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Cover illustration by Denver Auditor’s Office staff.
AUDITOR’S LETTER

May 18, 2023

We audited citywide information technology purchases to assess whether agencies, departments, and other branches of government in the city are following Executive Order No. 18 requirements when making technology purchases. I now present the results of this audit.

The audit found agencies are not following the required protocols to obtain approval for information technology purchases made using a city-issued purchase credit card or when requesting reimbursement after making a technology purchase. Furthermore, the audit found the city’s Technology Services agency has not developed sufficient citywide guidance for technology purchases and has not communicated and trained staff on these requirements in partnership with the Department of General Services. Allowing these purchases could lead to waste and abuse of city funds and expose the city to security vulnerabilities.

By implementing recommendations for stronger policies, review processes, definitions of technology purchases, and training, Technology Services will be better able to prevent city agencies from bypassing Technology Services’ approval of information technology purchases.

This performance audit is authorized pursuant to the City and County of Denver Charter, Article V, Part 2, Section 1, “General Powers and Duties of Auditor.” We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

We appreciate the leaders and team members in Technology Services who shared their time and knowledge with us during the audit. Please contact me at 720-913-5000 with any questions.

Denver Auditor’s Office

Timothy M. O’Brien, CPA
Auditor
Citywide Information Technology Purchases

MAY 2023

Objective
To assess how well the city's Technology Services agency enforces Executive Order No. 18 by administering, implementing, and communicating requirements to city leaders and employees — particularly those who buy technology services and equipment on behalf of the city.

Background
Technology Services was established by Executive Order No. 18. The agency is responsible for reviewing and approving all technology purchases to ensure the continued operations and security of the city.

City agencies bypass necessary approval for information technology purchases when they use purchase cards and expense reimbursements

Agencies have not been following the requirements in Executive Order No. 18. Specifically:

• Technology Services’ policies and procedures for hardware and software do not address technology purchases or any exceptions for making a technology purchase.
• The city’s system of record does not prevent city employees from buying technology with a purchase card.

Technology Services has not developed sufficient citywide guidance for technology purchases

Technology Services has not documented and communicated requirements to city agencies related to technology purchases. Specifically, it has not:

• Defined what constitutes a technology purchase.
• Defined what Technology Services considers “on the network.”
• Developed standard steps for approving technology purchases.

Additionally, Technology Services is not coordinating with the Department of General Services about what information should be communicated to city agencies as it relates to technology purchases.

WHY THIS MATTERS
City agencies that bypass Technology Services’ approval when purchasing technology are violating Executive Order No. 18. This noncompliance not only puts the security of the city’s data at risk, but it also wastes taxpayer dollars through missed opportunities for bulk discounts.
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BACKGROUND

Buying technology at the city

Technology is an integral part of the City and County of Denver’s operations. The city uses various technology to store and share data and to provide services to residents. These include:

- **HARDWARE** – such as computers, servers, and other devices.
- **SOFTWARE** – such as operating systems, applications, and databases.
- **CLOUD SERVICES** – such as Microsoft 365, which provides an online suite of business applications.

It is important for the city to ensure any services or equipment its agencies or employees buy is safe, secure, and keeps pace with rapidly changing technology. By purchasing the latest hardware and software, the city can ensure its operations are up to date and running smoothly. Additionally, it is essential that the city ensures its systems are secure and protected from cyberattacks by malicious actors.

As shown in Figure 1, the city is using three ways to purchase technology:

- Making a request for a purchase order.
- Paying out of pocket and seeking reimbursement.
- Using a city credit card, or “purchase card.”

All technology purchases require approval. This audit is focused on technology purchases using a purchase card and reimbursements for out-of-pocket expenses.

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**FIGURE 1.** Available ways to purchase technology at the City and County of Denver

1. TECHNOLOGY REQUEST
   - PURCHASE ORDER REQUEST
   - WORKDAY APPROVAL
   - TECHNOLOGY PURCHASED

2. TECHNOLOGY PURCHASED OUT OF POCKET
   - EXPENSE REIMBURSEMENT REQUEST
   - WORKDAY APPROVAL
   - EMPLOYEE REIMBURSEMENT

3. TECHNOLOGY PURCHASED WITH A PURCHASE CARD
   - RECONCILIATION
   - WORKDAY APPROVAL

*Source: Created by Auditor’s Office staff.*
PURCHASE ORDERS – Obtaining a purchase order first requires staff to make a formal request through the city’s system of record, Workday. When entering the request, staff can select the appropriate technology spending category. Once the purchase request is approved by both the employee’s supervisor or authorized approver and the city’s Technology Services agency, a purchase order goes to the vendor.

