

Digitalization Innovations on Streamlining Warehouse Operations: A Case of Intersec Security Company Ltd (Isco Ltd)

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Abstract: This study examined the effect of digitalization innovations on streamlining warehouse operations at Intersec Security Company Ltd (ISCO Ltd) in Rwanda. It specifically assessed the effects of digitalization innovations adoption, warehouse operational efficiency, and digital implementation on warehouse operations. The study was guided by an integrated theoretical framework incorporating the Technology Acceptance Model, Resource-Based View, Lean Theory, Diffusion of Innovation Theory, and Dynamic Capabilities Theory. A descriptive and explanatory research design was adopted. The target population comprised 171 employees of ISCO Ltd, from which a sample of 120 respondents was selected using stratified and purposive sampling techniques. Primary data were collected using structured questionnaires and analyzed using SPSS Statistics Version 26. Descriptive statistics, Pearson correlation, and multiple linear regression analyses were used to examine the relationships among the study variables and test the hypotheses. The findings showed that digitalization innovations adoption had a positive and statistically significant relationship with warehouse operations ($r = 0.597$, $p < 0.05$) and a significant positive effect ($\beta = 0.251$, $p < 0.05$). Warehouse operational efficiency was also positively and significantly related to warehouse operations ($r = 0.655$, $p < 0.05$) and had a significant positive effect ($\beta = 0.416$, $p < 0.05$). Digital implementation, measured through employee training, management support, ICT infrastructure, and system integration, demonstrated a positive and statistically significant relationship with warehouse operations ($r = 0.463$, $p < 0.05$) and was the strongest predictor in the regression model ($\beta = 0.417$, $p < 0.05$). Overall, the regression model was statistically significant and explained 42.8% of the variation in warehouse operations ($R^2 = 0.428$). The study concludes that digitalization innovations adoption, warehouse operational efficiency, and effective digital implementation significantly enhance warehouse operations. It recommends sustained investment in digital warehouse technologies and continuous employee training to strengthen system utilization and operational performance.

Keywords: Digitalization, Innovations, Warehouse, Operations, INTERSEC Security Company Ltd.

1. INTRODUCTION

Digitalization has become an important driver of operational efficiency and organizational performance. Advances in technologies such as Warehouse Management Systems (WMS), Radio Frequency Identification (RFID), Internet of Things (IoT), cloud computing, artificial intelligence (AI), and automation have transformed traditional warehouse operations by improving inventory visibility, accuracy, coordination, and real-time decision-making (Buyukozkan & Goçer, 2018; Kache & Seuring, 2017; Wamba et al., 2020; Gunasekaran et al., 2022). Unlike traditional warehouses that relied heavily on manual records and paper-based processes, digitally enabled warehouses can enhance stock control, reduce operational errors, improve responsiveness, and support cost-effective supply chain management (Faber et al., 2018; Fatorachian & Kazemi, 2021).

Globally, organizations have increasingly adopted digital technologies to improve warehouse efficiency and competitiveness. Companies in advanced economies, including Amazon and DHL, have integrated automation, robotics, AI, and digital tracking systems to improve inventory management and order fulfilment (Boysen et al., 2019; DHL, 2023). Developing economies have also adopted technologies such as barcoding, mobile applications, and cloud-based inventory systems, although the level of adoption varies because of differences in infrastructure, investment, and technical capacity (Amoako-Gyampah et al., 2021). Across Africa, countries including Kenya, South Africa, and Nigeria have invested in digital infrastructure and technology-driven logistics systems to strengthen supply-chain performance and operational efficiency (Adeniran & Johnston, 2020; World Bank, 2021).

In Rwanda, digital transformation is supported by national initiatives such as the Smart Rwanda Master Plan and Vision 2050, which emphasize ICT and digital technologies as instruments for economic and organizational development (Ministry of ICT and Innovation, 2020). Digitalization is particularly relevant to security companies because their warehouses manage sensitive and essential assets, including surveillance equipment, communication devices, uniforms, and other security materials. Effective digital warehouse systems can strengthen inventory accuracy, asset accountability, availability, and timely deployment.

Despite these developments, challenges such as inventory discrepancies, delayed stock reconciliation, limited real-time visibility, and inefficient resource utilization may persist, suggesting that the benefits of digitalization are not always fully realized. At Intersec Security Company Ltd (ISCO Ltd), the adoption of digital innovations provides an opportunity to improve warehouse operations, but the extent to which such technologies enhance operational performance requires empirical assessment. Therefore, this study examines the effect of digitalization innovations on warehouse operations at ISCO Ltd in Rwanda.

2. METHODOLOGY

2.1 Research Design

The research employed both descriptive and explanatory designs.

