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Citizen Science as a Driver of Employee Engagement: A Case Study of the *PENDAKI* Program

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Nunik Maharani[1*], Janette Maria Pinariya[1]
[1]LSPR Institute of Communication and Business
Jl. K.H. Mas Mansyur Kav. 35 Jakarta 10220 - Indonesia
[*]Corresponding author: janette.mp@lspr.edu

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Abstract - This study examines how the *PENDAKI* program at PT Austindo Nusantara Jaya Tbk (ANJ) fosters employee engagement through citizen science. The main goal is to understand how it creates employee engagement within corporate sustainability efforts. The research draws on internal communication theories, highlighting the importance of information exchange for organizational efficiency, employee performance, and motivation, and sustainability communication, which connects environmental issues with social values to promote sustainable practices. The study explores the question: "how can citizen science through the *Pendaki* program create employee engagement?". Using a qualitative descriptive case study approach, it focuses on *PENDAKI* program at ANJ from 2019-2024. Data was collected through semi-structured interviews with management, conservation staff, and employee participants across different operational areas, along with documentary evidence like internal research and program evaluation reports. The findings show that *PENDAKI* fosters employee engagement through several pathways. Participation increased employee awareness and understanding of biodiversity and conservation efforts. Employees felt they were contributing to the company's sustainability goals and values. The program offered opportunities for skill development in species identification and documentation, and recognition for contributions, which motivated further participation. It also reduced silos between departments and encouraged collaboration towards a shared conservation objective. Additionally, the program positively impacted the company's external image and fostered employee pride. The study concludes that *PENDAKI* creates employee engagement by fostering a sense of purpose, providing skill development opportunities, and promoting a shared commitment to biodiversity conservation, highlighting the role of communication strategies in the success of such initiatives.

Keywords: Citizen science; Employee engagement; Internal communication; *PENDAKI*; Sustainability communication.

Introduction

The modern business landscape is increasingly shaped by the imperative for sustainability. This shift is largely driven by escalating demands from consumers who actively prefer products and services originating from environmentally conscious practices (Boston Consulting Group, 2022). For businesses, embracing sustainability offers a multitude of benefits, including the potential to cultivate stronger customer loyalty, attract new segments of the market, and establish a distinct competitive

edge in an increasingly crowded marketplace. Furthermore, a robust commitment to sustainability serves as a powerful magnet for attracting and retaining top-tier talent, as a growing number of employees prioritize working for organizations that demonstrate environmental responsibility (Lesser et al., 2023). In today's financial climate, characterized by heightened scrutiny from investors towards businesses with strong environmental, social, and governance (ESG) credentials, the integration of sustainability into core business strategy is no longer optional but a prerequisite for long-term success (KPMG, 2023).

Within the palm oil industry, a sector often facing environmental scrutiny, there exists an organization dedicated to fostering the growth and adoption of sustainable palm oil practices: the Roundtable on Sustainable Palm Oil (RSPO). Established in 2004, the RSPO is a non-profit organization with a global membership base, bringing together diverse stakeholders from across the palm oil value chain (RSPO, 2024). These stakeholders include palm oil producers, processors and traders, consumer goods manufacturers, retailers, banks and investors, environmental and nature conservation non-governmental organizations (NGOs), as well as social or development NGOs. The RSPO's core mission is to develop and implement global standards for the production of sustainable palm oil. Membership in the RSPO is voluntary, yet members are obligated to adhere to the RSPO Principles & Criteria (RSPO P&C), the compliance of which is subject to annual audits. A central pillar of the RSPO P&C is the protection of biodiversity, underscoring the critical need to ensure that palm oil production does not contribute to the degradation of ecosystems or the loss of biological diversity.

An increasingly prominent approach in the realm of biodiversity protection is the concept of citizen science, often referred to as sains warga in Indonesia. Citizen science embodies a collaborative partnership between professional scientists and volunteer participants, who contribute their time and efforts to scientific research endeavors. Over the past decade, citizen science has witnessed significant growth in its adoption and popularity, emerging as both a valuable scientific methodology and a novel form of stakeholder engagement and public participation in the scientific process, ultimately contributing to the generation of new knowledge (Wehn et al., 2021). This participatory approach fundamentally empowers individuals to become actively involved in the scientific process, enabling them to contribute by collecting, analyzing, and sharing data. This transforms volunteers from passive recipients of scientific knowledge into active contributors (Bonney et al., 2009).

Within the context of a company, actively engaging employees in scientific projects can significantly enhance internal communication and bolster their sustainability initiatives, thereby fostering a greater sense of engagement and increasing motivation among the workforce (Jansen et al., 2024). This approach aligns with the principles of sustainability communication theory, which underscores the importance of transparent, inclusive, and participatory communication practices in achieving overarching sustainability goals. Citizen science emphasizes the direct participation of employees in meaningful scientific research projects that address real-world challenges (Studebaker, S., 2024). Companies frequently encourage their employees to contribute to these projects, thereby cultivating a culture of continuous learning and reinforcing a sense of social responsibility.