Purchase orders help the city ensure it gets the best deals on technology. The city has contracts with vendors to get discounted pricing when it orders hardware or software in bulk. For instance, the city has a contract with Dell Inc. to get discounted pricing on computers, monitors, mice, keyboards, and other computer devices. This helps the city save money while still ensuring it gets the technology desired for its environment.

REIMBURSEMENTS FOR OUT-OF-POCKET EXPENSE – When a city employee decides not to make a purchase through an approved purchase order and instead buys the technology with their own money, they can request to be reimbursed for the purchase.

However, such expenses still must be preapproved by the employee’s expending authority beforehand. If the employee does not secure this preapproval, the expense is considered an unauthorized purchase. The employee would then need to submit a form for each expense and include it in the expense documentation required for approval of the reimbursement.

When seeking reimbursement, an employee enters receipts and expense information into Workday. The request then must be approved by their supervisor, their expending authority, and the Controller’s Office’s Accounts Payable Division. Once all approvals are obtained, the reimbursement is processed, and the employee is reimbursed for the out-of-pocket expense.

PURCHASE CARDS – City credit cards are a convenient way for selected employees to order and pay for goods and services on behalf of their agency. The cards are issued by the Controller’s Office and assigned to employee cardholders for purchases under $2,000 and under city charter, General Services is the agency responsible for all city procurements, regardless of type. Employees must reconcile their receipts to ensure that all charges are business expenditures.

Executive Order No. 18

The city’s Technology Services agency provides all information technology-related infrastructure and services to city agencies, departments, and divisions of the City and County of Denver.

The city’s Executive Order No. 18 says Technology Services “has authority, and is required to, review and approve all acquisitions of technology.”

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2 Exec. Order No. 18, City and County of Denver (2021).
was not always the case. The order also says technology purchases are not to be purchased using a purchase card.

The 2005 version of Executive Order No. 18 — which named Technology Services the applicable authority to oversee technology service functions at the city — did not require the agency to review and approve all technology purchases.\textsuperscript{3}

However, the mayor recently updated the executive order based on a recommendation from one of our audits. Our January 2020 audit of Technology Services and the Department of Public Works found the 2005 version of the executive order was unclear on whether the agency had the authority to create and implement citywide information technology policies and, therefore, the city had none.\textsuperscript{4}

In January 2021, the mayor updated Executive Order No. 18, granting Technology Services the authority to administer, manage, and sustain technology services for all city agencies, departments, divisions, and other government entities that operate on the city’s network.\textsuperscript{5} Since then, Technology Services has had better control over the proliferation of uncontrolled and unsecure devices being used on the city’s network and putting systems at risk.

The city’s network

A “local area network” connects computers and other devices that are in the same building, office, or home. The size of a local area network can vary greatly, from a single-user home network to an enterprise network with thousands of users and devices — like the City and County of Denver has.

This local area network comprises all cables, access points, switches, routers, and other components that allow devices to connect to internal servers, web servers, and other internal networks. Local area networks also allow users to share resources, such as files, printers, and applications, with others on the network.

The development of local area networks began in the 1960s, when they were used mainly by colleges, universities, and research facilities such as the National Aeronautics and Space Administration. These networks were designed to connect computers to other computers. However, it wasn’t until 1983 that local area networks started to be used in businesses and government.

Technology Services manages and maintains the city’s local area network, which consists of over 40 entities — including city agencies under the mayor, independent agencies such as the Denver Art Museum, and the

\textsuperscript{3} Exec. Order No. 18, City and County of Denver (2005).


\textsuperscript{5} Exec. Order No. 18, City and County of Denver (2021).
judicial and legislative branches of government. These entities rely on Technology Services for support and to ensure their technology equipment is functioning properly.

Some agencies on the network — such as Denver County Court, the Denver Public Library, and others — have their own subnetworks. A “subnetwork” is a smaller network inside a larger one that segments these from one another. Technology Services is responsible for the initial setup of these subnetworks, but it does not provide ongoing support because these agencies manage their own subnetwork and technology.

Figure 2 illustrates the structure of a typical network. It demonstrates how the city network is both wired and wireless, and includes all the computers, servers, and switches that feed into the core switch. This core switch then ties into the internet, allowing for the flow of data to other networks. The diagram shows how the different components of the network are connected and interact with each other, making it a powerful tool for understanding how a network functions.

