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Tools of Change: A Technological Approach to Community-Led Park Reconstruction

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Abstract

The research, "Tools of Change: A Technological Approach to Community-Led Park Reconstruction," investigates the transformative power of technology in enhancing resource management for community-driven construction projects, centering on an innovative park rebuilding effort. Launched in early October 2023, the study led to the development of an advanced inventory system utilizing barcode technology to monitor tool donations and identify activity peaks within the tool shed. This system, strengthened by the capabilities of Google Sheets and automated via Google Apps Script with assistance from OpenAI's ChatGPT, provides a streamlined method for inventory management, enabling comprehensive analysis of tool usage patterns and contributing to significant operational efficiencies.

A pivotal aspect of the study was the authoritative guidance of Playgrounds by Leathers, responsible for overseeing the construction and safety certification of the playground. Insights gleaned from the inventory data analysis, such as tool usage trends and patterns, will be communicated with the organization, demonstrating the system's effectiveness in elucidating the logistical facets of the project.

The study aims to do more than merely aid in logistical enhancements; it endeavors to illustrate the substantial influence that accounting principles and inventory management have on the success of community efforts. By underlining the tangible benefits of an inventive inventory system, the research underscores the potential of such methodologies to transform project management practices in community contexts.

In essence, the project sets out to not just improve resource management processes in the context of park reconstructions but also to act as a beacon and exemplar for future community-led initiatives. With its thorough documentation and meticulous analysis, the research establishes itself as a pioneering examination of the use of accounting principles and artificial intelligence in project management, heralding a new wave of technological assimilation in community endeavors.

Introduction

Community-led initiatives frequently encounter unique operational challenges, especially in managing resources in projects dependent on volunteer labor and goodwill. Such a challenge presented itself during a park reconstruction project in Asheville, NC. Motivated by the local community's resolve, this endeavor sought to reconstruct a treasured playground that had been torn down over safety concerns. The project had an ambitious timeline, aiming for completion in a mere five days, necessitating extraordinary coordination and management of resources, with a particular focus on the tools necessary for construction.

To meet these challenges, the project's Tool Coordination team innovated by creating a custom-built inventory tracking system. Utilizing barcode technology and integrating it with Google Spreadsheets, the system was tailored to enable real-time tracking of tool check-ins and check-outs. The goal was not only to enhance logistical operations but also to ensure the project's progress without the delays or inefficiencies typical of manual tracking methods.

Faced with distinctive constraints, such as fluctuating volunteer availability and the imperative to balance costs with efficiency, the project presented a prime case study to evaluate a customized, technologically informed approach to resource management in volunteer-led endeavors. Thus, the research concentrates on gauging the impact of the bespoke inventory tracking system on the overall efficiency of the park reconstruction effort. This analysis intends to shed light on how personalized technological solutions can bolster the management of community-driven projects, emphasizing their capability to amplify organizational effectiveness, curtail waste, and elevate project results. This study enriches the dialogue on optimal resource management practices within the ambit of community-led initiatives, offering insights transferable to analogous endeavors globally.

The investigation explores the integration of inventive inventory systems with core accounting principles—Cost, Matching, and Materiality—and the advantages that ensue for community projects. While direct costs of tools were unrecorded due to the nature of donations, the inherent value of these tools to their owners accentuates the need for a dependable tracking system. By ensuring the efficient use and prompt return of donated items, the project demonstrates respect for the Cost principle by acknowledging the value of the tools and abides by the Materiality principle, which acknowledges the significant effect of even non-monetized contributions on project success. In examining tool usage patterns and correlating them with project stages, the study touches on the Matching principle, emphasizing the significance of matching resource utilization with specific project tasks. This method enhances logistical proficiency and provides valuable data on operational effectiveness, highlighting the transformative potential of such integrated systems in reshaping project management for community-led initiatives through adherence to these fundamental accounting principles.

Background

Project Scope and Planning

The Jones Park, now renamed Candace Pickens Memorial Park, reconstruction project emerged as a considerable venture by the Asheville community, involving extensive years of planning and groundwork. Triggered by the demolition of a beloved playground for safety reasons as determined by Asheville City Schools, the local populace was united in their goal to rejuvenate an essential community area. Deviating from the norms of traditional construction projects, this initiative stood out due to its dependency on a volunteer workforce and the leadership of a volunteer board of directors, which highlighted the project's deep-rooted community spirit. With a vast ambition to entirely rebuild the playground using environmentally friendly materials, the project set an aggressive timeline to be completed in a notably short span of five days. The success of such a demanding project was contingent upon precise organizational tactics and effective management of resources, optimizing the contributions of the volunteer labor force to meet the pressing deadline.

Development of a Custom Solution for Tool Management

Confronted with complex challenges in tool management, due to the shortcomings of manual tracking and compounded by uncertainties concerning the types and quantities of tools needed, the project faced considerable logistical obstacles. The ever-changing construction site and the breadth of tasks, combined with an absence of systematic tool storage and distribution, rendered traditional methods like paper-based logs insufficient. In light of the need for a system that could provide real-time visibility of tool availability and adjust to the fluctuating demands of the construction schedule, the team undertook the development of a custom-built inventory tracking system. The incorporation of barcode technology with Google Spreadsheet was strategically chosen to ensure prompt and precise tool check-outs and returns, tailored to meet the project's specific requirements. This forward-thinking strategy was not just about improving tool management; it also marked a substantial advancement in refining operations for a volunteer-driven construction project, adeptly managing the project's intricacy and magnitude.

