

# Barriers to the Adoption of Technology-Driven Logistics and Supply Chain Management in Non-Governmental Organizations: Evidence from ADRA, Rwanda

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## ABSTRACT

The integration of technology into logistics and supply chain management (LSCM) has emerged as a critical driver of efficiency, responsiveness, and sustainability across both private and non-governmental organizations. Despite these benefits, humanitarian NGOs frequently encounter barriers to the adoption of technology-driven solutions, often due to financial, infrastructural, and institutional constraints. This study investigates the challenges faced by ADRA Rwanda in adopting and implementing technology-enhanced LSCM systems. A purposive sampling strategy was employed, targeting the entire population of 108 ADRA staff and managers. Quantitative data were collected and analyzed using descriptive statistics-frequency tables, weighted means, standard deviations, and percentages-while inferential analysis was conducted through multiple regression, with R language serving as the analytical tool. The findings highlight several significant obstacles. A large majority (96 respondents, 88.89%) indicated that warehouse staff lack regular training on logistics-related technologies. Limited internet connectivity was identified as a critical barrier, with 96 respondents (88.89%) agreeing and 12 (11.11%) strongly agreeing. Resistance to change appeared less severe, as 93 respondents (86.11%) were neutral, while 15 (13.89%) agreed it could pose a challenge. Data security concerns were not widely considered an obstacle, as 88 respondents (81.48%) disagreed and 20 (18.52%) remained neutral. However, high implementation cost emerged as the most significant barrier, with 96 respondents (88.89%) strongly agreeing and ranking it first among the challenges identified. Based on these findings, the study recommends that ADRA Rwanda invest in continuous capacity building for warehouse staff to improve technological competence, negotiate partnerships with service providers to enhance internet connectivity, and explore phased or donor-supported financing models to mitigate high implementation costs. Addressing these challenges is vital for advancing digital transformation in humanitarian supply chains and strengthening organizational effectiveness.

## INTRODUCTION

In today's rapidly evolving global economy, technology has become the cornerstone of modern logistics and SCM. The integration of advanced tools such as blockchain, artificial intelligence (AI), barcode scanners, radio-frequency identification (RFID), big data analytics, and the Internet of Things (IoT) has significantly improved efficiency,

transparency, and responsiveness across supply chains. These technologies optimize inventory management, enhance demand forecasting, enable real-time tracking, and strengthen decision-making processes (Christopher, 2016).

Despite these potential benefits, NGOs often encounter significant barriers when attempting to

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adopt technology-driven supply chain solutions. Unlike private corporations that typically have stronger financial bases and established infrastructure, NGOs operate in resource-constrained environments, rely heavily on donor funding, and function in contexts characterized by political instability and limited technological infrastructure. These conditions create unique challenges for technology adoption that can limit the effectiveness of humanitarian supply chains.

ADRA (Adventist Development and Relief Agency) is the global humanitarian arm of the Seventh-day Adventist Church, operating in more than 120 countries. In Rwanda ADRA was founded in 1978 under the Rwanda Union Mission of the Seventh-day Adventist Church and registered under Rwandan law to provide humanitarian assistance to displaced persons, the vulnerable, and marginalized citizens (ESDA, 2020). Its work spans education, food security, health, economic empowerment, and disaster relief.

Despite its wide reach, studies on SCM in Rwanda have largely focused on integration strategies within public institutions, leaving technology adoption underexplored. This paper investigated the barriers to adopting technology-driven logistics and supply chain management systems within ADRA, Rwanda. The study focused on organizational, financial, and infrastructural challenges that hinder technology adoption, providing empirical insights that can inform both scholarly debates and practical strategies for enhancing humanitarian logistics.

### Research problem

Globally, technology has proven to be transformative in SCM by enhancing efficiency, transparency, and agility (Christopher, 2016). Across Africa, digital tools such as mobile platforms, IoT, and big data are increasingly being used to overcome infrastructure and operational barriers in transportation, warehousing, and inventory management (Gor & Muturi, 2019).

In Rwanda, commercial enterprises have begun adopting advanced technologies such as Transportation Management Systems (TMS), RFID, IoT, and GPS. While the advantages of adopting these technologies are widely recognized, little is known about the challenges faced by humanitarian organizations in Rwanda while implementing these tools. There is insufficient understanding of the particular barriers faced by NGOs like ADRA, Rwanda in adopting technology-enhanced LSCM. Without such evidence, efforts to design tailored interventions, inform donor strategies, and strengthen

the sustainability of humanitarian supply chains remain fragmented and ineffective.