2.2 Target Population

The target population for the study comprised employees of Intersec Security Company Ltd who are directly or indirectly involved in warehouse operations and digital innovation system usage.

2.3 Sample Size

The sample size was calculated based on the formula introduced by Taro Yamane (1967), which incorporates key statistical elements such as confidence level and margin of error. Based on this calculation, the sample was deemed adequate for meeting the study objectives and supporting valid generalizations about the population.

$$n = \frac{N}{1 + Ne^2}$$

Where:

n stands for Sample size, N stands for number of populations, e stands for margin error commonly equivalent to 0.05 for 95% confidence level.

Now, Given:

Target population (N)=171

Margin of error (e)=0.05

$$n = \frac{171}{1 + 171 * 0.05^2} \approx 120$$

Then n=120 respondents

3. FINDINGS

3.1 Background Information of the Respondents

This section presents the background information about the research participants. This includes the gender, age, education, department and experience

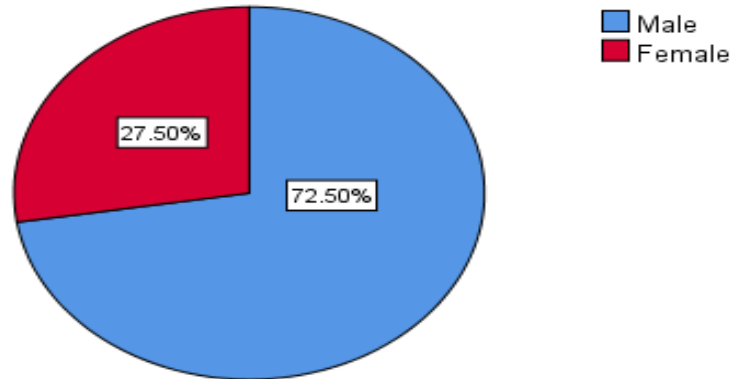


Figure 1: Distribution of respondents by gender

Source: Field Data, (2026)

The results from the findings showed that majority of the respondents were male participants. This is shown in Figure 1 as 75.5% of the research participants were male while the female represented 27.5%. The results showed that majority of the participants were male implying male dominance among the employees in ISCO Ltd.

3.2 Findings on Research Objectives

This section presents the findings in line with the specific objectives. In this study, the specific objectives were three. Hence, the section is divided into four sections, the descriptive statistics for each specific objectives and the inferential statistics section.

3.2.1 Findings on Digitalization Innovations Adoption

The first objective sought to determine the effect of digitalization innovations adoption on warehouse operations at Intersec Security Company Ltd (ISCO Ltd). To achieve this objective, the researcher gave structured questionnaires to the respondents with statements related to digitalization innovations adoption.

Table 1: Digitalization innovations adoption in warehouse operations

Statement	SD		N		A		SA		M	std.
	n	%	n	%	n	%	n	%		
WMS supports inventory management activities	1	0.8%	0	0.0%	5	4.2%	114	95.0%	4.93	.41
Barcode/Rfid tools are used to identify and follow items	1	0.8%	0	0.0%	4	3.3%	115	95.8%	4.93	.40
Automated mechanisms are applied within warehouse tasks	1	0.8%	0	0.0%	5	4.2%	114	95.0%	4.93	.41
Real-time tracking solutions are available	1	0.8%	0	0.0%	8	6.7%	111	92.5%	4.90	.44
Digital systems increase inventory visibility	1	0.8%	1	0.8%	11	9.2%	107	89.2%	4.86	.49
Warehouse processes are coordinated through digital platforms	1	0.8%	0	0.0%	9	7.5%	110	91.7%	4.89	.45

SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree, M=Mean, std=Standard deviation

Source: Field Data, (2026)

The findings presented in Table 1 indicate that respondents strongly agreed that various digitalization innovations had been adopted within the organization's warehouse operations. The findings revealed that 95.0% of the 171 respondents strongly agreed while 4.2% agreed that Warehouse Management Systems (WMS) support inventory management activities. This finding was supported by a high mean score (M=4.93, SD=0.41), indicating a strong level of agreement among respondents

regarding the use of WMS in warehouse operations. Similarly, 95.8% of the respondents strongly agreed whereas 3.3% agreed that barcode and RFID tools are used to identify and track items within the warehouse. The responses were supported by a high mean and low standard deviation ($M=4.93$, $SD=0.40$), suggesting consistency in respondents' views concerning the adoption of barcode and RFID technologies. The study further established that 95.0% of the respondents strongly agreed and 4.2% agreed that automated mechanisms are applied within warehouse tasks. The findings were supported by the mean and standard deviation values ($M=4.93$, $SD=0.41$), indicating widespread adoption of automation technologies within warehouse operations.