Methodology

Design and Implementation of the Custom-Built Inventory System

The methodology anchoring the inventory management of the Asheville park reconstruction project relied on the creation and implementation of a custom-built system. This system was deliberately designed to meet the distinctive challenges associated with the project’s dependence on a volunteer labor force and the necessity for an efficient tool management process. At the heart of the system's architecture was the employment of barcode technology, which enabled quick and precise tracking of tools, in tandem with Google Sheets, which provided the infrastructure for gathering and analyzing data.

For the duration of the project, every tool was tagged with a distinct barcode to facilitate its recognition and monitoring. The Google Spreadsheet was structured to log the barcode and status of each tool—whether checked in or out—accompanied by timestamps denoting the specific instances of each transaction. This setup permitted the continued observation of tool usage patterns even after the project’s conclusion.

Procedure for Tool Collection and Daily Tracking

The procedure for tool collection was systematized to optimize efficiency from the outset. Prior to the start of the project, each tool was logged into the inventory system through its barcode, cataloging its classification, description, and the contact information of its owner. Volunteers requiring tools for specific tasks would request them from the tool shed, where designated Tool Managers would check them out by scanning the barcodes using a dedicated barcode scanner, automatically updating the Google Spreadsheet with the tool's status as checked-out, alongside the corresponding timestamp and task designation.

Similarly, the check-in process mirrored this procedure, with volunteers returning tools to the designated collection point and scanning them back into the system. This process effectively ensured that the status of each tool was accurately reflected in real-time within the spreadsheet.

Evaluation Criteria for Inventory System Effectiveness

The effectiveness of the custom-built inventory system was evaluated against several key criteria, reflective of the project's operational goals and the system's intended functionalities. These criteria included:

- **Frequency of Tool Issue**: Measuring the rate at which tools were checked-out, providing insights into tool demands at various times of day and different phases of the project.
- **Duration Tools Spent On-Site**: Tracking the length of time each tool was utilized on-site, offering a proxy for tool demand and efficiency of use.
- **Demand Patterns**: Analyzing the patterns of tool check-outs relative to project phases, tasks, and times of day, enabling a nuanced understanding of tool usage dynamics and facilitating predictive adjustments to tool availability and allocation.

Collectively, these criteria provided a comprehensive framework for assessing the inventory system's performance, with a focus on ensuring that tool management processes contributed positively to the project's overall efficiency and the achievement of its ambitious timeline.

System Design and Implementation

Setting Up the Inventory Tracking System

The inventory tracking system for the Asheville park reconstruction project was conceived and implemented through a structured process, designed to optimize tool management within a volunteer-driven construction environment. The system's setup encompassed several critical steps, each contributing to its overall functionality and effectiveness:

- **Barcode Assignment and Cataloging**: Initially, each tool allocated for the project was systematically cataloged, with a unique barcode assigned and affixed to it. This step was crucial for establishing a comprehensive database of available tools, facilitating their subsequent tracking throughout the project's duration.
- **Google Spreadsheet Configuration**: A Google Spreadsheet was meticulously configured to serve as the central repository for the inventory data. This spreadsheet was designed with multiple fields to capture essential information for each tool, including its barcode, check-out/check-in status, and corresponding timestamps. The choice of Google Spreadsheet was predicated on its accessibility, real-time update capability, and ease of use for multiple volunteers. The use of this platform also allowed for updates to the inventory or changes to the operating script to take place while still in use by others, minimizing disruptions to tool shed operations.

- **Barcode Scanner Integration**: The system utilized Inateck BCST-54 barcode scanners [Figure 1] to streamline the check-out and check-in processes. Scanners were programmed to read the tool barcodes and automatically update the Google Spreadsheet with the relevant data, minimizing manual entry and reducing the potential for errors.

Technical Challenges and Solutions

The implementation of the inventory tracking system was not without its technical challenges, necessitating creative solutions to ensure its seamless operation:

- **Real-Time Data Synchronization**: Ensuring that the Google Spreadsheet reflected real-time updates with each tool's check-out and check-in presented a challenge, particularly in a dynamic construction environment with numerous simultaneous users. This was addressed by leveraging Google Spreadsheet's inherent capability for real-time updates and ensuring stable internet connectivity on-site.
- **User Training for Barcode Scanners**: The effective use of barcode scanners by a diverse volunteer workforce required straightforward, accessible training materials. Custom guides and quick training sessions were developed to familiarize volunteers with the scanners, ensuring that all participants could competently use the technology with minimal instruction.
- **Adaptability to Project Dynamics**: The system's design had to accommodate the unpredictable nature of the construction project, including changes in tool demand and volunteer availability. Flexibility was built into the system's design, allowing for rapid adjustments to tool allocation and inventory levels as dictated by the project's evolving needs.