### Objectives of the Study

The primary objective of this paper was to identify, examine, and analyze the challenges and barriers faced by ADRA, Rwanda in adopting and implementing technology-driven logistics and supply chain management solutions. Specifically, the study sought to:

1. Assess the extent to which organizational, infrastructural, and financial constraints hinder the integration of technology into ADRA, Rwanda's LSCM systems.
2. Investigate staff perceptions regarding training, internet connectivity, resistance to change, implementation costs, and data security as potential barriers to technological adoption in ADRA, Rwanda.
3. To rank the identified barriers according to their relative significance as perceived by staff and managers from ADRA, Rwanda.

### LITERATURE REVIEW

#### Models of Technology Adoption

This study was depended heavily on Resource-Based View (RBV) theory and Technology-Organization-Environment (TOE) Framework

#### Diffusion of Innovations Theory

Diffusion is understood as the process through which innovations are disseminated over time among members of a social system via particular communication channels .

#### Technology Acceptance Model (TAM)

In 1989, Davis introduced the Technology Acceptance Model (TAM) through his influential study titled "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." This model suggests that an individual's intention to utilize a particular technology is largely influenced by two core constructs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU refers to the extent to which a person believes that using a given technology will improve their performance or efficiency in a specific context. In contrast, PEOU pertains to the degree to which a user believes that interacting with the system will be free of effort, highlighting the system's user-friendliness .

#### Social Construction of Technology (SCOT)

The Social Construction of Technology (SCOT) framework views technological development as a socially driven process, shaped by the perceptions, interpretations, and interactions of relevant social

groups. Rather than accepting the perspective of technological determinism which holds that technological change follows a linear, cause-effect trajectory, SCOT highlights the central role of human agency and the contingent nature of innovation.

### **Sociotechnical Transitions – Multi-Level Perspective (MLP)**

The Multi-Level Perspective (MLP) provides a structured framework for understanding transformations within sociotechnical systems by analyzing how various layers within these systems interact and evolve. It explores how innovative developments in protected environments (niches) can challenge dominant systems (regimes) and contribute to systemic shifts in the broader sociotechnical environment .

### **Social Construction of Technology (SCOT)**

SCOT theory asserts that the development and meaning of technology are shaped by social dynamics rather than determined solely by technical aspects. It highlights how various social groups influence technological development through differing interpretations, interests, and interactions .

### **Actor Network Theory (ANT)**

ANT proposes that both human and non-human entities ranging from individuals to technologies act as participants within networks that shape outcomes through their interactions. It emphasizes that social phenomena are not purely human-centered but are influenced by material actors as well. Within Environmental Studies, ANT provides insights into the complex connections between people and the natural world by considering the agency of non-human elements in environmental systems.

### **Resource-Based View (RBV)**

RBV asserts that an organization's internal resources and capabilities especially those that are valuable, rare, difficult to imitate, and non-substitutable. It forms the basis for sustained competitive advantage .

### **Transaction Cost Economics (TCE)**

TCE analyses the costs of using different governance mechanisms used to manage economic exchanges .

### **Network Analysis**

This approach studies the relational structure among entities whether individuals, firms, or institutions and how these relationships affect information flow, power dynamics, and strategic decisions .

### **Digital Transformation and Sustainability Theory**

Digital transformation (DT) is closely linked with sustainability, functioning as a powerful catalyst for attaining sustainable development goals. DT refers to the strategic application of digital technologies to

reconfigure business operations and organizational structures.

To conclude, digital transformation serves as a crucial instrument for realizing sustainability. When digital technologies are purposefully embedded into the frameworks and processes of businesses and organizations, they have the potential to foster a future that is both environmentally sustainable and socially inclusive.

### **Research Gap identification**

Despite the increasing integration of technology in logistics and supply chain management (LSCM), various research and study gaps remain, particularly in geographical, sectoral, and contextual aspects. Jingfei et al (2024) aimed to solve the core problem of how to effectively integrate big data and IoT into e-commerce logistics supply chain management while Reza, et al., (2025)'s study aimed to develop and deploy AI-driven technologies for optimizing logistics operations both were limited to specific technologies. However, Longo, Nicoletti, Padovano, D'Atri, and Forte, (2019)'s research eventually sought to answer questions related to only blockchain technology. Salam (2017) addressed important questions on the role of collaboration enablers and their effective implementation to support effective collaboration in supply chain management. He tried to find out if technology combined with trust have a significant impact on supply chain collaboration or if trust and technology influence each other.