This active involvement not only accelerates the pace of data collection but also significantly enhances employees' scientific literacy and their overall awareness of environmental issues (Eleta, I., Clavel, G.G., Righi, V., Balestrini, M., 2019). By participating in citizen science initiatives, employees have the opportunity to develop new skills and cultivate new interests, which can be beneficial for both their personal and professional growth. Furthermore, these projects often foster teamwork and collaboration, as employees work together towards the achievement of shared objectives. Overall, well-designed citizen science initiatives have the potential to substantially enhance employee engagement and motivation, generating positive impacts for both the organization and the wider community.

Despite the clear benefits, efforts to address sustainability issues often suffer from a lack of adequate participatory approaches, a critical element for achieving meaningful progress (Farri, E., Cervini, P., Rosani, G., 2022). Without the broad participation of all relevant stakeholders, sustainability initiatives run the risk of failing to achieve their intended outcomes (Pucker, K.P., 2024). Actively involving communities, businesses, and individuals in these efforts helps ensure that the solutions adopted incorporate a diverse range of perspectives and valuable local knowledge. In this context, citizen science plays a pivotal role by actively engaging the public in scientific research

and data collection, thereby enhancing the overall effectiveness of sustainability projects (Lorenz & Lepenies, 2023).

This participatory approach not only empowers individuals but also cultivates a stronger sense of ownership and responsibility towards the management of the environment. Ultimately, the strategic integration of citizen science into sustainability efforts has the potential to bridge the persistent gap between ambitious goals and concrete actions, leading to outcomes that are both more robust and more inclusive.

According to Rufenacht et al. (2021), communication and dissemination represent fundamental pillars for the success of projects across all domains. This is particularly true for citizen science initiatives, where project success hinges on the active engagement of the community and often aims to reach and influence policymakers. Effective communication and dissemination efforts are crucial for reaching and meaningfully engaging the intended audiences, ultimately achieving the desired impact. These efforts also enhance the visibility and reach of the project, maintain the active involvement of participants, and increase the likelihood of influencing policy decisions. Ensuring the effectiveness of communication and dissemination necessitates meticulous planning, the adoption of best practices, and the allocation of adequate resources.

Yudarwati (2024) frames sustainability communication as a crucial social learning process, emphasizing the active participation and engagement of the community. Her research on the engagement of Balinese women in waste bank programs underscores the significance of cultivating a critical awareness regarding the intricate relationship between humans and their environment. Yudarwati argues that sustainability communication should transcend merely providing information; it must actively involve individuals in ways that connect environmental issues with deeply held local social values and norms. This approach fosters a more profound understanding and a stronger commitment to sustainable practices. Yudarwati's work demonstrates how social learning processes can effectively drive pro-environmental behavior.

Rufenacht et al. (2021) also highlight the significant role that public relations plays in effectively communicating the successes and broader impacts of citizen science projects. By strategically sharing compelling stories about how these projects contribute to scientific knowledge, environmental preservation, or the overall well-being of communities, organizations can construct a positive narrative around their brand. Effective public relations efforts underscore the collaborative involvement of stakeholders, thereby strengthening relationships and enhancing the company's image. Internally, citizen science projects cultivate a culture of engagement and sustainability among employees, which can be effectively communicated through internal channels to boost employee morale and loyalty.

Externally, successful projects often attract significant media attention, generating positive publicity and increasing the organization's visibility. By strategically integrating citizen science into their broader public relations strategy, companies can build a stronger and more positive reputation, clearly demonstrating their commitment to transparency, meaningful employee and community engagement, as well as a genuine dedication to social and environmental responsibility and overall sustainability.

To gain a deeper understanding of the phenomenon of citizen science and the associated dynamics of employee participation and engagement, this research focuses on a specific case study: PT Austindo Nusantara Jaya Tbk (ANJ). ANJ, a prominent food company operating in the agribusiness sector, stands out as the sole company in the palm oil sector to have adopted a citizen science approach for the explicit purpose of monitoring biodiversity within its operational areas in Indonesia. This innovative program is known as *PENDAKI*, an acronym for *Peduli Keaneakaragaman Hayati*, which translates to Caring for Biodiversity.

This study endeavors to examine the relationship between the implementation of citizen science and the creation of employee engagement. Therefore, the central research question guiding this investigation is: “how citizen science through the *PENDAKI* program can create employee engagement?”. The primary objective of this research is to gain a comprehensive understanding of the specific mechanisms through which citizen science initiatives, exemplified by the *PENDAKI* program, can effectively foster and enhance employee engagement within a corporate context.

