent, and the coordination of department sub-teams. To overcome these challenges and to institute best practices, these organizations adopted technologies (e.g., Smartsheet, K1000, SharePoint, and KnowBe4) that assisted their departments with task management, employee coordination, and security.

INTERVIEWS & SURVEY FINDINGS

Methodology

As part of the TNAt, our team conducted a survey and a series of interviews to gather data that would assist in identifying opportunities for applying technology to improve efficiency and effectiveness within the IT department.

Interviews

The interviews conducted can be defined as structured and unstructured interviews. Our structured interview was conducted with the department head, Bernie Acre, and involved a series of ten questions that sought to ascertain the roles and responsibilities of the department, uses of technology, challenges, and potential opportunities to apply technology to improve efficiency and effectiveness. The questions were designed and approved prior to the interview with the department head.

The remainder of our interviews were conducted as part of field visits to the Bryan IT Department and were unstructured in nature. However, while unstructured, each interview had three goals: (1) identify the role and responsibilities of the various sub-teams within the IT department; (2) identify how these various sub-teams were utilizing technology; and (3) seek to identify what, if any, opportunities existed for enhancing the effectiveness and efficiency of the IT department through the application of technology. To the best of our ability, our team sought to meet and interact with supervisors and representatives from as many sub-teams as possible. The result of these efforts was the opportunity to interview and interact with supervisors from each of the five departmental sub-teams.

Survey

The survey consisted of eight questions that explored a series of topics related to technology use within the department and opportunities to adopt and apply new technology. These questions focused on topics related to the roles and responsibilities of the department and individual staff, technology use within the department, challenges to technology adoption and implementation, and opportunities for applying technology to improve efficiency and effectiveness. A total of thirty-two employees from the IT department participated in the survey. The number of participants represents roughly 84% of the department workforce. Additionally, the survey was provided to supervisory and non-supervisory staff.

Findings

Departmental Objectives: Customer Support and Security

Employees within the Bryan IT department possesses a fairly uniform understanding of the department's primary objectives. When asked what they believed was the IT department's objective, the two most common answers related to *customer support* (mentioned in 78% of responses) and *security* (mentioned in 31% of responses). Answers related to customer support often focused on how Bryan IT seeks to assist departments throughout the city with installing, maintaining and updating technological equipment, providing advice, guidance, and input for strategic planning, troubleshooting technical problems, acting as problem solvers, and managing the City's many technical assets. Answers related to security touched on providing network, systems, and cyber protection from both internal and external sources. Taken together, almost every response mentioned at least either customer support or security as a primary objective of the department.

Employee Views of Department's Objective(s)

Interviews with the department head and employees frequently mentioned customer support as a key role. The department head highlighted this role of customer support when he indicated that one of the primary objectives of the department is to provide "support so as to make sure that the business [side of the City] can accomplish what it needs to accomplish" (Acre, 2019). Additionally, employees that we interviewed were often quick to highlight the integral role of IT within the city as a support unit for all other departments. Examples of this included GIS's role in maintaining city data, IT Help Desk's role in troubleshooting technical problems, and Communication's role in ensuring that communication devices, such as radios for public safety, were functional, up-to-date, and operable.

Positive View of How the Department Uses Technology

Staff interviews and the department survey clearly demonstrated that Bryan IT staff believe that the IT department uses technology well. Interviews with staff highlighted the belief that the department does an excellent job supporting its employees and ensuring that adequate tools and training are provided. For example, staff indicated that they are almost always able to gain access to the tools they need to fulfill their responsibilities. Additionally, staff highlighted their belief that they receive effective top-down support and have an experienced team that is able to effectively use available technological tools.

Results from the survey also support the notion that the IT department is effective with its use of technology. Department staff were presented with a series of survey questions that asked staff to indicate how well they thought the department integrated and used technology. These questions included the following topics: staying up-to-date with new technology, using technology to increase efficiency, providing technology training and development, coordinating technology within and outside of the department, and fostering civic engagement through technology.

As demonstrated in by the chart *Employee Views on How Well the Department Uses Technology*, staff tend to overwhelmingly agree that the department does well in all of these areas. The only question that does not fit this pattern is question 6, or how well does the IT department foster civic engagement through technology. In regard to this question, 47% of the department agrees that the department does well at fostering civic engagement through technology, while 41% are neutral and 13% disagree. This may be perhaps one area where the department could apply technology to improve the effectiveness of its interactions with citizens in terms of civic engagement.

Employee Views on How Well the Department Uses Technology
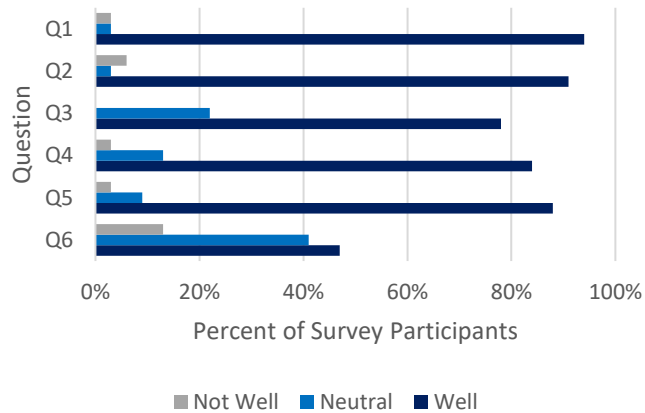
	Q1	Q2	Q3	Q4	Q5	Q6
Well	94%	91%	78%	84%	88%	47%
Neutral	3%	3%	22%	13%	9%	41%
Not Well	3%	6%	0%	3%	3%	13%

Survey Questions	
Q1	Stays up-to-date with new technology.
Q2	Uses technology to increase efficiency.
Q3	Provides employee development/training opportunities related to technology
Q4	Coordinates technology within the department.
Q5	Coordinates technology with other departments.
Q6	Fosters citizen engagement through technology.

Challenges to Adopting and Implementing Technology

Like all local government departments, the Bryan IT department faces challenges when it comes to adopting new technology. Our survey sought to ascertain the perceived impact of potential challenges by asking employees to rate each challenge on a 1 to 10 scale with 1 being "not challenging" and 10 being "extremely challenging". The six challenges rated by employees were budget, time, employee comfort with technology, "red tape", employees available for research and implementation of technology, and awareness of alternative sources of funding. The average

How Challenges are the Following to Adopting and Implementing Technology? (Average Response)
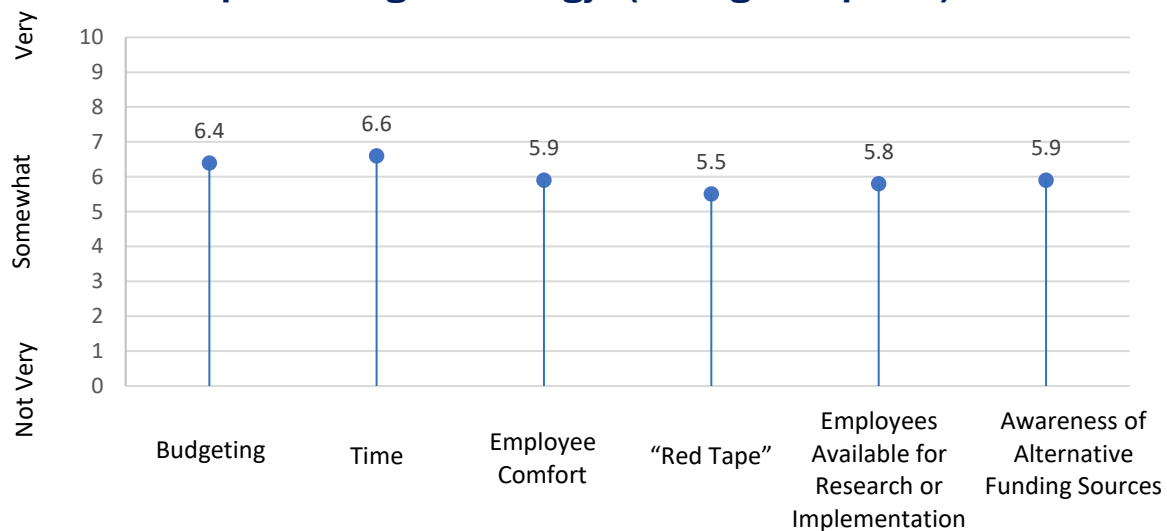
rating by employees for each of the five challenges to technological adoption and implementation fell between 5.5 to 6.6. In other words, most employees believe that each of these challenges is "somewhat challenging" when it comes to adopting and implementing the technology. As identified by employees, the two most challenging obstacles where budgeting (6.4) and time (6.6).

The survey results are reinforced by our findings from both our review of academic and professional literature and our interview with the department head and staff. Our literature review identified limited resources (financial and human) as a common challenge facing local government IT departments (Beaumaster, 2002; Norris, Mateczun, Joshi, and Finn, 2018). Bryan's Chief Information Officer echoed this sentiment when he stated in response to our question about challenges to local government IT departments that "time, money, and available resources" are factors that could potentially limit a department's success. Interviews with staff also highlighted that they could always do more with additional resources. However, it is important to note that staff at Bryan IT were quick to point out that they more often than not always receive the adequate amount of resources needed to provide exceptional customer support to the city and to fulfill their responsibilities.

Opportunities to Enhance Efficiency and Effectiveness

Task Management

When asked in the survey about specific tasks or processes where effectiveness could be improved through the adoption and implementation of technology, 25% of

Opportunities to Enhance Efficiency & Effectiveness in Bryan IT

survey participants identified actions related to task management for both daily tasks and long-term projects. Interviews with department employees echo these results. Employees reported during interviews that the IT department lacks a central and uniform task management system that allows for tracking and live status updates of assignments, thus making it difficult to assess the status of tasks and increasing the likelihood that key actions will be missed. According to information collected from

Employee Identified Opportunities to Enhance Effectiveness and Efficiency

Percent of Total Survey Participants

- Task Management: 25%
- Update Management: 9%
- Other: 13%

Opportunity
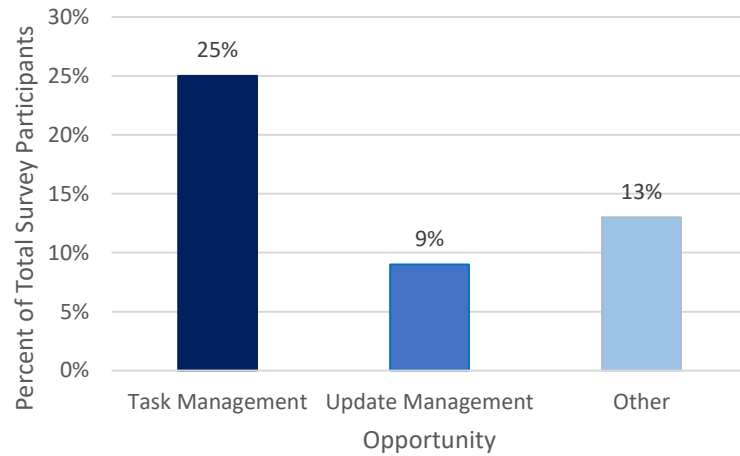
interviews, task management varies throughout the department with some sub-teams employing a system of weekly and/or monthly meetings, regular emails, or basic software such as OneNote (a note taking application from Microsoft) to track assignments. However, some sub-teams are experimenting with technological tools and software such as OneNote, Jira, Confluence, and Monday.com to improve their task management processes.

Mobile Device Management

Like other local governments, the City of Bryan is progressing towards becoming a more mobile workforce. As a result, it is likely that the city will increasingly use and rely on mobile devices to accomplish work on the go and away from the traditional office or work station. With this in mind, mobile device management will be a priority.

As identified in the literature and case studies, creating a culture that promotes security management is key to the success of local governments (Tittle, 2019). Adopting and implementing an acceptable mobile device management (MDM) system is part of a successful security culture. Comments from interviews highlight a potential, although not immediate, need for an improved MDM system. According to staff interviews, IT currently operates a basic version of MobileIron that meets security compliance requirements. However, Bryan IT is currently seeking to explore opportunities to enhance its MDM capabilities.

Our interviews with employees expanded on the potential opportunity for an improved MDM. The department head indicated that exploring potential MDM systems and improvements could be one avenue of research for this project (Acre, 2019). For the department head, a successful MDM system includes, but is not limited to, the ability to track mobile devices, remotely control and secure devices, restrict access, find devices when lost, and wipe the device if needed (Acre, 2019). Building on this observation, our interview with the IT Help Desk team also yielded information related to MDM. One of the roles of the IT Help Desk is to conduct an annual physical inventory.

As noted by employees, while IT does track who is using a device and where it should be through the IT Help Desk ticket system, just because it is logged as being at a certain location does not mean it is actually there. This makes a physical inventory of mobile assets difficult. An MDM system could assist with not only tracking devices for security purposes, but also for conducting a physical inventory. Finally, our interview with the Communication sub-team staff identified an MDM related need in being able to track the GPS location of mobile public safety devices, such as radios, for police and fire.

Automation

Interviews with staff identified two opportunities related to automation. The purpose of automation is to eliminate the need for employees to perform regular, time-consuming tasks, thus allowing employees to spend their time elsewhere. Interviews with staff suggested that one opportunity for automation is the gathering of external data for GIS. The GIS department manages hundreds of data sets and GIS layers. Some of this information is obtained internally while other information comes from external sources. Interviews with staff found that one opportunity, assuming that security concerns can be overcome, would be to find tools that would help implement a process that would automate the gathering of GIS data from external sources.

A second opportunity for automation involves generating security reports for the security sub-team. Security uses a number of different tools to monitor systems, track vulnerabilities, and identify threats. While the variety of tools provides increased security, there is difficulty when it comes to developing reports. Each of these tools generates numerous data sets that needs to be condensed into numbers and figures that can be shared with city leadership both within and outside the department. An additional challenge is that these various tools do not necessarily communicate with one another when it comes to presenting data and results. Staff suggested that there may be a potential opportunity to implement a tool, perhaps through API, that would help to automate portions of or all cybersecurity reporting between the various tools with the goal of being able to easily produce reports.

Employee Offboarding

Employee offboarding refers to the exit management process for when an employee leaves or separates from the organization. According to research by Aberdeen, an international intent-based marketing and data company, only 29% of organizations have a formal offboarding process (Cushing, 2016). Further, a survey by TEKsystems, an IT management company, found that only 14% of IT professionals believe they have a formal offboarding process (2015). Based on these studies, it is possible to conclude that organizations often fail to place an emphasis on establishing a formal process for offboarding and the role IT should play.

The lack of a formal off-boarding procedure was identified in staff interviews as a possible opportunity to enhance efficiency and effectiveness within the department. According to staff, IT's role in off-boarding includes, among other tasks, closing user accounts, securing and managing user data, and ensuring access is removed for employees who separate from the City of Bryan. However, there is no formal process or established time-table for completing the offboarding process. This is different from onboarding which has a formal process regarding which IT sub-

teams are involved in the onboarding process and at what stage. Based on this information, the offboarding role that IT plays could be made more efficient and effective through the application of technological tools that can help to ensure a more formal process.

Lifetime Vulnerability Tracking

During our interactions with IT department employees through interviews, field visits, and the survey, one potential opportunity to improve efficiency within the department is finding a tool that could assist with lifetime vulnerability tracking. The National Institute of Standards and Technology describes a vulnerability as a "weakness in an information system, system security procedures, internal controls or implementation that could be triggered or exploited by a threat source" (Paulsen and Byers, 2019). Effective vulnerability tracking and management include being able to track a vulnerability throughout its lifetime so as to identify when it first appeared, changes made to systems and assets to deal with vulnerability, its resolution, and any reappearances. Our interview with staff found that the department has already attempted to improve this task by applying tools such as Tenable vulnerability scanner, Confluence task manager, and the IT Help Desk ticket system. Unfortunately, none of these tools achieved the desired results, either because they did not work as expected or required more time and effort to set up than the department was able or willing to invest. Regardless of what technology is used, staff suggested that some key questions to consider would include how to track vulnerabilities that appear on multiple systems (are they all one issue or separate?), how to record a vulnerability that resurfaces (is it a new issue or an old issue that should be reopened), how to classify vulnerabilities, and who and how should the vulnerability be routed to for resolution.

Hard Drive Imaging

Hard drive imaging refers to creating a backup or copy of a desktop or laptop's operating system, saved files, and applications. Hard drive imaging can be used to set up new desktops and laptops or to provide a reset to a specific point in the asset's life. Based on results from the survey and comments from interviews, staff indicated that being able to image more devices at an improved speed would enhance efficiency and effectiveness within the department. Example responses from the survey included the suggestion that improved "computer imaging to allow deploying new or reimaged PC or laptops to occur faster" and that having a tool that could image 1-4 instead of the current 1-2 would be beneficial.

CONCLUSION OF NEEDS ASSESSMENT

To identify potential opportunities to enhance the effectiveness and efficiency of the Bryan IT department through technology, this report has reviewed and analyzed data gathered from academic and professional literature, case studies of other local governments, interviews with members of Bryan IT, and a departmental wide survey. Based on the data gathered as part of this technological need's assessment, our team found the following:

1. Key challenges for adopting new technology include ineffective implementation processes, limited resources, and ensuring that systems, networks, and devices are secure from threats and malicious actors.

2. Best practices identified by the literature include promoting innovation and technology awareness, automation, e-government through cloud computing, and security management.

3. Common practices in other local governments include identifying ways to improve task management, leveraging innovation and technology awareness to solve challenges, and improving security.

4. Interview and survey findings found that most employees believe that the core objective of the department is customer support.

5. Potential opportunities to enhance efficiency and effectiveness within the department include task management, mobile device management, opportunities for automation, employee offboarding, improving lifetime vulnerability tracking, and hard drive imaging.

With these findings in mind, the next section of this report will discuss suggestions regarding available technology that could be applied to take advantage of potential opportunities. Examples of technology previously discussed that could be considered include using Smartsheet or SharePoint to improve task management and coordination. However, while quickly identifying and implementing technology to enhance the department is ideal, there are challenges in finding a feasible solution. Challenges include implementation processes, limited resources (both financial and human), and security concerns related to new technology adoption. For example, automating external GIS data gathering may not be feasible due to security concerns, while having our team research an effective MDM system for the city may be beyond our capacity due to a lack of information about city needs and the process for implementing such a system. With these concerns in mind, our team recommends focusing on the potential opportunities for enhancing task management, employee offboarding, lifetime vulnerability tracking, and hard drive imaging.

SUMMARY OF NEEDS ASSESSMENT

The Library Department of Bryan oversees and staffs three libraries over two separate cities, governed by an interlocal agreement between Bryan and College Station. The department strives to provide access to information, technology, and resources to the citizens of both communities. In an effort to help the department accomplish this goal and provide guidance in the pursuit and adoption of new tools and technologies, this report provides a perspective based upon professional and academic research, department leadership interviews, and examination of a successful long-term technology plan in a leading library system. From this research, we conclude that the department would benefit from the exploration of improved intra-department communication, unified IT support systems, and metadata automation, as well as specific tools including Polaris Leap and expanded EnvisionWare self-service offerings. As the project continues, we intend to continue working alongside the leadership of the department to flesh-out and tailor suggestions to meet the developing needs of the libraries and adapt to their available resources.

INTRODUCTION

The modern library has expanded its services to incorporate not only the provision of physical (print) resources and research assistance, but also the provision of public access to technology and alternative forms of information. As technology improves, there are increased opportunities for learning and for decreasing inequality of access. In keeping with the spirit of libraries as an avenue for gaining knowledge, many public libraries have chosen to adopt technologies which not only improve internal processes, but also provide the general public access to costly technologies they may otherwise lack. Libraries have been quick to adopt new technology into their repertoire, especially with the advent of digital format offerings (e.g. ebook, DVDs, audiobooks). Some libraries have taken it a step further, incorporating streaming services, 3D printing laboratories, coding classes, and Virtual/Augmented Reality. Although the landscape of libraries may be changing, the mission remains the same: provide information to the public.

The Bryan Library Services Department is part of the Bryan/College Station Public Library System which provides library services to both cities through three branch locations: the Clara B. Mounce Public Library (Bryan), the Carnegie History Center (Bryan), and the Larry J. Ringer Public Library (College Station). The arrangement is atypical from an organizational standpoint: the physical assets of the Ringer Library are owned solely by College Station, while all librarians

across the system are employed by Bryan. This set-up has led to some difficulties with communication, IT hardware/software compatibility, and security requirements across systems.

The system vision statement is "To engage, enlighten, empower, and inform life-long learners in the Brazos Valley." and their mission statement makes special note of encouraging workforce development and early literacy (About, n.d.). The Library Services Department consists of 37.50 budgeted, full-time-equivalent positions (which includes some part-time positions) and is also supported at times through community volunteers (Financial Transparency, 2019). The system's budget is roughly $2.8 million with about $2.4 million of the total going toward salaries and benefits for employees (Financial Transparency, 2019).

Technology Currently in Use by Library Services Department

Overall System

Based on our initial interviews and site tours, the technological limitations of the Bryan & College Station Libraries appear to stem from two sources: the technological disconnect between the College Station and Bryan IT systems, and the level of community technological literacy. The general view of librarians and other staff is that the department tries to stay updated but does not have the funds or staff time available to monitor and direct large-scale changes like maker spaces (e.g. 3D printing, graphic design labs). Rather than aiming for the technological frontier, interests primarily focused on increasing access to existing services such as scanners and copiers, and addressing difficulties experienced by patrons using current systems (Jones, 2019) In the case of older facilities like Mounce, there are additional issues arising from the buildings themselves not supporting the current level of technology (Jones, 2019).

In general, the libraries are well-fitted to the services they provide, and the perceived needs of the community are generally met by the technology currently in place. An important point brought to our attention more than once was that there are undoubtedly many different technological apparatuses available for adoption (for instance, the increasingly popular makerspaces, 3D printers, etc.), but the limiting factor on appropriate technology is the ability of patrons to make use of it. At present, the publicly-available technology on hand meets or exceeds the technological literacy of many patrons, and there is not enough staff time to troubleshoot the difficulties they currently experience. Adding more complex technological devices would only compound this problem and require additional staff training. In the cases where patrons do desire more advanced devices, they often bring their own. The concern here is then directed to usable spaces with access to charging ports and consistent WiFi, both of which are readily available at the Mounce and Ringer libraries with some facility limitations in Mounce due to the building's age and electrical wiring (Koeninger, 2019; Jones, 2019).

In the survey, staff responded consistently that the Radio-Frequency Identification (RFID) tag implementation was a positive experience that improved efficiency within the department. The tags use electromagnetic signals to track the collections movements, provide additional security of resources, and allow for self-checkout. Additionally, a number of staff members noted that the Skedda reservation and scheduling software has been a major improvement for the coordination

of meeting rooms across all locations. The software is available to view online so patrons can identify available spaces and make reservations for self-guided events.

Primary requests for the system overall include the addition of *Polaris Leap,* a web browser extension to the current *Polaris* Integrated Library System (ILS) that would allow full access to the ILS from mobile devices and laptops for remote services. Perhaps the most significant capability that this would provide, according to staff interviews, would be the ability to register new patrons for library cards at outreach events. Furthermore, Polaris Leap would allow for the creation of a "Book-Mobile" so the collections could be brought directly to the public and those who lack transportation. Additionally, expansions to the current *EnvisionWare* products in use by the department would allow for greater self-service options to patrons with more advanced technology capabilities. This would increase the available time for staff to assist those in need of guidance and to complete their primary objectives such as collection development.

Another request was the implementation of an interlibrary chat system which would allow for greater coordination of staff across locations - particularly for technology troubleshooting. It was noted by a staff member that a chat system could also assist with diffusing patron conflicts and security situations that frequently arise in the facilities. It was mentioned in both the surveys and interviews that an aggregate search system across the print and digital collections could benefit patrons and increase resource usage, particularly for the digital collections. Finally, a desire for more coordinated social media and marketing outreach was expressed by staff members as well.

Carnegie History Center

The Carnegie History Center primarily serves the function of repository and access point for local history archives, including: historic newspapers, photographs, and other documents. The items in this collection are heavily used by researchers and genealogy hobbyists locally, nationally, and beyond. The technology in use at this location varies from microfiche readers to modern photoshop computers and are built around the archival resources housed in the building. The primary request of the branch's manager was a solution for metadata entry automation, or at least simplification, as digitizing their collections for remote access is a major goal at this time (Altman, 2019). The Carnegie History Center also benefits from unique funding sources such as endowments from deceased community members that provide more opportunities for the adoption of new technology than may be available at the more traditional branches (Altman, 2019).

Clara B. Mounce

The Mounce location houses the executive offices of the interlocal library system and is located in Downtown Bryan. Public technology in use at this location includes 21 public-use computers distributed between the two floors' computer labs. These public-use machines are augmented by two additional stations which have been outfitted for disability accessibility. Each lab is equipped with a coin-operated printer, with one further coin-operated printing and copying station downstairs. Other Publicly available technologies include two A-V systems upstairs, eight catalogue-search computers, and one RFID self-checkout station. Finally, the library has also provided numerous charging ports at various locations throughout the building for personal devices and has public WiFi available in all areas of the building. There are some limitations to

the building's technological capacity due to its age and electrical wiring. Internal systems (used by the library staff exclusively) include: two Adult Services computers, four Youth Services Computers, one Circulation Computer, two Cataloguing computers with RFID capabilities, and two Check-out computers, also with RFID. All public exits are equipped with RFID security gates to prevent theft of materials.

Primary requests at this location included improved security (cameras, emergency call buttons), a public access scanner, and an upgraded PA system for announcements.

Larry J. Ringer

The Ringer building has similar technological capabilities to Mounce but benefits from newer versions of most equipment and recently renovated facilities. Unlike Mounce, all public printers and copiers are located in one central technology cubicle, and all 20 public-use computers are located adjacently. While the public machines are more concentrated than in Mounce, the Catalogue machines are scattered throughout the building, which has on occasion caused problems for patrons trying to locate them. Rather than projector-based A-V systems, Ringer has equipped two meeting rooms with new LCD televisions, with HDMI standard connections.

Technology requests at Ringer were few, due to the recent renovation and upgrades, but the staff and branch manager identified greater tech support and improved scanning and printing services as areas for improvement.

LITERATURE REVIEW AND BEST PRACTICES

A variety of sources were used to explore the currently identified "best practices" for public library departments in the United States and around the world. As the digital age has spread its influence to touch the daily lives of most people and bring information to one's fingertips, libraries have had to re-evaluate themselves and their place in the larger framework of information accessibility for the public (Goertzen, 2017; Gorman, 2003; Lawson, 2014; King, 2018; McCook, 2018). As the landscape of information access changes, public libraries must strategically adapt their services to supplement or augment what individuals within the community could provide for themselves. Part of the difficulty with this process is the up-front expense of integrating a new technology into the library which includes but is not limited to: the cost of the technology itself, upgrading any current technologies to ensure compatibility, and staff training for utilization. Something as simple as laptops or the ability to process credit cards can be very taxing on the often limited budgets. Additionally, with the current pace of technological change it is difficult to estimate how long a "trendier" technology will remain viable for the community and how soon it will fall out of fashion or become obsolete (Jones, 2019).

In an American Library Association report, King provides some practical advice on distinguishing "trends" in technology from "fads". He notes that it is important to stay in tune with the requests made by community members as well as repetitive mentions of particular technologies in traditional media sources in order to remain up-to-date with emerging technologies. At the same time, are some red flags to look out for when considering whether to adopt a particular technology. Since libraries generally do not have the resources to be on the cutting edge - but, rather, following

fairly close behind - these tips are particularly apt for sorting through the options. First, if the developer or provider of a particular service stops sending out regular updates, bug fixes, or patches, it is probably a good indication that the service will soon be discontinued (King, 2018). Second, if the use or popularity of a service is already diminishing after a couple of years, then it is probably best not to pursue it for the library (King, 2018). Finally, if the service or technology is simply difficult to use, it would be best not to adopt it. This also applies to choosing between options; if one option is noticeably more user-friendly than the other, it is most likely better suited for public access (King, 2018). Making strategic decisions about which technologies to adopt and which to avoid will allow a department to follow the trends without wasting time and money on extraneous fads. According to a nationwide survey, it is best to search for solutions which provide for basic needs without adding extraneous complexity (Breeding, 2019).

The key "best practices" highlighted by the literature can be generally grouped into three categories: Internal systems, patron services, and technology access which are discussed in greater detail below.

High Quality Internal Systems

As library collections and services grow, the challenges for managing the numerous resources, licenses, and databases become more complex (Anderson, 2014). The use of Integrated Library Systems (ILS) technology allows for digitization of records and information as well as automation of various tasks within the departments (Breeding, 2019). However, these systems can be more or less intuitive, effective, and adaptable to each department's needs while also being extremely costly to replace - both in monetary terms and staff hours for retraining - once a system has been in use for any extended period of time (Jones, 2019). *Perceptions 2018: An International Study of Library Automation* surveyed "3992 libraries from 87 countries describing experiences with 127 different automation products, including both proprietary and open source systems" and identified some of the top performers (providers) for the field (Breeding, 2019). The survey allowed libraries to identify which system they were currently using, the pros and cons of the system for their needs, whether they were planning to make the switch to a new system, and, if so, to which one. The top performers among public libraries were Apollo, ByWater Solutions, and Polaris (which is currently in use by the department). Additionally, the survey gauged interest in open source ILS software which could be a less costly avenue for library automation than current proprietary systems (Breeding, 2019). However, these systems were mostly found to be of interest to academic libraries rather than small to mid-sized public libraries (Breeding, 2019).

Furthermore, the literature discusses the trends in resource management systems which can be split into two main categories: movement to unified resource management and increasing interoperability of specialized systems (Breeding, 2018). A unified resource management approach would pull print and digital collections into a single space while an interoperable strategy would maintain separate, specialized systems for the two and interact with one another. A unified system would implement a "discovery layer" that allows patrons to search across all collections simultaneously and generate efficiencies in management. However, the second trend of having a set of systems that interface is also popular among libraries that want greater customizability. The modular approach allows for libraries to integrate only those sub-systems that are necessary for their offerings while leaving out those that are currently unneeded (Breeding, 2018). This

flexibility can also be more effective for libraries that must implement new system over longer stretches of time due to budget constraints.

Exemplary Patron Services

Patrons are at the heart of every library department. No matter how large or well-visited a library may be, the point of a public library is always to serve the people that come to utilize its resources (McCook, 2018). Some patrons will visit just to check out books, while others prefer to attend story times and events. In recent years, more patrons visit to use the computers, or the free WiFi (Jones, 2019). Along with these core resources, community members will stop in for various informational, educational, or artistic programs, and others will "check out" spaces in which to conduct their own meetings and events. Technology within the library should provide or augment a smooth and enjoyable experience for the patron in whatever activities they hope to participate (Aspen, 2014). This takes place from the first interactions such as acquiring a library card and continues through to the day-to-day activities via self-checkout terminals, digital library catalogs, printing stations, and online self-service activities (e.g. reserving meeting spaces, renewing book/library cards).

A key aspect of library activities is to be receptive to patrons' needs and ensure they are able to adapt to changes in the community while remaining flexible in-service deployment to all levels of both traditional and technological literacy (Aspen, 2014). Some specific ways to achieve this is to integrate periodic assessments of services by community members or to provide mechanisms for ongoing anonymous feedback. Other strategies are to further engrain the library into the community through partnerships with local businesses and schools. This can take the form of digital literacy classes or clubs, employment search strategy and résumé assistance, and providing spaces for collaboration between researchers, non-profit organizations, and others. There are many types of patrons, including those that have yet to be reached within the community. Finding strategies to understand and address their needs is essential for providing comprehensive and exemplary patron services.

Equitable Technology Access

One common challenge faced by public library departments is the disparity between the most advanced community members and the most disadvantaged. An excellent library department will tend to the needs of both by providing access to high quality resources for more self-sufficient members while also providing instruction and guidance for those in need of greater assistance (King, 2018; Hammer, 2018). While this challenge has historically applied to community literacy efforts, the divide has only widened with the advent of advanced technologies (King, 2018) . A key aspect of technology accessibility is "universal design" in the sense that patron-facing technological aspects used within the library should be accessible to as many people as possible at varying levels of individual advancement or proficiency (Hammer 2018). As community hubs, libraries are uniquely suited to provide consistent WiFi and internet access to disadvantaged populations while serving as places of advancement for their technological capabilities.

While technology has widened some gaps in access, it has also provided opportunities for closing others. With the increase in popularity of digital materials, patrons with limited mobility or

transportation options can still have access to the library's collections (IT Roadmap, 2018). This, of course, relies on patrons having reliable internet access at home, but having resources ready and available is an excellent start. Beyond digital collections, there are technologies for expanded provision for hearing and vision impaired patrons through audiobook collections, large print formats (both physical and digital), and low-vision computer aids. Equitable access to library technologies and library services *through* technology are hallmarks of an excellent library system.