**FIGURE 2. The structure of the city’s network**
A “local area network” connects computers and other devices that are in the same place. It may comprise thousands of users and devices.

Source: Created by Auditor’s Office staff.
FINDING 1 AND RECOMMENDATIONS

City agencies bypass necessary approval for information technology purchases when they use purchase cards and expense reimbursements

We found almost all agencies and departments citywide use purchase cards or the expense reimbursement process to bypass required approval by the city’s Technology Services agency when purchasing technology equipment and services. These methods of buying technology also violate requirements in the city’s Executive Order No. 18.

As shown in Figure 3, we looked at a sample of 143 purchase card transactions and a sample of 71 expense-reimbursement transactions from Jan. 13, 2021, through Oct. 31, 2022.

Among the 143 purchase card transactions, we found:

- One hundred and thirty-two purchase card transactions — or 92% — were not approved by Technology Services and, therefore, violated the executive order.
- Five purchase card transactions — or 4% — included documented approvals for agencies to use their purchase card, which violates the order requirements that purchase cards are not to be used for technology purchases.
- Six purchase card transactions — or 4% — were not technology

**FIGURE 3.** Analysis of purchase card transactions and expense-reimbursement transactions for technology purchases

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Software</th>
<th>Cloud services</th>
<th>Computer supplies</th>
<th>News, game, and other subscriptions</th>
<th>Not technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>13</td>
<td>61</td>
<td>18</td>
<td>23</td>
<td>6</td>
</tr>
</tbody>
</table>

**EXPENSE REIMBURSEMENTS**

<table>
<thead>
<tr>
<th>Total 71</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
</tr>
</tbody>
</table>

purchases and were not subject to approval requirements.

Among the 71 expense-reimbursement transactions, we found:

- Sixty-one — or 86% — had no evidence of preapproval or subsequent approval for the technology purchase.
- Four — or 6% — were made by Technology Services staff but not preapproved by agency managers.
- Six — or over 8% — were not technology purchases and were not subject to approval requirements.

For the many purchase card and expense-reimbursement transactions that were not approved before the technology purchase, we found Technology Services had no documented policies and related procedures to address acceptable exceptions.

Not obtaining prior approval and bypassing the approval process exposes the city to several risks — including security vulnerabilities and incompatible equipment or software, data protection and privacy concerns, and missed opportunities for cost savings in the form of bulk-discount pricing.

- **INCOMPATIBILITY ISSUES AND SECURITY VULNERABILITIES** – When hardware and software are connected to a network without being vetted properly by Technology Services beforehand, these devices, software, or subscriptions will not have undergone a security or architectural review.

  Architectural and security reviews are important to ensure all components of a system are compatible and that the system will function as intended. By thoroughly examining the architecture of a system, Technology Services can identify and address potential issues before they become a problem. Additionally, architectural reviews can help identify areas of improvement and raise alternative solutions that may be more efficient or cost effective.

  Security reviews help to ensure new technology purchases do not introduce vulnerabilities and that they are compatible with other systems on the city’s network. City agencies may waste money if they buy technology that cannot be supported on the city’s network and have to be scrapped. And security vulnerabilities might be exploited by bad actors — either within the city or from elsewhere — resulting in downtime, lost and irretrievable data, ransom demands, and a loss of services to the public.

- **DATA PROTECTION AND PRIVACY CONCERNS** – When agencies sign up for cloud services for systems and applications without prior approval from Technology Services, regulated, operational, and financial data may not be protected. This could include private data of employees and Denver residents — which risks the city facing lawsuits, fines, and
reputational damage.

- **MISSED OPPORTUNITIES FOR BULK-DISCOUNT PRICING** – When agencies bypass the approval process to purchase computer supplies — such as keyboards, mice, webcams, and cables, the city does not take advantage of bulk-order discounts already arranged with preferred vendors. This costs taxpayers money. While the city may need to consider special circumstances for certain technology purchases — such as ergonomic needs of an individual employee — these agreements with preferred vendors should be taken advantage of whenever possible.

Some compensating controls to reduce these effects have been implemented to detect the addition of hardware, software, and cloud services to protect the city’s network. As a preventative control, Technology Services uses sophisticated security tools to detect when technology is added to its network, and the agency has the capability to shut down unauthorized hardware and software, as well as restrict access to websites used for cloud services, to ensure it can assess risks related to vendors’ security, data privacy, and protection standards.

Discussed below are other control measures that are also being considered to prevent the risk of Technology Services’ approval being bypassed.