Theoretical Framework

The theoretical framework for understanding the *PENDAKI* citizen science program's impact on employee engagement within corporate sustainability draws upon three interconnected domains: Citizen Science Theory, theories of Internal Communication, and principles of Sustainability Communication. Citizen Science Theory provides the methodological foundation for *PENDAKI*, defined as a collaboration between professional scientists and non-professional volunteers for scientific research (Bonney, Cooper and Ballard, 2016). This participatory approach empowers individuals to actively engage in the scientific process through data collection, analysis, and sharing, transforming them into active contributors of scientific knowledge (Bonney et al., 2009). Citizen science is characterized by its potential social and political impacts and fosters community dialogues (Hecker et al., 2018). Its growth reflects its capacity to address global challenges and reshape the science-society relationship (Bonney, Cooper and Ballard, 2016).

The European Citizen Science Association (ECSA) developed ten principles of best practice for effective citizen science projects: (1) Active involvement of citizens in generating new knowledge; (2) Production of authentic outcomes that answer research questions or inform policy; (3) Mutual benefit for both scientists and volunteers; (4) Varied participation of volunteers across research stages; (5) Feedback provision to volunteers on data utilization; (6) Recognition of research validity, acknowledging limitations while democratizing science; (7) Data accessibility through transparent and open formats; (8) Participant recognition in project outcomes and publications; (9) Comprehensive evaluation based on various impacts; (10) Addressing ethical and legal considerations.

These principles guide the field, with some requiring more resources for implementation (Hecker et al., 2018). Citizen science has grown significantly as a legitimate scientific practice and a tool for public engagement (Wehn et al., 2021). It provides crucial data for conservation (Pettibone et al., 2016) and can contribute to understanding broader ecological questions. Citizen science is a powerful tool for public engagement, integrating diverse perspectives, and enhancing participant knowledge and commitment. Its interplay with employee engagement highlights its potential to enhance skills, job satisfaction, and a sense of purpose (Bonney et al., 2016), boosting morale and productivity.

The second theoretical lens is Internal Communication, which is crucial for the success of citizen science programs. It plays a critical role in a company's efficient functioning and management by facilitating information exchange (Zdravkovska and Haque (2023) as cited in Widyastuti et al. (2024)). Internal communication is the bedrock for information sharing, essential for organizational development and effectiveness. Effective internal communication improves employee performance, motivation, and organizational outcomes, with leadership being vital. Open and transparent communication between superiors and subordinates fosters cohesion and helps achieve organizational goals (Dhone and Sarwoko, 2022; Salman et al., 2023 in Widyastuti et al., 2024).

Keeping employees informed about project objectives and their impact fosters ownership and accountability. Communication and dissemination are fundamental for project success, especially for citizen science aiming for community engagement and policy influence (Rufenacht et al., 2021). Effective communication enhances project visibility, maintains participant involvement, and increases the likelihood of policy impact. Communication in citizen science evolves to recruit, motivate, retain participants, recognize contributions, provide information, and share results (Rufenacht et al., 2021; Hecker et al., 2018; de Vries et al., 2019; Veeckman et al., 2019). Weder and Stranzl suggest that sustainability can be cultivated internally through communication, viewing employees as key agents of change.

The third domain is Sustainability Communication. Organizational communication is vital for a productive and engaged workforce aligned with company goals (Mazzetti & Schaufeli, 2022). Transparency in organizational communication is a key link to employee engagement, building trust and making employees feel valued. Understanding their contribution motivates employees and fosters belonging. Regular updates, feedback, and recognition boost morale and create a positive environment. Leadership is crucial in setting the sustainability vision and inspiring pro-sustainability behaviors, often requiring communication training (Enyioko, 2021; Pinariya, B.H.U., Pinariya, J.M., Yulianti, W., 2024). Effective leaders communicate sustainability-related information. Strong communication is essential for organizational learning and a sustainable competitive advantage.

Citizen science relies on effective organizational communication to inform, motivate, and align participants. This fosters transparency and trust, leading to sustained engagement. Open communication facilitates problem-solving and innovation. Well-defined communication channels are critical for participant engagement in citizen science (Anderson et al., 2020). The synergy of strong leadership, effective communication, and high engagement is essential for successful citizen science projects.

The synergistic interaction of these three domains is key to *PENDAKI's* success. Citizen science provides the data collection method, employee engagement strategies motivate participation and ownership, and sustainability communication integrates *PENDAKI* within the company's environmental commitment. Program design elements and strong leadership further strengthen this framework.