DEPARTMENT LEADERSHIP INTERVIEW TAKEAWAYS

Larry Koeninger - Department Head

Mr. Koeninger opened by noting the history of early adoption of new technology by libraries and by the Bryan/College Station system in particular. Digital records and catalogues offered an early expansion of library capabilities, and libraries have continued to eagerly pursue new solutions to challenges. However, Mr. Koeninger also noted that there appears to be a kind of plateau in new, applicable technology. Instead of seeking out different kinds of services the library might provide, Mr. Koeninger recommended that our focus be placed on ways in which current systems and services might be expanded or improved, especially those which can simplify librarian duties and require minimal re-training. Currently, the library is working to expand its digital holdings, an expensive but increasingly vital aspect of the library collection which provides greater access to many patrons. Similarly, the library serves as a public access point to the internet for tasks ranging from social media use to job applications and research. Ensuring that the technology offered to these patrons stays up-to-date remains a primary technological objective. Behind the scenes, the library benefits from technology which allows them to more easily track, maintain, and search the collection; most recently, a new RFID system has enabled staff to improve the tracking of materials and permitted simplified self-checkout for patrons. The library is also considering expanding their current ILS system to improve remote access, following the trend of updating a current system to meet evolving community needs. In Mr. Koeninger's opinion, the top technology priorities are:

- Increase streaming capabilities and expand digital holdings
- Aggregate searching capabilities which enable the entirety of the collection to be explored through a single portal
- Efficiency, effectiveness, and accuracy improvements to current systems and tasks
- Basic tech solutions, including self-service scanners and other basic augmentations to existing computers
- Improved community outreach educating the public on available services and programs

Jessica Jones - Ringer Library Director

Recently renovated and reopened, the Ringer location is the most up-to-date of the three locations. Ms. Jones has been very pleased with the updates and made special note of the ways in which technology access had been provided throughout the building. Numerous charging ports have been built into most tables and as a central computer lab and printing services center are available for public use. Ms. Jones noted that while there are many different technologies which some libraries

have chosen to adopt - such as 'maker-spaces' that include 3-D printing or dedicated programming labs - an important consideration in choosing new technology avenues is the capability of patrons to use new tools, and the community demand for such services. Currently, the technology implemented at Ringer meets almost all the needs of patrons, and exceeds the expertise of many users, requiring a great deal of librarian time to guide patrons through even basic processes on the computers. This is one of the strengths of designing the building to facilitate the streamlined use of personal devices. It enables those who are comfortable with technology to make use of the space on their own terms, with access to aid or other resources should they need them. Echoing Mr. Koeninger, Ms. Jones is fairly satisfied with the current types of tech available, and requests expansions of current systems rather than new avenues. Top priorities noted include:

- Mobile capabilities of the ILS system
- Improved outreach and social media advertising services to the community
- Increased tech support availability across the two main branches

Rachel Altman - Carnegie History Center Director

The history center serves as a repository of historical and out-of-print records - especially local history and genealogy - and serves as an access point to these resources for local and off-site researchers. The priority at this location is currently the conversion of physical records to digital format. This will increase the ease and breadth of access, and also protect old and fragile holdings from unnecessary handling. Currently, less than 20% of historical records are available in digital format, and in order to promote access to these valuable records, Carnegie staff spend a significant amount of their time scanning documents and entering important descriptive metadata. This process is difficult and tedious, and many of the technological requests from Carnegie revolve around improving the tools used to accomplish the conversion. Top tech priorities as described by Ms. Altman include:

- Improved metadata management and entry system
- Large-scale high-quality scanner, capable of handling large documents and maps
- Increased social media outreach

Unlike other locations which noted the importance of keeping tech updated, Ms. Altman pointed out that most of the technology challenges faced at Carnegie are back-end process solutions which the public has no interaction with, thus concerns over patron technological literacy are minimal.

SURVEY RESPONSES SUMMARY & ANALYSIS

The survey conducted of library staff, in contrast to the personal interviews, is an anonymous interaction with disidentified responses. Primary questions had to do with identified challenges faced in the department, areas where new technology might be useful (public facing/back-end processes), and assessment of current uses of technology. Librarians generally found the greatest challenges they currently face in use of technology and expanding their tech capabilities had to do with budgeting and available time for research to identify and implement solutions to problems (see the following chart).

How Challenging are the Following to Adopting & Implementing Technology? (Average Response)

Budgeting: 7.8
Time: 6.7
Employee Comfort: 5.4
"Red Tape": 6.5
Citizen Comfort with & Awareness of Technology: 6.4
Employees Available for Research or Implementation: 7.1
Awareness of Alternative Funding Sources: 6.3
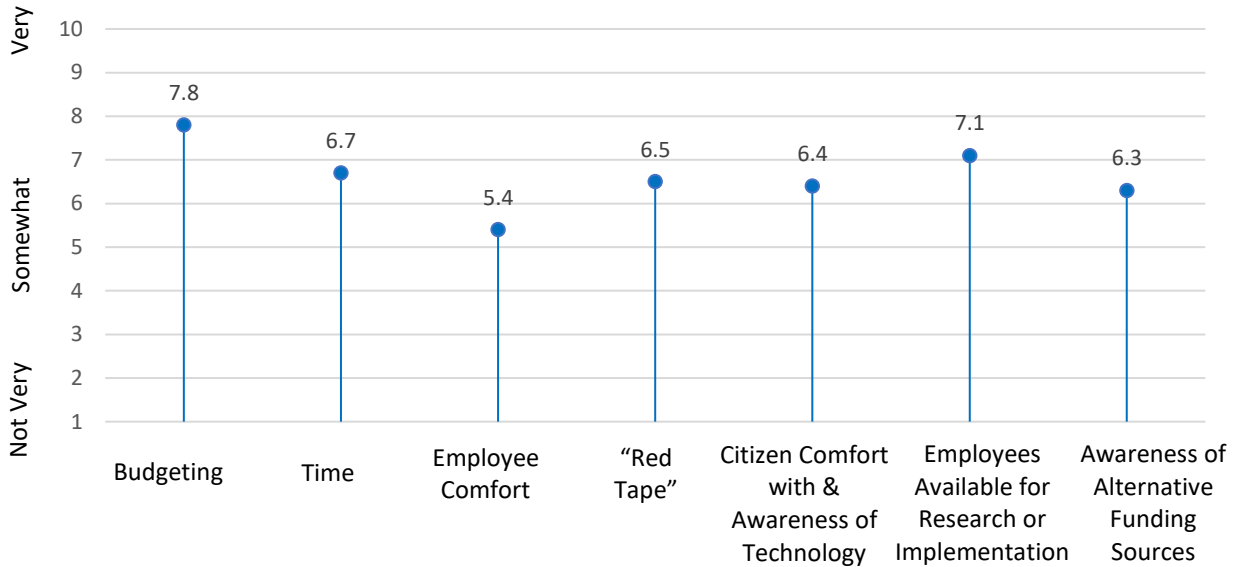
Overall, technology requests from staff fall in line with the expectations set by the interviews. Rarely in the responses was a new technology requested, instead, responses focused on augmenting basic tools like a PA system for the building, scanning capabilities, improved data entry, scheduling programs, and similar. Staff seem to agree that while both public facing and back-end technologies are important, back-end processes edge out patron-useable tech (see figure 2). There is a desire to improve services to the public by simplifying internal processes and making staff more available to perform research or outreach roles. By decreasing the amount of time dedicated to infrastructure maintenance, employees will be better able to pursue engagement with patrons.

Which Type of Technology Would Be The Most Beneficial At This Time?

Both, 6%
Community Facing, 22%
Behind the Scenes, 72%
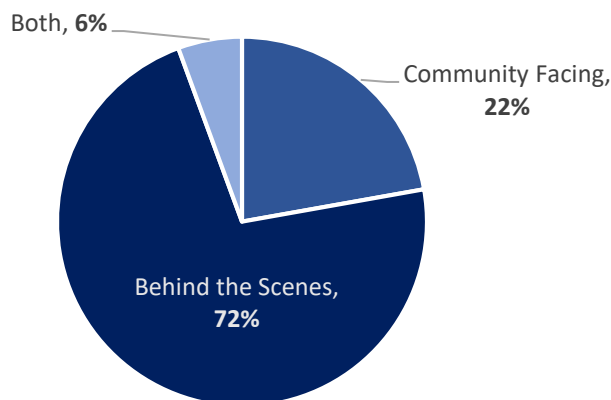
Specific requests in the survey primarily had to do with maintaining or improving current technology, in recognition that many of the services they provide are the only access patrons may have to those tools.

CASE STUDY

THE SAN ANTONIO PUBLIC LIBRARY SYSTEM

The purpose of this case study is to identify library services departments that are using innovative technology and to exemplify best practices in the field from academic and professional sources. The case study will serve as the framework for our sub-team to assist the Bryan Library Services Department in using technology to overcome current challenges. The themes of effectiveness, efficiency, and equity have been identified as key drivers in our technological research.

The San Antonio Public Library (SAPL) Central Branch is the main hub of a system consisting of the primary location and 29 satellite locations serving a population of nearly 1.9 million (Suszek, 2019). In an effort to upgrade their system, SAPL recently undertook a large-scale, multi-year technological initiative to improve access to technology for underserved populations as well as use technology to increase outreach and provision effectiveness (IT Roadmap, 2018). The project was a joint initiative by the Library Department and Information Technology Department with expert assistance in analysis and planning from Gartner Consulting. The Library Department IT Roadmap lays out the methodology, findings, and recommendations of the analysis and provides a clear picture of how to systematically identify the needs of the population while remaining attentive to the needs and resources of the staff and related departments (IT Roadmap, 2018). The project aligns well with the City of Bryan Capstone Project's goals of efficiency, effectiveness, and equity, as defined by the Scope of Work Memo.

IT Roadmap Methodology

The San Antonio Public Library conducted a large-scale assessment of their own technology use and needs in order to develop a long-term growth strategy as well as a technology adoption and implementation plan (IT Roadmap, 2018). To do this, they followed a similar list of steps to our own project which consisted of:

- Surveying customers & staff
- Interviews with library, City, and tech leaders
- Developing proto-personas and journey maps
- Focus groups
- IT assessment
- Trends and digital moments
- Forming a technology vision, and
- Identifying the desired future state and roadmap (IT Roadmap, 2018)

The SAPL team spent a large amount of time and resources collecting data and information from community members, both library users and non-users alike, to gain a thorough understanding of

how community members interact with the libraries and what solutions they used as substitutes for library services (IT Roadmap, 2018). Through the proto-personas and journey maps, the team used survey and focus group data to identify common user "types". They then walked through each type's hypothetical interaction with the SAPL systems and staff to identify key points of contact with technology and areas for improvement (IT Roadmap, 2018).

Through these strategies, they found that a major component to a patron's experience with library technology was the patron's own comfort level for using technology; those with less advanced technological familiarity and skills experienced greater difficulty and required more support from library staff to accomplish their personal objectives (IT Roadmap, 2018). This is in line with the information gathered from our own interviews and surveys. Ron Suszek, a Library Services Administrator at SAPL, noted that equity of services was a major consideration for the prioritization of projects in the IT Roadmap (Suszek, 2019). An example of this was clear in our visit to the SAPL Central Branch where we found two locations (one for adults and one for children) designated for low-vision capabilities that included braille resources and low-vision computer aids.

Key Findings

The report highlights key opportunities for improvement within the SAPL System. One of the major areas was marketing and informing the public about library services at the branch locations, on social media, and through the website and app (IT Roadmap, 2018). The team also noted that ease-of-use for the technology they currently have at the various branches was essential to reduce the amount of staff time dedicated to troubleshooting patron's technology issues (particularly with PCs and printers) and increase the staff's availability for their primary objectives (IT Roadmap, 2018). Additionally, they determined that it was important to offer patrons a more personalized experience and to work to overcome various types of physical, economic, or social barriers to library usage through the increase of alternative methods of provision such as digital and online resources and self-service solutions for patrons (IT Roadmap, 2018). A unique example of this from the SAPL Central Branch was interactive signage for the digital collections through which patrons can scan QR codes with their mobile devices to more easily explore the digital collections and receive information without having to find and ask a staff member (an activity noted by Mr. Suszek as a common social barrier for patron access). Finally, they placed emphasis on fostering opportunities for local businesses and organizations to use SAPL resources and services for innovation and collaboration (IT Roadmap, 2018). From our site visit to the SAPL Central Branch, we saw the employment assistance and local business collaboration computer lab area which provides patrons with a place to receive assistance with searching/applying for jobs, improving their resumes, and completing online onboarding paperwork.

In order to accomplish the aforementioned objectives, Mr. Suszek noted that SAPL prioritized staff development and talent modernization throughout the process (Suszek, 2019). He stated that the administration's strategy was to ensure clear and uniform communication to all branches and staff members in order to ensure "buy-in" and cooperation from the whole department. Additionally, efforts were made to redefine positions and duties in relation to technology alongside plans to provide a uniform minimum level of tech proficiency training for all employees that would

allow for better patron assistance and efficiency of technology solutions (Suszek, 2019). This strategy seems to be appropriate for the current situation in the Bryan Library Services department based on the interviews and survey data. More specific initiatives and improvement are listed below.

Approved Recommendations for SAPL: 5-Year Plan

Internal Systems

A substantial portion of the SAPL IT Roadmap was dedicated to improving the internal systems used by the department throughout its service area. The major pieces of these improvements that received funding through the City were: Staff Scheduling Software; Laptop Carts; Integrated Library System; and Pharos Public Business Services (IT Roadmap, 2018).

- **Staff Scheduling Software**: Due to the library system's vast service area, the study identified issues in coordinating staff members. Along with the large number of physical locations, complexities arose from varied hours of operation throughout the system as well as differing expertise required by different locations. The implementation staff scheduling software was intended to equip management with the necessary tools to ensure every location was adequately supported for its patrons needs (IT Roadmap, 2018).

- **Laptop Carts**: Although the name suggests a primary benefit to patrons, the laptop carts intended for procurement will allow for mass updates across the laptops' software as well as increase the security and ease of tracking for management (IT Roadmap, 2018).

- **Integrated Library System**: This refers to the "business system that manages circulation, customer accounts, collection development, cataloging" and other core library functions. By centralizing the information into a single system, management can more effectively identify patterns of patrons' needs as well as make decisions regarding long-term planning for the department's growth (IT Roadmap, 2018).

- **Pharos Public Business Services**: This is a hardware and software system package that covers the library's fax, print, scan, copy, and payment services through self-service kiosks which will allow for task reduction in high-volume service areas to increase efficiency (IT Roadmap, 2018).

Patron Services

The second largest portion of the SAPL IT Project Roadmap initiatives emphasized improvements in patron interaction and engagement. The funded changes include: Customer Analytics; Digital Signage; and Online Chat Support (IT Roadmap, 2018).

- **Customer Analytics**: This software is an excellent example of task automation to improve patron retention. It is designed to identify patrons whose activity has recently declined and send out automated messages inviting them back to the library and informing them of new offerings they may be interested in (IT Roadmap, 2018).

- **Digital Signage**: Although relatively simple in nature, digital information sources posted throughout the library locations provide increased instances of notifying patrons of new arrivals or programs in which they my wish to participate. This is additionally helpful for peak hours in which the staff may be too busy to engage every patron (IT Roadmap, 2018).

- **Online Chat Support**: This service is contracted out and provides live assistance to patrons and community members visiting the SAPL website. This service can provide more detailed information to patrons with limited mobility or time to browse the physical locations, as well as community members who do not frequent the library locations and may be intimidated by the vast quantity of resources and activities (IT Roadmap, 2018).

Technology Access

The smallest portion of allocated resources were dedicated to increasing technology access but this is also a long-term initiative that will change along with citizens' needs. The approach of SAPL was to conduct a Talent Modernization Assessment which they described as "an analysis of direct public service staffing to identify actionable insights in meeting community needs generally, but specifically related to digital inclusion and support of customers in using technology" (IT Roadmap, 2018). This assessment reflects the changing attitudes and goals of library service provision to include the importance of public access to technology and digital skills training for more equitable communities (IT Roadmap, 2018).

Limitations

One major limitation to studying the City of San Antonio is the size and resource difference between San Antonio and Bryan. The City of Bryan consists of around 85,000 residents and covers approximately 43.4 Square miles (City of Bryan, 2019) and, even when combined with College Station's population of roughly 114,000, is a fraction of San Antonio's 1.9 million. With 30 locations, SAPL is better able to tailor the services of individual branches to the needs of the local sub-populations, and with a much larger central branch, the number of staff and other resources which can be brought to bear on challenges are vastly greater than those available at any single location in the Bryan/College Station interlocal system. Nonetheless, the values and goals the two systems pursue share common themes of service provision and equity, so that while the options available to a larger system may not correlate directly with the opportunities present in the case of the Bryan system, the methods used and examples of successfully implemented technology are still instructive. Thus, we are hopeful that our assessment and conclusions will still be useful to the City of Bryan Library Services Department, as they remain committed to pursuing technological excellence centered around exemplary community service.

Case Study Findings

Overall, the San Antonio Public Library System - and the Central Branch in particular - provides an exceptional example of pioneering the integration of technology with public service. Along with the aforementioned funded initiatives, there were 19 other proposed projects spanning the 5 year timeline which would have further integrated technology and data analytics into the management and provision of library services. While the unfunded projects cover all three identified best practice categories, the final category of technology access would have been targeted more directly through the Gap Analysis of Public Technology Accessibility (which assesses issues of patrons with disabilities access to technology and services) as well as a Digital Literacy Coaching Service. The technologies and priorities of the SAPL case study will further inform our suggestions and dialogues throughout the upcoming semester as we transition into more detailed research of technology solutions for the Library Services Department's needs.

CONCLUSION OF NEEDS ASSESSMENT

This report has considered professional and academic literature, staff surveys, interviews with leadership, and a case study of a successful library technology development plan to construct a picture of where the Bryan Library Department stands vis-a-vis current technology use and directions worthy of exploration in the next segment of the project. Some general findings of the report are as follows:

1. Each of the three locations in the interlocal system serve unique populations and face challenges distinct to their community and resources.

2. The primary challenges to technology implementation are funding, patron tech literacy, and librarian time to research and develop new methods.

3. Desired technologies include intra-system communication and IT support, mobile library access, improved metadata systems, and basic technology like on-site scanning.

4. Specific programs for investigation and consideration are:

    a. Polaris Leap ILS extension, to improve mobile library capabilities.
    b. EnvisionWare self-service expansions, to enable more streamlined patron access to inventory.

While Polaris Leap and EnvisionWare expansions are at the top of the list for administration, it has been noted more than once that the costs of these add-ons may prove prohibitive (Koeninger, 2019; Jones, 2019). Other requests may prove more feasible in terms of time and resources, but, in any case, careful consideration of budget limitations will be an integral part of the next portion of the project. Attention to the technological capabilities and needs of both staff and patrons will make up an important part of developing the final technology plan, as will consideration of current strengths and opportunities upon which we may capitalize.

SUMMARY OF NEEDS ASSESSMENT

The purpose of this technological needs assessment is to (1) identify parks and recreation departments that use innovative technology and (2) to exemplify best practices in the field and from academic and professional sources. A brief overview of Bryan, TX is outlined and three main objectives for how technology can be used to increase efficiency and effectiveness in the Bryan Parks & Recreation department are identified. Interviews and surveys were conducted with the Bryan Parks & Recreation department head and other full-time staff members to gauge the current use of technology within the department as well as current tasks that can be assisted with the use of technology. This needs assessment contains a comprehensive literature review that discusses the different types of technologies available for parks and recreation departments. Case studies for Plymouth, Minnesota, Plano, Texas, and Allen, Texas served as the framework our team used to assist the Bryan Parks & Recreation department by implementing technology to overcome current challenges in the department and ensure the technology is efficient and effective. Finally, best practices for parks and recreation technology were identified from both the literature review and the case studies to create initial takeaways for the Bryan Parks & Recreation department.

In 2017, Bryan, TX had a population of about 82,000 people and a poverty rate of 23.6% (DATA USA, 2017). With high property taxes and low property value, Bryan, TX operates under a limited budget. Due to this, it is important to assist Bryan through technology to make their work processes more efficient and effective because they currently do not have the time or resources to accomplish all their goals and objectives set for Fiscal Year (FY) 2020 and beyond.

From the literature, case studies, survey, and interviews with Bryan Parks & Recreation employees, our team identified three primary objectives:

- Efficiency and effectiveness could be improved by upgrading the current recreation management software and adding modules that allow for additional risk assessment and maintenance reporting capabilities.

- Collecting data on park usage helps parks and recreation departments in tailoring their services to the needs of their residents.

- Installing WiFi throughout parks and recreation facilities would allow staff to use current and proposed systems and has the ability to foster citizen engagement.

DEPARTMENT HEAD INTERVIEW

Our team conducted an interview with Bryan Parks & Recreation department head Linda Cornelius. A total of 11 questions were asked and her responses have been summarized below. The full list of questions can be found in of Appendix A.

First, Ms. Cornelius explained that their department aims to provide both active and passive leisure activities through parks and recreation facilities to meet the needs of their citizens while enhancing quality of life in Bryan, TX. Along with creating and maintaining parks, trails, and recreation facilities, the Bryan Parks & Recreation department also maintains the city cemeteries. Ms. Cornelius noted that when there is an opportunity to purchase or implement new technology, the staff embraces the idea, but the budget is extremely limited so these opportunities may not arise. Going off of this, the biggest challenge with implementing technology in the Bryan Parks & Recreation department is the budget. Ms. Cornelius mentioned that there is a need for an improved website to see parks, trails, and facilities virtually, smart irrigation systems, WiFi, emergency weather systems, improved field lighting, and new playground/fitness equipment in parks to encourage physical activity. Currently, Bryan's Parks & Recreation department contracts out janitorial and landscaping services, so new technology implemented in those areas would need to be worked out with the contracting companies. To collect data, RecTrac, the department's recreation software, generates reports that determine the use of parks and recreation facilities and a facility work order system is used internally for maintaining facilities. In regard to technology within parks, Ms. Cornelius mentioned that there is a significant amount of vandalism in Bryan which makes some staff hesitant about implementing new technology. Because of this, additional security cameras have been requested. Also, park bathrooms are a main vandalism location, but high costs prevent any technological implementation to stop this. Lastly, Ms. Cornelius indicated that both community-facing and internal technologies would be of interest to Bryan's Parks & Recreation department.

After our questions, Ms. Cornelius discussed the department's plans for a new regional park in Bryan that would hopefully have some of the new technologies that she mentioned in our interview. Overall, this interview was helpful in determining a starting point for researching technology that could be utilized in Bryan parks.

SURVEY ANALYSIS

Our team developed a survey to be distributed among department staff to gauge the use of technology within the department. The Bryan Parks & Recreation Department Survey was sent out on 10/10/2019 to 22 full-time parks and recreation employees and closed on 11/04/2019. A total of 10 responses were recorded from the survey and have been summarized below. A list of the full questions and response data can be found in Appendix B.

A majority of respondents noted that the primary objective of Bryan's Parks & Recreation department is to provide recreation opportunities for citizens and improve the quality of life in Bryan, TX. There were a number of different roles and responsibilities mentioned, including:

- Recruiting for sports events
- Supervising and maintaining aquatic programs
- Training staff
- Providing youth programs
- Overseeing park operations
- Coordinating sports leagues

A majority of the department agrees that they stay up-to-date with new technology, use technology to achieve efficiency, provide training for new technologies, coordinate technology within and with other departments, and foster citizen engagement through technology. According to the survey, the most challenging obstacle regarding technology implementation is the budget. The least challenging obstacle is awareness of alternative funding. This alludes to there being a lack of funds for any technological implementations within the department, but this could be combated with the help of grants and other alternative funding.

When asked which tasks could be improved with the help of technology, the following were mentioned:

- Updating or modifying rentals
- Maintenance tracking
- Program reports to see when and who is visiting the parks and facilities
- Improved marketing strategies
- Centralized irrigation system
- Risk assessment software
- Software for scheduling league teams and updating team standings
- Improved payment processes
- Ability to send out citizen surveys

This is helpful for our team when researching potential technologies that could be adopted by Bryan's Parks & Recreation department.

If given more resources, staff mentioned they would want to implement a lightning/weather detection system, tree risk assessment software, a central irrigation control system, and facility/park inspection software. Hardwired internet would also be beneficial so staff do not have to rely on a wireless hotspot, which can result in slower speeds and frustration for staff. Additionally, updating RecTrac would be a priority; even though all respondents noted that RecTrac is effective, four mentioned that there is some hesitancy within the staff and training would be needed if updated.

Finally, most respondents noted it would be helpful to collect data regarding the following:

- Most popular times for each park
- How long people spend at parks
- Favorite and least favorite aspects of parks or facilities
- Total people using each park
- Total expenses per park

- Most/least popular parks
- Tracking maintenance of parks and/or park facilities

This is beneficial to our team as we can research software that allow for data collection methods similar to this. Our team used the takeaways from the survey, field visits, and interviews to guide the technological needs assessment for the Bryan Parks & Recreation department. Our first step of identifying best practices was conducting a literature review.

LITERATURE REVIEW

A large part of our research came from the UCLA Luskin Center for Innovation's Smart Parks: A Toolkit. This Toolkit consists of a compilation of technologies that help park managers figure out how to incorporate technology into their parks. Not only did the Toolkit introduce new technology, it discussed the challenges that managers may face during implementation. The Toolkit focuses on different park components such as landscape, irrigation, storm water, hardscape, activity spaces, urban furniture and amenities, lighting, and others. The Toolkit addresses the various challenges that parks face today, from "underutilization by the public to diminishing resources, such as funding for programming, maintenance, and staff" (Loukaitou-Sideris, Jessup, Ferdman, Gmoser-Daskalakis, & Hum, 2018, p. 7). Even so, these challenges can be seen as opportunities for park managers to address new approaches for technology and innovative management. The only downside to the Toolkit was that cost of each technology is not specifically addressed.

Landscape

A technology outlined in the Toolkit that could help decrease maintenance costs were automatic lawn mowers (Lokaitou-Sideris et al., 2018). Automatic lawn mowers can be programmed to run every day or several times per week while cutting vegetation into clippings that are fine enough to compost naturally. Gas pollution in the United States leads to numerous health issues and mortality, averaging to cost the U.S. up to hundreds of billions of dollars annually (Lokaitou-Sideris et al., 2018, p. 39). Gas mowers are cited to produce up to 5% of the air pollution in the nation; by using an automatic electric lawn mower, air pollutants and the cost of air pollution in the United States can decrease.

The next landscape implementation that can help save money and deter vandalism is the installation of green walls (Lokaitou-Sideris et al., 2018). Green walls are planting systems that uses vegetation to cover a vertical structure or roof (Lokaitou-Sideris et al., 2018). The health benefits of installing a green wall on a building include increased opportunities for parks visitors to connect with nature, which has been associated with benefits to mental health. Green walls have cooling effects and may reduce the need for air conditioning during some days of facility operation. Depending on the design, green walls can also assist in the treatment for infiltration of storm water or be a part of a department's groundwater recycling strategy. Green walls also serve as a teaching tool for residents to learn how to garden. In regard to operations and maintenance, greens walls help reduce graffiti or other types of vandalism by protecting walls from climbing or being tampered with. Other landscape technologies include: air-pruning containers that support plant health, increase their ability to withstand stress, and reduce the need for frequent re-potting; vibrating pollinators that vibrate near the same frequency as a pollinator's wing to induce

plants to release pollen; and near-infrared photography that can help determine the health of park life (Lokaitou-Sideris et al., 2018, p. 43; p. 53- 54).

The Toolkit identifies smart water controllers as a great way to optimize water use (Loukaitou-Sideris, et al., 2018). These controllers use both soil and weather sensors to determine the amount of water that is needed in a certain area and can be controlled by one central system. Smart water controllers allow for better water conservation and can shut off irrigation systems immediately if a leak is detected or if the area does not need to be watered. Due to this, smart water controllers also have the potential to conserve energy by halting irrigation until it is deemed necessary by the sensors. For example, when the city of Calabasas installed a citywide smart water controller system, they reduced water consumption by more than 25%, achieving savings of 47% from 2016-2017 (Loukaitou-Sideris, et al., 2018). Even though the system cost more than $700,000, they were able to regain its initial investment within five years due to the water savings (Loukaitou-Sideris, et al., 2018). Even without the soil and weather sensors, the centralized system provides easier irrigation data collection and management since all data is stored in one location and can be accessed by multiple staff members, even while offline. This being said, implementing a smart water system requires staff training to understand how to manage it properly.

The Miami-Dade County Parks, Recreation, and Open Spaces Department is seeing the benefit of cost-savings by implementing new irrigation technology. After partnering with IBM's Smarter Cities program, Miami-Dade County installed a system of water values designed to shut off when there is a leak, saving the department about $1M annually (Next City, 2015).

Lighting

According to the Toolkit, proper park lighting can increase park access and safety (Loukaitou-Sideris, et al., 2018). Motion-sensor lights turn on only when motion is detected through an infrared or reflected light sensor, in turn conserving energy. The report notes that motion-sensor lights increase safety within parks as well as decrease maintenance since the lights are not on constantly and do not require manual operation (Loukaitou-Sideris, et al., 2018). Off-grid light fixtures are highlighted as a light source that uses renewable energy, such as solar panels or wind turbines. Off-grid lighting increases safety while reducing energy costs; since these light fixtures are not part of the power grid, they can operate during a power outage as well as save energy (Loukaitou-Sideris, et al., 2018). Unfortunately, these light fixtures can be damaged by inclement weather. If parks have LED lighting, digital additions can be added to the fixtures to track weather, noise, and pedestrian data, though this may be costly and will require professional setup and training (Loukaitou-Sideris, et al., 2018). Lastly, lighting shields are noted as a way to reduce light pollution and energy use while increasing safety. Lighting shields are implemented on top of or around a light fixture to direct the light downward, increasing visibility for individuals at night (Loukaitou-Sideris, et al., 2018). Overall, the lighting technology outlined in the Smart Parks Toolkit increased safety while decreasing energy use and maintenance costs.

Park Technology

The National Recreation and Park Association (NRPA) (2017) outlines new technologies that can be implemented in parks, including WiFi, phone charging benches, mobile applications, QR codes,

and computer banks. WiFi in parks has become more of a necessity and encourages individuals to go out into their community while also allowing the city to collect data on demographics and the number of people in parks. Public/private partnerships are a recurring theme in bringing WiFi to public parks. The City of Sacramento announced that the visitors to Fremont Park can use the free WiFi during hours of operation due to a public/private partnership with Verizon (The Trust for Public Land, 2017). Sacramento plans to have WiFi in all of its 23 parks by the end of 2020. The UCLA Smart Park Toolkit identifies multiple different technologies to be implemented into parks that can be used to promote health and increase visitor use (Loukaitou-Sideris, et al., 2018).

Smart benches are solar-powered and can be used to charge devices while individuals are attending parks. This, along with WiFi, can bring more individuals to parks and has the potential to allow for a longer stay since their devices will be charging as they attend the park (Loukaitou-Sideris, et al., 2018). Smart benches use solar energy to power the charging devices which does not require to be linked to a power grid. Besides the technological benefits, smart benches also provide seating in outside areas. On this same note, solar-powered shade structures can be installed in parks to promote comfort as well as increase the number of visitors attending (Loukaitou-Sideris, et al., 2018).

Park-based information apps are useful for encouraging the public to learn more about the park they are at, easily register for classes or reserve recreation facilities, or report any needed maintenance. Rainey (2018) notes how AR and VR technology can be used in parks and/or park-designed apps to help educate users about the location they are in. The AR app *Play Biba* is focused towards children and can used with playground equipment or other structures within the park. The UCLA Luskin Center for Innovation (2018) also identifies the importance of connecting the community to the parks through apps, whether that be a park-based game or information regarding parks and facilities. Some cities have taken to park-designed apps that use GPS to create games or show information about different parks or trails. If an app is not of interest, the implementation of QR codes along park trails can be directed to a website providing information about that location, which could be useful for the City of Bryan as their citizens are interested in improved park trails.

The Toolkit identifies bicycle and pedestrian counters as a beneficial type of technology since they can be used to collect data on park visitors while encouraging community interest in biking or walking (Loukaitou-Sideris, et al., 2018). If numbers are displayed publicly, visitors can see how many people attend the park during a certain period of time which then has the potential to influence individuals to spend more time biking or walking around the area (Loukaitou-Sideris, et al., 2018). These counters increase the ease of data collection and reliability while reducing the time it takes for staff to collect information.

Another technology mentioned in the Toolkit is energy-generating exercise equipment, which promotes health and can be converted into clean, electric energy. These structures can be used to charge personal devices or send energy to a park's electrical supply if connected to their grid. By providing ways to charge electronic devices, this exercise equipment has the potential to increase visitors to the parks while encouraging health and physical activity for those who may not have access otherwise (Loukaitou-Sideris, et al., 2018). Similar to exercise equipment, interactive play structures use an integrated computer system for virtual games that encourages access for all of the community and increases physical activity (Loukaitou-Sideris, et al., 2018).

Weather Detection Systems

Visitor safety is one of the main concerns for managers and facilities operations. Severe weather is one of the extreme threats to people enjoying outdoor recreation activities (Earth Networks, 2017). The U.S. National Weather Service estimates that 20 to 25 million cloud-to-ground lightning flashes hit the U.S. each year and about two-thirds of all lightning deaths in the U.S. are associated with outdoor recreational activities (Earth Networks, 2017). Lightning detection systems can help park and recreation departments analyze their threat potential to their park locations and provide real-time updates for lightning data and other factors that are necessary to take into consideration with incoming storms. There are two different types of lightning detection systems: lightning prediction systems and lightning detection systems. Like the name mentions, lightning prediction systems anticipate the possibility of a lightning storm based on atmospheric conditions, but cannot offer any meteorological data on real weather events (Earth Networks, 2017). Lightning detection systems can detect lightning discharges in real time and pinpoint exact locations of storms (Earth Networks, 2017). ThorGuard offers lightning prediction technology and the ability to provide audible and visible warnings through remote horns and strobe lights. The company EarthWorks has various severe weather intelligence products and services to help protect and inform residents about dangerous weather including real-time storm tracking, customized mobile alerts, automated high-decibel outdoor audible alerts, and 24/7 access to meteorologists for events (Earth Works, 2019).

Security

For Bryan, ensuring that proper security measures are in place is essential. The National Recreation and Park Association (2017) notes that the installation of better lighting, cameras, or a green wall have the ability to deter vandalism. Shroades (2006) reviews first-hand accounts of facility managers and their experiences with preventing vandalism in the restrooms. Since Minneapolis public schools and the SMU campus have installed cameras, they have seen a significant decrease in vandalism and believe that even with minimal camera installation, there has been a difference. Facility managers from both locations agree that while cameras may be costly upfront, the perception of being watched has led to a decrease in vandalism and an increased feeling of safety from others. Many cities such as Southampton, NY have increased camera presence and switched to LED lighting in hopes to reduce crime in parks (Chinese, 2018).