Unlike the already-built workflow for purchase orders in Workday, Technology Services did not ask the Controller’s Office to build the same spend categories into the city’s system of record to support the approval workflow for purchase cards and expense reimbursements. Adding these would help to prevent technology purchase requests from bypassing the required Technology Services approval. Adding the same spending categories to allow for purchase card and expense reimbursement approval workflows, and training, would ensure an after-the-fact detective control over technology purchases. There still would not be a preapproval control.

Figure 4 on the next page shows the three teams, based on spending categories, that approve technology purchase requests in Workday, which should also be added to the purchase card and expense reimbursement approval workflows.

Federal guidance says organizations can implement both automated and manual controls, particularly to prevent or detect an issue. Preventive and detective controls are needed when an organization is failing to achieve an objective because of a risk in a specific process.

Staff in both Technology Services and the Controller’s Office told us Workday can enforce a similar approval workflow as is done with purchase order requests. These options include creating standard tags for certain types of expenses — such as hardware, software, computer supplies, cloud subscriptions, and news and other subscriptions — that can be used in the

---

memo lines of each transaction or placing mandatory checkmarks in the purchase card and expense reimbursement forms for employees to attest whether the expense relates to a technology purchase. Over time, such detective controls and corrective actions could minimize agencies incorrectly using purchase cards and reimbursements for technology purchases.

FIGURE 4. Technology Services purchase-request approvers in the city’s system of record, by technology category

<table>
<thead>
<tr>
<th>HARDWARE ASSET MANAGEMENT TEAM APPROVES</th>
<th>DATA CENTER OPERATIONS TEAM APPROVES</th>
<th>SOFTWARE ASSET MANAGEMENT TEAM APPROVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer equipment and accessories (not including computers and tablets)</td>
<td>Computer displays</td>
<td>Software (for perpetual licenses)</td>
</tr>
<tr>
<td>Computers and tablets</td>
<td>Computer printers</td>
<td>Computer services (for software licenses, maintenance, and subscription)</td>
</tr>
<tr>
<td>Computer displays</td>
<td></td>
<td>Computer software licensing rental or leasing service (not active)</td>
</tr>
</tbody>
</table>

Source: Created by Auditor’s Office staff.

Technology Services may also consider building a catalog of preapproved purchase options for at least the five technology purchase types described in Figure 4 by using ServiceNow and connecting this with Workday’s expense reimbursement process.

Agencies could then follow the prescribed request to purchase order method of purchasing technology by selecting preapproved options in Workday. If the desired option is not available, Workday could allow them to request a hardware, software, or cloud service from Technology Services.

1.1 RECOMMENDATION

Determine when purchase cards can be used

The city’s Technology Services agency should revise policy and procedure to reflect when a purchase card can be used to make technology purchases.

AGENCY RESPONSE – AGREE, IMPLEMENTATION DATE – DEC. 31, 2023
SEE PAGE 16 TO READ THE AGENCY’S RESPONSES.
1.2 RECOMMENDATION
Develop workflows for technology purchases

The city’s Technology Services agency should work with the Controller’s Office to determine requirements for monitoring and ensuring preapproval of technology purchases. Options include:

- Developing a catalog of preapproved technology purchase types in ServiceNow that connects with Workday’s workflows.
- Standardizing memo line entries with codes to better flag technology purchases or create flags based on keywords in Workday.
- Adding spending categories that trigger Technology Services reviews of purchase card reconciliations and expense reimbursement requests in Workday.
- Creating a required checkbox for purchase card reconciliations or employee reimbursement requests that requires city employees to attest that no technology was purchased.

AGENCY RESPONSE – AGREE, IMPLEMENTATION DATE – DEC. 31, 2023
SEE PAGE 16 TO READ THE AGENCY’S RESPONSES.
FINDING 2 AND RECOMMENDATIONS

Technology Services lacks detailed citywide guidance for technology purchases

Technology Services lacks a detailed policy and procedure for employees purchasing technology. There is no documented definition of what constitutes a technology purchase, no documented definition of what city entities are considered “on the network,” and no documented steps for approving technology purchases. Additionally, Technology Services has not communicated its requirements for technology expenses to the Department of General Services. This lack of communication has made it difficult for agencies to understand what General Services and Technology Services expect of them when making a technology purchase using purchase cards or when being reimbursed for an expense. As a result, the Department of General Services has not been able to communicate these review processes effectively and regularly to agencies.