Material and Methodology

This research employed a case study approach combined with a descriptive qualitative approach to explore how the *PENDAKI* citizen science initiative at ANJ effectively functions as a program for employee engagement. Qualitative data analysis is a research method that centers on the systematic collection and processing of non-numerical data. This data can encompass various forms, such as textual documents, in-depth interview transcripts, detailed observational notes, and visual artifacts. The primary goal of this analysis is to explore and gain an understanding of the underlying meanings, key concepts, inherent characteristics, and broader social phenomena from a diverse perspectives (Rohmah, M., 2024). This specific research undertook a case study of a biodiversity monitoring initiative within an agribusiness company that has strategically implemented a citizen science approach over a period of five years, spanning from 2019 to 2024, across its oil palm plantation units.

The primary data collection techniques utilized in this research included both interviews and the collection of documents that were readily accessible either directly or through online platforms. The researcher collected data from Jakarta through a combination of direct interviews, conducted either in person or remotely via platforms like Zoom, and written interviews, during the period of 19 February to 11 March 2025. Furthermore, the research involved a review of internal research conducted in 2022 and the *PENDAKI* 2024 program evaluation document, as well as a literature review.

Targeted interviews were conducted with biodiversity experts to explore the underlying rationale for adopting the citizen science approach within ANJ, to identify any challenges encountered during its implementation, and to gather the expert perspectives on the *PENDAKI* program itself. Additionally, a series of interviews were conducted with the ANJ team, encompassing individuals in key roles such as the Head of Conservation, active *PENDAKI* participants and dedicated *PENDAKI* Champion, as well as the Internal Communication Manager and the External Communication Manager. The *PENDAKI* Champion role is specifically assigned to staff within the Conservation Department, with responsibilities that include actively promoting the program, systematically collecting data on wildlife encounters from *PENDAKI* participants, and undertaking focused monitoring of 25 specifically identified unique species within their respective plantation locations. Notably, there are two *PENDAKI* Champions interviewees representing each region of the plantation sites.

Yin (1994) asserted that in the context of the questions commonly addressed within the case study method, and recognizing the intention to understand the research phenomenon in significant depth, even aiming to explore and elaborate on its nuances, it is insufficient for case study questions to solely focus on "what". Rather, it is crucial to also investigate "how" and "why" (Rahardjo, M., 2017). The "what" questions are primarily intended to elicit descriptive knowledge, while the "how" questions aim to acquire explanative knowledge, and the "why" questions are designed to uncover explorative knowledge.

Following the completion of the interviews, the researcher undertook a process of data coding, categorizing and grouping the collected data into several specific thematic areas. The primary objective of this thematic analysis was to discern and understand the specific ways in which the implementation of the *PENDAKI* citizen science project effectively contributes to the creation of an employee engagement program within ANJ.

Result and Discussion

PENDAKI represents an innovative citizen science approach adopted by PT Austindo Nusantara Jaya Tbk (ANJ), an agribusiness-based food company, to systematically monitor biodiversity within its Indonesian operations. Officially launched in 2019, *PENDAKI* actively involves ANJ employees in collecting flora and fauna data in both conservation and plantation areas (*PENDAKI*, 2024; ANJ, 2024). This leverages the regular presence of employees in these areas, making them more likely to encounter local wildlife. The primary motivation for *PENDAKI* stemmed from essential business needs, particularly ANJ's commitment as a member of the Roundtable on Sustainable Palm Oil (RSPO). As an RSPO member, ANJ is obligated to comply with the RSPO Principles and Criteria (P&C), which include Environmental and Social Impact Assessments (ESIA), a "No Deforestation" policy, biodiversity conservation and restoration, transparent monitoring and reporting, and community engagement. *PENDAKI* serves as an innovative tool for ANJ to meet these requirements through extensive biodiversity data collection within its concessions, informing environmental management practices.

The ANJ website (2024) indicates that *PENDAKI* participants engage in self-learning and receive briefings from the Head of Conservation to enhance their biodiversity identification and data collection skills. The program has improved the Company's monitoring performance, leading to an increase in recorded threatened fauna and flora species (IUCN Red List) within ANJ's areas. The experiences and learnings from *PENDAKI* have been shared in national and global forums as examples of best practices in conservation within the palm oil sector. As of December 2024, *PENDAKI* had recorded nearly 150,000 biodiversity records contributed by more than 3,300 citizen scientists. These records undergo annual review by biodiversity experts, who have confirmed a high accuracy rate of 84.3%. These reviews also identified at least 591 unique species recorded through the program.

PENDAKI received the Outstanding Achievement Award at the 2022 RSPO Excellence Awards for its contributions to conservation through innovative methodologies, highlighting its cost-effectiveness and sustainability. *PENDAKI* was also a finalist for the Biodiversity Champion award at the 2024 Reuters Sustainability Awards. Table 1 and Figure 1 provide data on citizen scientist participation and the geographical implementation of *PENDAKI* throughout 2019-2024 in ANJ's six plantation areas, namely PT Austindo Nusantara Jaya Agri (ANJA), PT Austindo Nusantara Jaya Agri Siais (ANJAS), PT Sahabat Mewah dan Makmur (SMM), PT Kayung Agro Lestari (KAL), PT Putera Mandiri Perkasa (PMP), and PT Permata Putera Mandiri (PPM).