Anticipated Functionality Versus Actual Use in the Field

The inventory tracking system was developed with the expectation that a stable internet connection was available. In practice, the system's performance in the field largely aligned with this anticipations, though some discrepancies emerged:

- **Efficiency in Tool Tracking**: The system effectively streamlined the check-out and check-in processes as anticipated, significantly reducing the time and effort traditionally associated with manual tracking methods. This efficiency contributed positively to the project's operational flow and volunteer productivity.
- **Adaptation to Real-World Conditions**: While the system was designed for adaptability, the complexity of real-world project dynamics necessitated ongoing adjustments. This included modifications to the spreadsheet layout and the

introduction of additional fields to capture unforeseen variables. Unexpected shifts in tool demand led us to add numerous tools to the inventory mid-project. While this possibility was anticipated, the act of adding new tools during regular operation proved excessively time consuming.

- **User Engagement and Compliance**: The ease of use of the barcode scanners and the straightforward nature of the Google Spreadsheet facilitated high levels of compliance with the tracking procedures. However, occasional challenges with scanner functionality and data entry errors underscored the need for ongoing support and troubleshooting, slightly diverging from the anticipated seamless user experience.

Overall, the inventory tracking system's actual use in the field confirmed its value in enhancing the logistical management of the park reconstruction project, despite deviations from its anticipated functionality. These insights provide a foundation for refining and optimizing similar systems for future community-led initiatives.

Data Analysis

Data Collection on Tool Usage

The implementation of the inventory tracking system facilitated the collection of data related to tool usage throughout the project duration. This data was instrumental in identifying patterns in tool utilization, including the frequency of use, duration of on-site presence, and peak demand periods. Key insights derived from the analysis of this data are represented visually in the Tables and Figures section.

- **Frequently Used Tools**: The data revealed a consistent pattern of high demand for certain tools, such as impact drivers, one particular circular saw which was extremely popular, and trigger clamps, which were integral to a wide range of construction activities. These tools were checked out more frequently than others, indicating their critical role in the project's execution.
- **Duration Tools Spent On-Site**: [Figure 2] Some tools, particularly those required for specialized tasks (e.g., leveling instruments), spent extended periods on-site but were utilized less frequently. The data on these tools highlighted the necessity of balancing availability with the practical realities of specific construction phases.

- **Peak Demand Times**: [Figure 3] Analysis of the check-out and check-in timestamps revealed distinct peak demand periods, particularly in the mornings and late afternoons. This pattern aligned with the project's work schedule and was indicative of strategic planning by the volunteers to maximize productivity during optimal working hours.

Analysis of Tool Utilization Patterns

The data analysis provided clear and valuable insights into tool usage patterns throughout the park reconstruction project. The high demand for tools such as impact drivers, a particular circular saw, and trigger clamps underscored their critical importance to the project's completion. Meanwhile, specialized tools that spent extended periods on-site revealed the need to carefully balance tool availability with the practical demands of each construction phase. [Figure 4] The analysis of check-out and check-in timestamps showed distinct peak demand times, notably in the mornings and late afternoons, aligning with the volunteers' strategic planning to optimize productivity during key working hours.

Although not groundbreaking, these findings were revelatory because they demonstrated the system's value beyond mere inventory recording. The data-driven insights illuminated the nuanced logistics of tool management, showing that a well-designed tracking system can support efficient project execution by highlighting areas where improvements in planning and resource allocation can have significant impacts. This reinforces the system's potential for enhancing strategic decision-making in future community-led initiatives.

Findings

System Effectiveness in Meeting Project Needs

The effectiveness of the inventory tracking system in meeting the project's needs was assessed through a combination of quantitative data analysis and qualitative feedback from project participants. Several key findings emerged from this assessment:

- **Streamlined Operations**: The system significantly streamlined tool management processes, as evidenced by the reduction in time required for tool check-out and check-in procedures. This efficiency minimized delays and enabled volunteers to focus more on construction tasks rather than logistical concerns.
- **Enhanced Organizational Capability**: The real-time visibility provided by the system into tool availability and location enhanced the project's organizational capability. This facilitated more effective planning and allocation of tools, ensuring that project activities progressed smoothly and without unnecessary interruptions.

- **Adaptability to Project Dynamics**: The system demonstrated a high degree of adaptability, allowing for rapid adjustments to inventory levels and tool allocation in response to evolving project requirements. This flexibility was crucial in accommodating unforeseen changes in the construction schedule and volunteer availability.
- **Challenges and Limitations**: The custom-built inventory system deployed in this project exemplifies an ideal balance for projects of similar scale, offering precise customization to meet specific operational needs. The system's flexibility and adaptability are particularly suited to mid-sized projects where complexity is significant but manageable, allowing for real-time adjustments without the excessive overhead associated with more complex commercial systems. This moderate scale facilitates the effective handling of technical challenges such as data entry errors and scanner issues, which are manageable within this scope but could escalate in larger projects, potentially leading to significant disruptions.