Urban Forestry

Tree Plotter, an urban forestry software, is used by many local governments, private organizations, and non-profit organizations to manage the number of trees in a set location. Tree Plotter keeps track of all tree types with easy access for data regarding different species of trees, how many should be planted, etcetera. Tree Plotter is used in Davis, CA to plot all trees in the areas offline or online and allowing real-time access by users. All urban forestry information is stored on Tree Plotter's cloud system and provide multiple different modules for their software.

Parks in Philadelphia are using ArcGIS to assign employees to look at risky trees and to alert contractors and custodians of problems more quickly (Next City, 2015). Philadelphia's deputy commissioner of parks and facilities said that his staff is able to be more "efficient, targeted, and

strategic" because they know their top priorities and are able to track their progress on iPads (Next City, 2015). The deputy commissioner also stated that on mowing contractors alone, ArcGIS helped save the department about $355,000 (Next City, 2015).

In Arlington, TX, Cartegraph is used as for both risk and tree management, which may be a viable option to save costs for Bryan. An urban forestry software is beneficial to the Bryan Parks & Recreation department as there currently is no other way to track tree growth, numbers, or risk except for documentation by hand. Additionally, this software has the potential to save money for the department.

Community Benefit

Parks and recreation departments provide numerous benefits to residents and cities. According to a study done by the Justice Policy Institute (2009), for every $1 spent in after school programming, $6 was saved in crime, court, and detention costs. Furthermore, public parks increase residential property values. In a national public opinion survey, 57% of respondents said if they were in the market to buy a new home, they would likely decide on a home that was close to a park and/or open space (Plymouth Parks & Recreation, n.d.).

The numerous social benefits of parks and recreation services help "contribute to the physical and mental well-being of residents by offering visitors opportunities for recreation, education about nature, and social contact" (Lokaitou-Sideris et al., 2018). Additionally, parks help reduce pollution and can increase local property values. Park managers should work closely with their community to identify how technology can be used to develop useful programming that addresses local needs and desires (Lokaitou-Sideris et al., 2018). Overall, the Toolkit showed how technology can be used to overcome operations and maintenance challenges by operating parks while conserving water and energy resources, thus reducing maintenance costs (Lokaitou-Sideris et al., 2018).

CASE STUDIES

Summary

Our team identified three parks and recreation departments that utilize technology to provide an example of what Bryan's Parks & Recreation department can look towards when moving forward with any potential technology implementation. First, Plymouth, Minnesota was selected due to their updated RecTrac software and comprehensive park data collection. Second, Plano, Texas was chosen because of their water conservation methods and centralized irrigation system. Lastly, our team reviewed Allen, Texas due to their eSports programs. Budgets

Plymouth
Updated RecTrac & park data collection

Plano
Water conservation & centralized irrigation system

Allen
eSports
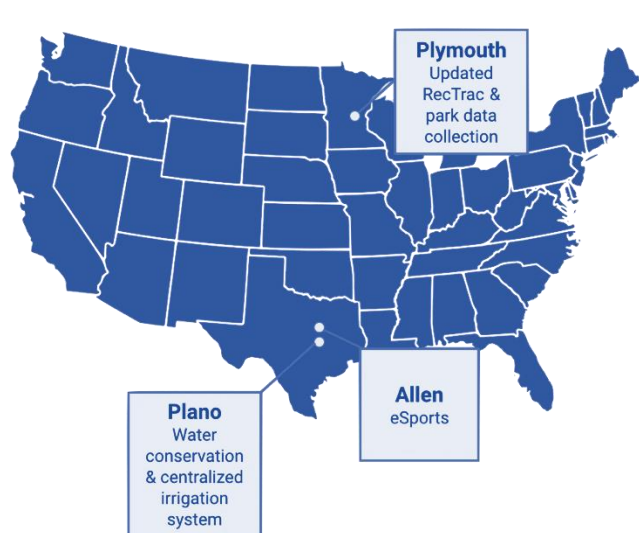
and other relevant financial information for Bryan, Texas and the three cities can be found in the budget information section of Appendix D.

Case Study: Plymouth, Minnesota

The Parks & Recreation department of Plymouth, Minnesota was chosen as a case study due to their up-to-date management systems, additional department divisions, and the National Accreditation received by the Commission for Accreditation of Park and Recreation Agencies (CAPRA). CAPRA is the only national accreditation for parks and recreation agencies and measures a department's overall quality of operation, management, professionalism, and service delivery to the community (Plymouth Parks & Recreation, n.d.). When Plymouth went through an extensive reaccreditation in 2015, it was one of only 97 accredited agencies nationwide. Not only has the Plymouth Parks & Recreation department been recognized for their management and services, but their department also uses different technological tools that the Bryan Parks & Recreation staff noted could help the department increase its efficiency and effectiveness. Additionally, the Plymouth Parks & Recreation system includes 66 developed parks totaling over 1,700 acres, 170.5-mile network of city, state, and regional trails, 58 city and school parks, 7 special use facilities, 9 playfields, and 3 public beaches (City of Plymouth, n.d.).

The Plymouth Parks & Recreation department uses the current version of RecTrac, the recreation management software used by many parks and recreation departments. The updated version is user-friendly and modern. Plymouth also utilizes RecTrac's league scheduling module to assist in an easier way for citizens to sign up for sports teams.

Plymouth has an urban forestry division with the goal to preserve and protect the environment (Plymouth Parks & Recreation, n.d.). This division is responsible for the maintenance and development of parks as well as tree care and preservation. This division allows for the specialization of attention to important park greenery as well as city tree life. Within this division, the software Cartegraph is used to track and maintain tree risk assessments. Plymouth also uses Cartegraph to manage risks for park facilities or equipment which provides a centralized management system to oversee all risk assessments.

Sonya Rippe, Project Coordinator for Plymouth Parks & Recreation, mentioned that their department uses Eco-Counter to track park activity, including popular times, most frequented parks, and other data points. Eco-Counter tools include posts or underground counters that count pedestrians and can differentiate between bikers, walkers, and runners. This data is useful for their department and can be used for marketing strategies, future park events, or projected park updates.

Additionally, the Plymouth Parks & Recreation department communicates transparency and fosters citizen engagement by publishing an annual report. The report outlines a yearly budget overview, current or completed projects, project costs, volunteer contribution, and all special events. Since transparency and accountability in the budget process has been identified as "a pillar of good governance", adding an annual report to the yearly activity guide that Bryan publishes every year can help increase transparency between the department and the community (Carlitz, 2013). When organizations analyze performance data, it can serve as a baseline for decisions, future endeavors and ensure that internal processes are efficient (Hatry, 2006). Having baseline

data on how many people are utilizing certain recreational programs and special events can help the recreation department asses their performance from year to year. Some performance and activity measures are already collected and published in the City of Bryan's annual budget, but improving and expanding a performance measurement system to include measures of meeting the needs and wants of clients and stakeholders, internal business practices, and financial measures can further improve organizational performance (see Developing Objectives of Appendix D).

Plymouth also engages with local businesses to expand program sponsorships; different companies can sponsor an event or an entire year of programs and events. Using these funds helps offset the costs for programs and special events the department holds throughout the year. Besides using Plymouth as a case study for maintenance software and other different technological tools, the department can also provide ideas of different ways that the city of Bryan can raise different revenue.

A challenge with using Plymouth as a case study subject is that they do not divulge any information regarding technology within parks or trails, as was the case for many cities similar in size to Bryan. This makes it difficult to note any technological improvements that Plymouth may have and compare them to the City of Bryan. Additionally, though Plymouth, MN has a population similar to Bryan of roughly 78,000, the poverty rate is only 5.22% (DATA USA, 2017). This is a drastic difference from Bryan's poverty rate of 23.6% and shows that even though these cities are similar in size, their demographic makeup is extremely different which can lead to differences in budget appropriations. This being said, it is clear that Plymouth exceeds in providing easy access for their citizens to register for activities/events along with resources devoted to data collection and urban forestry management.

Case Study: Plano, Texas

The Parks & Recreation department in Plano, Texas has won multiple awards and that is just one of the reasons that this city was chosen as a case study. Plano Parks & Recreation earned regional recognition at the Texas Recreation and Parks Society which recognizes organizations that are involved within the Society that made outstanding contributions to the field of parks and recreation. (City of Plano Parks & Recreation, 2019). The two most recent awards were the Facility Design Excellence Award and the Horizons award (City of Plano Parks & Recreation, 2019). The Facility Design Excellence Award recognizes a recreation facility project that demonstrates a high degree of professional design quality and recreation usage. The specific facility that the Plano Parks & Recreation department designed was an overhaul of their senior recreation center, allowing for senior citizens to partake in various classes that help them maintain a high quality of life. The City of Plano worked with a Dallas architectural firm called SmithGroup for the design on the facility and Byrne Construction Services were utilized as the construction manager for the project. These companies could be a point of contact if the city of Bryan is interested in constructing a senior center. The money for this project was raised through voter approval in a Plano bond election. The Horizons Award recognizes an outstanding professional with less than five years of parks and recreation experience. Their Community Outreach Specialist won the award for her ability to increase the level of awareness and engagement with Plano's Parks & Recreation department in the community (City of Plano Parks & Recreation, 2019).

Assessing what some of the bigger cities are winning awards for gives a full picture of the best practices that can help guide the Bryan Parks & Recreation department in improving their work processes (Data USA, 2017). For recreation management, the department uses ActiveNet which streamlines recreation registration, facility rentals and booking, and reporting. The Plano Parks & Recreation department described their experience with ActiveNet as satisfactory. Plano uses Cartegraph for facility and maintenance reporting and noted that it is continuously being expanded and integrated into additional areas of need. In addition, the Plano Parks & Recreation Planning Division uses ArcGIS to track information and data as well as maintaining data on its inventory.

To gather forestry related information, the planning division uses i-Tree tools. The department uses ICC Pro for their Motorola Intelligent Irrigation Control System and their current water conservation was developed by a collaborative effort of multiple internal departments, spearheaded by the City of Plano Public Works Department. When developing their plan, Plano examined data from surrounding municipalities and the region's main water provider, North Texas Municipal Water District.

To collect data about their residents' utilization of their park services, Plano's Park & Recreation Planning Division installed counters on some of the hike and bike trails throughout the city. In addition, the department has a program called "Weekend Care." During this program, staff members tour the park sites over the weekend for 36-40 weeks per year in order to make a note of the number of users, the type of utilization that occurs during peak times, and to take pictures to document everything visually.

Additionally, WiFi was introduced to a select number of park sites through a partnership with Toyota Motor North America, Time Warner Cable, and American Park Network. Since WiFi was first implemented, the department has worked with Plano's Technology Services to add WiFi to additional parks which will continue to expand on a site-by-site basis as funds and resources become available. It is important to note that not all locations have free WiFi; Time Warner customers have unlimited WiFi access in four of the Plano recreation centers, but for others, only one hour each day is free and then it costs $2.95 per hour (Light, 2016). Even so, the WiFi is helping residents stay connected while utilizing park resources and Plano can use the WiFi system to analyze their park visitation patterns and use the information to promote certain park events.

The Plano Parks & Recreation department has also been rewarded for their Comprehensive Annual Financial Report which gives a detailed explanation of the City of Plano's revenues and expenditures, providing residents with transparency of how money is being spent, and the financial condition of the department. As a result, Plano has been awarded the Certificate of Achievement for Excellence in Financial Reporting for 37 consecutive years.

Case Study: Allen, Texas

The Allen Parks & Recreation department was chosen as a case study city due to their Allen Event Center holding large events, such as eSports tournaments, to bring tourism to their city. Additionally, Allen's Parks & Recreation department was awarded a Gold Medal Award for parks and recreation management from The American Academy for Park and Recreation Administration (AAPRA) and National Recreation and Park Association (NRPA). The Gold Medal Award

recognizes communities in the United States that demonstrate excellence in parks and recreation through long-range planning, resource management, environmental stewardship, program development, volunteerism, professional development, and agency recognition (City of Allen Parks & Recreation, 2017).

The Allen Parks & Recreation department consists of 800 acres of developed park land, about 68 miles for hiking and nature trails, and 67 parks and recreation facilities. Allen has more funding and resources to implement its programs but exploring the parks and recreation departments that are recognized for being the best allow our team to discover what are considered the best practices in the parks and recreation field (Data USA, 2017).

The Allen Parks & Recreation department uses ActiveNet for their recreation software. This software handles all of their facility memberships, facility rentals, recreation program registration, point of sale, and reporting. ActiveNet also communicates with their Musco lighting system through a Skylogix platform. SkyLogix is a software that gives departments the ability to manage their facilities remotely through a laptop, tablet, or smartphone. With these two systems, the department is able to sync their sports field lights with reservation times. Additionally, the department directly exports their financials from ActiveNet into the City of Allen's budgeting software, Munis by Tyler Technologies.
Allen uses CityWorks as their work order and asset management software. CityWorks assists the department in tracking equipment, labor, and maintenance costs associated with preventative maintenance and repairs. GIS is integrated into the system, so the department has the ability to track the location and patterns of their maintenance needs. With the CityWorks software, management can track the work order fulfillment rates and trends of individuals and work crews as well as track both individual trees and areas of trees.

The department has two different centralized irrigation systems, the parks and golf course central controls. For the parks, the department uses a central controlled irrigation system called Interspec. Interspec allows the department to track flow rates based on each individual zone, track soil temps, moisture rates, rainfall, and set parameters which can shut the system down when a leak occurs. For the golf course, the department uses a Toro Osmac System with a Lynx Central Control operation system. The Lynx system allows for control of the system from anywhere to view real-time golf course information to make operational adjustments. Allen noted that the Lynx system allows for better management of resources and potential savings since the software allows for precise calibrations to irrigate exact areas of the golf course and easy programming edits as course conditions or weather impacts change.

Some of the facilities in the park system have WiFi, but not all. Allen Parks & Recreation and Allen IT work together to identify needs, implement connectivity when funds are available, and go through the master plan process to decide how they want to include technology for park facilities.

The Allen Parks & Recreation department used the MyAllen mobile app which allowed residents to quickly report problems or ask questions, but they now plan to use the CitySourced/Rock Solid software platform instead this coming year. This new software is a civic engagement software that

allows residents to contract officials to report problems around the community and other services built specifically for the needs of local government (News Staff, 2019).

To help deter unfavorable behavior, the department has a Park Ambassadors program. Residents who apply and are accepted help report maintenance concerns, report suspicious activity, and serve as a resource to the community by patrolling a city park for at least two hours per month (Allen Parks Foundation, 2019). The department said they do not have a process of collecting statistical data on this, but a Park Ambassadors program might be a useful to deter any unfavorable activity within Bryan parks.

On their advice on how to enter into the eSports market, they recommend that smaller eSports competitions be home grown and organic by partnering with a local eSport lounge business or school clubs.

BEST PRACTICES

Park Technology

From our literature review and case studies, we identified best practices that have increased the effectiveness and efficiency of parks and recreation departments. Providing WiFi in all the parks, phone charging benches, apps, QR codes, and computer banks are all technologies that have helped numerous parks and recreation department engage their residents to increase visitation rates and gave them the ability to gather data on who is visiting the parks.

Plymouth Parks & Recreation uses the Toro Sentinel Water Management Software (WMS) for smart irrigation. Toro Sentinel WMS includes a centralized data system that can access all of their smart controls, ethernet-based controllers, and soil sensors (TORO, n.d.). The WMS has the ability to create water reports based on the data collected through controllers and soil sensors, and all data can be accessed remotely through iPhone or iPad software as well. The Parks & Recreation department in Plano, Texas uses the ICC Pro, which is an irrigation system that provides real-time performance analysis and status reporting of water related processes, instant detection of system failures through text messaging and email, and operating this software is available via mobile phone (Mottech Water Management, n.d.).

Park-designed apps help notify residents about events and give them an opportunity to reserve pavilions, register for events, or leave feedback after visiting a park. A new app in Los Angeles allows park visitors to alert staff when specific areas require immediate maintenance, while Dallas, Oregon has an app with ways to report a problem, view an activity calendar, fill out forms, and more (Dellner, 2017).

Best Technology Practices for Parks & Recreation

Park WiFi

Smart System Irrigation

Cartegraph

Rec Trac

Including exercise-based structures in parks is a great way to promote physical activity and provide exercise equipment to those who may not have access otherwise. This can be beneficial for Bryan parks since providing exercise equipment was mentioned by Ms. Cornelius.

Management Software

RecTrac, a recreation management software by Vermont Systems, assists in the daily tasks for a parks and recreation department. RecTrac has twelve different modules to promote integration and easier reporting within the department (Vermont Systems, n.d.). Popular modules include activity and facility registration, equipment rentals, league scheduling, and more. RecTrac is a beneficial software since everything is centralized in one system where all modules can be managed. RecTrac also has add-on features that include access control, remote lighting control, and messaging services. Access control allows for automated door or gate control which could be beneficial for auto-locking bathroom doors mentioned by Ms. Cornelius to combat vandalism. Remote lighting controls provide the ability to control lighting systems from a central location when necessary. Messaging systems include SMS messaging or RecConnect email messaging allow for parks and recreation departments to target any demographic. This add-on would benefit Bryan Parks & Recreation by giving the department the ability to send out follow-up emails after park or facility rentals. Plymouth, MN uses the most current version of RecTrac with the additional league scheduling model. We identify RecTrac having the upper hand over ActiveNet due to additional modules that can be implemented as the department sees fit.

Risk assessment software allows for departments to effectively maintain parks and recreation facilities by streamlining regular inspections, preventative maintenance, and costs. (Cartegraph, n.d.). These software programs can be helpful for park management as it centralizes risk information and assists in making workflow more efficient. MainTrac is a maintenance software also by Vermont Systems that assists in the management of tasks, facilities, and equipment (Vermont Systems, n.d.). Through MainTrac, staff can track and log different facilities or park structures that require attention. Then, work orders can be submitted and updated through MainTrac. Other modules for MainTrac include asset management and inspection processing, though the base package includes tracking labor and operations. All of MainTrac's capabilities can be fully integrated with RecTrac.

Cartegraph allows for real-time maintenance updates, park and facility risk-tracking, as well as cost and labor management (Cartegraph, n.d.). Cartegraph works by establishing an inventory of all facilities, park equipment, etcetera, then determining how risky each of these are and how to prioritize maintenance, and finally estimating the budget for any updates (Cartegraph, 2019). Cartegraph has a centralized database that can be accessed by staff members to see all aspects of asset management within the city. Cartegraph can also be used for tree maintenance and assessments to view all trees in the area and determine which trees are at risk of falling. Arlington, TX, one city that utilizes this software, noted that Cartegraph assisted in making their risk management and workflows more efficient and was especially helpful during extreme weather where the Parks & Recreation department played a large role in the debris cleanup (Cartegraph, n.d.).

Little Rock, AR Parks & Recreation created their own safety management system (SMS) for risk management through Microsoft Office Suite programs since software was out of their budget. Courtney Perry, Safety & Training Coordinator for Little Rock Parks & Recreation, noted that their SMS was fairly time consuming to create, but works the best for them since it is cost-effective. Little Rock's SMS works by identifying potential risks and determining their severity based on a ranking system (Little Rock Parks & Recreation, 2018). These rankings then determine what should be the proper steps taken in order to mitigate the risk. Courtney mentioned that the department looked into Intelex SMS but decided that creating their own system would give them more flexibility to meet specific needs of the department. After review, Intelex SMS is used mainly for risks within the workplace, but has the ability to be tailored to specific needs. These risks and mitigating actions can be managed on a centralized dashboard, but it is unclear whether this can be used for park risk and maintenance management.

Implementation Challenges

Challenges that may occur when attempting to introduce new technology include budget restrictions, community fit, and specialization. Most technologies introduced in this technological needs assessment will require significant funds to implement within any parks and recreation department. If a department does not have the necessary budget, alternate funding such as grants are also available, but may delay the implementation process. Second, not all technologies may work as intended in every department. A new technology may succeed in one department and fail in another depending on what is needed within the community and desires of citizens. This notion is the same for parks and recreation management systems; if staff members are hesitant about new technology or satisfied with what is currently in place, some new technologies may not achieve the desired results. Finally, many technologies that have been outlined will require some specialization within the department or at least additional staff training. Depending on the technology, this could come at an extra cost to the department or might be an additional barrier to implementation, depending on how staff respond to the training.

Key Report Takeaways

Management

Updating the RecTrac software to the latest version and including additional RecTrac modules would be beneficial to the Bryan Parks & Recreation department. The updated software would be user friendly for both citizens as well as staff members. The additional modules would ensure efficiency and cohesion within the department as only one system would be needed to complete multiple tasks. As per a conversation with Ms. Rippe, their RecTrac software is updated to the latest version and use multiple of the offered modules including Activity Registration, League Scheduling, Facility Reservation, Household Management, and Point of Sale. Ms. Rippe also

mentioned that once the staff learned how to use the updated RecTrac software, there have been no complaints from the staff and it has been helpful in managing their recreation facilities.

Cartegraph would be helpful for the Bryan Parks & Recreation department since it can do risk management, facility and maintenance tracking, and tree risk assessments all in one centralized database. This reduces costs and allows for easier in-house management by having all the information in one location. With Cartegraph, Bryan would be able to implement many of the services that staff indicated would be useful for their department on our survey.

Internet & Collecting Data

Installing WiFi throughout the parks and facilities would allow staff to be more efficient and effective by being able to utilize all the software needed to do their job. The American Park Network (APN) delivers free, high-speed Internet access to parks, beaches, and other high traffic public venues. First, the company will work with the IT department and park management to complete a site survey and use the information to determine appropriate locations for installation of the WiFi system. The company restricts access to any sites that aren't family friendly and they even provide bi-monthly reports that summarize usage patterns, which can further assist parks and recreation departments in learning who and when residents are utilizing park resources. To meet the qualifications for free public WiFi systems, qualified parks need to have more than 500,000 total visitors annually, access to electricity and infrastructure to mount equipment, and have high pedestrian traffic. For smaller parks and recreation centers that don't meet these qualifications, APN offers low-cost, turn-key systems which include site surveys, equipment installation, monitoring, and maintenance.

There were multiple responses indicating different types of data that would be useful for the Parks & Recreation department. As mentioned before, the Plymouth Parks & Recreation department uses Eco-Counter to collect data on trail usage, and after further research into Eco-Counter, it has the potential to assist in park data collection for Bryan. Eco-Counter provides multiple options for pedestrian and bike counters, such as underground trackers, posts, or cameras. Along with this, their Eco-Visio software is compatible with all Eco-Counter tracking services and can present all tracking data in real-time. This data includes park attendance, hourly, weekly, and monthly trends, and most popular times for parks. These data points were among those mentioned in our department survey, so Eco-Counter systems may be a viable option for collecting data on Bryan's parks.

Park Technology

Implementing a smart irrigation system would provide easier irrigation data collection and management through soil and weather sensors through a centralized database. The centralized system provides easier irrigation data collection and management since all data is stored in one location and can be accessed offline. A smart irrigation system would increase safety and resilience by only watering when necessary based on climate conditions and changes in weather. This type of system would also decrease water waste and energy use since the system only runs as needed.

Weather Detection System

A weather detection system that utilizes detection instead of prediction would help the Bryan Parks & Recreation department ensure the safety of the residents and staff. Weather systems such as Earth Networks is a possible fit for the Bryan Parks & Recreation department.

Tourism/Esports

Texas A&M University has a eSport student organization that holds various tournaments and has qualified for larger tournaments throughout Texas. In 2018, more than 700 gamers from the Bryan/College Station area gathered in the Ford Hall of Champions at Kyle Field to host the Texas A&M eSports Experience which consisted of a day of tournaments and a panel of leaders in the gaming industry. This event was a student-led effort and a collaboration between the Division of Sport Management at Texas A&M, the Texas A&M eSports team, Texas A&M Athletics, and the Texas A&M Division of Marketing and Communications in hopes of creating a "recreational and competitive gaming community...and give students real world experiences in event management and production" (Peshek, 2018). Students in a Texas A&M sport management course taught by Dr. Sloane Milstein have to create and host an event that awards them with real-world experience. This might be an opportunity for Bryan Parks & Recreation to partner with students at Texas A&M University to create an eSports event once the regional park construction is complete.

Grant & Fundraising Resources

There are resources for parks and recreation departments to receive additional funding. The Texas Parks & Wildlife department provides a reimbursement of up to 50% to local governments who are developing public park/recreation areas, so long as the grant does not exceed $2,000,000. Reimbursements are granted through five individual programs that are funded through a portion of the state sales tax on sporting goods and through portions of the federal Land and Water Conservation Fund (Texas Parks & Wildlife, n.d.). These grants are distributed annually after the application deadline of October 1st. GameTime, a playground and park facility company, develops a yearly report for different funding opportunities available in regard to parks. GameTime outlines grants at the national, state, and global level (GameTime, 2019). FitLot, a nonprofit that helps build fitness parks, has a grant for $150,000 that can be used to help local parks and recreation departments develop parks that promote physical activity. KaBoom!, an organization that builds parks and playspaces, has multiple different grants available that range from community building to funds allocated for park equipment building. A majority of the grants available were focused on schools, health in schools, or disadvantaged youth; there were very few in GameTime's report that focused on parks or parks and recreation departments.

The above grants are helpful for the Bryan Parks & Recreation department when implementing new park technology; all of the above resources can be used to assist in updating park equipment or building new parks.

CONCLUSION OF NEEDS ASSESSMENT

Through conducting interviews, surveys, field visits, and a literature review, our team was able to analyze the technological needs of the Bryan Parks & Recreation department. Case studies were used to examine how other cities are dealing with needs similar to those of the City of Bryan. Software programs that allow for facility and maintenance risk assessments, data collection, an emergency weather system, a centralized irrigation system, and park WiFi implementation have been identified as technologies that can increase the department's efficiency and effectiveness. Moving forward, our team will work with the department to assess the costs and benefits of technologies that support the identified needs, ensuring the best fit for the department and the city of Bryan overall.

Potential Areas for Future Research:

- Facilities Tracking & Management
- Emergency Weather Systems
- Eco-Counter Data Collection
- Risk Assessment Software
- eSports
- Updated Park Technology
- Park WIFI

PART III:
Technological Recommendations

INTRODUCTION

Utilizing current and emerging technologies can provide cities with tools that enhance services for businesses and residents. The findings from the TNA helped our team identify potential technological solutions for the selected departments that would assist with improving departmental efficiency, effectiveness, and equity. This section of the report seeks to illustrate our team's findings that could be implemented in each department. These solutions are intended to serve as a framework for future adoption and implementation of the suggested technologies.

Technological Recommendation Goals

From January to April of 2020, the individual sub-teams conducted research into available technological solutions for their respective departments. The goals and technological recommendation phase of the project include:

1. *Identifying available technologies and providing recommendations based off necessity.*

2. *Providing practical and affordable implementation strategies.*

Research Processes

Key tasks related to this phase of the project included:

- **Meeting with Department Heads:** The purpose of these interactions were to ensure that (1) needs of the department were being met and (2) that research teams were focusing their time and efforts on the opportunities with the greatest potential for the department.

- **Identifying & Researching Technological Solution Options:** This phase involved gathering information about various technologies by contacting hardware/software companies, meeting with departmental staff, and case study research.

- **Developing Potential Implementation Strategies/Suggestions:** The developed implementation strategies include possible steps for implementing the recommended technologies, as well as measures of performance for identifying success.

INTRODUCTION

The Development and Planning Services sub-team researched and prepared recommendations for adopting new technologies based on findings from the TNA. The sub-team determined the department is successfully carrying out its responsibilities, but there is room for improvement. In particular, the department lacks an online portal system that would aid in tracking permits and building inspections. The City is currently working with their vendor, CentralSquare, to update and implement a new system. The process is ongoing and poses challenges of its own. Specifically, over the past two-and-a-half years, the vendor changed ownership multiple times. This created logistical barriers in the form of time, money, and effort for the City. Switching vendors now may increase the burden of such barriers.

In our initial surveys, interviews, and field visits, we found that launching an online portal is a priority that is almost uniform across the department. Thus, our primary recommendation is for the City to continue its negotiations with CentralSquare in implementing an online portal system. Additionally, our interviews revealed the need for improvement in collecting data and enhancing performance measurements. To improve performance metrics, we recommend the department utilize its current technologies and offer in-house customer satisfaction surveys.

We recognize the problems that may stem from waiting on negotiations with CentralSquare. Because of this, our implementation plan proposes an alternative solution that involves working with new vendors. If CentralSquare fails to provide adequate demos and solutions for the City by FY 2021, our recommendation is for the department to pursue a new vendor. This document is an analysis of our primary and alternative recommendations.

Recommended Solutions

Online Tracking and Permitting

CENTRALSQUARE TECHNOLOGIES

Performance Measure Surveys

Digital Handheld Devices

PROBLEMS & SOLUTIONS

Online Tracking and Permitting System

In January of 2020 we met with the Assistant Director of Development and Planning Services to discuss the findings in the Technological Needs Assessment. The Assistant Director agreed with our initial findings and confirmed the department was already working toward implementing an online portal system with their current software vendor, CentralSquare. To prepare for implementation the department conducted focus groups, collaborated with IT, and researched the software's success in other cities. The City intends to launch CentralSquare's new program, Public Administration, by the end of 2020.

Challenges of the Current Process

One problem that negatively impacts the productivity of the department is HTE, the current tracking software. This system is outdated and difficult for employees to learn and navigate. Additionally, HTE lacks the ability to allow customers and developers to track the status of their permits/inspections, forcing them to call front-desk staff for assistance with tracking and status updates. This creates inefficiencies for front-desk staff by taking time away from their other responsibilities. Survey data and observations from field visits suggest the current system is ineffective and unequitable for employees and customers. In the sections below we identify four software packages that could serve as potential solutions to these barriers.

Technological Solutions

Public Administration by CentralSquare

CentralSquare, previously owned by Superion, is a company that creates development and planning software in municipalities across the country. Superion's software eTRAKiT is currently used by College Station and was the software Bryan was in the process of adopting prior to the change in company ownership. eTRAKiT allows customers to apply and pay for services, permits, and fees, search for properties, schedule and cancel inspections, and renew licenses (City of College Station, n.d.). However, now under ownership of CentralSquare, the company is offering
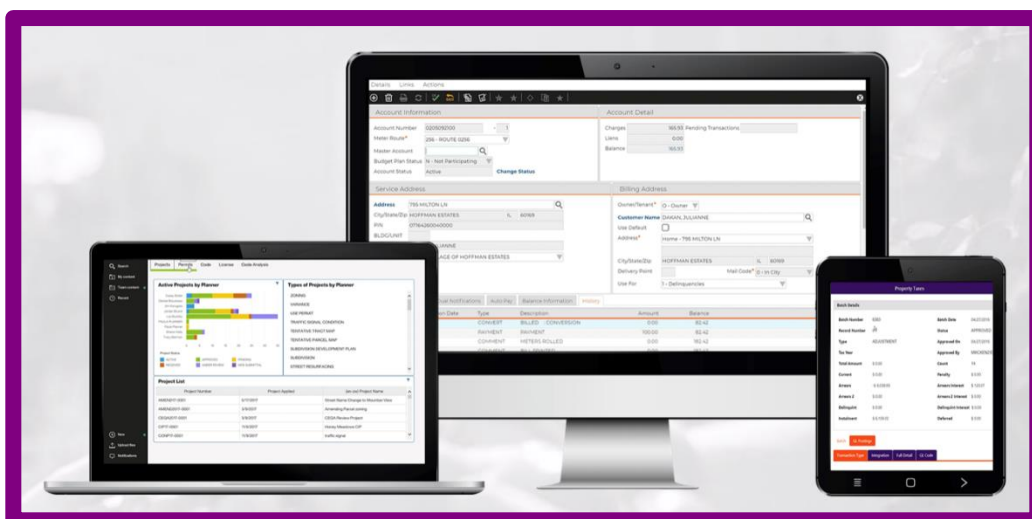
a new software called Public Administration. This program is said to provide the same functions as eTRAKiT, but with greater user accessibility and mobility. Public Administration also utilizes the power of artificial intelligence, interface adaptability, and customer satisfaction through engagement (CentralSquare, 2020).

▪ **Implementation Cost:** The City of Bryan's IT department stated Public Administration was offered to the city at no additional monetary cost (IT interview, 2020).

▪ **Barriers to Implementation:** One potential barrier would be employee adaptability to the new software. The department's long-term use of HTE may lead to difficulties with employees adjusting to the new system. However, as Public Administration is intended to increase accessibility and mobility, we believe this adjustment period will be relatively short.

Citizenserve by Online Solutions, LLC

Citizenserve offers an online permitting software configuration where citizens, businesses, and contractors can access the online portal 24/7. This program automates and streamlines the permitting process, while also allowing customers to view their permit/inspection statuses and pay online (Permitting, n.d.).

▪ **Implementation Cost:** According to Citizenserve's website, the approximate pricing for 20 staff members to use the software is about $36,000 annually. We would like to note this number is an approximation based on the number of employees within the development and IT departments that need access to the software. A set-up fee of $24,000 and data integration costs of $8,000 equate to a first-year total cost of $83,000. This does not account for the need to hire an additional Development Coordinator employee to maintain the software and split the workload amongst existing employees during the transfer period. That cost estimate is roughly an additional $40,000-$50,000 annually. This overall total cost would equate to around $130,000 for the first year, and around $80,000 annually for each following year.
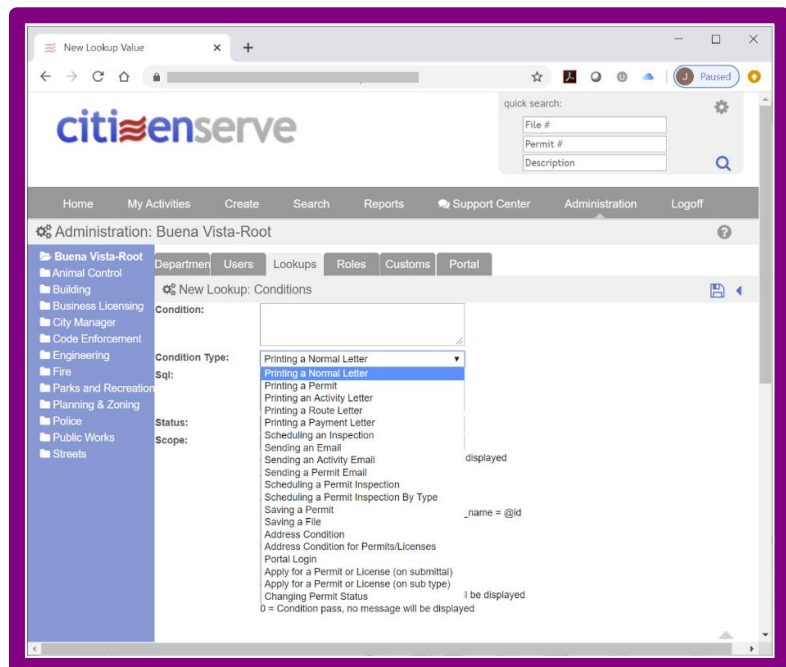
▪ **Barriers to Implementation:** There are logistical barriers to utilizing this alternative vendor because the city is already working with CentralSquare. Adopting Citizenserve would have high monetary costs and would require additional time for the City to learn a

new system and establish relationships with a new vendor. Additionally, the IT Department expressed in interviews that they will not be exploring alternative vendors.