In the context of Africa, the research of Husein and Ibrahim (2023), assessed the influence of Information and Communication Technology (ICT) on supply chain management efficiency and performance. They also covered ICT factors that contribute to that performance.

Most existing researches on technology adoption in LSCM have focused on developed economies, such as Europe, North America, and parts of Asia. However, there was a limited empirical work that exists for Africa, and even fewer for Rwanda.

The majority of studies assessing technology in logistics and supply chain management have primarily concentrated on commercial businesses, manufacturing industries, and the retail sectors. However, the humanitarian sector and NGOs heavily rely on supply chains for disaster relief, food distribution, and medical supplies was heavily neglected. There is a significant research gap in understanding the Barriers to the Adoption of Technology in LSCM within Africa, specifically in Rwanda, and the humanitarian sector. Addressing these gaps would provide context-specific insights,

helping businesses, policymakers, and humanitarian organizations make better use of technology for efficient, resilient, and sustainable supply chain operations.

## RESEARCH METHODOLOGY

### Research Context

This study was conducted within the Adventist Development and Relief Agency (ADRA), an international NGO with operations in Rwanda, focusing on its logistics and supply chain management practices. Rwanda provides a unique research setting, as the country has made significant investments in digital infrastructure while maintaining a vibrant NGO sector that plays a central role in service delivery, particularly in humanitarian response. ADRA Rwanda was selected because of its extensive logistics operations and its gradual integration of technological tools such as inventory management systems, GPS tracking, and digital reporting platforms. The organizational context shaped the choice of methodology, research design, and data collection procedures.

### Participants

Participants comprised staff and managers directly involved in ADRA Rwanda's logistics and supply chain operations. A purposive sampling approach was employed to ensure inclusion of individuals with relevant experience and exposure to technological tools. Data were collected primarily from the ADRA head office in Kigali and selected district offices with active logistics operations. The target population included all 108 ADRA staff and 10 logistics and supply chain officers, bringing the total to 118 participants. This census-style approach was adopted to capture comprehensive insights from the entire logistics and SCM workforce, rather than relying on sampling alone.

### Instruments of Data Collection

Two primary instruments were employed:

1. Questionnaires Structured questionnaires were the main data collection tool. They included both closed-ended questions (Likert scales, multiple choice, yes/no) to capture quantifiable data, and open-ended questions to elicit nuanced perspectives on the adoption, challenges, and benefits of technology in logistics operations.
2. Semi-structured Interviews Conducted with selected logistics and supply chain managers, interviews complemented the survey by providing deeper insights into managerial perspectives, adoption challenges, and organizational strategies. This ensured triangulation of data and enriched the interpretation of findings.

### Data Collection

Data collection was undertaken between March and April 2025. Questionnaires were distributed directly to participants after consent was obtained. Semi-structured interviews were then conducted with selected managers to validate and expand upon survey findings.

Strict adherence to ethical guidelines was ensured: participation was voluntary, confidentiality was guaranteed, and data were securely stored in password-protected files.

### Data Analysis of Study

A mixed-methods approach was employed:

- Quantitative Analysis: Responses from questionnaires were coded and analyzed using R software and Microsoft Excel. Descriptive statistics (frequencies, percentages, means, standard deviations, cross-tabulations) summarized data, while multiple regression analysis tested relationships between independent variables (technologies) and the dependent variable (SCM performance).

### Reliability Procedures

#### Reliability

Reliability was ensured by:

- Conducting a pilot test with 14 logistics staff from Akagera Motors, which identified and corrected ambiguous items.
- Measuring internal consistency using Cronbach's Alpha. Values ranged from 0.78–0.84 across questionnaire sections, indicating good reliability.

#### Validity

- Content validity was established through expert review. Construct validity was enhanced by aligning survey items with research objectives.
- Triangulation between questionnaires and interviews strengthened overall validity.

### Validity Statistics for Pilot Test

The questionnaire items related to barriers and challenges were adapted from the pilot study conducted in the main thesis. The pilot test for the barriers section yielded a Cronbach's alpha of 0.78, confirming acceptable internal consistency. For this paper, the instrument was tailored to focus on organizational, infrastructural, and financial constraints, staff perceptions on training, internet connectivity, resistance to change, implementation costs, and data security.