For smaller projects, the technological sophistication and training required for such a custom system might not be economically viable, as the system's complexity could overshadow the simplicity needed for smaller scopes. Conversely, larger projects often necessitate more advanced systems equipped with ERP integration or advanced analytics, which are beyond the capabilities of simple barcode scanning and spreadsheet tracking. The custom-built system's design, tailored to enhance volunteer usability, streamlines training and operation, crucial for maintaining the momentum in volunteer-driven initiatives like this one. This focus on user-friendly design is less practical in larger settings where training vast numbers of volunteers on complex systems could become a logistical challenge. Therefore, this custom solution strikes an optimal balance for this specific project scale—providing a cost-effective, efficient tracking system that meets the project's unique demands without the complications of larger, more generic systems, perfectly aligning with the project's volunteer nature and the need for a robust yet manageable system.

Effectiveness in a Community-Led Project Setting

Commercial inventory systems are designed for a broad range of applications, including complex warehouses and multi-channel retail operations, which often exceed the needs of community-led projects. The custom system was specifically designed to meet the project's needs, including volunteer management and simplified operations, ensuring effectiveness by directly aligning with the project's requirements.

In summary, commercial systems provide comprehensive solutions across many business types, but their cost, complexity, and broad approach may not suit community-led projects. The custom-built inventory system used in the Asheville park reconstruction shows that tailored solutions can better meet specific needs, providing a cost-effective, easy-to-implement alternative.

Implications and Summary

Commercial systems, while comprehensive, often incur high upfront costs for software, training, and hardware upgrades. By contrast, the Asheville park reconstruction project's custom system used easily accessible technologies like Google Sheets and barcode scanning, greatly reducing setup and ongoing costs.

Ease of Implementation

The complexity and feature-rich nature of commercial systems often necessitate extensive implementation periods and considerable training for users, which may not align with the time-sensitive and volunteer-dependent context of community-led projects. Conversely, the custom-built system prioritized simplicity and ease of use, enabling rapid deployment and minimal training requirements, thus better meeting the project's immediate needs.

Customization

While commercial systems offer a range of configurations, their generalized approach to inventory management may not fully align with the specific requirements of unique projects like the Asheville park reconstruction. The custom-built system was designed with the project’s particular needs in mind, allowing for tailored functionalities such as simplified check-in/check-out processes that directly addressed the project’s operational challenges.

The development and deployment of a custom-built inventory tracking system for the Asheville park reconstruction project provided invaluable insights into the utility of tailored solutions within the context of community-led initiatives. This discussion reflects upon the successes and limitations of the custom system, lessons learned from its implementation, and the comparative insights gained vis-à-vis commercial inventory systems.

Discussion and Reflection on the Successes and Limitations

The custom-built system achieved significant successes, notably in streamlining tool management processes, enhancing operational efficiency, and facilitating the effective utilization of volunteer labor. Its design, centered around barcode technology and a Google Spreadsheet, allowed for real-time tracking of tool usage, thereby minimizing logistical delays and optimizing the allocation of resources. These achievements underscore the potential of custom solutions to address specific project needs with agility and precision.

However, the system also faced limitations, particularly regarding data entry errors and the occasional technical challenges with barcode scanning. These issues highlight the importance of robust system design and the need for contingency plans to address technological glitches. Additionally, while the system effectively managed the inventory of tools, its reliance on internet connectivity posed potential risks in scenarios where connectivity was compromised.

Lessons Learned from Points of Failure and Unexpected Challenges

The project's experience underscored several key lessons.

1. The importance of user training and familiarization with new technologies became evident. Even a system designed for simplicity can encounter operational hiccups without adequate user orientation.
2. It was learned that an additional person should be on-hand at the Tool Shed to facilitate the addition of tools to the inventory while the job site is active. Several tools were donated based on a call for specific items. Entering these ad-hoc items to the tool inventory proved difficult and created opportunity for errors to be made. These errors made it difficult to return some last-minute donations to the project.
3. The use of Google Sheets, while simple and effective, experienced some hiccups when internet availability became unreliable. It would have been easier to manage using the system in an offline mode.
4. Some records show a tendency to record an entry more than once. These duplicate entries most frequently occurred during Check-In as more tools arrived in rapid succession as the job site began closing down. In order to ensure a tool was recorded as checked in, it was often scanned twice before the Check-In action was called.
   These lessons underscore the necessity of planning for variability and ensuring system robustness against the dynamic backdrop of community-led projects.

Insights Gained from the Custom Solution

Compared to commercial systems, the custom solution offered a level of simplicity and specificity that closely aligned with the project's needs. Commercial systems, while offering extensive functionalities, often come with complexities and costs that may not be justified for specific, short-term projects like the Asheville park reconstruction. The custom system's success demonstrated that targeted solutions could achieve high levels of effectiveness without the overhead associated with commercial alternatives.

The insights gained underscore the value of custom inventory tracking solutions in contexts where project-specific requirements, budget constraints, and operational simplicity are paramount. While commercial systems provide broad capabilities suited to a wide range of business scenarios, the agility and targeted functionality of custom solutions can offer compelling advantages for community-led initiatives.