EnerGov by Tyler Technologies

EnerGov is designed to automate and streamline permitting, inspections, code enforcement, and planning and regulatory management processes in municipal governments (EnerGov, n.d.).

- **Implementation Cost:** Tyler Technologies does not publicly provide data on their software pricing. Likewise, they would not release pricing estimates when we attempted to obtain this information.

- **Barriers to Implementation:** Adopting EnerGov would have high monetary costs and would require a substantial time commitment from the City.
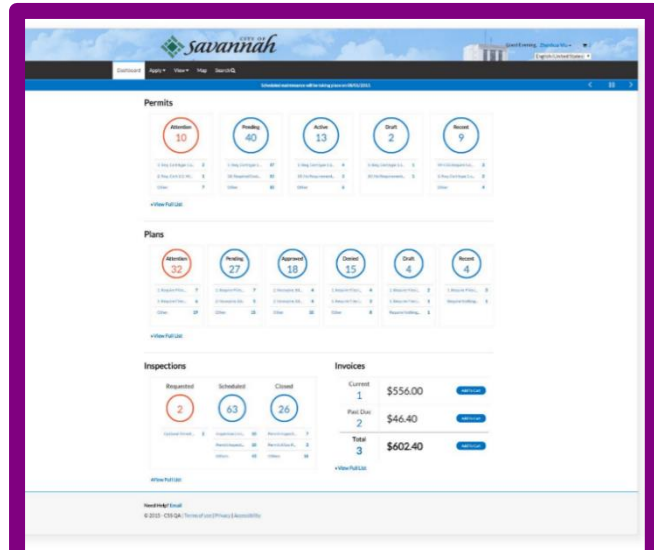
Citizen Access by Accela

Citizen Access is designed to cut turnaround times by creating a digital permitting process. Features of this software include an online citizen portal, electronic document review, data collection and reporting, geographic information systems (GIS) mapping, code enforcement, and mobile inspections (Accelerating Community Development, n.d.).

- **Implementation Cost:** Accela does not provide public cost estimates for Citizen Access. Attempts to contact the vendor were unsuccessful as the phone system was down, and representatives were unable to discuss pricing.

- **Barriers to Implementation:** As with the other alternative vendors, the financial costs and time commitments yield an unlikely adoption of this software.
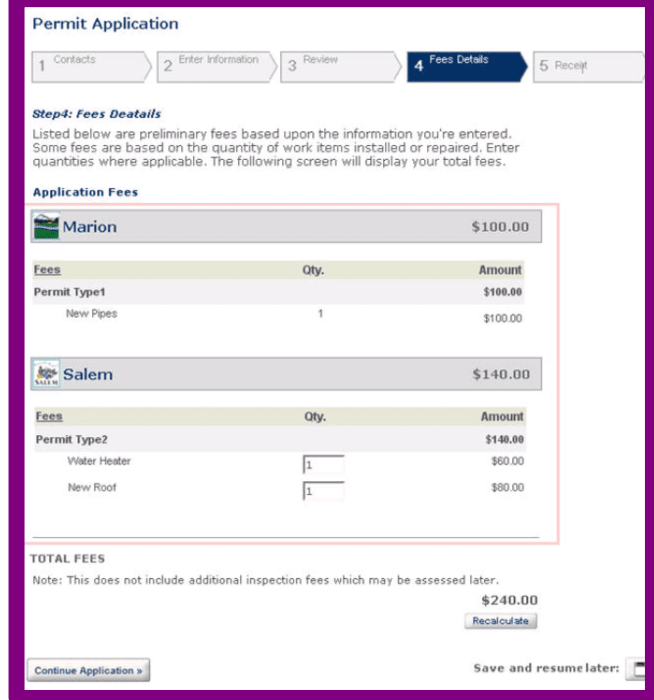
Implementation Plan

Given the City's relationship with its current vendor, and the effort put into implementing Public Administration, we determined it is best to continue working with CentralSquare. No further steps

are needed besides maintaining communication with the vendor and ensuring the demos and system are launched within the appropriate time frame (6 to 12 months, as indicated from previous interviews with the departments).

Additionally, we believe the Development and IT departments should seek to work more cohesively moving forward by increasing and improving communication. Increased communication would reduce information asymmetries between the departments for the remainder of the process, which is likely to improve the overall implementation. If there is a continued time delay in working with CentralSquare it would be of benefit to issue another Request for Proposal for an online portal system.

Expected Outcomes

Efficiency, Equity, and Effectiveness

Launching an online portal system will increase the effectiveness and efficiency of the department by automating tasks that are currently done using HTE. The software will provide customers with the ability to look up building inspections and permit statuses online, thus reducing the time the front-desk staff must spend answering phone calls to report on status updates. An online portal software will also increase equity within the City by providing another method for developers and customers to interact with the department. Users will have the ability to access the online system 24/7, and they will not be limited in their ability to obtain information when no one is in the office.

Performance Measures

Challenges with Current Process

The second problem identified in the TNA is with performance measures. Currently, the department uses quantitative indicators that record counts of output (i.e. the total number of inspections, number of days for review, number of permits issues, etc.). The department engages in individual performance reviews throughout the year, but they lack a qualitative measure to indicate overall customer satisfaction and engagement. A customer satisfaction survey is offered through the City's website, but there are visibility issues as the survey is located at the bottom of the webpage, contributing to a low response rate. As a result, the customer satisfaction surveys are not analyzed as performance metrics (Interview with Development Services, 2020). Additionally, using counts as a sole quantitative indicator for recording performance makes it difficult to track change. Our research indicated that multiple cities use percentages to more accurately depict change over time in an attempt to avoid such difficulties.

Proposed Solution

The overall costs and effort for adopting new performance measures would be relatively low. The Development Services department in Denton, TX uses unique measurements to assess department performance. While the City of Bryan relies on counts of output, Denton uses percentages to record both qualitative and quantitative measurements such as the percentage of applications reviewed and the percent of applications approved (Development Services Department, n.d.). Additionally, Denton counts how many community outreach and citizen education programs they offer.

Denton also has a tablet placed in their office for customers who visit in-person for inquiries and support. After a developer or customer visits the office, they are prompted to fill out a customer satisfaction survey available on tablets in the office. As well, at the end of e-mails from staff within the department is a link asking individuals to engage in the survey. These surveys are powered by SurveyMonkey and the responses are used to internally measure the department's services and performance.

The City of Bryan currently provides a link to their survey at the end of each e-mail and has a link available on their Development Services webpage. The department indicated that they receive few responses on these surveys, and most of the responses are complimentary rather than complaints. A relatively low cost and low effort solution to increasing response rates for the current survey would be to adopt a strategy similar to Denton's.

Technological Solutions

Digital Handheld Devices

A potential form of technology to increase survey responses may be the use of the City's iPads, or a different form of tablet/mobile device that is easily accessible. City employees already have access to these devices, thereby eliminating immediate future costs or barriers for acquiring them.

The development department currently already has a survey, reducing effort in working with IT to prepare these in-office tablets. The City also has the option of switching survey platforms (SurveyMonkey, Google Forms, Qualtrics) if necessary. Some platforms, such as Google Forms, are free and would only require the additional cost of time for analyzing the survey's results.
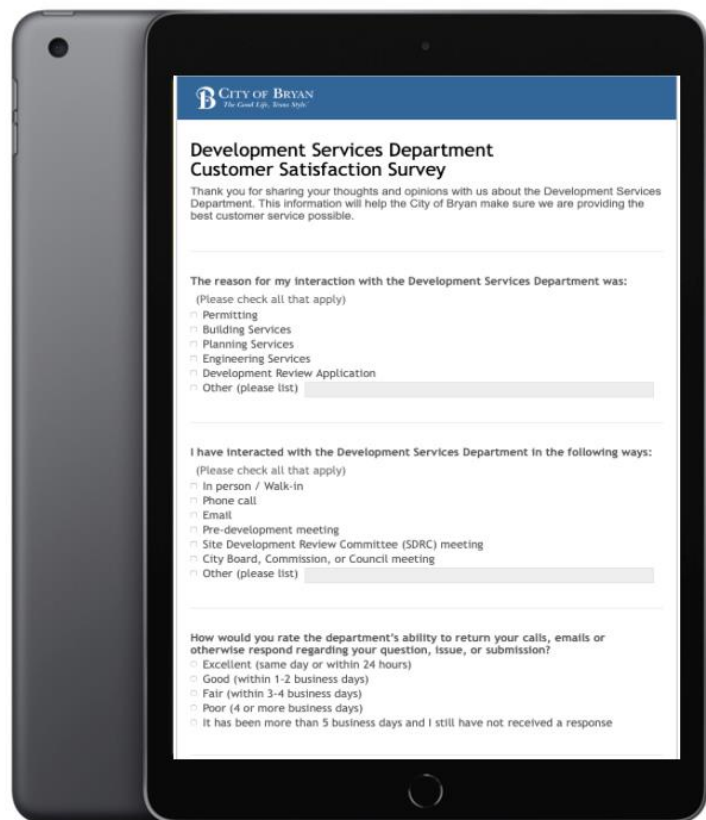
- **Implementation Cost:** In previous field visits and interviews, we learned that there are physical devices the department has access to that are currently being under-utilized. If the department chooses to shift their resources and utilize these devices, this will essentially be a zero-cost solution. However, if the department decides to purchase an additional tablet, the cost will be dependent upon what device the department chooses. Continuing with the current trend of the department's use of iPads, a 10.2-inch iPad can be purchased for $299.00 for 32 GB or $399.00 for 128 GB (Apple Store for Government, 2020). The department would also need to consider purchasing a locking iPad mount to secure the tablet in the office and allow for use. Locking countertop iPad stands range from $50 to $200, depending on the size and style of the mount (Displays2Go, n.d.).

- **Barriers to Implementation:** There are very few barriers to implementation. One potential barrier is that the department currently does not analyze the survey results and incorporate them into their performance metrics. Thus, if they are not currently analyzing the survey results, there would be some effort in taking the time to analyze the responses.

Implementation Plan

Implementation is intended to be fairly simple and low cost. The department's current customer satisfaction survey captures the reason for interacting with the department, method of interaction, rating of their interaction, and overall satisfaction. This survey is not heavily utilized in their performance measurements, as the city does not receive a substantial number of responses. Since the department already has a survey designed, this can be prompted on the tablet screen in the department, requiring little time or effort for implementation. We believe that, upon deciding what forms of technologies to use, the department will be easily able to provide the in-person surveys.

Expected Outcomes

Equity, Effectiveness, and Efficiency

Using the city's current resources to add an iPad or tablet in the department would be an effective way to increase the response rate to the department's current customer satisfaction survey. Providing a way to increase survey response rates and incorporate the responses into the overall measurement of the department's performance is an effective way to enhance performance measures. The in-house survey is an equitable and low-cost way to increase response rates for those that walk-in or have in-person appointments.

In line with the overall goals and objectives for the department, analyzing customer feedback and incorporating the results into performance measurements (whether published externally or recorded and discussed internally) can provide opportunities for improvement in the future. With a high priority of customer engagement and an emphasis on serving their community, the department can only benefit from adopting these strategies.

PRIMARY RECOMMENDATION

The City of Bryan's Development and Planning Services Department has been working to launch an online portal system for years, and situations external to the City and internal to the current vendor have slowed the City's efforts. Although we propose that the City continue to follow through with their current negotiations, an alternative solution would be to pursue a new vendor. The reason behind this being an alternative solution is due to the time, costs, and effort the city has already invested in CentralSquare. If CentralSquare continues to delay their deliverables to the City, by FY 2021 the City should reconsider this option and choose a new vendor, despite the sunk costs and time.

Additionally, given that the City does not have an online portal system, the department experiences several phone calls and high foot traffic each day. We recommend that the department places a digital handheld device in their front office to capture survey responses for those who walk in. Capturing these responses will provide a low cost and low effort way to incorporate customer satisfaction results into their current performance measurements.

CONCLUSION

We believe our primary recommendation and alternative solutions are adequate as they obtain the goal of increasing effectiveness, efficiency, and equity within the department. The process of incorporating an online portal system is one that will continue to take time and effort, along with the cohesion and synergy of multiple departments within the City. These steps, however, are necessary for both the City and customers hoping to accelerate the current process. As well, adopting enhanced performance metrics will provide the department with a better visual for their performance over given periods of time. While it is important to be cognizant of the potential barriers and costs these programs and metrics may impose, it is equally important to be aware of their benefit for all involved.

Introduction

In an effort to support the Bryan Fire Department in pursuing its mission to protect both citizens and property, the Fire Department sub team identified several opportunities to enhance departmental efficiency, effectiveness, and equity. Opportunities were identified by conducting a TNA that included reviewing academic and professional literature, developing case studies, conducting interviews and field visits, and surveying Bryan firefighters. Based on this research, the sub-team found that the Fire Department would benefit from employing technologies related to workflow synchronization, data-integration systems, drones and robots, thermal imaging cameras, simulation and mapping software, and recording technologies. While addressing each of these technologies would assist the Bryan Fire Department in improving departmental efficiency, effectiveness, and equity, our team will not explore all of these topics in this section of the report. This section focuses on providing technological recommendations for specific opportunities that were selected using information gathered from the TNA and based on input from Chief McGregor.
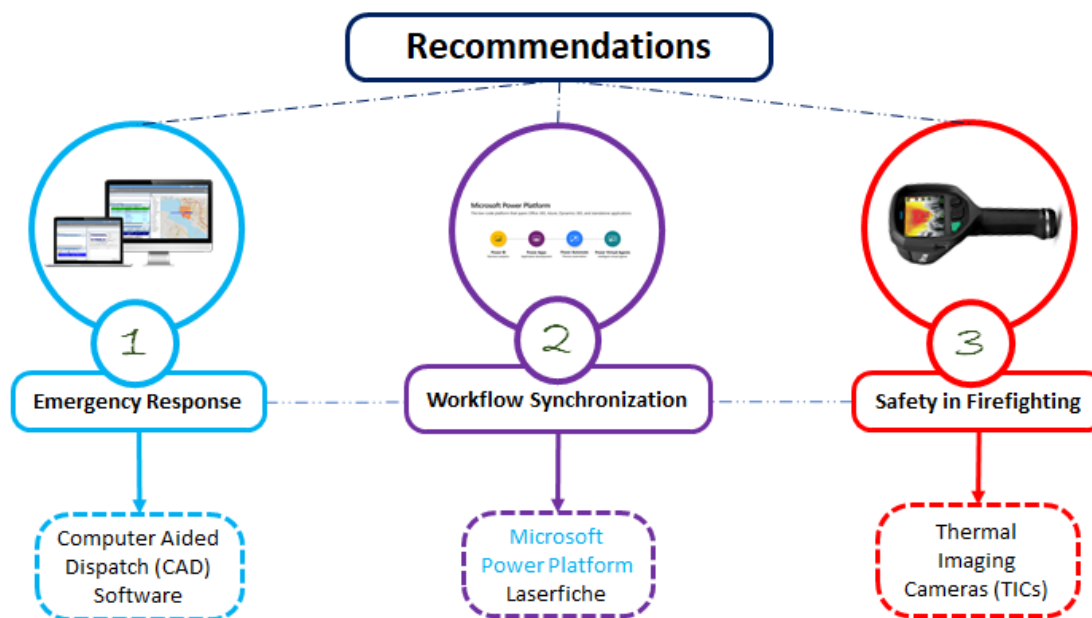
On January 31st, 2020, the Fire Department sub-team met with Fire Chief Randy McGregor to discuss initial findings from the Technological Needs Assessment (TNA) submitted to the City of Bryan in December of 2019. The TNA aimed to present new or existing technology opportunities to the Bryan Fire Department that would increase the efficiency and effectiveness of the department. Initial discussion with Chief McGregor regarding the various technologies discussed in the report were met with a warm response. He agreed with the assessment and expressed his hope that the implementation of new technologies increase firefighter safety and increase the efficiency of the department.

Chief McGregor identified three areas of focus for our recommendations: (1) emergency response, (2) records management, and (3) firefighters' safety. He specifically suggested to us to look for an updated computer-assisted dispatch (CAD) system that would be used by both the fire department and police department, a workflow platform that would allow for better records management by the Department, and new thermal imaging cameras (TICs) that could be on the body of every firefighter.

Opportunities & Solutions

Emergency Response

Reducing response time, coordinating teams, and managing multi-team responses all play a significant role in efficient and timely responses to emergencies. For firefighters to save the most lives and protect the most property, the right units must be sent to the right place in the fastest possible time. Therefore, the Bryan Fire Department needs to have the best and latest technology to effectively and efficiently respond to emergency calls for combating fire and for saving lives. That is why we are recommending that the Bryan Fire Department obtain a new CAD system to replace the 15-year-old one that is currently used.

Technological Solutions

Computer Aided Dispatch (CAD) Software

Chief McGregor indicated that the City of Bryan recently began looking into a new CAD system, as the one currently in use is becoming outdated. CAD systems, in the context of emergency services, are used to send messages to the dispatcher via a mobile data terminal as well as store and retrieve various data (Horn, 2005). CAD provides displays and tools that significantly improve dispatcher efficiency (Horn, 2005). A CAD system primarily does three jobs: it receives emergency calls, locates them, and then shares information immediately between responders, dispatchers, and supervisors (Central Square, 2020). All users can have access to information through their phones, tablets, and computers. After dispatching to a location, firefighters can report through the system to their supervisors. The data of each dispatch unit are stored in the system. Managers and dispatch units can analyze the data at any time later.

Next Generation 911 (NG911) is at the cutting edge of emergency response technology systems in the United States. Most 911 systems were originally built using analog systems (NG911, n.d.). For improved efficiency and effectiveness, it is necessary to upgrade the system to digital from analog systems. This transition expands the standard operating capacity of an emergency system

by allowing new forms of input into the system from civilians as well as improved tracking software (National 911 Program, n.d.). If successfully implemented around the country, NG911 could become the template for safe and resilient modern-day emergency communication. It is already implemented in public and private sectors across both the United States and Canada (NG911 Transition Policy Implementation Handbook, 2010; National 911 Program, n.d.).

The current challenge facing emergency response centers and municipalities is that the currently implemented CAD systems cannot properly handle the NG911 and other similar software. To meet these needs, the next generation of computer-aided dispatch (NGCAD) is in development (Sharah, Al-Mashari, Hossain, 2017). The systems of NGCAD are designed to utilize better and optimize new inflows of information from NG911(Sharah, Al-Mashari, Hossain, 2017). The primary barrier for implementation of NGCAD is the lack of research and understanding of CAD systems and how to optimize them (Sharah, Al-Mashari, Hossain, 2017).

For overcoming these issues, it is recommended that standardized awareness, education, and training programs about NG911 and NGCAD be established and maintained for public and private users of CAD systems (Sharah, Al-Mashari, Hossain, 2017). If municipalities can understand the various systems within the programs and how they interact to improve emergency services, they will become more efficient (Sharah, Al-Mashari, Hossain, 2017). Though municipalities can facilitate a better understanding of these systems, the policymaking and legislation to govern the various issues about NG911 have been dim (Moore, 2011). This includes the policies related to governance, decision making, cost estimates, source of revenue, spectrum management, and technologies as they pertain to NG911 and NGCAD (Moore, 2011). Time will tell if more focused state and national legislation will be passed to facilitate these next steps in emergency service provision. Though NGCAD and NG911 show promise for the future of emergency service dispatching and response, these are changes that will likely funnel down from the national level (Moore, 2011; Sharah, Al-Mashari, Hossain, 2017).

Information regarding NG911 and NGCAD have been included in this report in an attempt to keep the Bryan Fire Department aware of these potentially "game-changing" technologies and how to handle them once they begin being used. It would be detrimental for the Department and the rest of the city to not be aware of NG911 and how it will soon be changing how emergency response situations will be dealt with. Additionally, having an understanding of NG911 and NGCAD is beneficial to the Department now as many of the shortcomings associated with the implementation of new CAD systems can be mitigated in the same ways that struggles regarding NG911 and NGCAD would be.

Specific CAD systems that the Bryan Fire Department should consider as replacements to their current system include the Omnigo CAD and Central Square CAD systems. Both systems provide a plethora of features that allow for faster, and more accurate emergency response times (Omnigo 911 Dispatch software, n.d.; Central Square Technologies: Computer-Aided Dispatch Software, n.d.) :

Omnigo 911 Dispatch Software:
- the ability to connect Bryan's dispatch system to federal, state, regional, and other third-party systems

- customizable software design and terminology to fit the established norms of the current dispatch teams
- real-time "side-along" training capabilities that allows dispatchers to use the software without being live on the air
- up-to-date security installations that keep the system safe and secure

Central Square CAD System:
- customizable workflow and response plan for police, fire, and EMS
- automated recommendation capabilities
- direct out-bound messaging to emergency personnel of a caller's location
- utilizes Tellus systems that allows for easier and more effective CAD to CAD communications that can range over multiple jurisdictions

Moreover, both Omnigo and CentralSquare offer a records management system that can fully synchronize with their respective CAD system (Omnigo 911 Dispatch Software, n.d.; CentralSquare Technologies: Computer Aided Dispatch Software, n.d.). This would allow the Department to establish standards of what information they would want from the CAD system following calls to funnel into their records system. (Omnigo, 911 Dispatch Software, n.d.; CentralSquare Technologies: Computer-Aided Dispatch Software, n.d.).

- **Cost and Benefits**

  Though cost points were not able to be taken from Omnigo and CentralSquare, the cost of CAD systems generally varies greatly. They can range from $500,000 to several million dollars depending on the potential updating of the hardware system, software license, installation, and several other associated costs (Office of the Legislative Auditor, n.d.). The department and local dispatchers will almost certainly need training regarding a new system for efficient use of the system, thus increasing the initial costs. The primary cost will come in the form of licensing and installation of the system, with the secondary cost being in the training of staff to properly utilize the system. As mentioned, some systems have sophisticated training capabilities to better facilitate the learning process.

- **Expected Outcomes and Measures of Success**

  Updating the current CAD system has a direct impact on the efficiency and effectiveness of the Fire Department to save lives and property. It enables supervisors to use their resources more quickly and equips dispatch units to respond rapidly and efficiently to the emergency. An easily measured outcome of a new CAD
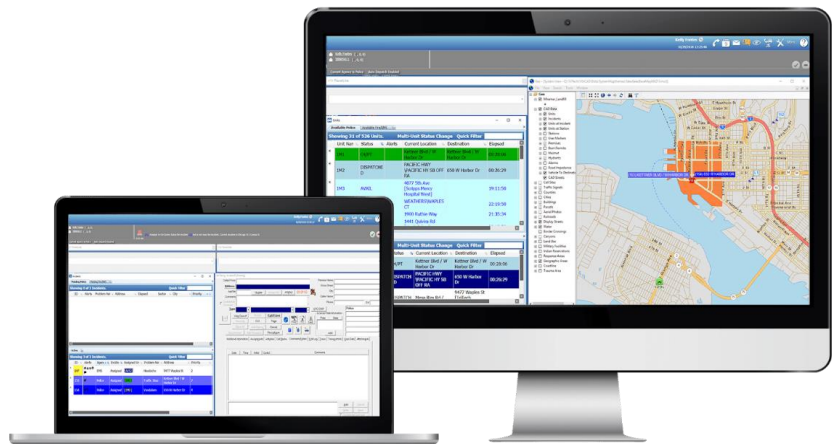
system would be its impact on emergency response time. The Department would be able to continue to measure average response times under the current CAD system and measure the average response times under a new system. While it is unlikely that there will be calls coming from the same locations that would allow for a direct comparison between systems, the Department could measure response times based on average distance traveled while accounting for variables such as time of the day and weather.

Workflow Synchronization

Challenges

Workflow synchronization is necessary for saving time and resources. Synchronization converges two parallel systems into one. One of the challenges for firefighters and other staff in the Department is reporting to two different platforms. For reducing the time of reporting, synchronization of workflow platforms is essential. The synchronization of workflow platforms would not only allow for more efficient reporting but could allow for the automation of some repetitive administrative tasks.

The main challenge with the current workflow platform in the Brayan Fire Department is reporting to two different platforms. Firefighters have to report to two different systems each month. The issue was raised both in interviews and in survey questions.

Technological Solution

With the rise of AI, workflow platforms have gradually become better at automating repetitive tasks while remaining flexible enough to adjust to different environments. Currently, there are several competitors in the market of smart workflow platforms such as Microsoft Power Platform, Laserfiche, and many other platforms.

Our primary recommendation is Laserfiche. Laserfiche is another type of workflow platform that is being used by the Bryan IT Department. The city has the license of this platform and has extensive experience with this platform. Moreover, we would like to introduce the Microsoft Power Platform as a secondary option.

Microsoft Power Platform

In 2018, Microsoft rolled out the Power Platform. Power Platform provides three useful tools: (1) PowerApps, (2) Power BI, and (3) Microsoft Flow (Knight, 2019). PowerApps is a tool for creating applications for replacing paper-based processes into an app that could be used both on a smartphone or in a web browser (Knight, 2019). If used with mobile phones, it can enable the integration of mobile phone features such as cameras, GPS, or microphones. Microsoft flow is a tool that enables the automation of routine tasks, such as approval of leaving requests or tasks or uploading site visit photos (Microsoft, 2020). Power BI is a dashboarding tool, designed to create reports and analytics of the operations and tasks.

- **Cost**

  The Microsoft Power Platform has two types of cost: purchasing and training. Microsoft offers different prices for different user types. For an individual user, the price starts from $10 per user per month (Microsoft, 2019). For organizations and departments, the price is $500 per month (Microsoft, 2019). The benefits of the program include the possibility of task automation and greatly enhanced efficiency in reporting.

- **Expected Outcomes and Measures of Success**

  Using the Microsoft Power Platform increases efficiency in two ways. First, the tool enables users to integrate different Microsoft products such as MS Office and other tools into task automation and app creation. Second, the tool can reduce the application development - in the case of need for new applications or automating a repetitive task - cost and effort up to 70%. Also it can increase process automation and efficiencies up to 15% (Forrester, 2018).

Laserfiche

Our primary recommendation is Laserfiche software for workflow platform synchronization. Laserfiche is an international provider of business process automation and content management (Laserfiche, 2020). The platform eliminates manual processes and replaces them with e-forms, e-documents, and provides analytics (Laserfiche, 2020). Moreover, for mission-critical processes, it has the option to eliminate emails, spreadsheets, and administrative processes. Finally, Laserfiche has a content management option. It can digitally capture videos, images, and documents (Laserfiche, 2020).

- **Cost**

There is no direct cost for using Laserfiche. The Bryan IT Department has the license of the software and can install it in the Fire Department computers. However, there are indirect costs associated with the offboarding and onboarding of the application. Also, the Fire Department may need training on using the Laserfiche.

- **Expected Outcomes and Measures of Success**

It is expected that employing the Laserfiche workflow platform increases efficiency in two ways. First, it can automate some of the repetitive administrative processes such as filling out forms, asking for approvals, and turning multiple forms into one single document. Also, it tracks how long it takes to process each form and identify each bottleneck in the process (Laserfiche, 2020). Moreover, the IT Department can help the Fire Department to identify repetitive tasks. By identifying these tasks, they could be automated, which can save time and lead to efficiency in the Department. It is a long-term process and requires cross-department coordination.

Safety in Firefighting

Challenges

The dangers in the line of duty for firefighters and EMS workers are ever present and easily understood. As firefighting and EMS technology has advanced, much of it has done so with the purpose of improving the safety of those in the field: stronger facemasks, safer ways to administer medical aid, flame resistant gear, have all been established with the aim of saving lives within the field. Thermal imaging cameras (TICs) improve the safety of firefighters by allowing them to be more situationally aware while they work in dangerous environments. Chief McGregor made it explicitly clear that he hoped to utilize more TICs to increase the safety, efficiency, and effectiveness of the Department.

Technological Solutions

Thermal Imaging Cameras (TICs)

TICs have become a mainstay in modern-day firefighting (Amon, Bryner, Lock, Hamins, 2008). They enable firefighters to accurately measure the temperature of heated areas, enhance decision-making ability during a fire, and increase firefighters' overall effectiveness in the field. From search and rescue of civilians and downed firefighters to detecting points of origins for fires, TICs are a vital and versatile tool in the modern firefighting arsenal (Avillom 2002; Szajewka, 2017). The versatility that TICs demonstrate their effectiveness and their importance for the safety of firefighters. Ideally, the department would utilize TICs that only require one hand to operate, allowing a greater range of motion for the firefighter and improving safety in the field (McGregor, 2019). Originally, the goal was to obtain TICs that could be mounted on the firefighters' helmets to extend safety and flexibility. However, the technology to make this style of TIC viable in the field is not yet available (McGregor, 2019; Szajewka, 2017).

Though the technology is seemingly straightforward, there are still potential implementation barriers to overcome. A universal problem with implementing TICs is purchasing them with the intention of easy use without training (Starnes, 2018). Before TICs are purchased, departments should research the capabilities of these devices and what they hope to gain from their use (Starnes, 2018). Bryan is able to perform this research, as on-site leadership inquired about this technology in the past. TIC-targeted training is another common downfall of fire departments, however, Bryan also has the capacity to overcome this barrier (Starnes 2018, McGregor 2019). The department already uses TICs and is successful in its virtual training sessions. This suggests they should have little issue with department-wide education and training for implementation. The National Fire Protection Association (NFPA), an "international nonprofit devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards," understands the growing relevance of TICs in global firefighting. As such, they established a substantive list of considerations on the education and training of TIC usage (NFPA, n.d.). This guidance, in part, states (Starnes, 2018):

- Both individuals and crews TIC training regiments should be enacted

- The authority having jurisdiction (AHJ) shall establish written policies for TIC training that meet the requirements of any established standards

- Policies shall address the training requirements for types of incidents where TICs may be used

- The training policy shall include an annual review of member competence in TIC technology, operation, application, use and limitations, care, and maintenance

The Bryan Fire Department currently has the means to overcome these barriers and can mitigate nearly all implementation difficulties with TICs through careful planning. The solution for implementation struggles regarding TIC usage entails increasing the technical experience and knowledge of the firefighters that use them.

Several suppliers sell thermal imaging cameras. FLIR K55 is one type of these cameras. It can store videos and photos that can be played back in the camera or on a computer. Firefighters can hold it with one hand and have a 10-year warranty for its detector (Western Fire Supply, 2020). Another type of camera is the EVOLUTION® 6000 Xtreme Thermal Imaging Camera. In addition to video recording, it is equipped with a rangefinder and a laser pointer (MSA, 2020). Many features of TICs such as video and picture recording, and laser pointers, are congruent across models and the differences between them are limited. If the Department plans on implementing wide-spread TIC usage, they will have to pinpoint the minute features they hope to have with the cameras and use this as a starting point for purchasing.

- **Cost**

  While this technology is costly, ranging from hundreds to thousands of dollars per camera, it has become a major firefighting tool with a plethora of applications that would be highly valuable to the Department (McGregor, 2019; Avillo, 2002; Szajewska, 2017). FLIR K55 cameras were found to be on the higher end of the cost spectrum costing $5,995.00 per device, with EVOLUTION 6000 TICs costing as low as $246 per device (Western Fire Supply, 2020; MSA, 2020). Commonplace across nearly all TIC manufactures are slight variations on nearly identical devices, leading to wide-ranging prices. The cost is highly dependent on the number of cameras the Department decides to purchase. Purchasing one for every firefighter in the Department would be quite costly, while having one for every firefighter per shift might be a more feasible purchase.

- **Expected Outcomes and Measures of Success**

  TICs have two types of impacts on saving lives and protecting properties. By using TICs, firefighters can pinpoint the epicenter of a fire outbreak in a building. It also enables firefighters to make an early decision on leaving a building if it is too dangerous for them to stop the fire – especially when a building is collapsing. It is one of the most efficient technologies that not only saves lives but saves resources by pinpointing the epicenter of a fire outbreak. The primary expected outcome of wide-spread TIC usage by the Department

is an increase in firefighter's situational awareness. Situational awareness has multiple methods of measurement, but the most common approaches to measurement are direct experimental techniques (Adams, Tenny, Pew, 1995). For example, the Situation Awareness Global Assessment Technique (SAGAT), is one of the most well-developed and widely used direct experimental technique that allows an organization to measure the situational awareness of its employees through controlled scenarios by "freezing" citations to get verbal information from the participants (Endsley, 2000). We recommend that when attempting to measure the impact of TIC usage, the Department utilize SAGAT and other direct experimental techniques to measure the situational awareness of firefighters without TICs, while using TICs, and after using TICs.