In addition, 92.5% of the respondents strongly agreed while 6.7% agreed that real-time tracking solutions are available within the warehouse system. This was supported by the mean score ($M=4.90$, $SD=0.44$), reflecting strong agreement regarding the presence of tracking technologies. The findings also showed that 89.2% of respondents strongly agreed and 9.2% agreed that digital systems increase inventory visibility within the warehouse. The responses were supported by a high mean score ($M=4.86$, $SD=0.49$), suggesting that digital systems have significantly enhanced inventory monitoring and transparency.

Finally, 91.7% of the respondents strongly agreed whereas 7.5% agreed that warehouse processes are coordinated through digital platforms. This finding was supported by the mean and standard deviation values ($M=4.89$, $SD=0.45$), indicating that digital platforms play a major role in coordinating warehouse activities at ISCO Ltd. These findings suggest that ISCO Ltd has highly adopted various digitalization innovations, including Warehouse Management Systems, barcode and RFID technologies, automation systems, real-time tracking solutions, and digital coordination platforms, all of which contribute toward streamlining warehouse operations.

The researcher also conducted interview with five key informants. According to the findings, the key informants explained that Intersec Security Company Ltd currently uses Warehouse Management Systems (WMS), barcode scanners, RFID technologies, computerized inventory systems, automated stock recording systems, and real-time tracking technologies. One of the informants indicated that *"these technologies are mainly used for inventory tracking, stock monitoring, order processing, and warehouse coordination."* Some respondents further noted that digital communication platforms are also used to coordinate warehouse, procurement, and logistics activities.

3.2.2 Findings on Digitalization Innovation Efficiency

The second specific objective sought to examine the effect of digitalization innovation on warehouse operations efficiency at Intersec Security Company Ltd (ISCO Ltd). To achieve this objective, the research participants responded to the question items related to the extent of use of the digital systems.

Table 2: Warehouse operational efficiency (extent)

Statement	SD	N	A	SA		
	n %	n %	n %	n %	M	std.
Inventory records are more accurate than before	1 0.8%	0 0.0%	28 23.3%	91 75.8%	4.73	.55
Order fulfillment is handled more quickly	1 0.8%	0 0.0%	26 21.7%	93 77.5%	4.75	.54
Operational mistakes have decreased	1 0.8%	1 0.8%	25 20.8%	93 77.5%	4.74	.56
Warehouse activities are completed faster	1 0.8%	1 0.8%	23 19.2%	95 79.2%	4.76	.55
Utilization of resources has improved	1 0.8%	0 0.0%	22 18.3%	97 80.8%	4.78	.52
Overall warehouse efficiency has increased	1 0.8%	1 0.8%	17 14.2%	101 84.2%	4.81	.52

SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree, M=Mean, std=Standard deviation

Source: Field Data, (2026)

The findings presented in Table 2 indicate that respondents strongly agreed that digitalization innovations have greatly improved warehouse operations within the organization. The findings revealed that 75.8% of 171 respondents strongly agreed while 23.3% agreed that inventory records are now more accurate than before the adoption of digital systems. This finding was supported by a high mean score and low standard deviation ($M=4.73$, $SD=0.55$), indicating a strong consensus among respondents that digital innovations have enhanced inventory accuracy. Similarly, 77.5% of the respondents strongly agreed and 21.7% agreed that order fulfillment is handled more quickly through the use of digital systems. The mean score ($M=4.75$, $SD=0.54$) suggests that respondents perceived digitalization as having significantly improved operational speed in warehouse

processes. The study further established that 77.5% of respondents strongly agreed while 20.8% agreed that operational mistakes have decreased following the implementation of digital technologies. The responses were supported by the mean and standard deviation values ($M=4.74$, $SD=0.56$), indicating that digital systems contribute to minimizing errors in warehouse operations.

Table 2 further shows that 79.2% of the respondents strongly agreed and 19.2% agreed that warehouse activities are completed faster due to digitalization innovations. The finding was supported by a high mean score ($M=4.76$, $SD=0.55$), reflecting a strong perception that digital systems have enhanced operational efficiency and task completion speed. The results also showed that 80.8% of respondents strongly agreed while 18.3% agreed that utilization of resources has improved with the adoption of digital technologies. This was supported by the mean score ($M=4.78$, $SD=0.52$), suggesting that digital systems have enhanced the efficient use of warehouse resources. Finally, 84.2% of the respondents strongly agreed and 14.2% agreed that overall warehouse efficiency has increased following the adoption of digital innovations. The finding recorded the highest mean score ($M=4.81$, $SD=0.52$), indicating very strong agreement among respondents regarding the positive impact of digitalization on warehouse efficiency.