In conclusion, the deployment of the custom-built inventory tracking system within the Asheville park reconstruction project illuminated both the potential and the challenges of custom technology solutions in volunteer-driven contexts. The project's experiences contribute valuable perspectives to the broader discourse on inventory management practices, especially in scenarios where customization and simplicity are key considerations.

Conclusions and Recommendations

Summary of Key Findings and Implications

The implementation of a custom-built inventory tracking system for the Asheville park reconstruction project yielded several key findings with broad implications for future community-led projects. Firstly, the project demonstrated the feasibility and effectiveness of leveraging simple, readily available technologies (barcode scanning and Google Spreadsheet) to address specific logistical challenges. This approach facilitated real-time tool tracking, significantly enhancing operational efficiency and resource allocation amidst the dynamic conditions of volunteer-driven efforts.

A critical insight from the project is the potential of custom solutions to meet unique project needs more directly and cost-effectively compared to commercial systems. Despite facing certain limitations, such as data entry errors and technical glitches, the custom-built system provided a tailored fit to the project's requirements, underlining the importance of adaptability and user-friendly design in technology solutions for community initiatives.

Comparison to Commercial Systems

Analyzing the cost-effectiveness of the inventory system implemented for the Asheville park reconstruction project reveals a stark economic benefit to the custom approach adopted. Over the course of the project, a total of 6,409 scans were recorded—not a premeditated figure, but the actual usage that unfolded naturally. The expenses associated with this actual use, which involved a barcode scanner and stickers, totaled $279, averaging out to a cost-efficient $0.04 per scan.

Comparatively, commercial systems present a less economically sensible option, especially given the brevity of the project, which aimed for completion within a mere five days. The notion of an annual subscription, such as Inflow's $1,068 cost or Fishbowl's $3,950 fee, is incongruous with the project's timeframe, rendering these costs exorbitant per scan at $0.21 and $0.66, respectively. Such annual commitments are laughably inappropriate for a project with such a quick turnaround, making the substantially higher costs—up 383% for Inflow and an eye-watering 1416% for Fishbowl—unnecessary burdens. Even Zoho, a more modest $39 monthly subscription, is misaligned with the project's duration, translating to a needless expense given the non-recurring nature of the event.

This experience solidifies the notion that the cost per scan is a pragmatic measure of operational efficiency, particularly critical for a community-led project with stringent budget constraints. The post-project tally of scans highlights the substantial cost savings afforded by the custom system, which offered scalability and financial prudence, confirming its suitability for a project of this particular scale and duration. Such a system's demonstrable efficiency and adaptability establish it as a prime example for similar projects where judicious resource management is crucial, and fiscal austerity is paramount.

Overview of Features Offered by Commercial Inventory Systems

Commercial inventory systems, as illustrated by platforms such as NetSuite Advanced Inventory, inFlow Inventory, and Zoho Inventory, offer a broad spectrum of functionalities designed to streamline and optimize inventory management across various scales of operations. These systems typically provide features for real-time inventory tracking, demand-based inventory replenishment, inventory control across multiple locations, and automation of inventory cycle counting. Additionally, they offer capabilities for managing serialized inventory, lot management, bin management, and integrated analytics for performance monitoring and decision-making.

Recommendations

For organizations or project leaders considering a custom-built versus commercial inventory tracking system, the following recommendations are proposed based on the project's experience:

1. **Assess Specific Needs and Resources**: Carefully evaluate the project's specific requirements, available resources, and the technical proficiency of participants. A custom-built system may offer greater flexibility and cost savings for projects with well-defined needs and limited budgets.
2. **Prioritize User Training and Support**: Regardless of the system chosen, ensure comprehensive user training and ongoing support to maximize adoption and minimize operational disruptions. This is particularly crucial for volunteer-driven projects where participants may have varied levels of tech savviness.
3. **Consider Scalability and Flexibility**: Opt for solutions that offer scalability and flexibility to accommodate changes in project scope, volunteer availability, and unexpected challenges. Custom systems should be designed with the capacity for adjustments and updates.
4. **Evaluate Long-term Value**: While commercial systems may present higher initial costs, assess the long-term value they may provide in terms of reliability, support, and advanced features. Determine whether these benefits align with the project's duration and goals.

Suggestions for Further Research or Improvements

The experiences and outcomes of the Asheville park reconstruction project offer a foundation for further research and improvement in several areas:

1. **Comparative Studies**: Conduct comparative studies of custom-built and commercial inventory tracking systems across various community-led projects to empirically assess their efficacy, challenges, and user satisfaction.
2. **System Integration and Automation**: Explore opportunities for integrating additional technologies (e.g., RFID technology, cloud storage) into custom systems to enhance automation, data accuracy, and real-time tracking capabilities.
3. **Impact on Volunteer Productivity**: Investigate the impact of inventory tracking systems on volunteer productivity and project outcomes, providing insights into optimal system features and configurations.

4. **Cost-Benefit Analysis**: Perform detailed cost-benefit analyses of custom-built versus commercial systems, considering not only financial costs but also factors such as time savings, user experience, and project success rates.