Expected Outcomes: Equity, Effectiveness, and Efficiency

These three recommendations have the potential to increase the efficiency and effectiveness of the Bryan Fire Department. The objectives of the Fire Department are measured in the value of the property saved, emergency response times, lives saved, and safety of firefighters and EMS staff. The degree to which organizational efficiency and effectiveness are attained could be a relevant measure and relationship between output and inputs. For example, TICs can help firefighters to make quick and effective decisions, which can lead to saving lives, and more efficient use of resources. Also, CAD systems are used for communicating with dispatched teams via a mobile data terminal or used for storing or retrieving various data, which is vital in making efficient and fact-based decisions. Finally, firefighters use two types of reporting formats, which contribute to wasted time for fire department staff. Using a single workflow platform not only saves time but also aids in the efficient maintenance of the Bryan systems by the IT Department.

The updated CAD system increases equitable access to each emergency service for every resident of Bryan City. The system provides unparalleled access to the caller information and automated tools to send the right responder to the right location with critical data (CentralSquare, 2020). Better 911 emergency call services mean every individual irrespective of their age and background have better services at the time when they need it the most.

CONCLUSION

Though we recommend that the department seriously inquires about implementing a new CAD system, TICs, and a workflow processing system, we understand the difficulty in doing so. Subsequently, we established a primary recommendation with the idea that just implementing this technology would significantly improve the efficiency and effectiveness of the department.

Our primary recommendation to the Fire Department is to prioritize the purchasing and department-wide use of TICs. Of the three recommended pieces of technology, TICs allow for the greatest increase in efficiency and effectiveness of the department. TICs additionally address the key concern of firefighter safety while simultaneously having the lowest implementation cost and potential training curve. Regarding a single system workflow platform and a CAD system, these technologies will require a broader and more expensive implementation strategy that would heavily include the IT and Police Department.

With that being said, we recommended the full synchronization of a Laserfiche workflow platform. This would allow for a more efficient and concise records management system within the department as well as keep costs down as the City has licensing to Laserfiche. Furthermore, other departments use or are being recommended Laserfiche as a workflow platform. Were the Fire Department to follow suit, it would allow for uniformity and shared understanding across departments. Regarding a CAD system, we recommend that the Central Square CAD system. Central Square offers a system with all of the needed modern-day capabilities of a CAD system at a self-proclaimed "fair price". Additionally, Central Square software is being recommended to other departments so licensing fees have the potential of being diminished if Central Square technologies were to be implemented across multiple departments.

Implementing these recommendations will likely require a compromise among competing values between the departments if they have different views on efficiency and effectiveness, on the implementation process, and the technical details of recommendations. However, if the Fire Department can overcome obstacles and coordinate the implementation of the proposed primary recommendations, then the department will see improvements related to efficiency, effectiveness, and equity

INTRODUCTION

After an extensive research process our team conducted a TNA for the IT Department that identified six opportunities to improve efficiency and effectiveness. These recommendations included areas of opportunity related to task management, mobile device management, automation, employee offboarding, lifetime vulnerability tracking, and hard drive imaging. After consulting with the Chief Information Officer (CIO) and other IT supervisors, it was determined that our team would focus its attention on providing recommendations regarding technological solutions and implementation plans to improve *the onboarding, offboarding, promotions, and transfers processes* (collectively termed in this report as employee management processes) and *hard drive imaging*. Based on our exploration of possible technological solutions for these challenges, our team recommends that the IT department increase effectiveness and efficiency of employee management processes and hard drive imaging by implementing Laserfiche and Symantec Ghost.

PROBLEMS & SOLUTIONS

Onboarding, Offboarding, Transfer, and Promotions

The employee management processes of onboarding, offboarding, position transfers, and promotions represent key events for an employee in an organization. How these employee management processes are carried out within the City of Bryan can affect both individuals and departments in their ability to effectively and efficiently carry out their duties. While successfully executing these employee management processes requires coordination among a variety of City departments, the IT Department plays a unique role in providing and/or removing access for employees to

Onboarding	Process of assisting new employees with adjusting to social and performance aspects of a new job (Bauer, 2010).
Offboarding	Process of transitioning an employee (voluntarily or involuntarily) out of the organization (Olson and GetFive, 2019).
Transfer	Process of transitioning an employee to a new role and/or department that is not the result of a promotion.
Promotion	Process of transitioning an employee to a higher level of responsibility and compensation.

appropriate programs, files, email groups, technology, etc. Additionally, IT ensures that new employees receive cybersecurity training through KnowBe4 (KnowBe4 is a cybersecurity awareness program that assists employees with identifying, avoiding, and reporting threats), as well as making sure that employees are assigned to a supervisor who will help to monitor an employee's cybersecurity training status.

Discussions with staff from the IT and Human Resource Departments provided key information regarding the role that IT plays in providing and removing access in the employee management process. An outline of this process is provided below:

Current Workflow Process
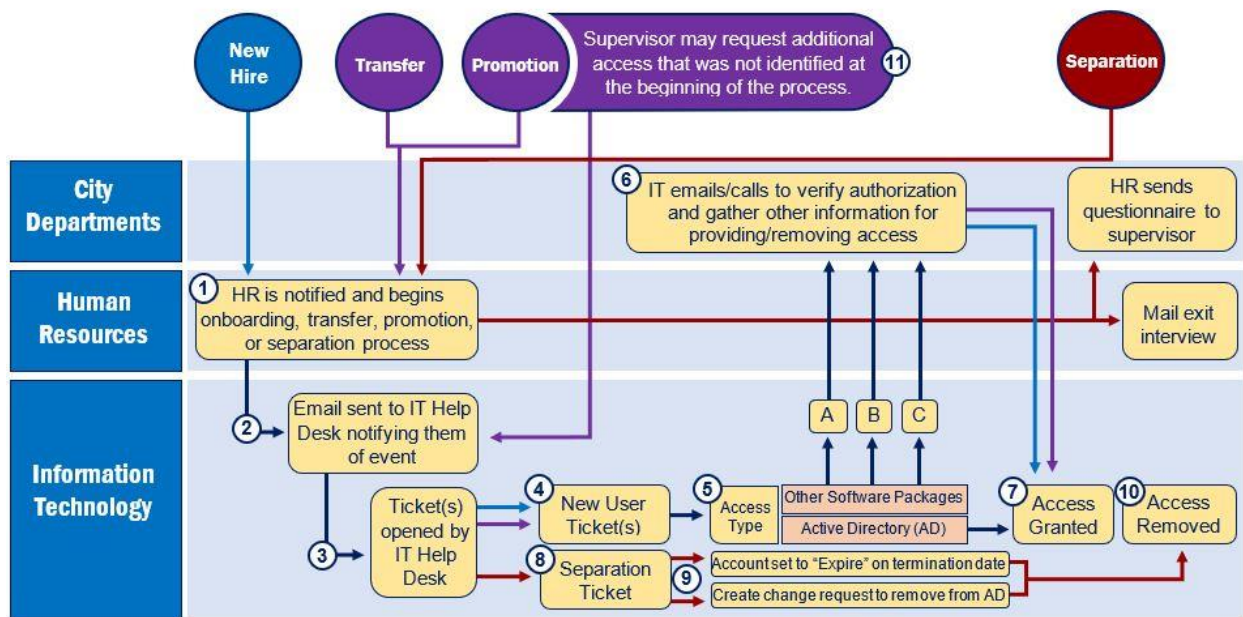
1. **Human Resources is Notified:** The onboarding, offboarding, transfer, or promotional process begins when the Human Resource (HR) Department is notified about a new hire, transfer, promotion, or separation.

2. **Email Sent to IT Help Desk:** After being notified, the HR department sends an email to the IT Help Desk that provides some general information about the employee. For new hires, transferred, or promoted employees, the information provided will include identifying data (employee name, ID number, etc.) and a request for some basic access. For employees who are separating from the organization, the email will contain basic information such as their name, position, and department.

3. **Help Desk Ticket(s) Created:** Once the IT Help Desk receives an email from HR notifying them of an event, Help Desk Technicians create and open new-user (see steps 4-7) or separation tickets (see steps 8-10).

4. **New User Tickets:** New user tickets are created by the IT Help Desk. Based on the access type requested, these tickets are either handled directly by IT Help Desk Staff or sent on to appropriate staff in other IT sub-departments.

5. **Access Types:** There are two types of access: access involving the active directory (AD) and access involving other software packages. The IT Help Desk handles access involving the AD. For all other types of access, the IT Help Desk will create tickets that are then sent on to appropriate staff.

6. **Contact Supervisor:** Staff providing access to additional software or technology will typically need to contact the new user's supervisor to (1) gain additional information about what type and level of access is needed and (2) verify that the access is approved.

7. **Access Granted:** IT provides access rights for the requested individual.

8. **Separation Ticket:** A separation ticket is created when the IT Help Desk is notified by HR of a pending separation or recent termination.

9. **Preparation for Separation/Termination:** Upon receiving notification prior to or after a separation/termination, IT Help Desk staff will set the account to expire on the termination date. As well, they create a change request to remove the employee from all active AD groups and place the employee in an AD group called "Terminated" 30 days after termination. Accounts can remain active longer if a supervisor requests it.

10. **Access Removed:** IT remove access rights for the requested individual.

11. **Additional Access Request:** When supervisors hire, transfer, or promote a new employee, there are often additional requests for access made following the initial request. These additional requests can occur due to factors that include a supervisor access requirement for an employee's position, forgetting to request a specific type of access, or lacking knowledge of the different types or levels of access.

Challenges of the Current Process

Based on discussions with the City of Bryan staff and a review of IT's role in the employee management processes, the following issues were identified:

- **Inefficient Communication:** Our review of the workflow process and IT's role in the employee management processes revealed several gaps or inefficiencies regarding communications. These issues included the following:

    o *Failure to accurately communicate access needs:* The initial email sent by HR for a new user as a result of a hire, transfer, or promotion often only contains general position information (employee name, ID number, basic access needs, etc.) and not detailed information on access type or level, sometimes failing to ask for a specific access altogether. This results in delays that affect employee effectiveness as IT staff must spend time reaching out for additional information or an employee's supervisor must restart the access request process for a new user.

- o ***Inability to track requests:*** The current process does not allow IT, HR, or supervisors to track the status of a request. This can lead to a request "falling through the cracks," thus slowing the overall process.

- o ***Failure to provide adequate notification for separations:*** IT staff highlighted the need to improve the separation notification process so that staff could remove a user's access in a timely manner and archive their data. IT staff noted that it is not uncommon to receive a notification regarding a separation *days or weeks after* the employee has left the organization. This failure to provide adequate notification not only reduces process effectiveness and creates potential security concerns.

- o ***Excessive communication:*** While effective communication is key for any organization, excessive communication can lengthen out the process, create delays, and reduce the time that employees have to spend on other issues. Opportunities to reduce excessive communication include (1) removing the need for HR to directly notify the IT Help Desk regarding an event, (2) eliminating the need for IT Help Desk to create, open, and assign tickets to IT staff in other sub-teams who deal with providing access to additional software and technology, and (3) reducing the need for IT staff to directly engage with supervisors to gather additional information and approval.

- ▪ **Lack of Awareness/Knowledge:** Interviews and discussions with IT staff found that one common issue was the lack of awareness or knowledge among other department supervisors regarding the following: (1) effectively identifying all types and levels of initial access that a newly hired, transferred, or promoted employee needs and (2) appropriate information about the types and levels of access options available.

- ▪ **Lack of Formal System for Documenting Approval:** While IT staff always seek approval regarding access for an employee, there appears to be no formal process for documenting that approval. Requests for supervisor approval are typically conducted via an email or phone call. While approval is always gathered, there appears to be a lack of organized documentation demonstrating that approval was provided.

Each of these issues presents obstacles that can lead to inefficient use of employee time and resources and lead to interdepartmental frustration. The example of providing Laserfiche view-only access demonstrates these concerns. A process that should only take a few minutes can instead become a day or more as IT staff wait for a response from supervisors. This not only impacts IT staff who must spend additional time answering questions and gathering information, but also employees who need access to carry out their responsibilities. As a result, employees in both departments can become less productive during the process. Finding a solution that improves how access and separation requests are handled in the employee management process will help to improve the effectiveness of employees in IT and other departments.

Proposed Solution

To improve the effectiveness and efficiency of IT's role in the onboarding, offboarding, transfers, and promotion processes, it is recommended that the department implement technology that can assist with automating these business processes. The use of technology to automate business processes and workflows has the potential to help organizations realize real cost, time, and labor savings (Chui and Merimida, 2015). To bring these outcomes to the Bryan IT Department and its role in the onboarding, offboarding, transfer, and promotion processes, *our recommendations is to adapt current or adopt new technology that will allow for the use of autonomous forms that can streamline the workflow processes and improve communication*.

An autonomous system that will improve the current workflow process for the aforementioned employee management processes will:

1. *Reduce communication gaps* by assisting supervisors with clearly communicating access and separation needs.

2. *Reduce communication inefficiencies* by removing unnecessary steps from the process.

3. *Streamline the workflow process* by assisting staff with quickly communicating actions to the appropriate individual.

4. *Assist with notifying IT of pending separations/terminations* prior to an employee leaving.

5. *Reduce the time* employees spend on onboarding, offboarding, transfer, and promotion tasks.

An example of how these autonomous forms could be implemented in the workflow process is described below:
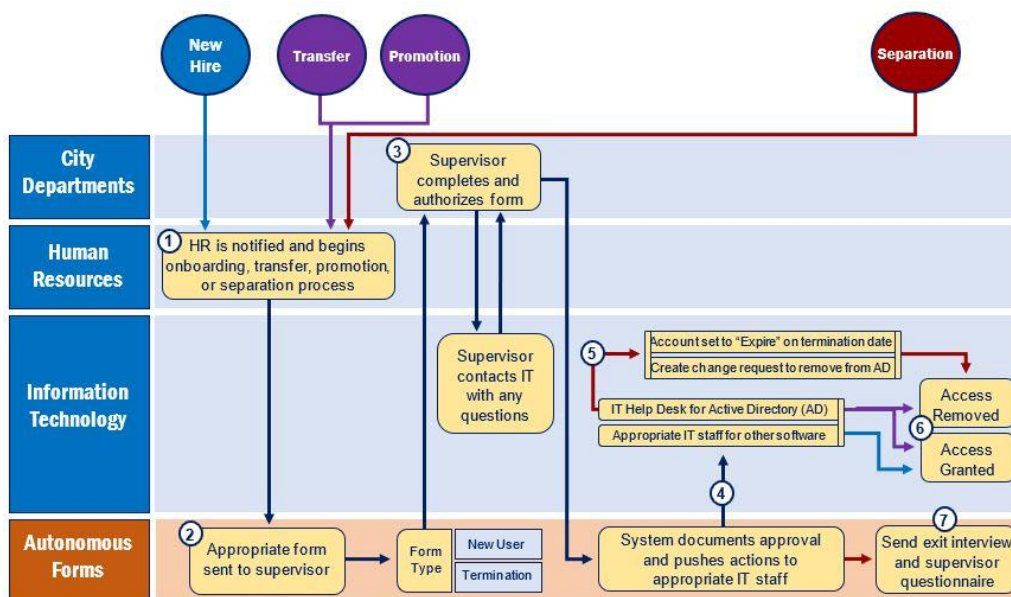
1. **HR Initiates the Appropriate Process:** Similar to the original workflow process, HR initiates the process upon receiving notification of the event. However, instead of sending an email the HR department simply opens a new form and fills out the appropriate information.

2. **Autonomous Form:** After HR has initiated the process, the appropriate New User Form or Separation/Termination Form is sent to the appropriate supervisor.

3. **Supervisor Fills Out Form:** The form is sent to the appropriate supervisor who fills out the appropriate information, selects from a list access options or notes a pending separation/termination, identifies any additional information, and then provides authorization. Authorization can be captured via meta-data that identifies a supervisor in a department. This stage will help reduce or eliminate the need for IT staff to contact a supervisor to gather additional information or seek authorization. This form can also be customized to provide brief descriptions of access types and levels. However, if a supervisor needs additional clarifying information, they can contact the IT department. Additionally, requiring supervisors to fill out a short separation autonomous form will assist with ensuring that IT is notified of the need to remove access for an employee.

4. **Documentation and IT Actions:** The system will then document the requested authorization or separation and proceed to notify the employee assigned to a specific process based on the form type and actions needed. Access or separation actions connected to the AD are sent to the IT Help Desk. All other types of access or access removal are sent to the appropriate IT sub-team or staff member.

5. **Active Directory Removal:** In the event of a separation, the IT Help Desk will take the necessary steps to revoke employee access connected to being in the Active Directory. These steps include setting the account to expire on the termination date and creating a change request form that reminds IT to move the employee to the "Terminated" group in the AD 30 days after the separation occurs.

6. **Access is Removed or Granted:** IT staff grant or remove access rights for the requested employee.

7. **End of Employment Forms:** Simultaneous to notifying IT staff of the need to remove a separating employee from the AD and revoking their access, the autonomous system will also send a Supervisor Questionnaire and Employee Exit Interview form to the appropriate individual. This will assist HR with ensuring that forms are delivered quickly after a separation, as well as encouraging feedback.

To assist the City and Bryan IT with using autonomous forms to improve the workflow management process related to onboarding, offboarding, transfers and promotions, our team has identified several technological options. When implemented, these technological options have the potential to help solve the identified issues and improve the effectiveness and efficiency with which the department carries out these tasks.

Technological Solutions

Laserfiche

Laserfiche is a global company that offers effective document management and business automation solutions that can be used to improve workflow processes in an organization (Laserfiche, n.d.). Laserfiche can be used to create customized autonomous forms that can be integrated into a workflow process. The use of these forms would allow the City to automatically push actions and information to the appropriate individuals who can then act accordingly. The City of Bryan currently owns roughly 250 licenses for Laserfiche, thus making integration into the current onboarding, offboarding, transfer, and promotion processes relatively simple when compared to other options (McGinty, 2020).

- **Implementation Cost:** There are no anticipated additional financial costs for using Laserfiche to create autonomous forms to improve IT's role in the access and separation processes. This is due to the City's current ownership of roughly 250 licenses (McGinty, 2020). Additionally, any number of City employees may be authorized to use Laserfiche via the "view-only" mode.

Offboarding, Onboarding, Transfer, & Promotion: Comparison of Solution Options

Laserfiche	smartsheet
Description	**Description**
Laserfiche is a document management and business automation software that assists with improving and automating workflow processes.	Smartsheet is an Excel-like, cloud-based work management and automation platform that assists with improving organizational workflows and collaboration.
Cost	**Cost**
$0.00 — There is no anticipated additional financial cost since the City owns licenses for the software.	Cost $75,000 annually to replace 250 Laserfiche licenses. However, 250 licenses may not be needed. — per user $25 monthly
Effort	**Effort**
Low — Identified efforts include employee time spent creating forms, new workflow processes, and meeting with other city employees.	Efforts would not only include creating the forms, but also implementing a new system and providing training to employees. — Mid

- **Effort:** Effort is expected to be minimal for Laserfiche when compared with alternative solutions due to employee's familiarity with the product. Potential identified efforts include the need to meet and coordinate with other employees within the City, developing and testing the forms, troubleshooting issues, and evaluating the success of the new workflow process.

- **Examples of Success: Davie County and Palm Beach Gardens**

  ***Davie County, North Carolina*:** Davie County found Laserfiche to be a successful tool for streamlining its contract approval process. Through Laserfiche, the County was able to: eliminate the use of paper, track contracts to ensure that documents were not delayed or lost in the process, improve communication between city employees and contractors, automatically route contracts for approval from one department to the next, and effectively capture and document contracts. Davie County accomplished this by creating Laserfiche forms that allowed individuals to enter information into and approve contract forms online.

Davie County now has a clear workflow process for contract approval, can hold employees responsible, avoid bottleneck issues, improve documentation, and reduce paper and printing costs (Gallimore, 2019).


Davie County's Contract form using Laserfiche Forms

Palm Beach Gardens, Florida: Using the Laserfiche Workflow tool, Palm Beach Gardens has been able to streamline their travel authorization process, remove unnecessary paper communication, improve documentation, and improve the speed at which travel and travel reimbursements are authorized. Laserfiche Workflow allows employees to upload a scanned copy of their travel request form. The Laserfiche system monitors for new uploads and upon finding one will automatically send an email to the travel coordinator. The travel coordinator can then review the request, electronically approve it and pass it along to finance who will then approve or deny the form. This process is completed within the

Palm Beach Garden's Template for Travel Approval using Laserfiche Workflow

security of the Laserfiche system which will protect information, document forms and authorization, and reduce inefficient communication (Crump, 2018).

Smartsheet

Smartsheet offers a cloud-based software solution that can assist with implementing business automation practices, improving workflow processes, and gathering and reporting data (Smartsheet, n.d.) This is accomplished by using the system to create easy to use autonomous forms that can send information and actions to appropriate employees. Smartsheet is fairly easy to use and has the look and feel of Excel, Google Sheets, and Google Forms and presents several options for form and workflow process creation. Additionally, Smartsheet can easily integrate with other technologies such as Microsoft Teams, Slack, and Google Hangouts. Smartsheet is an effective and proven tool used by other public organizations, such as the City of New Braunfels, in solving issues similar to those discussed in this report.

Example of Smartsheet spreadsheet view.

Example of Smartsheet form creator view.
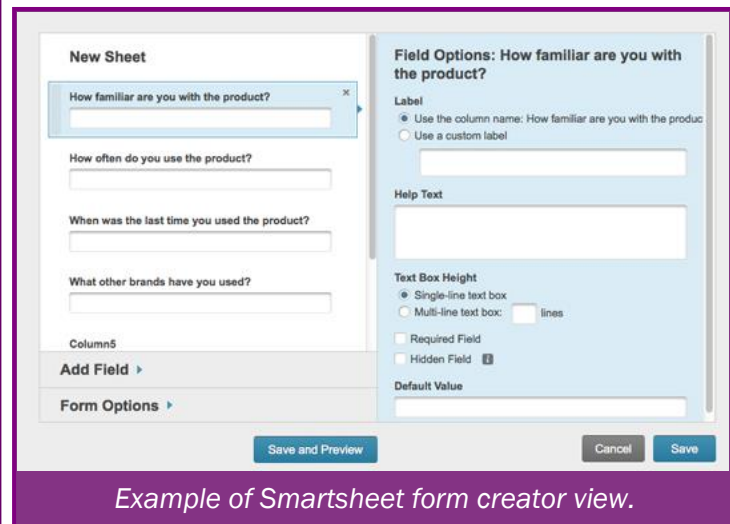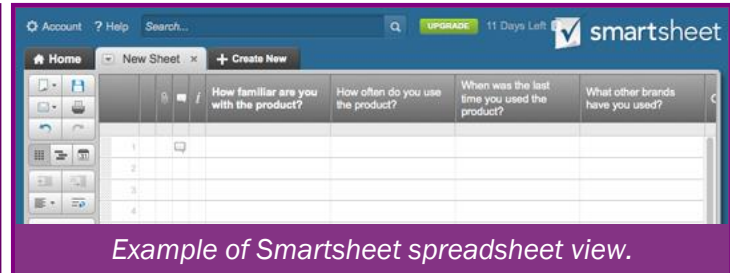
- ▪ **Implementation Cost:** The standard business cost for one user is a monthly fee of $25. However, a discount is applied with the purchase of each additional user license. To compare this product cost to Laserfiche, the cost to the City to purchase 250 licenses for Smartsheets to replace the same number of Laserfiche licenses could be as much as $75,000 annually. However, Smartsheet does offer an enterprise pricing plan, but only upon request and intent to purchase.

- ▪ **Effort:** Effort is expected to be higher than Laserfiche. This heightened effort is a result of having to gain approval for, purchase, implement, and train employees on Smartsheets. Additional efforts included those identified in the Laserfiche solution option such as meeting with City staff, creating the forms, testing and deploying forms, and evaluating project success.

▪ **Example of Success: New Braunfels, Texas**

As identified in the New Braunfels case study, the New Braunfels IT department has already taken the step of implementing Smartsheet to solve issues related to training for the Fire Department. Using Smartsheet, New Braunfels has been able to streamline the training authorization processes, improve the tracking of required trainings, and manage the training budget. The benefit of Smartsheet for New Braunfels is that it has assisted with automating large portions of the training request and authorization process, as well as removing the need to use paper forms. Additionally, Smartsheet allows users to track where a training request is so that employees can be held accountable for providing timely approval or denial of trainings.

Implementation Plan Framework

Proposed Implementation Framework

Both Laserfiche and Smartsheet offer similar strategies and advantages for improving the workflow processes related to providing or removing access for onboarding, offboarding, transfers, and promotions. As such, the use of either system will follow the same implementation strategy, with two additional steps for the use of Smartsheet. The implementation strategy is outlined below and was the result of research conducted about each product and our team's conversations with City employees.

▪ **Approval:** The first step in implementing Laserfiche or Smartsheets to improve the employee management processes is to gain initial approval and buy-in from key supervisors. Supervisors include, but are not limited to, the Chief Information Officer, IT Systems Manager, and the Human Resource Office Manager. Additional budget approval will be required in the case of Smartsheet. To gain budget approval, the department will need to identify the number of users needed and meet with Smartsheets to identify the best available pricing option. Doing so may include requesting a demo from the

Offboarding, Onboarding, Transfer, & Promotion: Proposed Implementation Frameworks

	Laserfiche® Implementation		smartsheet Implementation	
1.	**Approve**	Gain initial project approval and buy-in from CIO, HR Managers, etc.	Approval will include both supervisor and a budget request approval.	**Approve**	1.
2.	**Engage**	Meet with stakeholders and gather suggestions/desires for the process.	Purchase appropriate number of product licenses	**Purchase**	2.
3.	**Identify**	Identify workflow processes and access options/needs for each form type.	Train appropriate employees on use of the new software	**Train**	3.
4.	**Develop**	Create access/separation forms using Laserfiche.	Meet with stakeholders and gather suggestions/desires for the process.	**Engage**	4.
5.	**Deploy**	Make access/separation forms available for use.	Identify workflow processes and access options/needs for each form type.	**Identify**	5.
6.	**Evaluate**	Evaluate process effectiveness using suggested or other performance measures.	Create access/separation forms using Laserfiche.	**Develop**	6.
			Make access/separation forms available for use.	**Deploy**	7.
			Evaluate process effectiveness using suggested or other performance measures.	**Evaluate**	8.

company to ensure that the product will meet the department's needs. Once this research is complete, the department can submit a budget request and/or decision package.

- **Purchase (Smartsheet Only)**: Once approval has been gained for the implementation of Smartsheets, the department will need to officially purchase the product. This will include ensuring that the contract for purchasing access to Smartsheet is acceptable and that the appropriate number of user licenses are purchased.

- **Train:** IT will need to become familiar with the product via online tools, support from Smartsheet, tutorials, etc. Once IT is familiar and comfortable with the product, IT staff can assist other users throughout the City with learning the new software. Regarding the use of Laserfiche, some training for employees may be necessary if determined by IT.

- **Engage:** A key step in developing an effective workflow process for employee management processes using Laserfiche or Smartsheets includes meeting with City employees outside of IT. The purpose of these meetings is to gather input about needs, gain a better understanding of the current issues, and get buy-in for the new process from employees who will play a key role in the new process. Recommended tools for meetings include one-on-one meetings, surveys, or small focus groups.

- **Identify:** Once additional information has been gathered IT staff should identify (1) what access and separation information must be on the appropriate form (access type, level, etc.) and (2) map out the workflow process for these forms.

- **Develop:** IT staff should develop the forms in Laserfiche or Smartsheet and conduct initial tests to verify that they work as expected prior to rolling out the forms.

- **Deploy:** Notify City staff of the new process for access approval or removal and integrate forms into the workflow process.

- **Evaluate:** Gather data regarding the new process and evaluate to see if the new process is successful. The City can identify its own evaluation measures or use those recommended in the *Measures of Success* subsection on page 135

Potential Implementation Obstacles

As with the implementation of any new process or technology, there are potential obstacles that may prevent or slow the implementation of a new employee management process. Potential obstacles that were identified through research and engagement with staff include:

- **Technology Biases:** When conducting research for the TNA, our team found that a common challenge faced by IT departments was an unwillingness of employees to adopt new technology (Beaumaster, 2002; Bowen, 2019). This challenge was reaffirmed in discussions with City staff from various departments who highlighted that biases against adopting new technology, or technology in general, could present an issue. There employees within the City prefer using "paper" to collect information and conduct

processes. IT and collaborating departments will need to be sensitive to the biases of other employees and identify opportunities to engage employees in transferring from an outdated paper system to a more efficient and effective digital process.

- **Signature Documentation:** Key to having an effective digital employee management process is the ability for supervisors to quickly and easily authorize the granting or removal of access by the IT department. However, there are concerns that a digital process will make it difficult, if not impossible, to gather the signatures that HR needs as part of the employee management process. Staff within the IT department suggested that there are ways to gather signatures, or signature-like information, using Laserfiche. Options include purchasing signature pads (an expensive option) or relying on unique identifying metadata. Regardless of the path chose, IT will need to collaborate with other departments in order to find an acceptable alternative.

- **Inter-departmental Collaboration:** Employee management process touch every department. Because of this coordination and collaboration with other departments, especially key stakeholders such as HR, is crucial. IT will need to engage other departments and key players in an effort to implement a long-lasting process that fulfills the needs of its customers when it comes to improving the employee management process.

Identifying Success: Expected Outcomes and Measures of Success

By implementing the proposed solution of autonomous forms using Laserfiche or Smartsheet, it is hoped that the IT department will experience improved effectiveness and efficiency related to its role in the onboarding, offboarding, promotion, and transfer processes. To assist the department in identifying the success of implementing the new process, our team has identified expected outcomes and suggested some measures for identifying success.

Expected Outcomes:

- **Improved Efficiency:** Implementing autonomous forms to assist with employee onboarding, offboarding, transfers, and processes is expected to streamline communication, reduce communication gaps, and remove inefficient communication. It is expected that this will improve the speed with which access (especially for access to software outside the AD) is provided.

  Additionally, implementing these processes will reduce the time that staff spends on these issues, thus freeing IT staff to deal with other matters. It is expected that individuals in the Systems sub-department of IT will see the greatest benefit. However, IT staff in the IT Help Desk sub-department should also see benefits as the need to create new tickets that must then be sent to staff in other IT sub-departments.

- **Improved Separation/Termination Notification:** Integrating autonomous forms into the workflow process will assist supervisors and HR by providing prior notice regarding separations and terminations. As a result, the IT Help Desk staff will see a decrease in the number of separations/terminations reported after an employee has left. This will allow IT

Help Desk employees to more effectively remove access and reduce security concerns regarding those who have left employment with the City.

- **Documentation of User Access/Removal:** Autonomous forms through either Laserfiche or Smartsheets will assist the City in documenting access authorization and removal. Authorization by a supervisor can be captured via meta-data that can identify an appropriate supervisor, thus acting as an electronic authorization signature.

Suggested Measures of Success:

- **Time to Provide Access**: To measure success related to improved efficiency, the department should track data related to the time it takes to provide access once it has been requested for a new user through Laserfiche. This can be accomplished by tracking the time it takes IT Help Desk or other IT sub-departments to resolve requests for access. For an effective evaluation, it is recommended that the department gather data before implementing the autonomous forms and then compare data from the old and new processes.

- **Prior Notification of Separation:** To identify if the new process is assisting with reducing the number of late separation or termination notifications, it is suggested that IT Help Desk track the number of separation/terminations notices it receives and whether those notices were provided before to or after the separation/termination date. This data should be gathered before and after the implementation of the new workflow process.

Hard Drive Imaging

Challenges of the Current Process

Based on discussions with City of Bryan's IT staff and a review of IT's role in hard drive imaging, the following issues were identified:

- **Time:** The IT department currently duplicates approximately 350 devices a year. They can duplicate 2 systems at one time, which can take an hour each to duplicate and additional time to allow for cooling of the device.

- **Space:** The IT department currently has two devices that can duplicate necessary applications. However, due to the amount of space available, the IT department can only use one device at a time.

- **PC-based system:** The IT department was previously using Symantec Ghost Solutions, however, due to the lack of ability to support PC-based systems, they switched to Logicube Supersonix-NG.

- **Costs:** The IT department's current system costs approximately $2,266.92; more cost-efficient systems are available on the market.

Each of these issues presents obstacles that can lead to inefficient use of time and resources and can increase the amount of time it takes to duplicate a system. Based on discussions with the City of Bryan's IT staff, they would prefer a more compact, PC-based system. While speed is not necessarily a concern, the IT department would like to be able to complete more hard drive images at one time.

Hard Drive Imaging: Comparison of Solution Options

Proposed Solution

To improve the effectiveness and efficiency of IT's role in hard drive imaging, our team recommends that the IT department adopt new software to replace its current tool set. The proposed solution options include Symantec Ghost, a hard-drive imaging software that uses an online web console to quickly guide and coordinate actions, and Acronis True Image, a software package that also uses an external drive to quickly complete disk images. By implementing one of these two software, our team believes that IT can overcome the current challenges associated with hard-drive imaging.

Technological Solutions

Symantec Ghost Solutions Suite 3.3

Symantec Ghost Solutions is an award-winning software solution that can be used for imaging and deploying desktops, laptops, tablets and servers. It provides a quick and easy way to migrate to the latest operating systems, perform custom configurations, inventory machines, and deploy software across different platforms and operating systems (Broadcom, N.d.). Ghost Solutions Suite 3.3 comes with three new features.