The findings suggest that digitalization innovations have significantly streamlined warehouse operations at ISCO Ltd by improving inventory accuracy, speeding up order fulfillment, reducing operational errors, enhancing resource utilization, and increasing overall warehouse efficiency.

The findings from interview with the key informants indicated the improved inventory management thanks to adoption and use of digital systems. One of the informants *“stated that there has been improved inventory accuracy, faster order processing, quicker retrieval of stock information, and reduction in operational mistakes.”* The informants also mentioned that warehouse activities are completed within shorter periods compared to before digitalization. Some respondents further observed that customer service delivery has improved due to timely handling of orders and better stock management. The respondents explained *“that digital systems have significantly improved inventory accuracy by minimizing manual recording errors and improving stock monitoring”*. They noted that barcode scanners and RFID systems help in accurate identification and tracking of items, which reduces stock losses and discrepancies. Some respondents added that real-time inventory updates have improved accountability and stock control within the warehouse.

3.2.3 Findings on Digitalization Innovation Implementation

The third specific objective sought to assess the effect of digitalization innovation implementation on warehouse operations at Intersec Security Company Ltd (ISCO Ltd). The findings of this objective are reported in the table below.

Table 3: Implementation challenges on streamlining warehouse operations

	SD	D	N	A	SA		
Statements	n%	n%	n %	n %	n %	M	std.
Limited training reduces effective system use	10.9%	10.9%	1 0.9%	3328.2%	8169.2%	4.64	0.64
Employees show resistance to new changes	43.4%	76.0%	2521.4%	6555.6%	1613.7%	3.70	0.90
ICT infrastructure is not sufficient	21.7%	32.6%	1714.5%	4841.0%	4740.2%	4.15	0.89
Some systems are difficult to operate	43.4%	32.6%	1916.2%	6152.1%	3025.6%	3.94	0.91
Employees receive enough training for the systems	21.8%	21.8%	1614.3%	5044.6%	4237.5%	4.14	0.86

SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree, M=Mean, std=Standard deviation

Source: Field Data, (2026)

The findings presented in Table 3 indicate that respondents generally agreed that digitalization innovations implementation have a significant impact on warehouse operations, although some implementation challenges still exist. The findings revealed that 69.2% of 171 respondents strongly agreed while 28.2% agreed that limited training reduces effective system use within the organization. This finding was supported by a high mean score and low standard deviation ($M=4.64$, $SD=0.64$), indicating strong agreement among respondents that inadequate training negatively affects the effective utilization of digital systems. Similarly, 55.6% of the respondents agreed and 13.7% strongly agreed that employees show resistance to new technological changes. The finding was supported by the mean and standard deviation values ($M=3.70$, $SD=0.90$), suggesting that resistance to change remains a challenge during the implementation of digital innovations.

Table 3 further established that 41.0% of respondents agreed while 40.2% strongly agreed that ICT infrastructure is not sufficient to fully support digital warehouse operations. This was supported by a relatively high mean score ($M=4.15$, $SD=0.89$), implying that limitations in technological infrastructure may hinder the full effectiveness of digitalization innovations. In addition, 52.1% of the respondents agreed and 25.6% strongly agreed that some digital systems are difficult to operate. The finding was supported by the mean score ($M=3.94$, $SD=0.91$), indicating that system complexity may affect employees' ability to effectively utilize digital technologies in warehouse operations. The findings also showed that 44.6% of respondents agreed while 37.5% strongly agreed that employees receive enough training for the systems implemented within the organization. This finding was supported by the mean and standard deviation values ($M=4.14$, $SD=0.86$), suggesting that although training is provided, there is still a need for further improvement to enhance effective system utilization.

Table 4: Digitalization improvement strategies (IV)

	SD	D	N	A	SA		
Statement	n %	n %	n %	n %	n %	M	std.
Leadership actively supports digital transformation	65.4%	10.9%	34.3%	33.2%	33.9%	3.86	1.07
Systems work together smoothly (integration)	00.0%	21.8%	2219.6%	7768.8%	119.8%	3.87	.59
There is ongoing improvement of digital solutions	00.0%	10.9%	65.4%	7365.2%	3228.6%	4.21	.58
Collected data is applied in management decisions	00.0%	10.9%	65.4%	759.8%	3833.9%	4.27	.60

SD=Strongly Disagree, D=Disagree, N=Neutral, A=Agree, SA=Strongly Agree, M=Mean, std=Standard deviation

Source: Field Data, (2026)

Table 4 presents the findings on warehouse operations at Intersec Security Company Ltd as the dependent variable of the study. The findings indicate that respondents generally agreed that digitalization innovations have positively influenced warehouse operations within the organization. The findings revealed that 33.9% of the respondents strongly agreed while 29.5% agreed that leadership actively supports digital transformation within the organization. In addition, 30.4% remained neutral, whereas 5.4% strongly disagreed and 0.9% disagreed. The finding was supported by the mean and standard deviation values ($M=3.86$, $SD=1.07$), indicating that respondents generally perceived leadership support as important in facilitating digital transformation initiatives.