In conclusion, the Asheville park reconstruction project illustrates the significant potential of custom-built inventory tracking systems to support the unique needs of community-led projects. By carefully considering project-specific requirements, prioritizing user experience, and embracing technological innovation, project leaders can enhance operational efficiency and contribute valuable insights to the ongoing evolution of inventory management practices in volunteer-driven initiatives.

References

In preparing the scientific analysis of the custom-built inventory tracking system utilized in the Asheville park reconstruction project, and comparing this system to commercial alternatives, the following sources of information were instrumental:

1. **NetSuite**. (2022). NetSuite Advanced Inventory. [Online]. Available at: www.netsuite.com. This source provided insights into the functionalities and benefits of a comprehensive commercial inventory management system, highlighting capabilities such as demand-based inventory replenishment and real-time inventory visibility across multiple locations.

2. **Rodgers**, **D**. (2023, September 20). Email communication on project logistics and expectations. This personal communication outlined operational considerations and project constraints, informing the customization requirements for the inventory tracking system and emphasizing the need for a simple, efficient solution.

3. **inFlow Inventory**. (2023, January 24). How To Get Started with Asset Tracking and Reduce Waste. [Blog Post]. Available at: https://www.inflowinventory.com/blog/asset-tracking-for-small-business/. This article offered perspectives on asset tracking within business operations, which contributed to understanding the broader context of inventory and asset management practices relevant to the project.

4. **Zoho Inventory**. Clear the Clutter: 4 Warehouse Optimization Tips. [Online]. Available at: https://www.zoho.com/inventory/guides/optimize-your-warehouse-storage.html. This resource provided guidelines for efficient warehouse and inventory management, including item organization based on movement and relevance, which were considered in evaluating the project's custom-built system against commercial alternatives.

5. **Fishbowl Inventory**. A Guide to Effective Inventory Management for SMBs. [Online]. Available at: https://www.fishbowlinventory.com/. This guide explored various aspects of inventory management, highlighting challenges and best practices that informed the development and implementation of the custom-built inventory tracking system for the project.

6. **Citizen-Times**. (2023, June 5). Former Jones Park Playground Rebuild Set for October: See the New Design. [Online]. Available at: https://www.citizen-times.com/story/news/local/2023/06/05/former-jones-park-playgroun

d-rebuild-set-for-oct-see-the-new-design/70281154007/. This article provides an overview of the planning and community engagement process leading up to the reconstruction of the Jones Park Playground, offering insights into the project's background and significance.

7. **Rebuild Jones Park**. Home Page. [Online]. Available at: https://www.rebuildjonespark.org/. This website serves as a central hub for information on the Jones Park reconstruction project, including project updates, volunteer opportunities, and community involvement strategies, contributing to a comprehensive understanding of the project's scope and community impact.

8. **Leathers & Associates**. Justin Fowler. [Online]. Available at: https://www.playgroundsbyleathers.com/about/justin-fowler/. This biography page provides information on Justin Fowler, the job site supervisor for the Jones Park reconstruction project, detailing his experience and role within Leathers & Associates in guiding community-led playground projects.

These sources collectively informed the project's approach to developing a custom-built inventory tracking system tailored to the specific needs and constraints of a community-led construction project. They also provided valuable comparison points for assessing the potential advantages and limitations of commercial inventory systems in similar contexts.

Example of Google Apps Script

```
/**
 * This function is triggered every time a cell is edited in the spreadsheet.
 * It looks for specific commands entered in cells and executes corresponding actions,
 * such as clearing content, switching sheets, or performing inventory operations.
 */
function onEdit(e) {
  // Extract the last input value and the sheet where the change was made
  var lastInput = e.value;
  var sheet = e.range.getSheet();
  var sheetName = sheet.getName();

  // Utility function to switch to a specified sheet by name
  function switchToSheet(sheetName) {
    var spreadsheet = SpreadsheetApp.getActiveSpreadsheet();
    var targetSheet = spreadsheet.getSheetByName(sheetName);
    spreadsheet.setActiveSheet(targetSheet);
    return targetSheet;  // Returns the target sheet for further operations
  }

  // Maps predefined commands to their respective sheet names and actions
  var commands = {
    "####-ISSUE/RETURN": {
      sheetName: "Tool-Issue-Return",
      action: function () {
        e.range.clearContent();
        var targetSheet = switchToSheet("Tool-Issue-Return");
        targetSheet.getRange("B4").activate(); // Focus on a specific cell
      }
    },
    // Other commands follow a similar structure, omitted for brevity
  };

  // Execute the action associated with the command if it exists
  if (commands[lastInput.toUpperCase()]) {
    var command = commands[lastInput.toUpperCase()];
    command.action();
  }
}

/**
 * This overloaded version of the switchToSheet function allows for activating a specific cell.
 * Note: This function was intended to demonstrate overloading, which is not directly supported in JavaScript,
 * hence the somewhat duplicated functionality.
 */
function switchToSheet(sheetName, cell) {
  var spreadsheet = SpreadsheetApp.getActiveSpreadsheet();
  var sheet = spreadsheet.getSheetByName(sheetName);
  spreadsheet.setActiveSheet(sheet);
  if (cell) {
    sheet.getRange(cell).activate();
```