1. **Modern Web Console:** Ghost Solutions Suite 3.3 has a new web-based console that can be specifically designed for technicians with minimal experience. It is designed to complement the full console and is easy to

Symantec Ghost Web Console View
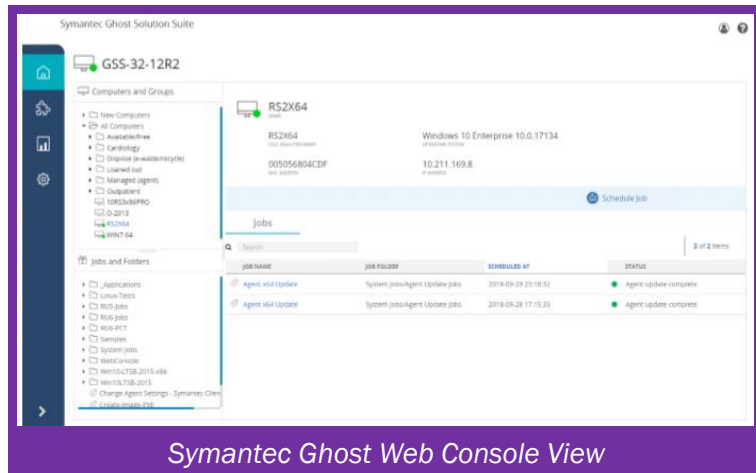
use with built-in wizards that can be used for tasks such as Windows 10 migration and deploying images. Ghost Solutions Suite 3.3 comes with a modern UI and can work with any browser. With this web console, many tasks can be delegated to frontline technicians which can optimize resources and reduce costs (Symantec, N.d.).

2. **Guided Wizards:** Ghost Solutions Suite 3.3 comes with guiding wizards that makes it easy to learn the system such as, creating jobs for an in-place upgrade to Windows 10 and to deploy and configure images (Symantec, N.d.).

3. **Fasting Imaging:** Ghost Solutions Suite 3.3 supports IPXE that drastically improves the speed to image a machine (Symantec, N.d.).

4. **Additional features:**

    ▪ Disk image capture and deployment

    ▪ Scripted operating system installation

    ▪ PC user and application settings migration

    ▪ Intelligent driver to device mapping

    ▪ Remote task execution and sequencing

    ▪ Windows, Mac, and Linux support

    ▪ Tablet support for selected models

    ▪ Automation

Guiding Wizard Tool
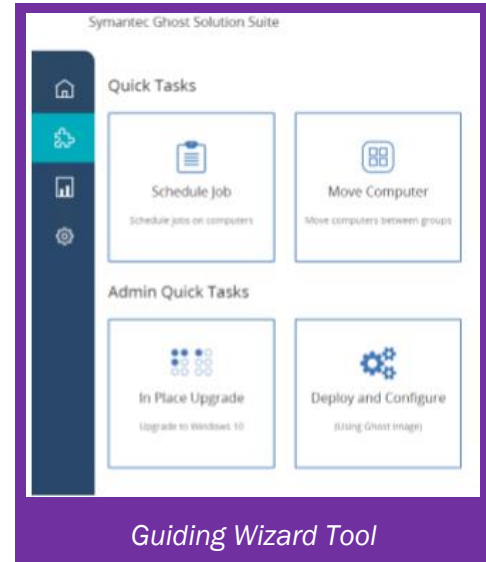
In addition, Symantec offers a complimentary guide and support for switching to Windows 10. Symantec offers several ways to migrate to Windows 10 which include either a wipe and reload re-imaging process or updating the operating system in place without performing any imaging. Although in-place upgrades are easier to use when upgrading the operating system - because it retains all of the contents on the computer - every application must be compatible with Windows 10 to avoid having applications that do not work or that need to be cleaned up manually. To counteract this problem, wipe and reload may be a good strategy. This requires a standard or gold image (also known as Hardware Independent Image (HII)). It is important to also consider whether to upgrade to Windows 10 in-place or to image it as part of the upgrade/refresh strategy.

▪ **Implementation Cost:** Cost will be relatively inexpensive. With Symantec Ghost Solutions, it would cost $97 per master device. With multiple master devices, Symantec Ghost can duplicate multiple devices at one time for a relatively inexpensive price.

- **Effort:** Effort is expected to be low for Symantec Ghost Solutions compared with alternative solutions due to the employee's familiarity with the product. The City of Bryan has previously used Ghost Solutions and it comes with a user-friendly interface that is easy to learn.

Acronis True Image 2020

Acronis is another option for replicating computer operating systems, software, patches, and drives; it is an easy-to-use software that allows for multiple PC's to be duplicated at once (Guru, 2020). One feature includes taking a full image or mirror image backup or partial image. This can be especially useful for designating specific hard drive images for certain employees (Sisodia, 2019). Other features include being able to convert full image backups into virtual hard disk formats and to be able to test different system settings or to be able to run the system as a virtual machine. Lastly, it comes with ransomware protection that can detect and stop ransomware effectively and it is equipped with military-grade AES-256 encryption (Sisodia, 2019). Acronis just recently released its latest True Image 2020 version.

- **Implementation Cost:** Acronis True Image 2020 includes several cost and subscription packages depending on the number of devices the City of Bryan is planning to image at one time, and some include optional cloud-based options.

Acronis True Image Purchase Cost		
Standard (one-time	Advanced (1-year	Premium (1-year
For 1 Computer — $59.99	$49.99	$99.99
For 3 Computer — $89.99	$79.99	$149.99
For 5 Computer — $119.99	$99.99	$159.99
Features — Full image backup, Active disk cloning, Quick recovery / Universal restore, Ransomware, and crypto mining blocker	Includes all standard features plus Replicate backups in the cloud, Office 365 Cloud backup, and End-to-end encryption	Includes all standard and advanced features.

- **Effort:** Effort is expected to be higher than Symantec Ghost Solutions due to having to implement and learn an entirely new system. However, Acronis provides additional support and resources to help make the transition.

Implementation Plan Framework

Potential Implementation Obstacles

Both Symantec and Acronis offer similar strategies and advantages for improving Hard Drive Imaging. As such, the use of either system will follow the same implementation strategy. The

implementation strategy is outlined below and was the result of research conducted about each product.

- **Approval:** The first step in implementing Symantec Ghost or Acronis to improve Hard Drive imaging is to gain initial approval and buy-in from key supervisors. For Acronis, the IT department will need to determine which package that best suits their needs. Additionally, the IT department will need to obtain budget approval. To gain budget approval, the department will need to identify the number of systems they would like to image to determine the best pricing options. Doing so may include requesting a demo from the company to ensure that the product will meet the department's needs. Once this research is complete, the IT department can submit a budget request and/or decision package.

- **Identify:** Once additional information has been gathered, IT staff should identify measures of success and collect data from the current system.

- **Purchase:** Once approval has been gained for the implementation of Symantec Ghost or Acronis, the department will need to officially purchase the product. This will include ensuring that the contract for purchasing Symantec Ghost or Acronis is acceptable and that the appropriate number of user licenses are purchased.

- **Train:** IT will need to become familiar with the product via online tools, support from the company tutorials, etc.

- **Develop:** IT staff should develop the system for Symantec Ghost or Acronis and install the new software. Additionally, the IT staff should conduct initial tests to verify that they work as expected prior to rolling out the system.

- **Deploy:** The IT department should integrate the new system into their hard drive imaging system and begin using software to image devices.

- **Evaluate:** Gather data regarding the new system and evaluate to see if the new system is successful.

Potential Obstacles

As with the implementation of any new process or technology, there are potential obstacles that may prevent or slow the implementation of a new employee management process. Potential obstacles that were identified through research and engagement with staff include:

- **Purchasing Approval:** Implementing Symantec Ghost will require spending financial resources. As such, gaining approval through the appropriate budget process is essential.

- **Ensuring Compatibility:** Discussions with IT staff related to hard-drive imaging identified specific needs including the need for the any new system to be located on site and the ability to image more than four machines at a time. Our team attempted to verify

that Ghost would be compatible with these desires and current processes. However, before purchasing, IT should ensure the product will meet its needs and fit into current processes.

Expected Outcomes and Measures of Success

By implementing the proposed solutions of Symantec Ghost Solutions Suite 3.3 or Acronis, it is hoped that the IT department will experience improved effectiveness and efficiency related to its role in hard drive imaging. To assist the department in identifying the success of implementing these new technologies, our team has identified expected outcomes and suggested some measures for identifying success. These outcomes and measures are highlighted below.

Expected Outcomes:

- **Improved efficiency:** Implementing Symantec Ghost Solutions Suite 3.3 or Acronis will reduce the time to image a machine and allow for the IT department to hard drive image more devices in a shorter time period. Additionally, implementing one of these solutions will allow for more employees with minimal experience to hard drive machines with its user-friendly interface. Lastly, implementing one of these solutions allows an efficient method of migrating to Windows 10, a PC-based system.

- **Improved costs:** Implementing one of these solutions will reduce the costs of hard drive imaging. The IT department's current system costs approximately $2,266.92, while Symantec Ghost Solutions Suite 3.3 costs approximately $97 per device and Acronis costs between $50 - $160.

Suggested Measures of Success:

- **Time to Image a Machine**: To measure success related to improved efficiency, the department should track how long it takes to image a machine. Both of these proposed solutions reduce the time to image a hard drive allowing the IT department to image more devices.

- **Simultaneous Hard Drive Imaging**: To measure success related to improved number of machines being imaged at once, the IT department should evaluate if these proposed solutions are imaging more machines at once.

CONCLUSION

To provide the IT Department with the tools needed to improve effectiveness and efficiency for the aforementioned employee management processes and hard-drive imaging, it is recommended that the IT Department implement a solution package involving Laserfiche and Symantec Ghost. This solution package has the added benefit of meeting the departments needs without taxing the department's employee or financial resources. By implementing this low cost and low effort solution package, the Bryan IT department will be able to reduce communication gaps, improve process awareness, a document authorization for their employee management processes of onboarding, offboarding, promotions, and transfers using Laserfiche. Additionally, adopting Symantec Ghost will improve hard-drive imaging by reducing the time and costs for imaging a hard-drive. Through the implementation of these technological solutions, the Bryan IT Department will improve its task effectiveness and efficiency and continue its history of excellent customer support to the City of Bryan.

Proposed Implementation Plan for Suggested Solution Package

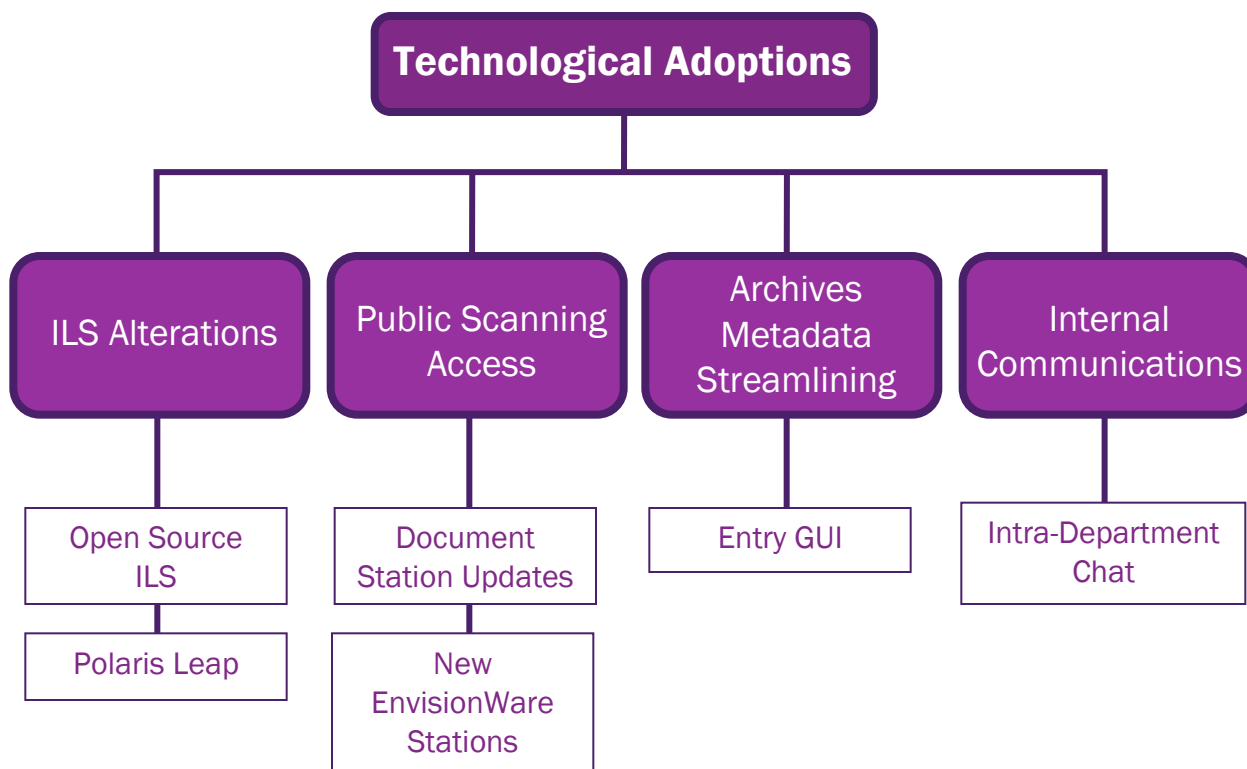| Action	Approval		Develop		Deploy		Evaluate	
	1	2	1	2	1	2	1	2
Laserfiche - Onboarding, Offboarding, Promotion, Transfer Using Laserfiche Forms								
Gain initial project approval from CIO or IT Supervisor	■							
Meet with Human Resource Office to coordinate project and gain support		■						
Hold any additional meetings with city employees to gather information regarding needs and desired outcomes				■				
Identify gaps where Laserfiche can improve processes and information to be included on forms			■					
Identify measures of success and collect data from the current processes				■				
Develop the forms and processes in Laserfiche			■					
Test the forms and new processes				■				
Notify and provide training, if needed, to appropriate employees						■		
Make the forms and new process available for use					■			
Collect data using measures of success and evaluate new processes							■	
Symantec Ghost - Hard Drive Imaging								
Gain initial project approval from CIO or IT Supervisor	■							
Seek a product demo from Symantec and ensure that product will meet City's needs			■					
Seek a product price quote based on the department's and City's needs				■				
If needed, submit budget proposal or decision package	■							
Gain approval to purchase product		■						
Identify measures of success and collect data from the current processes				■				
Purchase and install new software; conduct any necessary training			■					
Test the new software and make any adjustments			■					
Begin using software to image hard drives					■			
Collect data using measures of success and evaluate new processes							■	

Priority was determined based on the importance of each action for (1) intended outcomes and (2) how each action affected other actions in the implementation process.

INTRODUCTION

At the conclusion of the fall semester, the results of the Technological Needs Assessment for Library Services found a number of areas for potential improvement. These areas included mobility and outreach expansion, improved internal communication, archival information entry and access, and collection access and navigation. Certain key issues - such as bridging the system gap between the City of Bryan and City of College Station IT infrastructure and facilities updates - were deemed to be out of scope for this project. Thus, our recommendations will limit their focus to solutions that can be implemented at the individual library level. With this scope in mind our implementation strategy focuses on opportunities to enhance mobility and outreach capabilities, improve patron access, and streamline work processes.

Technological Adoptions

- **ILS Alterations**
  - Open Source ILS
  - Polaris Leap
- **Public Scanning Access**
  - Document Station Updates
  - New EnvisionWare Stations
- **Archives Metadata Streamlining**
  - Entry GUI
- **Internal Communications**
  - Intra-Department Chat

CHALLENGES & SOLUTIONS

Mobility and Outreach

Challenge

During our discussions with department leadership, it was mentioned that the ability to go into the community and essentially bring the library to the patrons would be a great benefit to their service capabilities. For example, this would allow librarians to attend events (e.g. First Fridays) and register new library cards from anywhere with internet access. The software could also allow for the eventual implementation of a mobile library which could be used to take portions of the collection to disadvantaged areas within the community where individual transportation may be lacking (Kenneally & Payne, 2000). These solutions also provide some of the more direct opportunities for increased equity of services in the department, considering the distance barriers between the library locations (only one branch per city) can be insurmountable for potential patrons without access to transportation.

Technological Solutions

Open Source ILS

Our recommended technology solution would eliminate the need to consider integration into the current Polaris ILS by moving to an Open Source ILS. Evergreen ILS is a well-established option that was developed by the Georgia Public Library Service in 2005 and has widespread adoption in the US (Evergreen FAQ1, 2013). Additionally, we were able to obtain price estimates for a transition to Evergreen ILS. However, a representative from Equinox Open Library Initiative suggested that Koha, which has similar rates of adoption and services, would be a preferable option for the size of the current system while maintaining the ability to scale up as the system grows (Gragg & Goodson, 2020).

Major Open Source ILS Products

- **Benefits**

  Migrating to an open-source system has a number of distinct benefits. Switching to open source would eliminate the recurring fees associated with the Polaris system, resulting in an annual savings of around $30,000-$35,000 (Wendell Gragg, Personal Communication, 2020). The system is free to implement and comparatively inexpensive to support with migration services potentially provided by the Equinox Open Library Initiative, a non-profit organization consisting of library professionals and Evergreen and Koha developers (Equinox OLI, n.d.). The freeing up of this level of funds would present an opportunity to

address numerous other service avenues within the department. Additionally, open-source ILS are highly customizable to the needs of individual library systems and developers frequently release new code packages to address community desires (Evergreen FAQ1, 2013). This means that a sufficiently technical librarian could design and deploy tailored solution packages for the Bryan/College Station System. Or, if the time needed to create such solutions is prohibitive, the service could be outsourced to Equinox.

By contrast, the Polaris system has pre-made solutions for various gaps that can be purchased (e.g. Polaris Leap for browser applications) and integrated into the system, but the packages are not fully customizable and are an expense on top of the annual maintenance fees.

Challenges for Implementation

Major challenges to switching systems arise primarily from the initial stages of the process. Overhauling an ILS and transferring large amounts of data is an arduous process for all staff. Changing ILS systems is often regarded as an intimidating and unpopular process and the training required to transition all librarians and staff to the new system is time-consuming. Moreover, if the change alters any of the visual interfaces used by patrons, a certain amount of community re-training may be required. The transition would also likely require a request-for-bid process by the city and additional considerations for "hosted" versus "self-hosted" servers and compatibility with the library's other current systems (Gragg & Goodson, Personal Communication, 2020). A specific consideration is that Evergreen and Koha run on Linux Servers which the IT Department may or may not wish to manage. While the cost for the system itself is zero, the cost of the transition will likely eliminate any savings within the first year. That said, the savings and opportunities presented for the long term would outweigh the initial costs and effort.

The one-time expenses for the Evergreen Open Source ILS option total about $30,342, but these costs could also be spread over a 5-year contract at a 20% discount, which would bring the total transition costs to about $24,274, or $4,955 per year for five years (Goodson, 2020). These costs include the initial software implementation, the data transfer and conversion and training services for all employees if the city chooses to self-host and maintain the ILS servers. If the city chooses for Equinox to host and maintain the servers, the estimated annual fee is roughly $20,000 (Goodson, 2020). While this remains a substantial cost, it is still $10,000-$15,000 less than the current Polaris fees, for all the additional benefits discussed in this section.

- **Impacts**

Open source ILS is a browser-based software that facilitates the mobility and outreach capabilities desired by the Library Services Department. The increased mobility combined with the cost savings should allow for the development of more robust outreach services as well as open up possibilities for modular growth (e.g. book-mobiles, self-service locations) in the future. The increased mobility and outreach capabilities will ideally improve access for disadvantaged areas within the community, as well as provide the ability to adjust to modest growth trends throughout the two cities without the need to build a new branch location. The options for customizations will also ideally provide the

opportunity to streamline processes in the interest of increasing staff efficiency and reducing the perception of being consistently overburdened (as noted in both interviews and survey responses).

Finally, the system is browser-based - as opposed to having a software package on each computer – which would mitigate the current cross-system technical difficulties faced by the department when interacting with both the Bryan and College Station IT infrastructures (Gragg & Goodson, Personal Communication, 2020). It would also allow the management of the system and all software updates or changes to be under the purview of the Bryan IT Department which will decrease opportunities for miscommunication between branch locations. Open source platforms are also well suited to adapting to shifts in digital traffic and remote access. This could prove beneficial if a crisis- such as the current COVID-19 outbreak- significantly changes patron access options and requires remote services to be employed.

Polaris Leap

Polaris Leap is a web-based application that is designed to complement the current capabilities of the Polaris ILS. The usefulness of this extension stems from its portability. Unlike the core ILS, Polaris Leap can be used on a tablet and its services brought directly to patrons. While the actual price of Polaris Leap integration is not publicly available, a previous inquiry by the department stated the price to be approximately $10,000 (Wendell Gragg, Personal Communication, 2020).

- **Benefits**

   The web extension can perform many of the same functions as Polaris ILS such as registering new users, checking books in and out, placing items on hold, and managing circulation data (Polaris Leap User Guide, 2014). The application would integrate seamlessly into the current proprietary system setup and comes with the support and maintenance provided by the company under the current contract, although possibly with an increase in the recurring costs. Other benefits of retaining the Polaris system is the ability to leverage staff familiarity to deploy the system with minimal retraining, as well as mitigate the need to migrate large amounts of data between systems.

- **Challenges for Implementation**

   In addition to the base price, the work involved with setting up Polaris Leap would likely be substantial as it would need to be deployed through both the Bryan and College Station IT infrastructure; though the effort is less intense than changing ILS. Another issue with
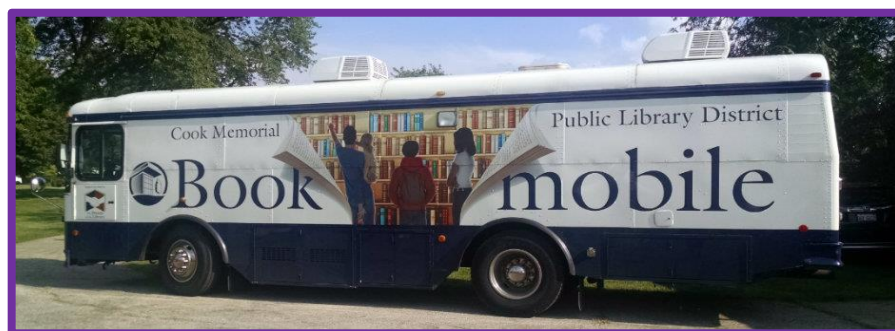

Image Retrieved from

adding greater mobile capabilities is the staff time required to perform outreach activities once the application is in place. Although this would also likely occur with the change to open source software, the additional savings could potentially be used to fund a currently unused staff position.

- **Impacts**

  Improving mobility and outreach capabilities could have substantial impacts on the Library Services Department's marketing and community relations. The ability to travel to other areas in the community and register citizens for library cards remotely would likely result in greater membership and open opportunities for increased patronage. This would also afford more interactions through which to inform the public about the department's various offerings beyond checking books in and out (e.g. programming, job application guidance) that are not as well known throughout the city.

Improving Patron Experience

Challenge

The library serves as a significant community access point for the information in the library's physical and digital holdings as well as access to computers and technology such as word-processing, printing, email, and other necessities of modern communication. Thus, enhancing patron access to resources includes both simplifying access to library holdings and ensuring that necessary technologies are available to users.

Technological Solutions

EnvisionWare Self-Service Document Station or Integrated Scanning Service

EnvisionWare is a self-service solution that is currently in use by the department to allow printing and associated payment by patrons. Following our discussions with staff, it seems that the next logical step for EnvisionWare would be the adoption of scanning, copying, and faxing services. There is currently no scanning available, and the fax machines available at both locations are in need of an upgrade to improve their usability. Printing services, while in theory self-service, still routinely require the intercession of a librarian to aid in navigation.
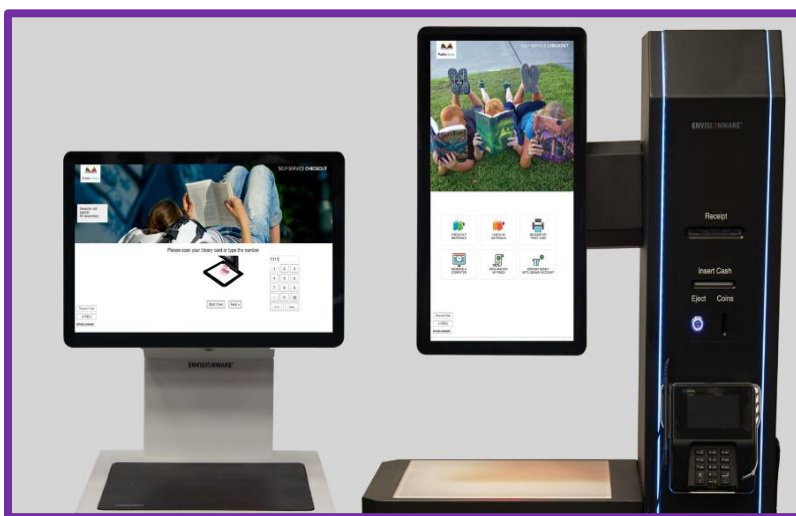

Image Retrieved from https://www.envisionware.com/onestop/

- **Benefits**

    As part of the Library 2.0 movement, efforts to increase patron's self-service ability are in direct response to efficiency concerns in the modern age (Casey & Savastinuk, 2007). The lack of access to expected technology and difficulty of available options results in not only wasted patron time but also in the disruption of librarian tasks and public information assistance to act as technical support for frustrated patrons. While some patrons may linger for hours in a library, others may wish to conduct their business in as streamlined a manner as possible due to busy schedules. With budget-constrained staffing on the rise, decreasing the workload faced by staff for routine tasks will allow for greater time and energy being spent with patrons that need additional assistance as well as other non-routine tasks (Casey & Savastinuk, 2007). This not only helps to maximize task efficiency but also allows for more flexible and personalized customer service.

- **Challenges for Implementation**

    In the initial press release, the EnvisionWare Document Station had a base price of $2,500 per station, so a reasonable estimate for both the Mounce and Ringer locations would be at least $5,000 total (EnvisionWare, 2017). It is not clear what expense would be required to integrate scanning into the current arrangement. Additionally, these solutions do not account for the substantial number of patrons that require assistance when utilizing technology, as described by the staff in both interviews and surveys. Furthermore, there are some constraints with integrating scanning into the current set-up due to payment collections. According to an arrangement with the Friends of the Library, the printers and fax machines are paid for by the Friends of the Library who then collect the cash proceeds that arise from their use (Wendell Gragg, Personal Communication, 2020). One common complaint about the current configuration is the inability to use card-based payment (which will not be solved by either suggestion) as the implementation of card payments present other issues regarding city fund regulations. Additionally, there are concerns from some staff members that the new equipment will still require heavy monitoring to prevent damage to the physical assets.

- **Impacts**

    Ease of use and perceived usefulness are key factors in the adoption of self-service technologies (Chang & Chang, 2009). From our interviews and department-wide survey, the self-checkout stations are noted to have been increasingly popular with regular patrons. This supports the expectation that a sufficiently user-friendly scanning station would be quickly adopted by patrons and provide much-desired services. Greater use of EnvisionWare solutions generally could also lead to more self-checkout stations for patrons or potentially result in a 24-hour library kiosk that could act as a miniature branch location and increase the department's footprint in the city.

Aggregate Resource Search – Discovery Interface

Another technological improvement that was mentioned frequently in the staff survey was implementing an aggregate resource search feature. The most common method found in the literature is the integration of a Discovery Layer Interface. These interfaces allow users to search

across all collection information (both print and digital), identify the location and availability of resources, and place holds or requests directly from the layer (Breeding, 2014).

- **Benefits**

    The interface exports records from the ILS and other sources to inform its searches, but does not require that records be updated in the ILS itself for use, which cuts down on the more complex processes of updating ILS records (Breeding, 2014). The implementation of a discovery layer would allow for more streamlined and intuitive access to both print and digital resources which could encourage greater use of the digital collections. Staff members noted in the survey that some patrons had difficulty identifying digital records through the current catalog interface and suggested a discovery layer to increase their ease of use. Popular options for the technology are Bibliocommons, Summon, Vufind and Blacklight.

- **Challenges**

    The discovery layer is still required to integrate with the ILS to maintain real-time system communication and patron request processing, which may limit the options available for selection. The process of setting up a discovery layer would likely require a large amount of IT Department time and effort as well as staff (and patron) training. There are numerous options for discovery interfaces, so more research would be needed to identify the annual and recurring costs. In addition to cost, there is disagreement among staff over whether a discovery interface is needed at this time.

- **Impacts**

    The addition of a discovery layer interface has the potential to streamline search processes by aggregating all records (print and digital) into a single set-up. This would limit the need for users to switch between the OverDrive (digital collection) search interface and the print collections catalog interface if they are willing to use either format. This could also potentially increase the use of digital items which require high-cost annual license fees to retain access.

PC Reallocation at Clara B. Mounce Library

A suggestion from the Automation Services Supervisor, based on his observations of public PC usage, is to reallocate a portion of the current PCs into Public Access Catalogs (PACs), disability access PCs, and low-vision PCs. The Mounce Branch has two lab areas with a total of 21 computers which, according to staff, are rarely all in use simultaneously.
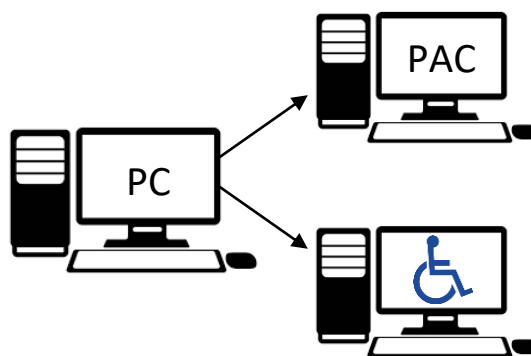
- **Benefits**

    A clear benefit to this strategy is that it utilizes underused current assets to fill observed needs for the community with minimal additional cost to the department. Reconfiguring some of the computers to PACs would allow for more collection search options dispersed throughout the library and would only require

moving the physical machines and changing the permissions/access of the system (which can be done in-house by current staff). The switch to disability access and low vision PCs would require an adjusted desk structure and a low-vision interface, respectively, but these costs are much lower than purchasing an entirely new computer for these purposes.

- **Challenges**

    Barriers to making this change would be the potential for larger community programming activities that require the use of all current computers in the lab. Furthermore, administrators would need to determine exactly how many PCs should be reallocated to each new form as well as budget the time required to make the physical adjustments within the branch.

- **Impacts**

    The reallocation of PCs should improve the overall patron experience by better utilizing the current assets in place at the Clara B. Mounce Branch. Additionally, the change to more disability access and low-vision computers will tangibly increase the equity of services within the Mounce location at a low cost to the department.

Patron Special Outreach

- One of the continual struggles mentioned by staff was the challenges associated with outreach and marketing of library services and activities. In addition to the collections, the library also offers several classes and activities, connections to social services, and opportunities for different community members to find ways to connect and receive assistance. Tying in the previous sections, mobility facilitates expanded interaction outside of the library's walls, self-service frees up time for more personalized patron encounters, and a chat system (described in the next section) can allow busy staff members to discreetly notify others that someone is in need of assistance upon arrival. All of these can facilitate effective outreach and marketing within the department.

Image Retrieved from http://yalsa.ala.org/blog/2017/09/04/outreach-services-for-teen-library-staff-what-some-staff-are-doing-outside-the-walls-of-libraries-24/

- **Benefits**

    Increased patron outreach offers an opportunity for the Library Services Department to establish a stronger presence in the community, particularly for disadvantaged populations with the Cities of Bryan and College Station. A 1999 article from a library-focused publication highlighted the place held by libraries among the homeless communities and the opportunity for libraries to reach out to those with unique needs (Herberger, 1999). In our interviews and surveys, it was mentioned that the libraries receive consistent patronage from homeless members of the community. Non-typical services such as records retrieval

and job search assistance are common occurrences at the Mounce branch. For other members of the community, digital forums such as regularly updated blogs and social media presence may be enough to disseminate information and spark interest, particularly among younger patrons (Rutherford, 2008). Additionally, a greater and more consistent social media presence can also provide opportunities for efficient information dissemination.

- **Challenges**

    It was noted in the literature that such efforts require dedicated staff time to maintain a consistent update schedule, as well as content monitoring if comment sections are available (Rutherford, 2008). This option was not asked about in either the surveys or interviews, but we feel that it would address some of the concerns about the marketing of library services and activities to the general public. The greatest barriers to these activities are the availability and willingness of staff to create and maintain usable forums for patrons as well as the initial marketing push required to establish a user base within the community.

- **Impacts**

    Outreach options could increase traffic within the library branches and help to inform community members about the possibilities provided to them by the department. By utilizing more digital communication options, we also anticipate greater involvement by younger members of the community which will help to establish the next generation of library patrons and ensure the long-term viability of the department.

Streamlining Work Processes

Challenge

Two specific areas of technological improvement were brought up in the surveys and interviews for the Technological Needs Assessment: a chat system for the Mounce and Ringer staff, and metadata automation for Carnegie. Streamlining the work process in the abstract provides an opportunity to eliminate some inefficiencies within the day-to-day department activities.

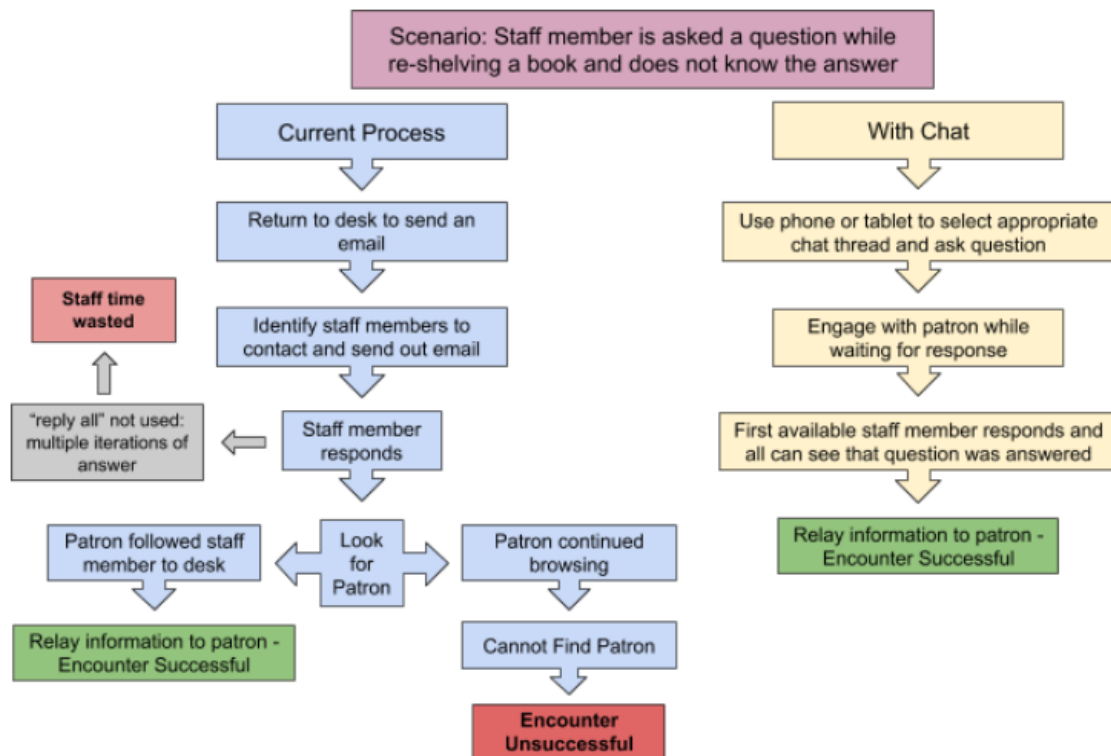### Technological Solutions

Inter-Library Chat

A requested technological improvement within the department would be the deployment of a chat system in which the staff could easily communicate from separate locations within and between branches. It was mentioned in our most recent update meeting that a chat system had already been reinstated, but the information about general benefits and challenges has been retained for thoroughness.