### Data Interpretation

Findings from quantitative and qualitative analyses were interpreted in relation to the study's objectives and existing literature. Quantitative patterns were contextualized with qualitative narratives to provide a

holistic view. Divergences between survey and interview data were critically examined to uncover underlying factors influencing adoption. The

interpretation process emphasized both theoretical contribution and practical implications for NGO supply chains in Rwanda.

## RESEARCH FINDINGS AND DISCUSSION

### Presentation of Findings

To assess the extent to which organizational, infrastructural, and financial constraints hinder the integration of technology into ADRA Rwanda's LSCM systems.

**Table 1: Financial and Infrastructural Barriers**

Barrier	Strongly Agree 5	Agree 4	WM	SD
High implementation cost	96 (88.89%)	12 (11.11%)	4.89	0.32
Budget constraints	96 (88.89%)	12 (11.11%)	4.89	0.32
Limited internet	12 (11.11%)	96 (88.89%)	4.11	0.32

SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),

SD >0.5 or high -Respondents responses dispersed on the responses

(WM: weighted mean and SD: Standard Deviation)

Source: Field data

This table highlights the most prominent barriers as perceived by staff. Both high implementation cost and budget constraints were unanimously recognized by staff as significant challenges, with 88.89% of respondents strongly agreeing and 11.11% agreeing in each case. The resulting weighted mean for both variables was 4.89, the highest in the dataset, and the standard deviation was a low 0.32, indicating strong consensus. This reinforces the idea that financial limitations are the most significant hindrances to technological integration within ADRA, Rwanda's logistics and supply chain systems.

Similarly, limited internet connectivity was widely acknowledged as an infrastructural barrier. A combined 100% of respondents either agreed (88.89%) or strongly agreed (11.11%) with this statement, resulting in a high weighted mean of 4.11 and a low SD of 0.32. This unanimity suggests that poor or unreliable internet access is a serious infrastructural constraint, which likely impacts the implementation and use of digital tools for supply chain management.

To Investigate staff perceptions regarding training, internet connectivity, resistance to change, implementation costs, and data security as potential barriers to technological adoption.

**Table 2: Organizational/Behavioral Barriers**

Barrier	Strongly Agree 5	Agree 4	Neutral 3	Disagree 2	Strongly Disagree 1	Mean	SD
Resistance to change	0 (0%)	15 13.89%	93 86.11%			3.14	0.35
Lack of automation	0 (0%)	0 (0%)	0 (0%)	101 (93.52%)	7 (6.48%)	1.94	0.25
Regulatory issues	0 (0%)	0 (0%)	0 (0%)	15 13.89%	93 (86.11%)	1.14	0.35
Lack of regular training	96 (88.89%)	12 (11.11%)	0 (0%)	0 (0%)	0 (0%)	4.89	0.32

SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),

SD >0.5 or high -Respondents responses dispersed on the responses

(WM: weighted mean and SD: Standard Deviation)

Source: Field data

In contrast to the financial and infrastructural barriers, organizational and behavioral factors showed much lower levels of perceived significance. For instance, resistance to change was met with a majority of neutral responses (86.11%), and only 13.89% agreed that it was a barrier. The weighted mean was 3.14, with an SD of 0.35, indicating some uncertainty or variability in responses. This suggests that while a few staff members recognize resistance to change, most are either unsure or do not perceive it as a critical issue. This could reflect a lack of awareness of organizational change dynamics or limited experience with past technological transitions.

Furthermore, lack of suitable automation was overwhelmingly rejected as a barrier, with 93.52% disagreeing and 6.48% strongly disagreeing, resulting in a low mean of 1.94 and a narrow SD of 0.25. This implies that either

automation tools are already in place or that the need for them is not perceived as pressing. Likewise, regulatory restrictions were not seen as problematic, with 86.11% of respondents strongly disagreeing and the rest disagreeing. The mean score for this barrier was 1.14, the lowest across all items, with an SD of 0.35. These results suggest that organizational and policy-related challenges are not considered significant barriers to technological adoption by ADRA Rwanda staff, at least not when compared to financial and infrastructural constraints. This aligns with Objective 1 by indicating that internal organizational structures and external regulatory environments are relatively conducive to technology use.