Table 1. *PENDAKI* biodiversity records and citizen scientists (2019-2024)

Year	Biodiversity records	Citizen scientists
2019	6,122	1,030
2020	20,277	2,441
2021	21,474	2,120
2022	30,709	2,314
2023	31,414	1,161
2024	34,347	3,315

Source: Internal data ANJ, 2025

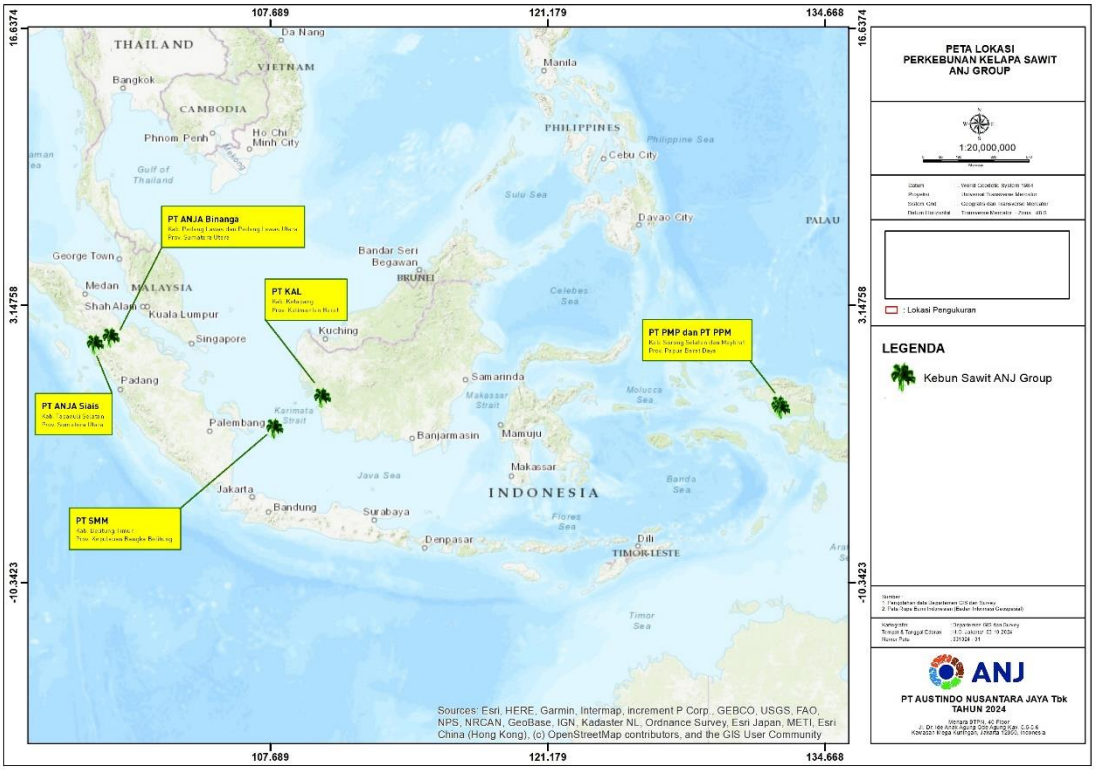


Figure 1. Location map of *PENDAKI* program implementation
Source: Internal data ANJ, 2025

PENDAKI operates by inviting voluntary participation from ANJ employees to document flora and fauna encounters using various accessible methods. Initially relying on paper forms, the program has evolved to incorporate digital devices like Google Forms, WhatsApp groups for real-time reporting, a dedicated *PENDAKI* Champion application, and a centralized dashboard for data management. Citizen scientists or *PENDAKI* volunteers report encounters with details on the species (Latin, common, or local name), location, date, and time, typically accompanied by photographic evidence for identification.

The collected data is reviewed and analyzed by the conservation team, who provide feedback to the citizen scientists, confirming species identifications. The program also includes "*PENDAKI* Champions," who are more actively involved in promoting the program, conducting outreach, and focusing on monitoring specific iconic species. These champions receive training and capacity development in species identification and data collection methods. Regular campaigns and outreach are conducted to raise awareness about PENDAKI among all ANJ employees, informing them about biodiversity protection laws and encouraging participation.

Analysis of Results

PENDAKI has significantly increased the volume of biodiversity data collection. As of December 2024, nearly 150,000 biodiversity records were collected by more than 3,300 citizen scientists, with a high accuracy rate of 84.3% after verification by experts. The program has documented an impressive 591 unique species within ANJ's operational areas, including several threatened species on the IUCN Red List. Erik Meijaard provided insight into the origin of *PENDAKI*, explaining that the initial idea came from Rona Dennis's prior experience at BHP Billiton.