Similarly, 68.8% of the respondents agreed and 9.8% strongly agreed that digital systems work together smoothly through system integration. Only 19.6% remained neutral while 1.8% disagreed. The responses were supported by the mean score ($M=3.87$, $SD=0.59$), suggesting that system integration has enhanced coordination and efficiency within warehouse operations. The study further established that 65.2% of respondents agreed while 28.6% strongly agreed that there is ongoing improvement of digital solutions within the organization. Only 5.4% remained neutral and 0.9% disagreed. This finding was supported by a relatively high mean score ($M=4.21$, $SD=0.58$), indicating that respondents acknowledged continuous enhancement of digital systems used in warehouse management. Additionally, 59.8% of the respondents agreed whereas 33.9% strongly agreed that collected data is applied in management decision-making processes. Only 5.4% remained neutral and 0.9% disagreed. The finding was supported by the highest mean score among the statements ($M=4.27$, $SD=0.60$), suggesting that digital data generated from warehouse systems significantly supports managerial decisions and operational planning.

The findings from the interview conducted with the key informants also confirmed these results. The respondents identified several challenges including inadequate employee training, resistance to change among some staff members, insufficient ICT infrastructure, high implementation costs, and occasional system failures. One of the informants said “...here at ISCO, staff are expected to adapt to new technologies but with very few training sessions...” Some informants indicated that certain employees initially found digital systems difficult to operate, especially during the early stages of implementation. Key informants explained that staff mainly adapt to new systems through training sessions, continuous practice, and technical support from the ICT department. One of the informants noted that “...although some employees initially resist technological changes, most eventually become comfortable with the systems after gaining experience and understanding their benefits...”

3.2.4 Inferential Statistics

The researcher further used inferential statistics to measure the relationships and effect of using digital systems on streamlining the warehouse operations at ISCO Ltd. This was done using Pearson correlation analysis and multiple regression analysis.

Table 5: Pearson correlation analysis matrix

		Warehouse Operations	Digital Adoption	Operational Efficiency	Digital Implementation
Warehouse Operations	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	120			
Digital Adoption	Pearson Correlation	.597**	1		
	Sig. (2-tailed)	.000			
	N	120	120		
Operational Efficiency	Pearson Correlation	.655**	.173**	1	
	Sig. (2-tailed)	.000	.000		
	N	120	120	120	
Digital Implementation	Pearson Correlation	.463**	.118	.136	1
	Sig. (2-tailed)	.000	.201	.139	
	N	120	120	120	120

** . Correlation is significant at the 0.01 level (2-tailed).

Source: Field Data, (2026)

Pearson correlation analysis was conducted to examine the relationship between digitalization innovation variables and warehouse operations at Intersec Security Company Ltd. The analysis focused on the relationships between the dependent variable (warehouse operations) and the independent variables, namely digital adoption, operational efficiency, and digital implementation. The findings reported in Table 5 revealed that digital adoption had a positive and statistically significant relationship with warehouse operations ($r=0.597$, $p<0.05$). This implies that increased adoption of digital technologies is associated with improved warehouse operations within ISCO Ltd. The positive correlation suggests that the use of digital systems, such as Warehouse Management Systems, barcode technologies, and automation tools, contributes toward streamlining warehouse activities.

Similarly, operational efficiency was found to have a strong positive and statistically significant relationship with warehouse operations ($r=0.655$, $p<0.05$). This indicates that improvements in operational efficiency through digital innovations are associated with enhanced warehouse performance. The finding further suggests that digital systems contribute to faster task completion, reduced operational errors, and better utilization of warehouse resources. The analysis as shown in Table 5 further established that digital implementation had a positive and statistically significant relationship with warehouse operations ($r=0.463$, $p<0.05$).

This implies that effective implementation of digital systems positively influences warehouse operations at ISCO Ltd. The finding suggests that successful deployment and use of digital innovations enhance coordination, operational control, and decision-making within warehouse processes. These Pearson correlation findings indicate that all the independent variables had positive and statistically significant relationships with warehouse operations, since all the p-values were less than 5% level of significance.