Technology Services does not have sufficient policies and procedures to govern agencies making technology purchases

Technology Services officials told us Executive Order No. 18 is what they use to define what a technology purchase is, as well as what constitutes an agency operating on the city’s network. Specifically, it says technology refers to any software, hardware, or cloud service that connects to the network. However, it does not address specific technologies like audio equipment, computer peripherals, and subscription services.

Furthermore, Technology Services' hardware and software policies do not address the definition of technology purchases. This decision to solely rely on Executive Order No. 18 for such essential details leaves Technology Services without additional documented guidance to clarify what constitutes a technology purchase and what is “on the network.” It also has not defined a list of technology purchases that are allowable and unallowable — which would then inform what types of purchases Technology Services needs to review and approve in advance of a purchase. This ambiguity has resulted in agency employees being unaware of the requirements for technology purchases.

We found that the executive order and hardware and software policies are still poorly defined or missing elements.

UNCLEAR DEFINITION OF A TECHNOLOGY PURCHASE – Executive Order No. 18 defines a technology purchase as “any software, hardware, or cloud service

7 Exec. Order No. 18, City and County of Denver (2021).
that connects to the Network." However, this vague description leaves room for subjectivity in what individual city agencies might consider "technology."

Although the executive order's definition may be clear to information technology experts, it is not clear to all personnel citywide. Agency staff responsible for approving purchases told us that — based on their interpretation of Executive Order No. 18 — they believe an electronic reading device is not a technology purchase. But Technology Services staff told us this type of technology is indeed a technology purchase.

Of 11 agencies we surveyed, only two had purchasing policies of their own — and neither of those were compliant with Executive Order No. 18's requirement that Technology Services review and approve technology purchases. A surveyed city employee responsible for approving purchases for their agency said they believe Technology Services is not required to review their agency's technology purchases, which contradicts the order.

Leading practices say an organization's technology team is responsible for defining and communicating roles and responsibilities for information technology, including authority levels, responsibilities, and accountability. Given agencies' misunderstanding of what Executive Order No. 18 requires, it is important for Technology Services — as the city's authority on information technology — to support them with clear definitions and procedures.

**UNCLEAR DEFINITION OF "ON THE NETWORK"** — Technology Services has no documented definition of which city entities are considered operating on the city's network.

Executive Order No. 18 says Technology Services has the authority to administer and implement all technology for agencies that operate on the city's network. It defines this technology as being "hardware and software components and systems that support the digital services for Users including connectivity, email, storage, cybersecurity, and all other digital technology."

Technology Services says every agency is on the network, but some agencies believe they are not subject to the executive order. For example, the Denver City Council does not believe it is subject to executive orders from the Mayor's Office because it is the legislative branch of city government. In addition, Denver International Airport is considered separate because although it is owned by the city, it is a government enterprise — operating much like a business. It has its own information technology team and runs on its own network.

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8 Exec. Order No. 18, City and County of Denver (2021).
10 Exec. Order No. 18, City and County of Denver (2021).
It is critical for Technology Services to be clear on who is on and off the network to ensure the city and its technology assets are protected from cybersecurity threats.

**NO LIST OF ALLOWABLE AND UNALLOWABLE TECHNOLOGY PURCHASES** – Technology Services has not created a list of allowable and unallowable technology purchases to indicate which require Technology Services' review and approval before being purchased.

Technology Services staff told us they are looking at whether they can create a catalog in ServiceNow that will detail preapproved technology that agencies can purchase. But there is no plan or time frame for when this could be implemented. Because Technology Services has not created a list, agency personnel do not know what they can or cannot purchase and what approvals are needed.

**MISSING REQUIREMENTS TO REVIEW AND APPROVE A TECHNOLOGY PURCHASE** – Technology Services is missing requirements in its policies and procedures for agency staff to review and approve a technology purchase.

For example, the “Software Asset Management” policy and procedure as well as the “Hardware Asset Management” policy and procedure provide overall guidance for acquiring technology equipment or services, but the steps and requirements for either requesting reimbursement or using a purchase card are not detailed — and neither policy reflects Executive Order No. 18’s requirements to review and approve a technology purchase.11

Although Executive Order No. 18 says technology cannot be bought with a purchase card, we found instances where a purchase was made on a card.