> "This successful model was adapted for ANJ with the core idea of developing a cost-effective way to gather wildlife information." (Erik Meijaard and Rona Dennis, personal communication, 19 February 2025).

Both Meijaard and Dennis emphasized citizen science's potential to generate substantial data at a lower cost than traditional methods like extensive camera trap networks. The long-term operational costs of *PENDAKI* are much lower than ongoing expenses for widespread camera installations. Meijaard highlighted the importance of the human element and engagement of human resources, arguing that technology alone cannot create the same level of interest and engagement as a well-designed citizen science program.

Both Meijaard and Dennis believe that *PENDAKI* has significant potential to enhance ANJ's biodiversity conservation profile. While acknowledging the difficulty in precisely measuring cultural change, they pointed to anecdotal evidence and the company's success in winning awards as indicators of a positive shift in perceptions towards biodiversity and ESG within the organization. Dennis noted that *PENDAKI* helps employees understand the importance of sustainability efforts like RSPO certification.

Meijaard emphasized that *PENDAKI*-generated data is valuable because it is understandable and actionable by managers without a scientific background, possessing the potential to bridge the gap hindering adaptive management in many companies. Dennis added that *PENDAKI* fosters a sense of urgency and familiarity with biodiversity issues on the ground among employees. They also discussed initial program failures and the importance of thorough preparation, including knowledge transfer through training, fostering a sense of ownership among staff, and having strong internal advocates and senior management support. Meijaard identified the large number of observations and broad participation as key indicators of *PENDAKI's* success. However, he cautioned about the challenges of replicating this success in other companies due to unique contexts. He stressed the importance of leveraging additional benefits beyond data collection, such as employee engagement, public relations opportunities, and enhanced sustainability efforts.

> "Citizen science complements, rather than replaces, traditional scientific methods, by providing vast amounts of data and fostering widespread engagement. I acknowledge potential concerns about the accuracy of identifications by non-experts, but the significant increase in knowledge among participating staff over time, mitigating this concern. I'd like to understand the psychological and social dynamics within the company influenced by citizen science, such as changes in power relations and knowledge transfer." (Erik Meijaard, personal communication, 19 February 2025).

Interviews with the ANJ team, including management and field-level participants, revealed several key themes:

PENDAKI and its Objectives

PENDAKI utilizes a citizen science methodology directly involving employees in biodiversity data collection. Suprianto defined it as a method of biodiversity data collection using a citizen science approach, inviting employees to be directly involved in collecting data within the Company's area. M Ovan Syahputra stated the main function as recording or inventorying flora and fauna in the Company's operational environment. The overarching objective is to ensure the company remains on track with its commitment to biodiversity protection (Suprianto), specifically by monitoring the development and sustainability of diverse wildlife (Vience Sibarani).

> "PENDAKI is aligned with ANJ's core values of "Respect for People and the Environment" and its vision/mission of "Elevating the lives of people and nature"." (Suprianto, Vience Sibarani, and Firman Hidayat, written communication, 7-8 March 2025).

The program supports the company's commitment to global sustainability standards like RSPO and ISPO, which emphasize biodiversity protection (Suprianto). *PENDAKI* is viewed as a cost-effective effort to record flora and fauna (M. Ovan Syahputra), providing a highly economical means compared to engaging external ecological consultants (Nardiyono and Boy Tarigan).

> "The collected data serves as crucial considerations for the Company's environmental management actions." (M. Ovan Syahputra, written communication, 9 March 2025).

Employee Participation and Motivation

PENDAKI involves various employees across departments and operational locations. More than 3,300 (now in 2025 has reached over 4,000) citizen scientists are involved in data collection (Nardiyono and Tarigan). The program aims to foster interest and voluntary contributions among all employees. Claudia Munthe observed employees' desire to voluntarily and enjoyably observe wildlife.

Key drivers of employee participation include: (1) curiosity and interest in nature (Firman Hidayat); (2) learning and increased awareness of local flora and fauna and protected species (M. Ovan Syahputra and Vience Sibarani); (3) sense of contributing to the Company and a larger conservation effort (M. Ovan Syahputra); (4) rewards and recognition, such as PENDAKI-branded merchandise for top contributors (M. Ovan Syahputra, Vience Sibarani, and Imam Mujiono); (5) social interaction and recognition through WhatsApp groups and public acknowledgment (Claudia Munthe, Nita Ekaniana, and Riftyza Gestandi); (6) the active role of PENDAKI Champions or Conservation Supervisors in promoting the program, reminding colleagues, and collecting data (Suprianto and Imam Mujiono).