Table 6: Regression output summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.768 ^a	.590	.580	.30400

a. Predictors: (Constant), Digital Adoption, Digital Implementation, Operational Efficiency

Source: Field Data, (2026)

Table 6 presents the model summary results of the multiple regression analysis conducted to determine the effect of digitalization innovations on warehouse operations at Intersec Security Company Ltd. The findings indicate that there is a

strong relationship between the independent variables and warehouse operations, as shown by the correlation coefficient value ($R=0.768$). This implies that digital adoption, operational efficiency, and digital implementation collectively have a strong association with warehouse operations within the organization. The coefficient of determination revealed that the independent variables explained 59.0% of the variation in warehouse operations ($R^2=0.590$). This suggests that digital adoption, operational efficiency, and digital implementation significantly contribute toward streamlining warehouse operations at ISCO Ltd, while the remaining 41.0% of the variation may be explained by other factors not included in the study.

Table 7: The Analysis of Variance (ANOVA) results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.434	3	5.145	55.668	.000 ^b
	Residual	10.720	116	.092		
	Total	26.154	119			

a. Dependent Variable: Warehouse Operations

b. Predictors: (Constant), Digital Adoption, Digital Implementation, Operational Efficiency

Source: Field Data, (2026)

Table 7 presents the Analysis of Variance (ANOVA) results used to determine whether the regression model significantly predicts warehouse operations at Intersec Security Company Ltd. The ANOVA findings indicate that the overall regression model was statistically significant since the p-value was less than 5%. The findings revealed that the regression model ($F=55.668$, $p<0.05$) was significant and suitable for predicting warehouse operations. Hence, the regression model was statistically significant. This implies that the independent variables, namely digital adoption, operational efficiency, and digital implementation, collectively have a significant effect on warehouse operations at ISCO Ltd.

Table 8: Analysis of the regression coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	
		B	Std. Error	Beta	t
1	(Constant)	-.500	.411		-1.218
	Digital Adoption	.251	.110	.215	2.292
	Operational Efficiency	.416	.089	.437	4.654
	Digital Implementation	.417	.066	.379	6.310

a. Dependent Variable: Warehouse Operations

Source: Field Data, (2026)

Table 8 presents the regression coefficient results showing the effect of digitalization innovation variables on warehouse operations at Intersec Security Company Ltd. The findings revealed that digital adoption had a positive and statistically significant effect on warehouse operations ($\beta=0.251$, $t=2.292$, $p<0.05$). This implies that increased adoption of digital technologies contributes positively toward improving warehouse operations at ISCO Ltd. The finding suggests that the use of digital tools and systems enhances the effectiveness and coordination of warehouse activities. The study further established that operational efficiency had a positive and statistically significant effect on warehouse operations ($\beta=0.416$, $t=4.654$, $p<0.05$).

This indicates that improvements in operational efficiency significantly enhance warehouse performance. The positive coefficient implies that efficient warehouse processes, reduced operational errors, and faster task execution contribute toward streamlined warehouse operations. Similarly, digital implementation had a positive and statistically significant effect on warehouse operations ($\beta=0.417$, $t=6.310$, $p<0.05$). This finding indicates that effective implementation of digital systems strongly improves warehouse operations at ISCO Ltd. Among all the independent variables, digital implementation had the strongest influence on warehouse operations as indicated by the highest standardized beta coefficient. The findings indicate that digital adoption, operational efficiency, and digital implementation all had positive and statistically significant effects on warehouse operations.

4. DISCUSSION OF FINDINGS

This section discusses the study findings in relation to the specific objectives and relevant empirical literature.

4.1 Digitalization Innovations Adoption

The study established that Intersec Security Company Ltd (ISCO Ltd) has adopted various digitalization innovations to support warehouse operations. Respondents reported the use of Warehouse Management Systems (WMS), barcode and RFID technologies, automation systems, digital platforms, and real-time tracking solutions. These technologies enhance inventory visibility, traceability, coordination, and operational control.

The findings are consistent with Gunasekaran et al. (2022), who reported that advanced warehouse management systems improve inventory accuracy and order fulfilment. Similarly, Yakkaluri (2024) found that RFID technologies enhance inventory traceability and reduce operational errors. The findings also support Kamble et al. (2023), who noted that IoT-enabled and real-time tracking technologies improve operational visibility and decision-making. In addition, the use of automation and barcoding at ISCO Ltd is consistent with evidence that automation can improve processing speed and reduce human error, while barcoding provides an important foundation for inventory control and coordination (Amoako-Gyampah et al., 2021).

4.2 Digitalization Innovation Efficiency

The study found that digitalization innovations contribute to improved warehouse operational efficiency through greater inventory accuracy, faster order fulfilment, reduced operational errors, improved resource utilization, and enhanced productivity. The significant positive relationships identified between digitalization, operational efficiency, digital implementation, and warehouse operations further demonstrate the contribution of digital technologies to warehouse performance.