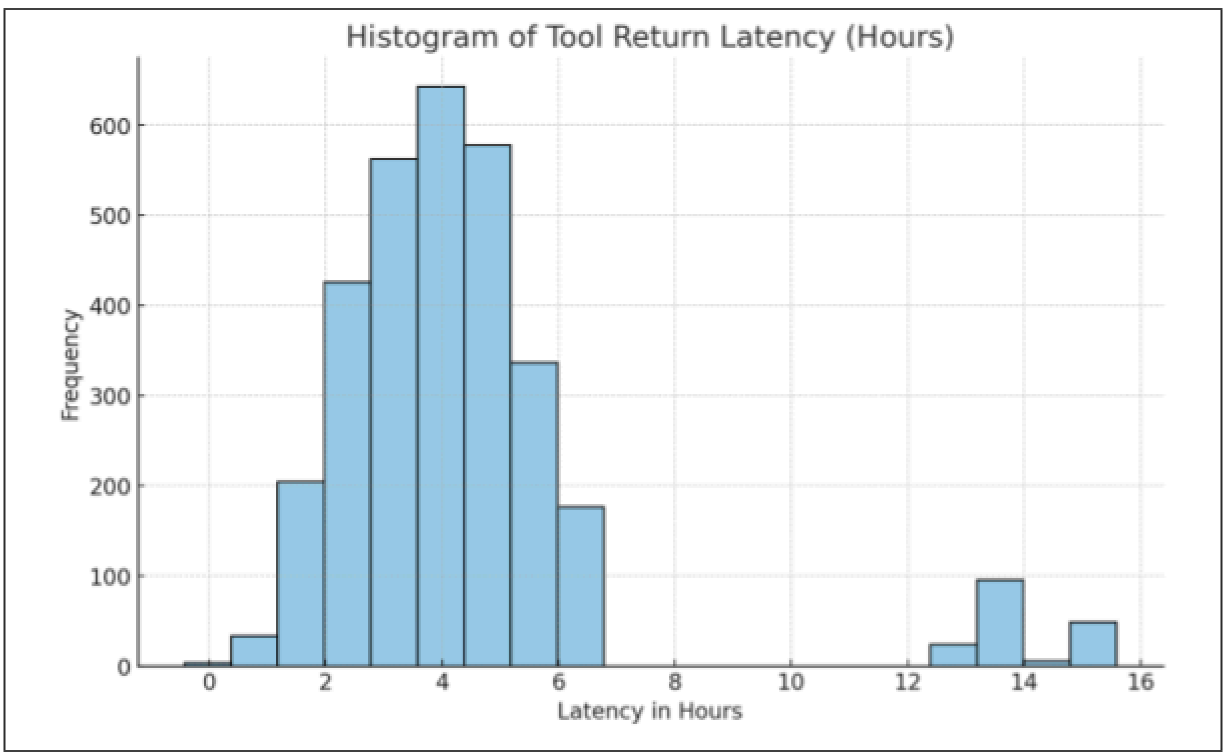
```
  }
}

/**
 * Adds inventory items to the spreadsheet. This function is designed to be triggered
 * by a specific command input by the user. It prompts the user for information
 * about each tool and appends it to the inventory.
 */
function addToInventory() {
  // Implementation involves counting "TOOL-" barcodes, prompting for information, and updating the inventory sheet
  // Omitted for brevity
}

/**
 * Removes items from the inventory based on data in the "Tool-Issue-Return" sheet.
 * It moves items to "Returned" or "Donated" sheets based on their status.
 */
function removeFromInventory() {
  // Implementation involves reading data from one sheet and moving it to another, updating sheets as necessary
  // Omitted for brevity
}

/**
 * Facilitates the check-in process of inventory items, applying color coding and moving data between sheets.
 */
function performCheckIn() {
  // Implementation involves applying color coding, checking for non-empty cells, and appending data to a transaction
record
  // Omitted for brevity
}

/**
 * Facilitates the check-out process of inventory items, applying color coding and moving data between sheets.
 */
function performCheckOut() {
  // Similar in structure to performCheckIn, but for the checkout process
  // Omitted for brevity
}

/**
 * Looks up a tool by its barcode and displays information about it, including the owner and contact details.
 */
function toolLookup() {
  // Implementation involves searching for a tool by its barcode in the inventory and displaying its details
  // Omitted for brevity
}
```

Tables and Figures

Figure 1: Inateck BCST-54 barcode scanner.