**Table 3: Perceptions Regarding Data Security as Potential Barriers to Technological Adoption**

Barrier	Disagree 4	Neutral 5	WM	SD
Data security concerns	88 (81.48%)	20 (18.52%)	2.19	0.39

SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),

SD >0.5 or high -Respondents responses dispersed on the responses

(WM: Weighted Mean and SD: Standard Deviation)

Source: Field data

In terms of staff perceptions related to the risks of technological adoption, the only notable item was data security concerns. However, this was largely dismissed as a major issue. A significant 81.48% of respondents disagreed that data security is a barrier, while 18.52% remained neutral. No respondents agreed or strongly agreed. This resulted in a relatively low weighted mean of 2.19 and a standard deviation of 0.39, indicating mild disagreement but slightly more spread in responses than in other categories. These findings suggest that data security is not currently viewed as a critical concern by staff, which may either reflect confidence in the organization's current systems or a lack of awareness about potential cybersecurity threats. Moreover, it is important to connect these findings to the narrative information provided alongside the Table 2 striking 88.89% of respondents acknowledged that warehouse staff do not receive regular training in logistics-related technologies. This is a critical insight under as it shows that training and capacity-building gaps are widely recognized by staff, even if they do not perceive data security or resistance to change as significant problems. The absence of training undermines the organization's ability to effectively use the technology it already has or plans to adopt.

**Table 4: Ranking the Identified Barriers According to Their Relative Significance as Perceived by Staff and Managers from ADRA, Rwanda**

Ranking and Frequency (%)								
	N	1 <sup>st</sup> place	2 <sup>nd</sup> place	3 <sup>rd</sup> place	4 <sup>th</sup> place	5 <sup>th</sup> place	Weighted Mean	Sd.
Lack of skilled workforce	108	0 (0%)	12 (11.11%)	96 (88.89%)	0 (0%)	0 (0%)	3.11	0.32
High investment /implementation costs	108	93 (86.11%)	15 (13.89%)	0 (0%)	0 (0%)	0 (0%)	4.86	0.35
Integration of new Technology	108	0 (0%)	20 (18.52%)	88 (81.48%)	0 (0%)	0 (0%)	3.19	0.39
Data security and privacy	108	0 (0%)	0 (0%)	0 (0%)	84 (77.78%)	24 (22.22%)	1.78	0.42
Resistance to change	108	0 (0%)	70 (64.81%)	38 (35.19%)	0 (0%)	0 (0%)	3.65	0.48

SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),

(SD >0.5 or high -Respondents responses dispersed on the responses)

(WM: Weighted Mean and SD: Standard Deviation)

Source: Field data

### Financial and Resource Barriers (High Implementation Costs & Lack of Skilled Workforce)

The results show that high investment and implementation costs dominate as the most significant barrier, with 86.11% of respondents ranking it first and another 13.89% second, leading to a weighted

mean of 4.86 and a very low SD of 0.35. This consistency reflects almost unanimous agreement that financial constraints remain the greatest challenge to technology adoption in ADRA Rwanda. In contrast, the lack of skilled workforce was largely placed in the third position (88.89%) and occasionally in the second position (11.11%), giving it a weighted mean

of 3.11 and a similarly low SD of 0.32. This shows that while human resource limitations are a recognized barrier, they are perceived as less pressing than the financial burden. Taken together, the data confirms that while both cost and skills matter, the financial aspect overshadows workforce capacity as the leading resource-based obstacle.

### **Organizational and Operational Barriers (Resistance to Change & Integration of New Technology)**

Organizational challenges are evident in the responses to resistance to change and integration of new technology. Resistance to change was ranked second by 64.81% of respondents and third by 35.19%, with a weighted mean of 3.65 and SD of 0.40, showing broad agreement that it is an important barrier, second only to financial constraints. On the other hand, integration of new technology was seen as a moderate challenge, with 81.48% ranking it third and 18.52% ranking it second, leading to a weighted mean of 3.19 and SD of 0.39. Together, these results highlight that while staff recognize the technical difficulties of integrating new systems, the deeper issue lies in organizational culture and employee attitudes toward change, which pose a greater obstacle than technical implementation itself.

### **Security and Compliance Barriers (Data Security and Privacy)**

When it comes to data-related concerns, data security and privacy ranked lowest overall, with 77.78% of respondents placing it in fourth position and 22.22% in fifth. Its weighted mean of 1.78 and SD of 0.42 indicate that while some variation exists in perceptions, there is general consensus that security concerns are not currently seen as a priority barrier compared to financial, organizational, or operational issues. This suggests that for ADRA, Rwanda, the focus remains on overcoming immediate structural and cultural challenges before data security becomes a central consideration in technology adoption.

### **Overall Interpretation**

This ranking provides clear guidance for ADRA Rwanda, suggesting that tackling financial obstacles and managing organizational resistance should be prioritized to facilitate smoother technology adoption.