As discussed in Finding 1, the agency's policies and procedures also do not mention when or if a purchase card should be allowed to be used to purchase technology. For example, if Technology Services can approve the use of a purchase card to buy technology, the exception to that requirement should be documented in policy. Federal guidance says policies and procedures should establish the standards of conduct that the organization assigns to employees.12 If the policies do not reflect what is expected, then leaders cannot hold their organization to the standards they have set.13

Because of Technology Services' lack of clear definitions and policies, the city faces several risks. As we laid out in Finding 1, agencies are making unauthorized technology purchases. Leaders and staff within city agencies are risking the security, confidentiality, and integrity of the city’s network.

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11 Exec. Order No. 18, City and County of Denver (2021).
and data through these unauthorized purchases. And the city could be missing out on cost-savings opportunities through bulk-discount pricing.

Ultimately, city agencies are violating Executive Order No. 18. This compromises the security of the city’s network when agencies purchase technology that has not been reviewed and approved by Technology Services.

2.1 RECOMMENDATION Clarify policies and procedures for technology purchases

Once workflows are determined, as outlined in Recommendation 1.2, the city’s Technology Services agency should:

- Refine its relevant policies and procedures.
- Develop supplemental procedures to address city employees’ roles and responsibilities for technology purchases — both for agencies on the network and Technology Services personnel.
- Finalize and approve these policies and procedures.

AGENCY RESPONSE – AGREE, IMPLEMENTATION DATE – DEC. 31, 2023
SEE PAGE 16 TO READ THE AGENCY’S RESPONSES.

2.2 RECOMMENDATION Update documentation for technology purchases

The city’s Technology Services agency should change its policies and procedures to define “technology purchases” and “on the network” to ensure compliance with Executive Order No. 18. This change should include guidance on when purchase cards and expense reimbursements can be used for technology purchases and it should better define what technology purchases require preapproval from Technology Services.

AGENCY RESPONSE – AGREE, IMPLEMENTATION DATE – DEC. 31, 2023
SEE PAGE 16 TO READ THE AGENCY’S RESPONSES.

2.3 RECOMMENDATION Update guidance for when purchase cards can be used for technology purchases

Following Recommendation 1.1, the city’s Technology Services agency should work with the Controller’s Office to update credit card usage policies and procedures to reflect when purchase cards can be used for technology purchases.

AGENCY RESPONSE – AGREE, IMPLEMENTATION DATE – DEC. 31, 2023
SEE PAGE 16 TO READ THE AGENCY’S RESPONSES.
Executive Order No. 18 was reissued in January 2021. Since this change, Technology Services has not provided adequate and detailed communication or training to city agencies on the executive order’s new requirements. Specifically, there was no training on when to use a purchase card and when to apply for reimbursement for technology purchases.

Technology Services officials said that the Department of General Services — as the official authority for citywide purchases — should be the agency responsible for providing initial and periodic training about requirements for technology purchases, like it does for all other purchases of goods and services. However, Technology Services did not communicate the specific guidance from the executive order to General Services’ Purchasing Division for it to be added to training given to new employees and employees new to a purchasing role.

We found no evidence the two agencies are working together to shore up communications and training on technology purchase requirements and exceptions, as defined in Executive Order No. 18.

Federal guidance says a successful training program would consist of details from defined policy and procedure. It would also communicate roles and responsibilities for users and establish expectations for monitoring and review.¹⁴

Without proper communication and training, city employees may intentionally or unintentionally bypass purchase requirements — resulting in violations of Executive Order No. 18 and other consequences such as introducing security risks, wasting resources, and subjecting the city to possible lawsuits and reputational damage for mishandling protected data.¹⁵

Therefore, it is essential that Technology Services and General Services work together to ensure city staff who buy technology services and equipment have the information and understanding they need to follow approved processes and comply with requirements.

### 2.4 RECOMMENDATION

**Develop and conduct training on technology purchases**

Once recommended process, policy, and procedural changes have been implemented as described in recommendations 1.2 and 2.2, the city’s Technology Services agency should work with the Department of General Services to develop a required training and periodic refresher, specifically for those personnel responsible for technology purchases citywide. This should include:

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¹⁵ Exec. Order No. 18, City and County of Denver (2021).
• Definitions for technology categories, how to purchase technology on purchase cards, and what receipts are required for out-of-pocket reimbursements.

Once training has been developed, Technology Services should develop a communications plan to disseminate Executive Order No. 18 and Technology Services' policies and procedures for technology purchases annually to applicable staff who make citywide technology purchases. This training should also discuss security, data protection and privacy, and financial resources risks when agencies bypass Technology Services' preapproval of technology.