In examining the interaction, participation, and involvement of task force volunteers in assisting and empowering the public. Pinariya, Josphine, Yulianti, and Yunia (2021) note that volunteering fosters interpersonal engagement and accountability for a shared purpose.

Data Collection Process

Employees primarily document wildlife encounters during their routine work (M. Ovan Syahputra) (Figure 3). The main method involves taking photos and sharing them with the Conservation Team via WhatsApp, along with location details (Claudia Munthe and Imam Mujiono). Traditional physical forms are also used to record observations.

> "The collected data is managed in a centralized digital database. The data undergoes review and validation by the Conservation Team to ensure accuracy. Challenges like inconsistent species naming are addressed through cross-checking procedures. The data submission workflow, particularly for physical forms, was identified as sometimes inefficient, and efforts to streamline it are needed." (Nardiyono and Boy Tarigan, personal communication, 25 February 2025).

Impact of PENDAKI

PENDAKI has generated a substantial collection of flora and fauna data, providing valuable knowledge about biodiversity in ANJ's operational areas. There has been a notable increase in recorded species, from dozens to hundreds, and now thousands (Claudia Munthe).

> "The program has effectively fostered a greater sense of awareness and responsibility towards biodiversity among employees. Employees are now more likely to protect wildlife and report illegal activities like poaching. *PENDAKI* has helped in breaking down silos between departments, fostering enhanced communication and shared goals around conservation." (Nardiyono and Boy Tarigan, personal communication, 25 February 2025).

The data supports ANJ's sustainability commitments and reporting requirements, including RSPO and ISPO certification. The collected data has the potential to be used for biodiversity assessments and to inform conservation management strategies (Imam Mujiono, Nardiyono, Boy Tarigan).

> "From a communication perspective, externally communicating *PENDAKI* enhances the company's reputation and demonstrates its commitment to environmental protection." (Nita Ekaniana and Riftyza Gestandi, personal communication, 24 February 2025).

Challenges and Solutions

A key challenge is maintaining employee motivation and ensuring consistent data submission, with fluctuations in participation rates requiring ongoing monitoring (Suprianto, Claudia Munthe, Imam Mujiono, Nardiyono, and Boy Tarigan).

> "Solutions implemented include regular outreach, reminding *PENDAKI* Champions, providing feedback and rewards, and fostering a sense of community through WhatsApp groups." (Suprianto, Vience Sibarani, Imam Mujiono, Nardiyono, Boy Tarigan, personal and written communication, 24 February and 8 March 2025).

> "Initially, some employees lacked a clear understanding of the program's goals and their role, but consistent outreach, meetings, and clear communication have helped overcome this. Inconsistency in species identification and data recording was another challenge. Solutions included targeted training for *PENDAKI* Champions on identification and data entry, alongside efforts to validate and standardize the collected data. The inefficient data submission workflow for physical forms needs further streamlining." (Claudia Munthe, personal communication, 26 February 2025).

Program Improvements

Regular program updates and outreach are needed to maintain momentum and engagement (Claudia Munthe and Imam Mujiono). Simplifying the data submission process to the central database is highly desirable. There is a need to explore other uses for the collected data, such as in-depth ecological studies and informing conservation actions (Imam Mujiono, Nardiyono, Boy Tarigan).

> "Engagement efforts should be tailored to different employee groups and locations to be more effective. Continuously fostering two-way communication and listening to feedback from *PENDAKI* participants is crucial for ongoing improvement. If possible, we need to patent *PENDAKI* program." (Claudia Munthe, personal communication, 26 February 2025).

Utilizing internal communication platforms like notice boards to share findings and acknowledge contributions is proposed (Nardiyono and Boy Tarigan).

Communication Role and Challenges

The communication team plays a vital role in reinforcing the program's message internally and externally. Strategic communication contributes to employee pride and strengthens ANJ's commitment to sustainability. The External Communication Manager coordinates with the Conservation Team to gather data and photos, collaborating with Internal Communication to produce engaging content across various platforms. The Internal Communication Manager focuses on the *PENDAKI* brand image, including the logo (Figure 2) and promotional materials, and oversees publications in the internal magazine "Cakrawala", encouraging program documentation.

> "The media appreciates PENDAKI's efforts, including its dedicated application and website, positioning ANJ's conservation efforts as advanced." (Nita Ekaniana, personal communication, 24 February 2025).

External communication strategically highlights ANJ's sustainability programs, showcasing *PENDAKI* as a unique example of employee engagement and targeting media interested in sustainability and conservation. Internal communication emphasizes the use of internal media to discuss *PENDAKI* and the recorded flora and fauna from existing platform (Figure 4). Future plans include incorporating more engaging audio-visual content for internal communication, and encouraging more program documentation. While there is currently no formal measurement of communication effectiveness for *PENDAKI*, opportunities exist for awareness surveys and assessing employee roles (Riftyza Gestandi).