- **Benefits**

    Studies of chat use for workplaces find that they help facilitate coordination and reduce the time needed to complete small-scale interactions when compared to email or phone calls (Churchill & Bly, 1999). These improvements fall precisely in line with the staff's expressed needs to deal efficiently with security concerns, multi-patron interactions, and technology troubleshooting between branches. Additionally, many chat systems are free or

low-cost and generally intuitive and user-friendly (Rutherford, 2008). A comparative example of use in daily patron interactions is provided below.

The chat system would be designed to provide a more efficient communication system for sensitive information such as security concerns as well as technical information such as technological troubleshooting. A frequently mentioned type of incident from our staff interviews involved individuals coming into the library to engage in inappropriate behavior that was not visible by the security cameras. Patrons would report the behavior but also request that the staff member they informed not approach the individual so they would not be recognized as the informant. A chat system would allow for the discreet and efficient transfer of information to the appropriate staff (e.g. branch manager) to address the situation while being considerate of the patron's concerns.

▪ **Challenges**

Chat systems and other "social software" can come with hidden upkeep costs such as training time and transitioning to consistent use of the technology rather than previous technologies (Rutherford, 2008). Employee pushback, even in small degrees, can be detrimental to the implementation and efficient use of such a technology, so all staff members would need to be on board with the system and properly trained in its use (Rogers, 2003). Based on past experiences with chat systems, the service would need to have the ability to configure fairly strict regulations regarding sub-chats and logging conversation records to avoid any inter-departmental issues (Jessica Jones, Personal Communication, 2019).

- **Impacts**

  The successful implementation of a chat system would assist staff with some of the more problematic interactions they have to face. The creation of themed chat threads would also allow for more organized communication flows between staff members and incorporate staff interaction across branches for technological troubleshooting or patron inquiries while away from the desk. Streamlining the staff communication process would ideally increase overall patron satisfaction and efficiency of interactions.

Metadata GUI - Laserfiche

Archival workers initially requested we research options for an automatic metadata entry system which would be capable of populating searchable information into the library catalogue with a minimum of human intervention. While such a program would greatly enhance the efficiency and effectiveness of the archives, current Optical Character Recognition (OCR) software does not perform well with low-resolution images or cursive text (CARLI, 2020), which is much of what the Carnegie Branch is attempting to digitize. Additionally, the current method of archival entry is unintuitive and difficult to work with (Altman, Personal Communication, 2019). Rather than using an OCR product, the adoption of an intercessory program that could improve ease-of-entry for metadata information could be greatly beneficial. The intercessory program could create data-entry forms that could then be uploaded into a metadata cataloging software.

- **Benefits**

  Carnegie Center staff noted the challenges presented by the current metadata entry options. As it stands, recording descriptive and searchable terms into the archival records requires workers to interface with a DOS-like program that lacks an intuitive interface. The desire was expressed for a system that would enable them to both enter complicated information into the system quickly and without errors as well as foster more rapid familiarity and ease-of-use for experienced archivists and new staff alike. The city's currently licensed Laserfiche software was identified as a potential interface to create a standardized form by which relevant metadata information could be entered (Laserfiche, 2020). The form could then output the information as a text file in the appropriate "coding" which could then be inputted through the metadata entry software (Laserfiche, 2018). The standardized interface would allow for decreased training time and fewer errors during the data entry process. This efficiency increase would allow librarians to pursue other priorities such as collection management, community outreach, and programming, as well as improve the rate at which the collection is made available in digital format.

- **Challenges**

- Time, effort, and expertise would be needed to create the forms themselves, likely through the IT Department working in close contact with the archival staff. Additionally, learning the new entry interface, troubleshooting the entry process to ensure it is free of errors, and ensuring the forms properly mesh with metadata intake would all require time and attention, along with additional staff training. Monetary costs are anticipated to be minimal, as the Laserfiche tool is already in use with other departments in the city and can be adapted to several purposes.

▪ **Impacts**

The primary anticipated impact of transitioning to a Laserfiche-based entry interface is a reduction of time dedicated to this singular task, which monopolizes librarian efforts in the digitization initiative. Digital access is one of the primary goals of the Carnegie branch, which serves as a repository for unique historical records that are referenced by local and even international researchers. Thus, the impact of improvements to the process of making these records available online are not only felt in the Bryan/College Station community but are also beneficial to academic and personal research far beyond their regional borders. More immediate benefits for the community also include an increase in efficiency that enables greater allocation of time to community outreach and social media presence, public benefit programs, as well as collection development, management, and conservation.

Proposed Solutions

Recommended Solution Package – Three Year Plan
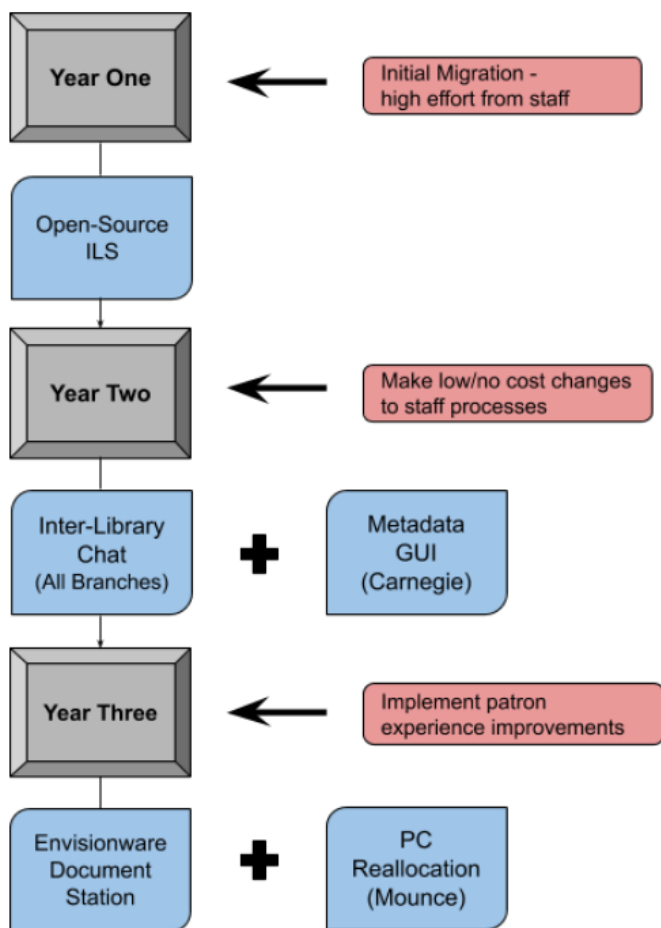
This package hinges on the cost savings provided by migrating to an Open Source ILS. In the first year, only the migration can feasibly take place as this will take large amounts of time and effort from all staff to complete the data transition and re-training processes. The implementation of the two potentially higher cost patron experience improvement solutions occurs in the third year when, presumably, the cost savings of migrating can be realized. Between these two steps, the essentially costless improvements to staff processes can be executed with only some training required. Both the chat system[1] and metadata GUI are intended to be intuitive- otherwise, their ability to streamline processes is less effective- which means the integration into current processes should be fairly smooth and not add a significant burden to any lingering concerns from the ILS migration.

This solution package is our primary recommendation because it allows for nearly every request from the department and all categories of needs to be addressed within three years. That said, this plan can be stretched out over as many years as is appropriate

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[1] Please note that a chat system was reinstated by the department prior to the conclusion of the capstone

for the department's needs. As mentioned in the previous sections, the ILS migration will allow for significant savings each year compared to the $30,000 - $35,000 annual maintenance fees of the current Polaris ILS. Specifically, if the servers are self-hosted by the IT Department, the transition costs will be approximately $30,342 in year one or $4,855 per year for five years. Additionally, the customizability of the ILS will allow the current mobility barriers to be addressed while potentially offering a more streamlined resource search service that would normally require a discovery interface. The savings in subsequent years can be used to upgrade the current document processing equipment and integrate scanning capabilities while potentially creating an opportunity for funding additional staff hours to increase outreach capabilities within the community. Furthermore, the reallocation of PCs and the creation of a metadata GUI will address the equity of access concerns at the Mounce location and the efficiency challenges of the Carnegie location, respectively.

The major costs involved in this package are high levels of staff effort to make the migration from Polaris to open source as well as the transition services costs from the Equinox Open Library Initiative. There will also be a substantial need for re-training of staff on the new system before the efficiency gains and cost savings can be realized. Following the transition, comparatively minor costs should be expected. The two Document Stations require about $5,000 in physical assets and the PC Reallocation will cost between $150 - $500 per new ADA compliant desk (prices found via web search) and anywhere from $0 - $1,200 for low vision computer aids such as screen reader software (AFB, 2020). These costs do not include potential training time for the new technologies or potential patron adjustment costs.

## Alternative Package 1 – Low Cost Combination

Each technology in this package could be implemented at a very low cost to the department. The Inter-Library Chat could coordinate and streamline staff communications with a free application and the Metadata GUI for Carnegie could be developed using the current City-owned Laserfiche software. As described in the recommended package, the PC Reallocation costs can vary widely but are relatively low compared to the Document Stations and the up-front ILS transition cost. This package would be a good option if the department decides that migrating to an open-source ILS would be infeasible at this time but would still like to make improvements to processes and equity of access for patrons. Also, because the Metadata GUI and PC Reallocation are specific to single branches, they could be implemented simultaneously without being overly disruptive to staff or patrons.
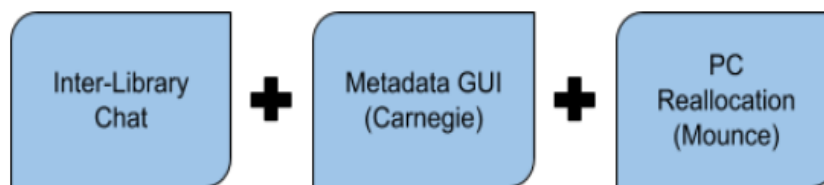
The drawbacks of this package are the limitations for long-term growth and improvements within the department. Without the dramatic savings of moving to open-source ILS, the department budget will still be heavily limited by the current maintenance fees. This package does not address the mobility and outreach concerns, nor does it address the lack of scanning capabilities for patrons.

Alternative Package 2 – Mobility Maximization

This package is designed to address the mobility limitations by implementing Polaris Leap and the Inter-Library Chat. Polaris Leap will allow Librarians and Staff to conduct outreach activities within the community while the Chat system would allow for streamlined communication with those out in the field. This package would hopefully increase the patronage of all three library branches by better informing the public of the department's offerings. This would also increase the department's opportunities to interact with disadvantaged populations in the community that may be unable to travel to the current branch locations.
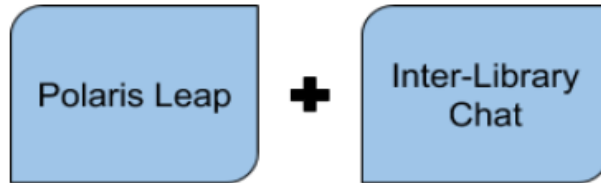
The costs of this package are the initial implementation cost of the Polaris Leap browser extension (roughly $10,000 according to a previous quote) plus any additional maintenance costs this would add to the annual Polaris fees. Furthermore, this package would require additional staff time and any related transportation costs dedicated to going out into the community for engagement opportunities (e.g. First Fridays or neighborhood visits). As mentioned previously, the Chat system would require little to no additional costs to the department aside from some general usage training.

Expected Outcomes and Measures of Success

To determine the success of the technology implementation, there must be relevant benchmarks and measures for monitoring the process and results. Suggested benchmarks and measures are provided below.

Expected Outcome		Measure of Success
Increased Efficiency	If an open-source ILS is adopted, the department will be able to provide the same level of services with greater flexibility and mobility as with Polaris for a much lower annual cost.	Track the budgetary change brought about by the transition as well as whether the department's offerings of resources, programming, and other services remain the same or change from previous levels.
Improved Access for Patrons	We expect that the adoption of a mobility enhancement technology (Polaris Leap or open-source ILS) will increase public access to library services over time.	Number of library cards issued from remote locations (currently zero), trends in digital or another remote-services usage.

Efficient PC Usage	By converting some of the PCs currently in use to public access catalogs or disability access PCs, we expect that patron use of the current number of PCs will be allocated more efficiently.	Both before and after the change, track the number of people using each type of computer and how long it is in use. Such tracking should be possible from the system itself which tracks log-ins and usage times (patrons must log in to use the regular or disability access computers. Public access catalog usage could potentially be tracked by simple observation or by the number of searches per computer (if possible).
Streamlined Staff Communications	By adopting a staff chat, we expect a better collaboration between staff within and between branches as well as more fruitful patron interactions.	this will be difficult to measure beyond staff impressions but perhaps use of the chat system could be discussed and general impressions documented on a weekly or monthly basis to track the system's efficacy.

CONCLUSION

The Library stands to benefit from numerous technologies in terms of effectiveness and budget, both in the traditional sense of funding and in the expanded sense of budgeted time spent on various tasks. By implementing tools that expand access to library resources beyond the doors of the library, the department will enable patrons to more easily access information without excessive dependence on Librarian oversight and intervention. These recommendations will increase the number of technology services available to the public and improve behind-the-scenes processes such as communication and data entry so that more time and resources may be put to use in programming, collection development, and other needs. Options described in this document have been carefully considered for their potential impact for the community and the needs of the staff and have also been selected for their comparatively low impact on the department budget. It is hoped that the combinations of services outlined here may prove useful in crafting a response to the needs of the library as they are now, and as they develop in the near future.

INTRODUCTION

At the conclusion of the fall semester, our sub-team discovered multiple areas for potential improvement in the Parks & Recreation Department's Technological Needs Assessment (TNA). Additionally, our sub-team identified potential areas for future research, which included:

- Implementing software that will allow for facility and maintenance risk assessments

- Data collection

- Emergency weather system

- Centralized irrigation system

- Park WiFi

Due to the difficulty, budget constraints, and low benefit returns on the park WiFi implementation and centralized irrigation system, these two topics are not included in the following implementation plan. The implementation strategy will focus on opportunities to:

- Update the Recreation Management Software

- Streamline Risk Assessment and Work Order Tracking

- Increase Data Collection

- Use GIS to manage current operations and future planning

- Install an Emergency Weather System

The Parks & Recreation Department has three challenges that particularly affect the department. In this implementation plan, our sub-team identified technological solutions to these challenges and broad strategies on how to implement the recommended technologies and literature that identifies some of the best practices when implementing new processes in an organization. Additionally, our sub-team outlined implementation strategies regarding a problem that affects the whole city.

CHALLENGES & SOLUTIONS

Recreation Management

Challenges

One challenge is the older version of the recreation management software that is currently in use, RecTrac. RecTrac is a recreation management software by Vermont Systems that has 12 different modules that include facility registration and league scheduling (Vermont Systems, n.d.). Currently, the department employs an older version of the software and updating the software would improve the challenges that the department is currently facing.

Technological Solution
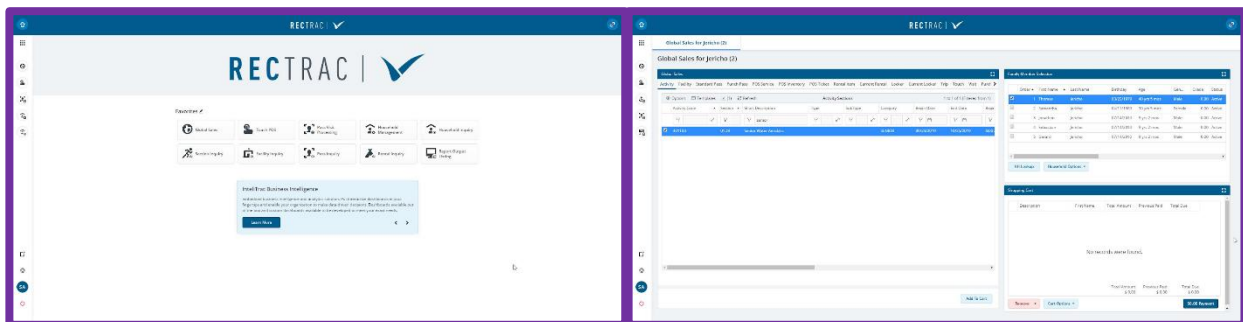
Updating RecTrac

The benefits of updating to the newest version of RecTrac include easier recreation management, a more modern and user-friendly design, and improved communication with Bryan residents through the ability to send emails following the rental of park facilities. The multiple modules for activity registrations, membership management, and league scheduling management allow for the department to better customize the software to best fit their needs.

- **Implementation Cost**

  In terms of time as a cost, implementing RecTrac will require the IT Department to make sure that the updated version will be compatible with current operating systems and that the transfer of data from one version to the other will go smoothly. The cost to update RecTrac to the most current version would be roughly $9,000 according to a quote received from Vermont Systems.

- **Barriers to Implementation***:*

  Since updating RecTrac is our primary recommendation and the department already has an older version of the software, we anticipate costs to be low. As a result, barriers due to budget constraints should be minimal. The primary barrier for updating RecTrac will involve gaining employee buy-in and convincing current employees to accept the adoption of changes to current technology. We anticipate that active promotion and encouragement by senior staff for the adoption of an updated RecTrac system will be needed to counter expected pushback from employees who wish to continue with the current system.

Implementation

Since the department already has the older version of RecTrac and has conducted business with Vermont Systems before, our sub-team determined that updating the current software will fulfill their recreation management needs and limit both costs and training time. Once purchased, we believe that the implementation of an updated RecTrac can be completed within one year. To accomplish this, the Parks & Recreation department will need to work with the IT department to ensure smooth implementation of the software and avoid negatively impacting the efficiency and effectiveness of the updated software. Additionally, Parks & Recreation leadership will need to schedule a time to view an online demonstration and receive training for the updated software. This will allow leadership to have a clear understanding of the product before training other employees.

Expected Outcomes: Effectiveness, Efficiency, Equity

Updating RecTrac will increase effectiveness and efficiency by addressing challenges brought up by department staff including updated rental processes, program reports, and sports league software. For example, the unlimited user menu configuration and custom screens of an updated RecTrac system allow each employee to customize their home screen for quick access to modules related to their work duties. Additionally, the marking tools capture repeated business and can target demographic and activity groups through email messaging options. The league scheduling features will also improve effectiveness and efficiency by eliminating streamlining current tasks and eliminating redundant actions. For example, the updated system can automatically generate league schedules and allows for team data to be reused from year to year. Finally, this new software will increase equity by gaining the ability to send out surveys to all the residents that rent pavilions or attend events, so the department can collect feedback from across the community and identify park and facility improvement needs.

Risk Assessment/Work Order Tracking

Challenge

The need to streamline facility risk assessment and work order tracking processes presents a second challenge. While the department has a facility work order system that is used internally for maintaining facilities, facility problems are only added to the work order system once a problem arises. Risk assessment software will allow for the department to be proactive by streamlining regular inspections and improving preventive maintenance efforts, thus reducing long-term costs.

Technological Solution

Implementing MainTrac

MainTrac is a maintenance software that can be used to track the department's tasks, facilities, trees, parks, contract costs, and equipment. Through MainTrac, staff can log and track maintenance needs for different facilities or park structures and proactively submit work orders that can be updated in real-time. This software will be beneficial for the Parks & Recreation department by replacing the need to track operations by hand and allow for the improved collection of park maintenance data. Though it will require additional training, the department would benefit in the long run from having comprehensive data regarding work orders and labor tasks. In addition,

mobile MainTrac allows employees to remotely input information from the job site. This software would help the department proactively combat maintenance problems through preventive maintenance and job scheduling. An additional advantage that MainTrac, like RecTrac, is a product from Vermont Systems, thus ensuring system compatibility.

- **Implementation Cost:**

    The cost of implementing MainTrac for the department would be roughly $20,000 with an additional $2,000 annual fee according to a quote from Vermont Systems.

- **Barriers to Implementation:**

    As with RecTrac, implementing MainTrac will require the IT department to ensure that the software is compatible with Parks & Recreation's current operating systems and that the staff is properly trained for the software.

Implementing Cartegraph

Cartegraph is another operation management software which allows for real-time maintenance updates, risk-tracking, and labor management. The software is similar to MainTrac but is not compatible with RecTrac. As previously mentioned, the department would gain long-term benefits from having comprehensive data regarding work orders, park maintenance, and labor tasks. Cartegraph will require the IT department to ensure software compatibility with Parks & Recreation's current operating systems and that staff are properly trained. An advantage to this software is that it allows for GIS Integration. One of our recommendations was increasing the department's use of the GIS system, thus, bringing the two systems together allows the ability to "consum[e] spatial and non-spatial attribute information about assets, analyzing assets in context with each other, and improve communication by automating workflows" (Cartegraph, 2019).

- **Implementation Cost*:***

    After reaching out to Cartegraph, the company provided two different options for implementation: the targeted solution or full parks and recreation solution. The targeted solution would be $2,000 per year for strictly playground inspections with mobile access through a phone or tablet. The full parks and recreation solution would cost $20,000-$27,000 and include assets for park amenities, structures, equipment, playgrounds, trees, athletic spaces, benches, fences, and landscape areas. This solution includes mobile access, preventative maintenance, and work order creations, though it is unclear whether or not this is a one-time or yearly fee.

- **Barriers to Implementation*:***

    Anticipated barriers of adding this new software include budget and employee hesitancy to adding new technology to their established workday. Additionally, assessing all the department's assets and conducting a risk assessment of parks and trees near the parks will be tedious, but will benefit the department in the long run by knowing when a facility was last updated and when a structure or tree might pose a risk to the public. Effective implementation will require communication between the Parks & Recreation department and the Facilities Services department so that both departments can effectively use the software to communicate and track the status of work orders and maintenance needs.

Implementation

The implementation of this software will be expensive and time-consuming. It will take time to survey, assess, and input the condition of all park equipment, trees, and facilities into the system. If the department is not already aware of this information, it will have to be reactive to potential future problems instead of being proactive. MainTrac is our recommended risk assessment/work order tracking software due to its compatibility with RecTrac and the ability for training to occur in parallel with training for an updated RecTrac. Inspection processing and asset tracking should begin with the older facilities and equipment first to ensure that the older facilities and equipment are still safe.

Expected Outcomes: Effectiveness, Efficiency, Equity

Implementing a risk assessment software will increase equity by helping the department track park safety needs. Additionally, implementing this software will improve the effectiveness and efficiency by allowing the department to be proactive in knowing which facilities, parks, and equipment require maintenance, improvements, or replacement. Knowing this information will assist with identifying preventive maintenance needs and avoid increased costs related to equipment deterioration.

Data Collection

Challenge

When asked what data would be beneficial to the department if collected, the staff mentioned topics including popular times for each park, how long people spend at the parks, total people using the park, and most and least popular parks. Without knowing this information, it is harder to identify where to focus maintenance efforts and prime locations for events where is the best place to hold certain events.

Technological Solutions

Implement Eco-Counter & Eco-Vision

Eco-Counter offers various products that count the amount of bicycle and pedestrian traffic in a certain area. Some sensors can count and distinguish between bikers, pedestrians, and cars, while other eco-counter sensors focus on pedestrians. This variability in products would allow the department to have flexibility in the type of sensors they install in different areas. Eco-Visio is the online data analysis platform that is paired with a physical eco counter. The count data is viewed in the dashboard and includes various visualization modules that allow for interactive charts and graphs.

- **Implementation Cost:**

  While the Eco-Visio software is free with any purchase of an Eco-Counter, Eco-Counters range in price from $2,000 to $7,000 per counter depending on the counter and its capabilities.

- **Barriers to Implementation:**

Implementing the Eco-Counter data collection software, Eco-Visio, would require a larger effort than the aforementioned management software. While Eco-Visio is a software that can be installed on computers or tablets, it requires data collection counters to gather data. These counters include tiles in walkways, counting posts, or counting sensors that would need to be physically installed in areas where data is wanted regarding the number of people at a park. Because of this, staff would need to work more closely with the IT department to ensure that once these counters are implemented that they are properly connected to the Eco-Visio system. Eco-Counter software and tools will require significant training to implement and maintain but can provide beneficial results to the Parks & Recreation Department regarding citizens at their parks. However, once the battery in the Eco-Counter dies after 1-2 years, the Eco-Counter would need to be replaced entirely. Because of this, the department would need to pay for new Eco-Counters each time a battery runs-out.

Implementation

Since Bryan's Park system consists of 56 parks, the department would have to determine which locations should be prioritized for data collection. The department should analyze which facilities are currently using most of the department's resources and put the trackers there to ensure that the traffic in those areas warrants those resources or if even more are needed.

Expected Outcomes: Effectiveness, Efficiency, Equity

Data collection methods such as Eco-Counters and Eco-Visio would provide effectiveness within the department as they provide a way to quickly gather park usage data, which allows for future use in planning projects or the addition of new park features. The Eco-Counter tools are efficient in the sense that everything can be managed from the Eco-Visio platform in real-time and allow for rapid data collection. This is beneficial for the department as it currently lacks the methods for collecting data on when and how often visitors use the parks. To make data collection comprehensive and equitable, Eco-Counters must be spread throughout a variety of parks and locations in Bryan. This will help the department know if resources are being effectively and efficiently allocated within parks.

Geographic Information Systems (GIS)

Through the multi-department meetings, our team discovered that the city currently has ArcGIS software. GIS software allows users to collect information and produce interactive maps and applications that allows city workers to plan and maintain their operations while promoting more interaction with residents. If the department utilizes Bryan's current ArcGIS software, they can use geographic information to improve their operations through a variety of analysis capabilities and software add-ons. Examples of potential add-ons include:

- **Cycling Infrastructure Inventory**

  This add-on can be used to inventory bike lanes, paths, routes, and parking. A comprehensive inventory of cycling infrastructure can help with future maintenance management workflows (ESRI, n.d.). This type of add-on shows the importance of having a compatible maintenance/risk tracking software and GIS system.
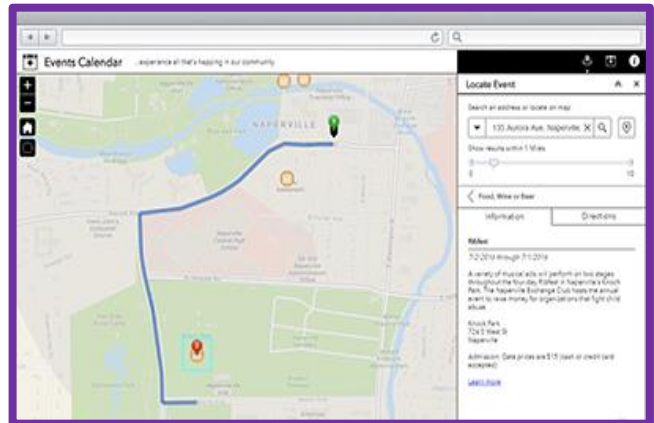
- **Events Calendar** can be used by the public to discover when and where events are happening in their community from any personal device.

- **Photo Surveys** can be used to publish street-level photo collections. An application like this one can help citizens see which pavilion or park they might want to rent for an event without ever having to go visit the location.
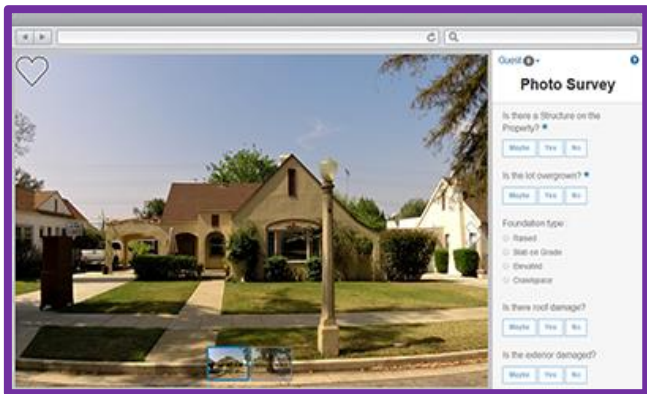
Overall, ArcGIS is a software that can further enhance the other technologies that we have recommended. It can be integrated with a risk assessment software to allow staff to be aware of where there are trees at risk of falling or which locations are most prone to citizen complaints.

- **Implementation Cost:**

  Since there are various products that ArcGIS offers to businesses, the department would have to ensure that the current version that the city owns would allow for the mentioned add-ons and others that would allow the Parks & Recreation department to fully utilize the software for their needs.

- **Barriers to Implementation**:

  Similar to the implementation of the risk assessment software, the work to input all the data into a GIS system is a tedious and time-consuming one.

Implementation

The department should first check if MainTrac and ArcGIS are compatible with each other. If both software are compatible, the data that is input during the implementation of the risk assessment software should also be input for the GIS system. Being able to update both systems at the same

time would make the process of implementing more efficient and effective and will allow the staff to decide what needs to be visualized.

Expected Outcomes: Effectiveness, Efficiency, Equity

ArcGIS would increase the effectiveness and efficiency of the department similar to the risk assessment/work order tracking software by allowing the department to be more proactive about maintenance. Additionally, the use of ArcGIS can increase equity by using add-ons that improve accessibility for all residents. For example, the photo survey add-on would help residents that might have limited physical ability to see the site pavilion they want to rent without having to physically visit the site.

Emergency Weather Systems

Challenge

Currently, Bryan does not have an emergency weather system in place to warn residents about unsafe weather and if they need to seek shelter or not. In the past, there has been an increase in severe weather in the Brazos Valley area. Having a city-wide emergency weather system would be very beneficial to the public safety of Brazos Valley residents.

Technological Solution

Earth Networks Weather System

Earth Networks provides an array of different weather alert systems, including Sferic Siren, an automated outdoor alerting system for lighting, hail, or tornadoes. Sferic Siren uses information from Earth Networks' weather station and sensors that track weather conditions and lightning detection to provide real-time storm tracking and alerts. This system would be beneficial to Bryan because none of their outdoor sporting parks currently have a weather alert system. The detection and the siren are automated, so people do not have to wait for human intervention to get to safety. Earth Networks provides a free weather safety audit and lightning risk assessment for departments to determine their weather risk and which of their weather systems would work best for a department's needs. There is no publicly available cost of any of Earth Networks weather systems, including Sferic Siren.

- **Barriers to Implementation**

  As of now, the only barrier to implementation is the lack of available costs and the need for proper staff and training to set up the new system. There is also some discussion on who would handle the emergency weather system and whether or not it is specific to the Parks and Recreation department. After speaking with the IT department, they recommended implementation be handled by Public Safety as opposed to just the Parks and Recreation department. However, determining who should take charge of this implementation could delay the process.

Implementation

Since the need for an emergency weather system is a public safety issue for Bryan residents, this recommendation does not come out of the Parks and Recreation budget. Rather, it should be posed as a public safety need while the departments are putting together their budget requests to Bryan.

The city will need to inquire about the price of installing the weather stations and how many weather stations would be needed. This could be a joint venture between Bryan and College Station, since how far the sirens travel is of interest to both cities.

Expected Outcomes: Effectiveness, Efficiency, Equity

Sferic Siren would promote equitable outcomes given that there are not any restrictions on who it benefits. Park and sports field attendees would be notified of incoming inclement weather. Additionally, this weather alert system is effective in that it can detect lightning or severe weather and send out a siren for the surrounding area. It accomplishes this task efficiently by not requiring any manual labor to do so. Sferic Siren is beneficial for the Parks and Recreation Department and the City of Bryan in general due to the increased safety it provides citizens.

CONCLUSION & MOVING FORWARD

Primary Recommendation

Our primary recommendations are for the Parks & Recreation Department to (1) update their RecTrac software to the latest version, (2) implement MainTrac, and (3) increase their use of Bryan's current ArcGIS software.

1. **Update RecTrac:** Updating RecTrac will allow for easier management by staff through its modules and user-friendly design. Since the department currently owns RecTrac software, it will be relatively inexpensive to update to the latest version.

2. **Implement MainTrac:** As Bryan Parks & Recreation Department currently has no work order or labor tracking software, implementing MainTrac would be a beneficial asset to the department. Having the ability to track work orders, maintenance requests, and labor will assist in effective service delivery for the Parks & Recreation Department. Since MainTrac is compatible with RecTrac software, the department's work processes will be integrated, thus ensuring that staff and the department as a whole are working efficiently. Out of our recommendations, implementing MainTrac has the highest cost, but the potential benefits of the software would allow for growth and integration within the department. Both MainTrac and RecTrac would require staff training so the staff must be aware of how the software would be beneficial to their positions and department's work processes.

3. **Increase use of ArcGIS:** Since the department already owns the ArcGIS software, increasing the park and recreation department's use of it should be inexpensive. The only potential costs identified include purchasing add-ons to customize the software for the department. The implementation of ArcGIS would follow the implementation of RecTrac since the staff must first survey various facilities and gather data before visualizing information in ArcGIS.