AGENCY RESPONSE – AGREE, IMPLEMENTATION DATE – DEC. 31, 2023
SEE PAGE 16 FOR THE AGENCY’S FULL RESPONSE TO OUR RECOMMENDATIONS.
AGENCY RESPONSE TO AUDIT RECOMMENDATIONS

The following agency narratives are reprinted verbatim from the agency’s response letter.

RECOMMENDATION 1.1

AGENCY RESPONSE: AGREE

AGENCY’S TARGET DATE FOR IMPLEMENTATION: DEC. 31, 2023

Technology Services will revise policy and procedure to reflect when a purchase card can be used to make technology purchases.

RECOMMENDATION 1.2

AGENCY RESPONSE: AGREE

AGENCY’S TARGET DATE FOR IMPLEMENTATION: DEC. 31, 2023

Technology services will work with the Controller’s Office’s to determine requirements for monitoring and ensuring preapproval of technology purchases.

RECOMMENDATION 2.1

AGENCY RESPONSE: AGREE

AGENCY’S TARGET DATE FOR IMPLEMENTATION: DEC. 31, 2023

Technology Services will review and revise applicable policies and procedures. Associated purchasing standards and procedures will be updated and/or created to address technology purchasing roles and responsibilities.

RECOMMENDATION 2.2

AGENCY RESPONSE: AGREE

AGENCY’S TARGET DATE FOR IMPLEMENTATION: DEC. 31, 2023

Technology Services will revise its policies and procedures to include purchase card and expense reimbursement guidance. These revisions will better define “technology purchases” and “on the network” to ensure compliance with Executive Order No. 18.
RECOMMENDATION 2.3
AGENCY RESPONSE: AGREE
AGENCY’S TARGET DATE FOR IMPLEMENTATION: DEC. 31, 2023
Technology Services will work with the Controller’s Office to update policies, and procedures to reflect when purchase cards can be used for technology purchases.

RECOMMENDATION 2.4
AGENCY RESPONSE: AGREE
AGENCY’S TARGET DATE FOR IMPLEMENTATION: DEC. 31, 2023
Technology Services will work with General Services to develop required training and periodic refresher. Training will include risks associated to purchasing unapproved technology. This training will be specifically for those personnel responsible for technology purchases citywide.
OBJECTIVE

To assess how well Technology Services enforces Executive Order No. 18 by administering, implementing, and communicating requirements to city leaders and employees — particularly those who buy technology services and equipment on behalf of the city.

SCOPE

Our audit focused on technology purchases that were made with purchase cards or reimbursed through expense reports. We reviewed transactions and processes from Jan. 13, 2021, through Oct. 31, 2022. Technology purchases that were preapproved through a purchase order were not in scope.

METHODOLOGY

We used several methodologies to gather and analyze information related to our audit objectives. The methodologies included but were not limited to:

- Interviewing key Technology Services personnel to obtain information about policies, procedures, training, communication, and workflows as it relates to technology purchases.
- Reviewing and assessing policies and procedures for various aspects of technology purchases.
- Testing a sample of purchase card transactions and expense-report transactions to determine the extent to which agencies were purchasing technology without the consent of Technology Services, as discussed in the appendix.
- Analyzing a sample of agencies’ purchasing policies to determine the extent to which they align with technology purchase requirements in Executive Order No. 18.
- Reviewing citywide training for information on technology purchases.
APPENDIX

Analyzing technology purchases for noncompliance

We sought to identify how many purchase card transactions and expense reimbursement transactions could potentially have violated the city’s Executive Order No. 18 during the time period we audited.

We first downloaded a report from the city’s financial system of record — Workday — that contained all purchase card transactions and expense reimbursement transactions from Jan. 13, 2021, through Oct. 31, 2022. The report contained:

- 320,209 purchase card transactions.
- 33,162 expense reimbursement transactions.

We then created four tests to identify transactions that potentially violated city requirements for technology purchases. Table 1 lists the fields in the Workday report we applied our tests to and the types of transactions we sought to identify. For example, one test flagged all transactions recorded under the city’s “Technology Supplies and Equipment” ledger account.