According to Poernomo, Sulistyo, and Sufa (2022), without effective communication, it is impossible for different parts of an organization to synergize. Poernomo et al. extensively discusses safety culture, which is shaped by how workers think and respond, and refers to the perception of policy, commitment to procedure, and attitudes within a group regarding risk. It highlights that developing a safety culture requires consistency between actions and communication. The communication climate within an organization is crucial for building trust and influencing employee decisions and behaviors.

Communication satisfaction, reflecting an evaluation of an affective internal situation, also plays a role. While Poernomo et al. focuses on safety culture, the underlying principles of fostering a positive internal environment through effective communication and promoting desired behaviors align with how *PENDAKI* aims to cultivate a culture of sustainability and engagement within ANJ. The positive outcomes of *PENDAKI*, such as increased employee awareness and pride, suggest a positive shift in the internal "sustainability culture" driven by the program and its communication strategies.

Both Ekaniana and Gestandi believe that *PENDAKI* has a positive impact on employee engagement, increasing awareness of conservation issues and participation in documentation. Externally sharing *PENDAKI's* successes creates pride among participants and employees. Feedback and testimonials from *PENDAKI* participants are used in communication materials. *PENDAKI* has influenced the company's communication culture, aligning it with ANJ's mission and values. The program encourages cross-departmental interaction and communication through WhatsApp groups, potentially breaking down silos. The enthusiasm of managers to participate in *PENDAKI* activities indicates a positive shift in organizational culture.

> "The role of strong leadership in promoting awareness and engagement is crucial, with General Managers showing attention to the program. A key challenge is ensuring PENDAKI is not just about data collection but fosters a deeper understanding and action towards conservation among participants and employees in general." (Riftyza Gestandi, personal communication, 24 February 2025).

Pinariya et al. (2021) examines risk communication in the context of the Covid-19 pandemic, noting the challenges of communicating about a disaster without causing undue fear or downplaying the risks. Raising awareness about the virus was a key responsibility of the task force. Although *PENDAKI* does not directly focus on communicating immediate physical risks, it does aim to increase employee awareness and understanding of biodiversity and conservation efforts. This increased awareness can be seen as a form of long-term environmental risk awareness, aligning with the broader principles of risk communication in promoting understanding and responsible behavior.

Figure 2. *PENDAKI* logo. Source: ANJ and PENDAKI websites



Figure 3. *PENDAKI* citizen scientists in the field. Source: ANJ website



Figure 4. *PENDAKI* biodiversity documentation. Source: *PENDAKI* website

Conclusion

The *PENDAKI* citizen science program has a clear and positive relationship with ANJ employee engagement. Participation in *PENDAKI* significantly increases employee awareness and understanding of biodiversity and conservation efforts within the company. This enhanced understanding fosters a stronger connection with ANJ's values. Furthermore, employees feel they are actively contributing to the Company's core vision of "Respect for people and the environment" through *PENDAKI*.

PENDAKI also provides valuable opportunities for skill development in species identification and documentation, with staff training provided. Participants have improved their identification skills over time. Importantly, the program actively recognizes and rewards employee participation, serving as a strong motivator and enhancing job satisfaction. By allowing anyone to participate regardless of department, *PENDAKI* has reduced silos and encourage collaboration across the company. Employees also express pride in working for a company that values biodiversity and involves them in conservation. This sense of pride enhances employee loyalty and engagement. Finally, feedback mechanisms within *PENDAKI* make employees feel more valued and engaged.

The active and enthusiastic participation of employees, which is crucial for *PENDAKI's* success, is directly facilitated by effective internal communication. The program's ability to increase employee awareness and understanding of biodiversity and conservation efforts at ANJ relies on clear and accessible internal communication channels. This enhanced understanding, in turn, leads to a greater sense of connection with the Company's values. The feeling of actively contributing to the Company's goals and values**,** indicates that ANJ effectively communicates its vision of "Respect for people and the environment" and how *PENDAKI* aligns with it.

The opportunities for skill development and recognition are also intrinsically linked to internal communication. Employees need to be informed about training opportunities, and the recognition and rewards for participation need to be communicated effectively to motivate continued engagement. The impact of *PENDAKI* to reduce silos and encourage collaboration highlights the role of internal communication in fostering a shared understanding and a sense of common purpose across different departments.

Finally, the feedback mechanisms within *PENDAKI* demonstrate the importance of two-way communication in fostering a sense of value and encouraging sustained engagement. In conclusion, the success of *PENDAKI*, as highlighted by the active and enthusiastic participation of employees, is fundamentally supported by effective internal communication. Simultaneously, *PENDAKI* serves as a crucial tool for sustainability communication, allowing ANJ to demonstrate its commitment to biodiversity and conservation to its employees, ultimately enhancing employee engagement.

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