### **CONCLUSION**

1. Assess the extent to which organizational, infrastructural, and financial constraints hinder the integration of technology into ADRA, Rwanda's LSCM systems.

The analysis shows that financial barriers are the most critical constraints to the integration of technology in ADRA Rwanda's logistics and supply chain systems. Both high implementation costs and limited budgets

were rated with the highest weighted means of 4.89, supported by low standard deviations, which indicates near-universal agreement among respondents. This highlights the overwhelming financial challenge facing ADRA in adopting new technologies. Infrastructural barriers were also evident, particularly the lack of suitable automation, which respondents largely agreed was a limitation, reflected in a weighted mean of 1.94. On the other hand, regulatory restrictions were consistently perceived as the least significant obstacle, suggesting that government policies or compliance requirements are not hindering ADRA's technological adoption. Taken together, these findings confirm that the integration of technology is mainly constrained by financial and infrastructural limitations, with regulatory issues playing almost no role.

2. Investigate staff perceptions regarding training, internet connectivity, resistance to change, implementation costs, and Data security as potential barriers to technological adoption in ADRA, Rwanda.

Staff perceptions provide further insight into barriers hindering technology adoption. Limited internet connectivity stood out as a major infrastructural challenge, with respondents strongly agreeing that it undermines the adoption of digital solutions, reflected in a weighted mean of 4.11. This makes internet reliability a significant practical concern for ADRA. Resistance to change was identified as a moderate organizational barrier, with a weighted mean of 3.14, suggesting that cultural and behavioral reluctance exists but is not as pressing as financial or connectivity challenges. Data security and privacy, however, were consistently downplayed, with a weighted mean of 2.19, showing that staff perceive it as a relatively minor concern at this stage. Training was acknowledged as a gap in the qualitative responses but was not quantified at the same level as other factors, suggesting that while skills development is necessary, it was overshadowed by cost and internet issues in staff perceptions. These findings reveal that staff prioritize practical obstacles like costs and connectivity over more abstract or long-term issues such as security.

3. To rank the identified barriers according to their relative significance as perceived by staff and managers from ADRA, Rwanda.

When ranking the identified barriers, high implementation costs clearly emerged as the most significant challenge, with the majority of respondents placing it first, reflected in a weighted mean of 4.86. This was followed by resistance to change, which ranked second overall with a mean of

3.65, showing that organizational culture remains a considerable issue alongside financial obstacle. The lack of skilled workforce and integration of new technology were both rated as moderately important, with means slightly above 3.00, indicating that while they are recognized as barriers, they are not as urgent as cost and resistance. Finally, data security and privacy consistently ranked lowest, with a mean of 1.78, confirming that it is currently perceived as the least pressing barrier to technology adoption. The weighted means and low standard deviations across the barriers indicate strong consensus among staff, reinforcing the reliability of the rankings.

### Recommendations

1. Prioritize financial and infrastructural investment for technology integration.

ADRA Rwanda should focus on overcoming the most critical barriers identified, namely high implementation costs, budget constraints, limited automation, and weak internet connectivity. This can be achieved through strategic partnerships with donors, phased investment plans, and targeted infrastructural upgrades. By addressing the financial and infrastructural bottlenecks first, the organization will create a more conducive environment for the successful adoption of modern technologies in its logistics and supply chain operations.

2. Strengthen organizational readiness through change management and staff development.

Resistance to change and lack of skilled workforce, although secondary to financial barriers, remain significant challenges. ADRA should adopt structured change management programs that foster a culture of openness to innovation while investing in continuous staff training and capacity-building initiatives. Training programs should emphasize both technical competencies and mindset shifts, ensuring that staff not only acquire new skills but also embrace the value of technological transformation.

### Suggestions for Further Study

1. Explore the effectiveness of training and capacity-building programs. Future studies could examine how targeted training interventions influence staff readiness, performance, and acceptance of new technologies in humanitarian supply chain management.

2. Investigate the role of donor funding models in supporting technological adoption. Since financial constraints were the primary barrier, it would be valuable to analyze how different donor policies, funding cycles, and reporting requirements shape

the ability of NGOs like ADRA, Rwanda to invest in technology.

3. Conduct comparative studies across NGOs and countries. To provide broader insights, future research could compare barriers to technology adoption across different humanitarian organizations or contexts. This would help determine whether ADRA Rwanda's challenges are unique or part of wider patterns in the NGO sector.

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