These findings are consistent with Christopher (2021), who emphasized the role of digital technologies in improving coordination and efficiency across supply-chain activities. Similarly, Ivanov et al. (2019) observed that digital systems and analytics strengthen operational planning, forecasting, and resource allocation. The findings also concur with Tikwayo and Mathaba (2023), who reported that digital warehouse technologies improve operational responsiveness, speed, and effectiveness. Overall, the evidence suggests that effective use of digital technologies can enhance warehouse operational performance at ISCO Ltd.

4.3 Digitalization Innovation Implementation

The study established that effective implementation is critical to realizing the benefits of digitalization innovations. Respondents identified limited employee training, resistance to technological change, inadequate ICT infrastructure, and system complexity as challenges affecting effective utilization of digital systems. These findings are consistent with Amoako-Gyampah et al. (2021), who emphasized the importance of employee training in successful technology adoption. They also support Venkatesh and Bala (2008), whose Technology Acceptance Model highlights the influence of perceived ease of use on technology acceptance. Kache and Seuring (2022) similarly identified system integration and technical complexity as challenges that can disrupt information flow and operational efficiency.

Despite these challenges, regression analysis showed that digitalization innovations adoption, warehouse operational efficiency, and digital implementation had statistically significant positive effects on warehouse operations. Notably, digital implementation was the strongest predictor in the model. This finding underscores the importance of employee competence, management support, adequate ICT infrastructure, and effective system integration in achieving successful digital transformation. It is consistent with Warner and Wäger (2019) and Mikalef et al. (2020), who emphasized organizational capabilities, leadership support, and employee competence as important conditions for realizing the operational benefits of digital transformation.

5. CONCLUSION

The study concludes that digitalization innovations significantly contribute to streamlining warehouse operations at Intersec Security Company Ltd (ISCO Ltd). The findings indicate that the company has adopted technologies such as Warehouse Management Systems, barcode and RFID technologies, automated systems, digital platforms, and real-time tracking solutions, which have improved inventory visibility, coordination, and operational control.

The study further concludes that digitalization positively influences warehouse operational efficiency by improving inventory accuracy, reducing operational errors, enhancing resource utilization, accelerating order fulfilment, and increasing overall productivity. The statistically significant relationships between digitalization innovations adoption, warehouse operational efficiency, digital implementation, and warehouse operations demonstrate the importance of digital technologies in improving warehouse performance at ISCO Ltd.

Finally, the study concludes that effective implementation is critical to realizing the benefits of digital transformation. Factors such as employee training, management support, adequate ICT infrastructure, and system integration influence the effectiveness of digital warehouse systems. Therefore, despite challenges associated with technological change and system complexity, effective adoption and implementation of digital innovations can substantially enhance warehouse operational performance.

REFERENCES

- [1] Abdullahi, M., & Abdullah, Z. (2019). Digital transformation and supply chain performance: A review of literature. *Journal of Business and Management*, 21(3), 45–56.
- [2] Abubakar, A. M., Bala, K., & Tijjani, B. (2019). Digital transformation in logistics: A conceptual review. *Journal of Supply Chain Management*, 8(2), 45–61.
- [3] Adeniran, T., & Johnston, K. (2020a). Digital transformation in African logistics. *African Journal of Information Systems*, 12(3), 45–60.
- [4] Adeniran, T., & Johnston, K. (2020b). The impact of digital technologies on supply chain efficiency in Sub-Saharan Africa. *African Journal of Information Systems*, 12(3), 78–95.
- [5] Alkahtani, A., Nordin, N., & Khan, M. (2020). Digital technologies and operational performance in logistics: Evidence from developing economies. *International Journal of Supply Chain Management*, 9(5), 612–620.
- [6] Amit, R., & Schoemaker, P. (2023). Strategic assets and organizational rent. *Strategic Management Journal*, 14(1), 33–46.
- [7] Attaran, M. (2020). Digital technology enablers and their implications for supply chain management. *Supply Chain Forum: An International Journal*, 21(3), 158–172. <https://doi.org/10.1080/16258312.2020.1751568>
- [8] Barney, J. B., Ketchen, D. J., & Wright, M. (2021). The resource-based view of the firm: Ten years after 1991. *Journal of Management*, 27(6), 625–641.
- [9] Bauer, W., Hämmerle, M., Schlund, S., & Vocke, C. (2018). Transforming manufacturing through Industry 4.0: Digital transformation in practice. *Procedia Manufacturing*, 17, 221–226.
- [10] Ben-Daya, M., Hassini, E., & Bahroun, Z. (2019). Internet of Things and supply chain management: A literature review. *International Journal of Production Research*, 57(15–16), 4719–4742. <https://doi.org/10.1080/00207543.2017.1402140>
- [11] Bhamu, J., & Sangwan, K. S. (2014). Lean manufacturing: Literature review and research issues. *International Journal of Operations & Production Management*, 34(7), 876–940.
- [12] Bottani, E., & Rizzi, A. (2019). Economical assessment of RFID technology in supply chains. *International Journal of Production Economics*, 112(2), 548–569.
- [13] Boysen, N., de Koster, R., & Weidinger, F. (2019). Warehousing 4.0: A literature review and research agenda. *European Journal of Operational Research*, 277(2), 396–411.
- [14] Braun, V., & Clarke, V. (2023). *Successful qualitative research: A practical guide for beginners*. Sage Publications.
- [15] Christopher, M. (2021). *Logistics and supply chain management* (6th ed.). Pearson.
- [16] Creswell, J. W. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage Publications.
- [17] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
- [18] De Koster, R., Le-Duc, T., & Roodbergen, K. J. (2007). Warehouse order picking: A review. *European Journal of Operational Research*, 182(2), 481–501.