The estimated cost for these recommendations would be roughly $30,000 plus an additional $2,000 annual fee for MainTrac. This cost includes quotes received from Vermont Systems for both RecTrac and MainTrac.

Our team's primary recommendation for new technologies will help the Parks & Recreation department increase effectiveness, efficiency, and equity. The update of RecTrac will be a low cost, low effort implementation when compared to the high-cost implementation of MainTrac and high-effort implementation of ArcGIS, but all are necessary for the department to streamline their work processes and increase accessibility and interaction with residents. To increase the probability of success of this implementation, the department will have to highlight the significance of having a well-maintained Parks & Recreation department when making budget requests and fully develop and define performance measures to ensure that the benefit of the suggested software is maximized.

PART IV:
Conclusion

Section 4.1
Conclusion

Strategic Task and Technological Analysis

The completion of this report is the result of over 2,000 hours of work in pursuit of identifying technological needs within selected departments for the City of Bryan. The recommendations contained herein have been crafted through data collection, interviews, and surveys beginning in the fall of 2019. Ending in the Spring 2020, the team concluded by presenting their final recommendations and implementation strategies to the City.
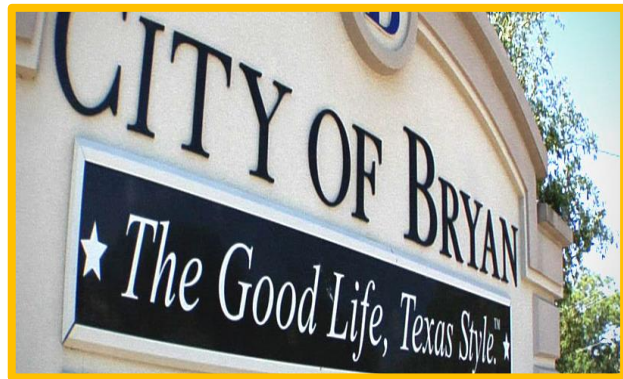
SYNERGIES: CONNECTIONS BETWEEN DEPARTMENTS

A critical consideration for the City was the ability to find synergistic solutions across departments. By identifying such solutions, time, funds, and effort could be allocated more effectively to improve overall City services or processes. Following the spring semester update with the City, representatives from each sub-team met with the IT department to discuss potential areas of overlap. As a result of this and other meetings, the team was able to identify three synergistic opportunities.

Communication

A major point of synergistic improvement was communication between the City's IT Department and other departments. There were multiple cases of ideas or concepts brought up by the groups that were either already being investigated by the IT Department or had never been mentioned to them as a potential need (IT Staff, Personal Communication, February 18, 2020). Consistent and detailed communication between City departments could enhance

Departmental Synergies

- Communication
- Laserfiche
- Weather Alert Systems
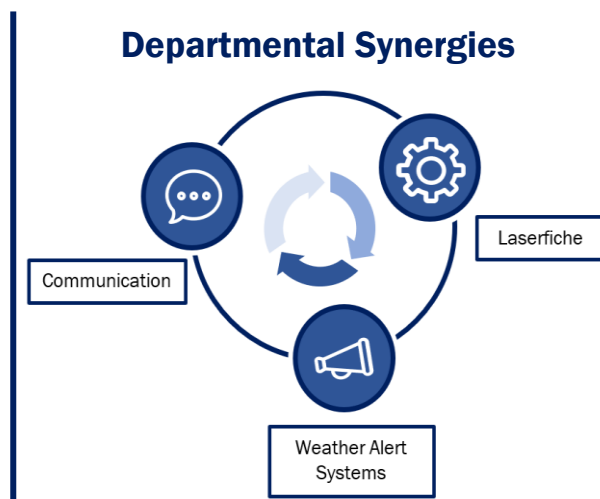
strategic planning and provide greater support for technological needs and desires.
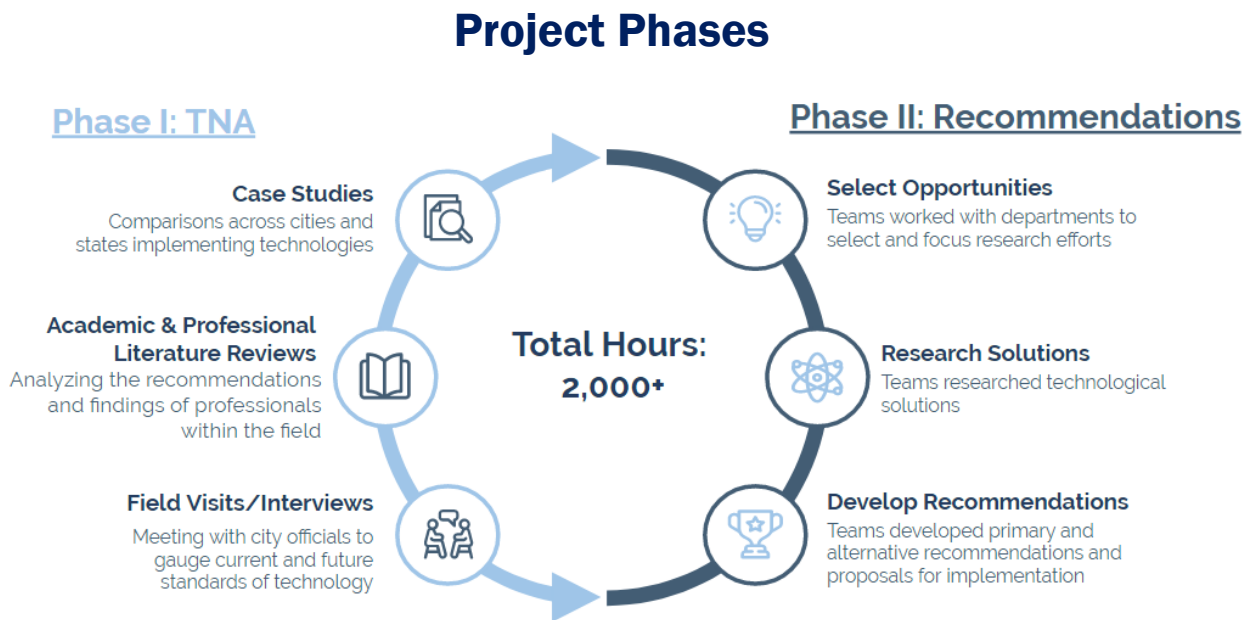
Laserfiche Utilization

Careful planning and close inter-departmental coordination could allow for improvements among multiple departments with an already owned software product, Laserfiche. The City currently owns Laserfiche licenses and the program can be used for many different forms of workflow automation and streamlining. Laserfiche was referenced as a solution for employees within the IT, Library, and Fire departments along with Human Resources.

Weather Alert Systems

The inclement weather sensor and alert system described in the Parks and Recreation section of this document was identified as a solution that applies to the broader category of public safety (IT Staff, Personal Communication, February 18, 2020). As such, it falls under the purview of the Fire Department and the Police Department. Thus, it may be more appropriate to move the weather siren system considerations to a higher administrative level within the City. By moving the system under the general umbrella of public safety, it may be possible to garner more diversified support, as well as funding sources, to implement the technology.
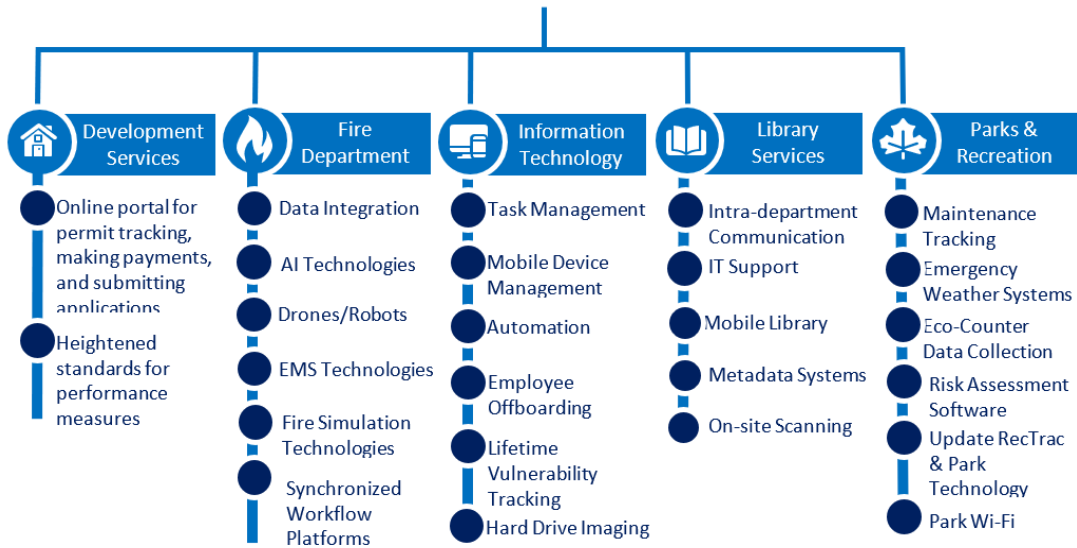
PROJECT REVIEW

The completion of this project occurred in two phases: The Technological Needs Assessment (Phase 1) and the Technological Recommendations (Phase 2). These opportunities identified in the TNA used various methods that included conducting case studies, reviewing academic and professional literature, interviewing departmental employees, and conducting department-wide surveys.

Project Phases

Phase I: TNA

Case Studies
Comparisons across cities and states implementing technologies

Academic & Professional Literature Reviews
Analyzing the recommendations and findings of professionals within the field

Field Visits/Interviews
Meeting with city officials to gauge current and future standards of technology

Total Hours: 2,000+

Phase II: Recommendations

Select Opportunities
Teams worked with departments to select and focus research efforts

Research Solutions
Teams researched technological solutions

Develop Recommendations
Teams developed primary and alternative recommendations and proposals for implementation
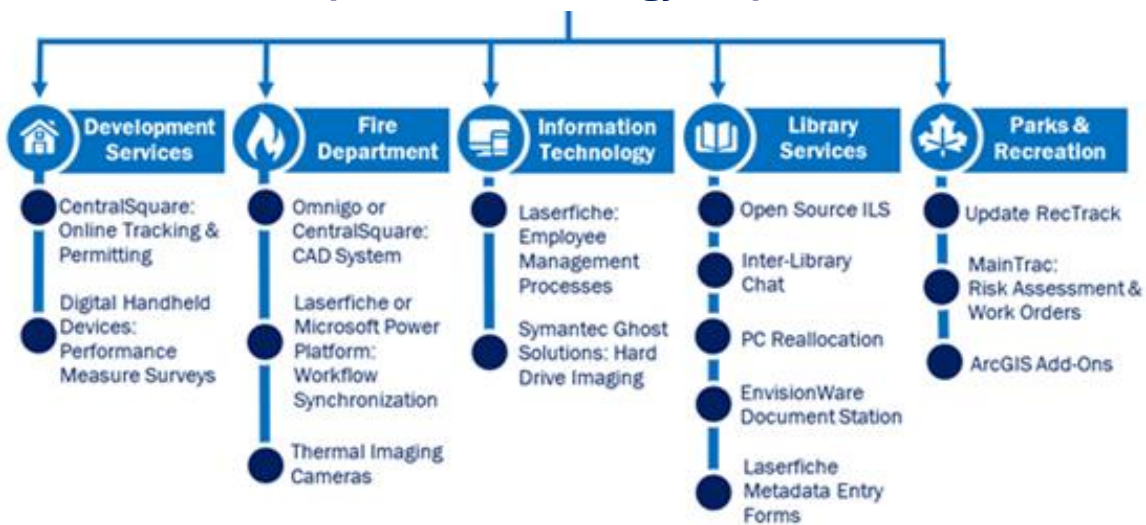
The Technological Recommendation section is meant to expand upon the findings elaborated in the TNA by providing technical solution options and implementation strategies. In consultation with vendors and department representatives, our team identified specific technological solutions that addressed the aforementioned needs and opportunities within the TNA.

Department officials will need to conduct additional research into the specific technologies and complete various approval processes to ensure they select the most feasible and beneficial options for the City. That said, the identified opportunities from the TNA in phase 1 and the technological solutions developed in phase 2 for each department are summarized in the graphics below:

Technological Needs Assessment: Opportunities for Technology Adoption

Development Services	Fire Department	Information Technology	Library Services	Parks & Recreation
Online portal for permit tracking, making payments, and submitting applications	Data Integration	Task Management	Intra-department Communication	Maintenance Tracking
Heightened standards for performance measures	AI Technologies	Mobile Device Management	IT Support	Emergency Weather Systems
	Drones/Robots	Automation	Mobile Library	Eco-Counter Data Collection
	EMS Technologies	Employee Offboarding	Metadata Systems	Risk Assessment Software
	Fire Simulation Technologies	Lifetime Vulnerability Tracking	On-site Scanning	Update RecTrac & Park Technology
	Synchronized Workflow Platforms	Hard Drive Imaging		Park Wi-Fi

Technological Recommendations: Options for Technology Adoption

Development Services	Fire Department	Information Technology	Library Services	Parks & Recreation
CentralSquare: Online Tracking & Permitting	Omnigo or CentralSquare: CAD System	Laserfiche: Employee Management Processes	Open Source ILS	Update RecTrack
Digital Handheld Devices: Performance Measure Surveys	Laserfiche or Microsoft Power Platform: Workflow Synchronization	Symantec Ghost Solutions: Hard Drive Imaging	Inter-Library Chat	MainTrac: Risk Assessment & Work Orders
	Thermal Imaging Cameras		PC Reallocation	ArcGIS Add-Ons
			EnvisionWare Document Station	
			Laserfiche Metadata Entry Forms	

MOVING FORWARD

It is important to note the COVID-19 pandemic and the its impacts will have on local governments in terms of regulatory and budget constraints. The need to effectively and efficiently switch to digital modes of service delivery has become a necessity. These factors emphasize the importance of technological solutions within these settings.

Our team suggests the following steps for moving ahead with implementing the recommended technologies:

1. **Hold Internal Departmental Discussions:** After reviewing the findings, department heads should hold internal discussions to identify which, if any, recommendations the department can implement at this time.

2. **Move Forward with Implementation:** Following the selection of recommendations to implement, the department head should assign a staff member to pursue the selected recommendations and coordinate with other departments as needed.

The changing needs of the community and the development of new technologies may result in better options becoming available by the time the City is in a position to move forward with technological updates. It is intended that the research and suggestions contained within this report will provide a useful starting point for the City of Bryan's next step in acquiring cost-effective and practical technologies.

Appendix

Appendix A: Departmental Head Interview Questions

General Department Head Interview Questions

1. What do you see as the primary objectives of your department?

2. What are your department's major roles and responsibilities?

3. What are some strengths and weaknesses in your department's use of technological tools?

4. What are some of the challenges (e.g. human capital/budget constraints) and opportunities (e.g. grants) for using technology to attain your primary objectives?

5. What are some specific tasks and processes where you think technology could be used more strategically to attain your primary objectives?

6. Given the scope of work for this project, what are your top technological priorities?

7. If your department was given significantly more resources, what are your top technological priorities?

Specific Department Head Interview Questions

Development Services

1. What are some of the ways you work with other departments in the City of Bryan?

2. How is the department currently measuring its performance?

3. What were the recommendations proposed by Mr. Paul Zucker for the City of Bryan's development services department?

Fire Department

1. What areas would you like to see efficiency and effectiveness improved upon within your department?

2. What types of data do you collect?

   a. What are those data points?

   b. What do you do with your collected data-points?

Information Technology

1. How does the IT department support other departments within the City of Bryan?

   a. What is the process for other department to communicate their needs?

2. What is the process for selecting and developing IT projects within the IT and other departments?

3. What are some of the different technological systems the IT department uses?

Library Services

1. How was the transition process for the most recently implemented technologies?

2. How open do you feel the City of College Station would be in regard to technology changes that impact the interlocal agreement?

3. Would you be interested in technology that works primarily behind the scenes (i.e. used by staff only) or technology that is community-facing (i.e. mostly used by citizens/patrons/participants)?

Parks and Recreation

1. What services does the department currently contract out?

2. How is your department currently collecting data regarding administrative tasks, parks, as well as recreation facilities?

3. Have there been any previous attempts at preventing park vandalism? If so, what did those attempts include?

4. Would you be interested in technology that works primarily behind the scenes (i.e. used by staff only) or community-facing (i.e. mostly used by citizens/participants)?

Appendix B: Departmental Survey Questions

General Departmental Survey Questions

1. What do you see as your department's primary objective?

2. What are your major roles and responsibilities?

3. How strongly do you agree or disagree with the following about your department?

    a. Stays up-to-date with new technology
    b. Uses technology to increase efficiency
    c. Provides employee development/training opportunities related to technology
    d. Coordinates technology within your department
    e. Coordinates technology with other departments
    f. Fosters citizen engagement through technology

4. What are some examples of technology that you use on a daily basis?

5. How challenging are the following to new technology adoption or implementation? (rate from 1 to 10 with 1 being not challenging and 10 being very challenging)

    a. Budgeting
    b. Time
    c. Employee comfort with technology
    d. Citizen comfort/awareness of technology
    e. "Red Tape"
    f. Employees available for research/implementation
    g. Awareness of alternative funding (e.g. grants)
    h. Other:

6. What are some specific tasks or processes that you complete regularly where technology could be used to improve effectiveness (i.e. accomplishing your objective)?

7. What are some specific tasks or processes that you complete regularly where technology could be used to improve efficiency (i.e. accomplishing your objective in a cost-effective or timely manner)?

8. If you were given significantly more resources to implement new technology into your work processes, what would be your top priorities?

Specific Departmental Survey Questions

Development Services

1. How does technology within your department help to improve customer service

2. What types of new technologies do your feel would help your department obtain its long-term goals?

Fire Department

1. Have you ever used modeling technologies for controlling forest fires, home fires, or evacuation purposes?

2. How important is integrating several sources of data such as weather data, traffic congestion data, population data, aerial data, and field data for firefighting?

3. How important is employing new technologies such as smart fire alarms, drones, and CCTV cameras for early fire detecting and reporting?

Information Technology

No additional questions were asked.

Library Services

1. How was the transition process for the most recently implemented technologies?

2. Which recently implemented technologies, if any, do your feel have made significant improvements to your provision of services?

3. Which recently implemented technologies, if any, do your feel have caused problems or complications in your provision of services?

4. Which of the following do your think would be more beneficial at this time?

    a. Technology that works primarily behind the scenes (i.e., used by staff only)
    b. Technology that is community-facing (i.e., used by citizens/patrons/participants)
    c. Both

Parks and Recreation

1. If you work directly with RecTrack, the Recreation Tracking Software, how well does the software support the roles and responsibilities of the department?

2. In your opinion, what kind of data about the usage of Bryan parks and facilities would be helpful in achieving the department's mission? (i.e., what times are most people at parks, how many facilities are rented out per month, etc.)

Appendix C: Examples of Current Technology in Bryan IT

GIS

- **GIS Mapping Applications:** GIS currently uses employs and a variety of GIS Mapping Services, such as ArcGIS to map and manage a variety of data sets.

- **Drones:** GIS currently assists with maintaining drones and training pilots. There are currently six drones in use and ten Federal Aviation Administration certified pilots (five in IT and five in Fire). The city's drone fleet is used in a number of ways but are often flown in support of Police and Fire operations such as accident scenes, missing individuals, or wildfires.

- **Confluence and Jira:** used for task management.

Operations

- **Radio Equipment and Devices:** the sub-team services and manages seven sites with RF (radio frequency) equipment and close to 1000 handheld and car radios for a variety of departments.

- **Monitoring Software and Test Tools:** The sub-team uses various software and tools to monitor communication equipment for various issues such as interferences, and to ensure that equipment used throughout the city is functional and operational. Examples include desktop software or the use of a handheld cable and antenna analyzers to test equipment functionality and status.

- **Crescent and ArcGIS:** software used to track the location, connection, paths, and line-of-sight propagation of communication assets.

- **Server Virtualization Software:** allows organizations to partition a single physical server into multiple "virtual servers" that can operate independently of each other and with different operating system configurations (CISCO, 2019)

Security

- **Cisco Umbrella:** integrated cloud console that provides a secure web gateway, cloud-delivered firewall, cloud access security broker functionality, and DNS-layer security and threat intelligence (Diaz, 2019).

- **Lansweeper:** IT asset manager that provides information on assets such as listing hardware specifications, installed software, user details, etc (Lansweeper, n.d.).

- **Tenable:** used for vulnerability scanning of networks and systems.

- **Vectra:** cloud and AI-driven threat detection and response platform (Vectra, n.d.).

- **LogRhythm:** a product that provides a reduction in risk by detecting, responding to, and neutralize cyberthreats through its Threat and Lifecycle Management framework and AI-enabled Security Operations Center (LogRythm, n.d.).

- *Mimecast:* email filtering tool used to check and verify links and attachments for threats.

- **KnowBe4:** a training program to assist employees with becoming aware of and improving their cybersecurity practices. Uses training videos as well as a simulated email phishing campaign to test employees.

Systems:

- **Laserfiche:** a digital content manager that can be used to capture and store documents and automate workflows (Laserfiche, n.d.)

Systems Support (IT Help Desk):

- *I-Support:* help desk software used to assist with incident, problem, and change management. It is used to create IT service tickets, as well as being used to store a list of City assets with associated information such as purchase price and location within the City.

- **Lansweeper:** IT asset manager that provides information on assets such as listing hardware specs, installed software, user details, etc (Lansweeper, n.d.).

- **Hard Drive Imaging Tools:** The IT Help Desk is responsible for device imaging, or the copying of the contents and setup of one hard drive to another, as part of deploying new or reimaged desktops and laptops. Currently, the department uses a system that allows for the imaging of one or two hard drives at a time.

- **Dameware:** remote access software for the purpose of providing troubleshooting and support for City desktops and laptops.

- *Active Directory Users and Computer Module:* a Microsoft Management Console used to administer the active directory by managing objects (i.e., users and computers), organizational units, and their attributes (Petters, 2019).
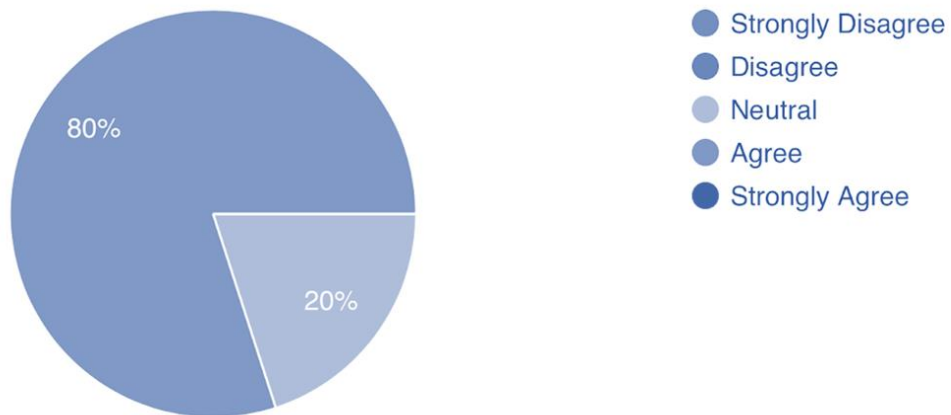
Appendix D: Parks and Recreation

Survey Results

1. What do you see as your department's primary objective?

2. What are your major roles and responsibilities?

3. How much do you agree with the following statements?
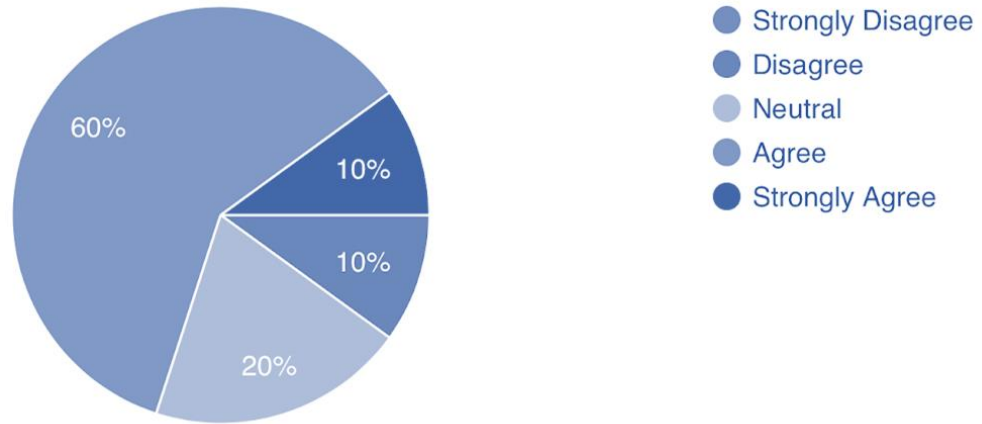
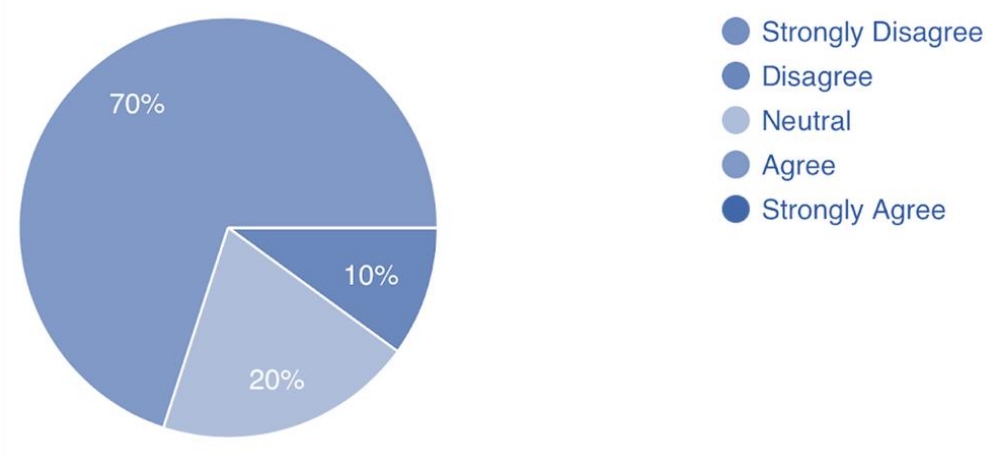   a. My department stays up-to-date with new technology.
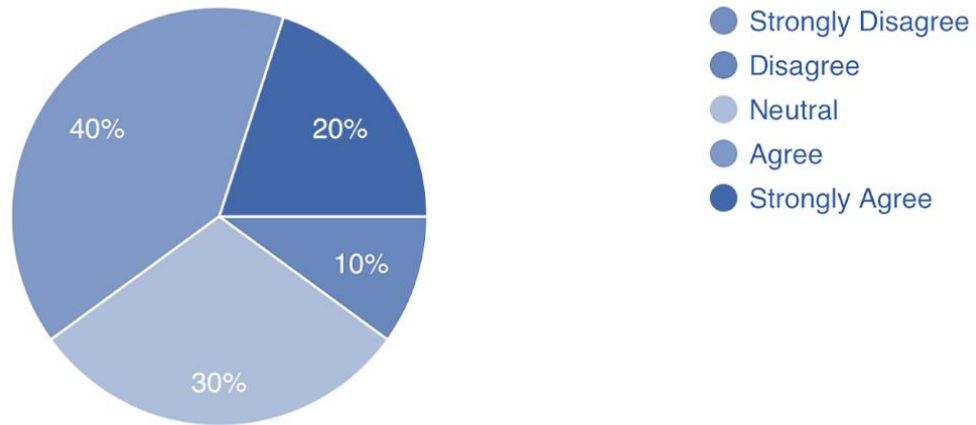
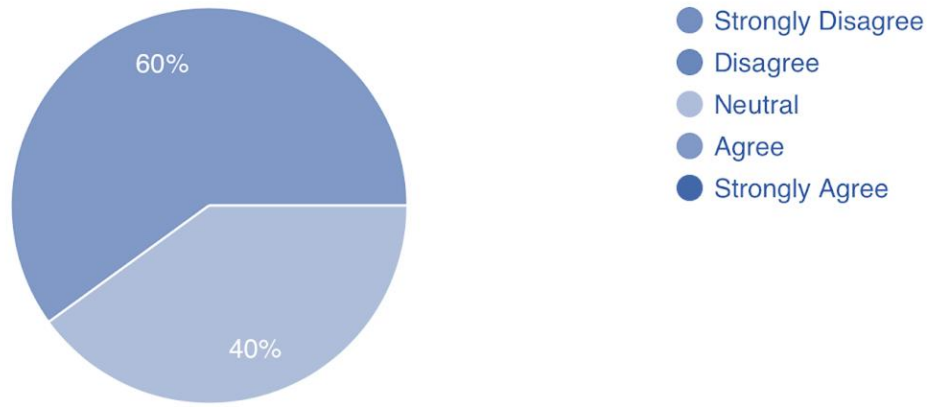   b. My department uses technology to increase efficiency.

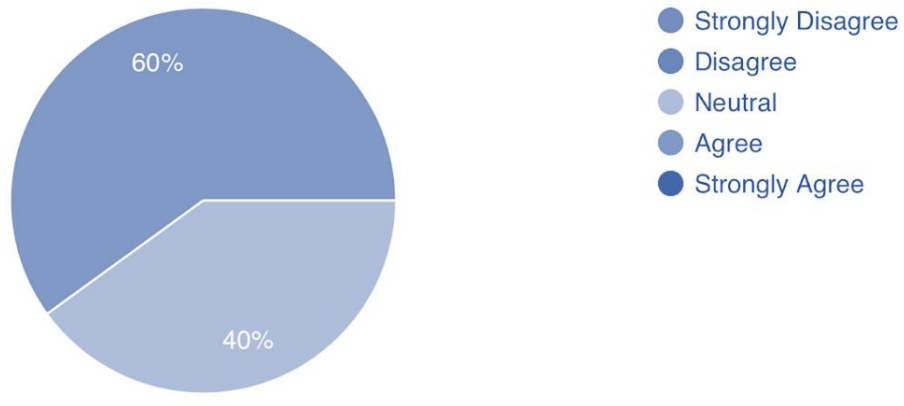c. My department provides employee development/training opportunities related to technology.

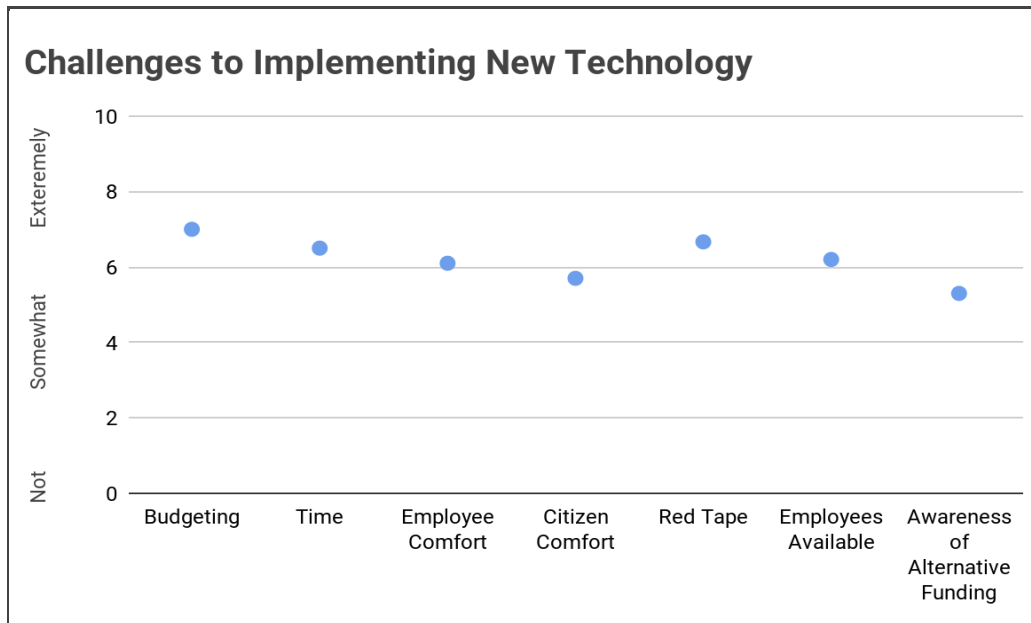d. My department coordinates technology within my department.

e. My department coordinates technology with other departments.

f. My department fosters citizen engagement through technology.

4. How challenging are the following to new technology adoption or implementation?

These questions were answered on a scale of 1-10 with 1 being not at all challenging and 10 being extremely challenging. The above table shows the answers ranked from most to least challenging with the average score of each.

Developing Objectives

Budget and Financial Information for Case Study Cities

Bryan, TX

- Bryan's median household income is $43,310 and median property value is $129,200.

Plymouth, MN

- Plymouth's median household income of $91,867 and median property value of $326,000, helps create more local taxes to help fund a city department.

- Throughout 2017, Plymouth program sponsors contributed $28,400 to the department and $20,633 in 2018.

- The total amended budget for Plymouth's Parks & Recreation department for FY 2019 was around $10M whereas the total adopted budget for Bryan's Parks & Recreation department for FY 2019 was around $5.5M (City of Plymouth, 2019; City of Bryan, 2019). There is a wide range between these numbers which must be taken into account when looking at Plymouth's park technologies. Plymouth's Parks & Recreation department allows for roughly $7M allocated just for parks, forestry, and recreation as opposed to the $5.5M for Bryan's entire Parks & Recreation department. This means Plymouth has more flexibility when looking to implement updated technologies to their department.

Plano, TX

- It is important to note that Plano, Texas is a much bigger and wealthier city than Bryan with 285,312 residents, a median household income of $94,306, a poverty rate of 7%, a Parks & Recreation department budget of $59.30 Million, and about 71 parks in their park system.

Allen, TX

- The population of Allen is 96,865. Median household income is $104,132, a poverty rate of 5.06%, median property value is $261,600, and a department budget is about $16M with about 100 full time personnel.

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