Of all the transactions in our population, our tests flagged 27,987 purchase card transactions and 1,330 expense reimbursement transactions that potentially violated Executive Order No. 18’s requirements.

| TABLE 1. Identifying purchase card and expense reimbursement transactions for further analysis |
|---------------------------------|----------------------------------------------------------------------------------|
| **Workday fields**             | **Recorded as “Technology Supplies and Equipment.”**                             |
| Ledger account                 | Associated with the following spend category descriptions: “Software,” “Data Voice or Multimedia Network Equipment or Platforms and Accessories,” “Computers and Tablets,” “Network Switches,” “Computer Servers.” |
| Spend category                 | Containing a technology-related word. Our list of words included items such as “computer,” “iPad,” “laptop,” and “dropbox.” |
| Line memo and vendor           | Tied to technology-related merchant category codes such as the codes for merchants selling computers, software, or electronics. |

**Source:** Created by Auditor’s Office staff.

Expense reimbursement transactions

To further evaluate the 1,330 expense reimbursement transactions, we first reviewed the line memo field for each transaction to determine whether the purchase was for technology equipment or services. For this, we defined technology purchases as items that were either hardware or software.
Among the 1,330 transactions, we identified 71 technology purchases. We determined the remaining 1,259 were not technology purchases.

We then used this pool of 71 reimbursement report transactions for our detailed testing — the results of which we discuss in Finding 1.

**Purchase card transactions**

To further evaluate the nearly 28,000 purchase card transactions that our tests flagged, we calculated a random sample using:

- A rate-of-occurrence estimation.
- A precision range of 5%.
- A confidence level of 95%.

This resulted in a statistical sample of 377 transactions.

We tested each transaction in that sample to determine whether the purchase was for technology. Similar to our testing of expense reimbursements, we defined technology purchases as items that are either hardware or software. Of the 377 transactions, we identified 166 technology purchases and 261 transactions that were not technology purchases.

Based on our sample results, we are 95% confident that between 39% and 49% of all 27,987 purchase card transactions flagged by our tests were likely technology purchases. This translates to between 10,900 and 13,769 transactions being a technology purchase.

To improve our chances of identifying a technology purchase for our detailed testing within such a large pool of transactions, we developed a weighted risk score to identify transactions with the highest chance of being technology purchases.

We first performed a statistical analysis — called a “logistic regression” — using our results of the 377 sampled purchase card transactions. This type of analysis uses multiple inputs to show the relationship each has on a binary outcome. In our case, we used the four tests described in Table 1 as our inputs and our outcome was whether the transaction was a technology purchase.

We calculated the success each test had on identifying whether the transaction was in fact a technology purchase. We used these calculations to obtain a weighted risk score on a scale from zero to one. The higher the score each test had, the better it would be at flagging technology purchases.

We performed another statistical analysis — referred to as a “t-test” — using the weighted risk score to obtain a risk score cut-off. Using this type of analysis, we determined the average scores between the technology purchases and all other purchases were statistically different. The average risk score of the technology purchases was about 0.5, while the average score of all the other purchases was less than 0.2.

We assigned each of the 27,987 purchase card transactions a weighted risk score. Using the average risk score of 0.5 associated with the technology purchases in our sample, we separated the list of flagged transactions. Of the 27,987 transactions:

- 2,417 had a risk score of 0.5 or greater.
- 25,570 had a risk score lower than 0.5.

From the group of 2,417 transactions associated with a risk score of 0.5 or greater, we selected a random sample of 130 transactions to test. We calculated this statistical sample using a precision range of 5% and a confidence level of 90%.
Of the 130 purchase card transactions in our statistical sample, we found 120 violated the city’s Executive Order No. 18.

We used these results to then estimate the number of potential violations among the remaining 2,417 transactions we identified as having a risk score of 0.5 or greater. We found that between 87% and 96% of the 2,417 transactions likely violated the executive order — or between 2,112 and 2,312 violations.

In addition to the 130 transactions in our statistical sample, we used our professional judgment to include 13 other transactions from the group with a risk score lower than 0.5. This resulted in our ultimate sample for analysis of 143 transactions — the results of which we discuss in Finding 1.
Office of the Auditor

The Auditor of the City and County of Denver is independently elected by the residents of Denver. He is responsible for examining and evaluating the operations of city agencies and contractors for the purpose of ensuring the proper and efficient use of city resources. He also provides other audit services and information to City Council, the mayor, and the public to improve all aspects of Denver’s government.

The Audit Committee is chaired by the Auditor and consists of seven members. The Audit Committee assists the Auditor in his oversight responsibilities regarding the integrity of the city’s finances and operations, including the reliability of the city’s financial statements. The Audit Committee is structured in a manner that ensures the independent oversight of city operations, thereby enhancing residents’ confidence and avoiding any appearance of a conflict of interest.

Our Mission

We deliver independent, transparent, and professional oversight in order to safeguard and improve the public’s investment in the City and County of Denver. Our work is performed on behalf of everyone who cares about the city, including its residents, workers, and decision-makers.