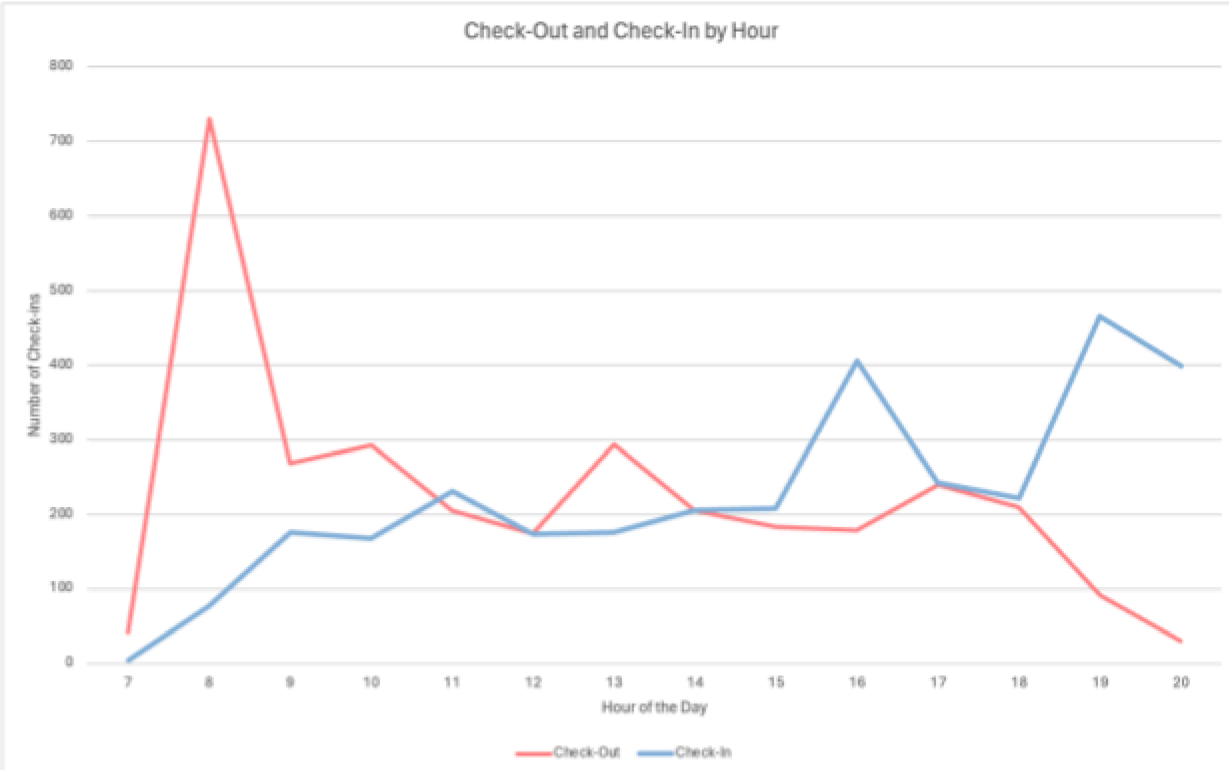
This scanner essentially functioned as a wireless keyboard. Scanning a barcode entered the ID number into a cell and “pressed Enter.” Likewise, scanning a command code like “####-CHECK-OUT” or “####-CHECK-IN” triggered the spreadsheet to perform scripted tasks of recording the Tool ID and a Timestamp to determine frequency of use and time spent on the job site.

Figure 2: Histogram of Tool Return Latency (Hours)



This histogram displays the distribution of time intervals between when tools were checked out and returned during the park reconstruction project. The vertical axis labeled "Frequency" represents the number of tools returned within each latency range in hours. The majority of tools were returned within 2 to 6 hours, while a smaller number took 12 to 16 hours to be returned. This data provides insights into how long tools typically remained in use before being checked back in, helping to understand usage patterns and project logistics.

Figure 3: Check-out and Check-In by Hour



Line Chart showing the number of Check-Outs and Check-Ins by hour each day. This chart describes trends that were conveyed verbally by the job foreman. It was expected that Check-outs and Check-Ins would be inversely proportional as demonstrated by this chart. The mid-afternoon Check-In surge suggests more people left the job site each day to prepare dinner at home.

Figure 4: Heatmaps of Check-Outs and Check-Ins by Hours Each Day

Count of Check-Out	Hours													
Days	07	08	09	10	11	12	13	14	15	16	17	18	19	20	Grand Total
4-Oct	21	109	54	49	26	26	41	27	36	23	49	34	11		506
5-Oct	3	137	46	60	60	59	65	39	38	40	56	53	26	7	689
6-Oct		181	53	56	14	22	69	52	37	20	68	60	20	6	658
7-Oct	18	193	50	70	46	37	54	43	32	39	65	27	27	17	718
8-Oct		111	65	57	59	30	64	44	40	56	1	36	7		570
Grand Total	42	731	268	292	205	174	293	205	183	178	239	210	91	30	3141

Count of Check-In	Hours													
Days	07	08	09	10	11	12	13	14	15	16	17	18	19	20	Grand Total
4-Oct	4	9	31	46	19	18	15	14	26	40	48	13	160	11	454
5-Oct		6	22	26	71	23	59	59	36	129	56	35	74	94	690
6-Oct		19	66	38	10	40	31	34	43	77	66	43	23	193	683
7-Oct		33	30	30	56	38	41	55	29	72	44	65	104	101	698
8-Oct		10	26	28	75	54	30	43	74	88	28	65	105		626
Grand Total	4	77	175	168	231	173	176	205	208	406	242	221	466	399	3151

Heatmap showing the number of Check-Outs by hour each day, and Check-Ins by hour each day. The subtle trends that emerge coincide not just with start and end times, but with typical meal times as well. The mid-afternoon Check-In surge suggests more people left the job site each day to prepare dinner at home.