- [19] DeHoratius, N., & Raman, A. (2008). Inventory record inaccuracy. *Management Science*, 54(4), 627–641. <https://doi.org/10.1287/mnsc.1070.0789>
- [20] DHL. (2023). *Digital warehousing: The future of logistics operations*. DHL Supply Chain.
- [21] Faber, N., de Koster, R. B. M., & Smidts, A. (2013). Organizing warehouse management. *International Journal of Operations & Production Management*, 33(9), 1230–1256.
- [22] Gajdzik, B., & Wolniak, R. (2021). Digitalization and future supply chains. *Sustainability*, 13(9), 4984–4997.
- [23] Gunasekaran, A., Subramanian, N., & Papadopoulos, T. (2023). IT for competitive advantage in logistics. *Transportation Research Part E*, 99, 14–33.
- [24] Heizer, J., Render, B., & Munson, C. (2020). *Operations management* (13th ed.). Pearson.
- [25] Ivanov, D., Tsipoulanidis, A., & Schönberger, J. (2019). *Global supply chain and operations management*. Springer.
- [26] Kache, F., & Seuring, S. (2020). Big data in supply chains. *International Journal of Operations & Production Management*, 37(1), 10–36.
- [27] Kamble, S. S., Gunasekaran, A., & Gawankar, S. A. (2022). Sustainable performance in supply chains. *International Journal of Production Economics*, 246, 108417.
- [28] Kothari, C. R. (2020). *Research methodology* (3rd ed.). New Age International.
- [29] Ministry of ICT and Innovation. (2020). *Smart Rwanda Master Plan 2020–2030*. Government of Rwanda.
- [30] Mukamana, J., & Nduwimana, C. (2021). Digital transformation in Rwanda logistics. *East African Journal of Management Studies*, 5(2), 44–59.
- [31] Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2019). Digitalization in practice. *International Journal of Information Systems*, 5(1), 63–77.
- [32] Pavlou, P. A., & El Sawy, O. A. (2021). Dynamic capabilities. *Decision Sciences*, 42(1), 239–273.
- [33] Queiroz, M. M., Wamba, S. F., de Bourmont, M., & Telles, R. (2021). Digital supply chains review. *International Journal of Production Economics*, 235, 108080.
- [34] Resnik, D. B. (2018). *Research ethics*. National Institute of Environmental Health Sciences.
- [35] Richards, G. (2018). *Warehouse management* (3rd ed.). Kogan Page.
- [36] Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
- [37] Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research methods for business students* (8th ed.). Pearson.
- [38] Schwab, K. (2016). *The fourth industrial revolution*. World Economic Forum.
- [39] Shah, R., & Ward, P. T. (2007). Lean production measures. *Journal of Operations Management*, 25(4), 785–805.
- [40] Staudt, F. H., et al. (2015). Warehouse performance measurement. *International Journal of Production Research*, 53(18), 5524–5544.
- [41] Teece, D. (2023). Dynamic capabilities. *Strategic Management Journal*, 44(2), 301–321.
- [42] Tikwayo, L., & Mathaba, T. (2023). Industry 4.0 in warehouses. *Logistics*, 7(2), 24.
- [43] Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, 39(2), 273–315.
- [44] Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model. *Management Science*, 46(2), 186–204.
- [45] Waller, M. A., & Fawcett, S. E. (2013). Big data analytics in supply chains. *Journal of Business Logistics*, 34(2), 77–84.
- [46] World Bank. (2022). *Digital transformation for inclusive growth in Africa*. World Bank.
- [47] Yamane, T. (1967). *Statistics: An introductory analysis* (2nd ed.). Harper & Row.
- [48] Zhong, R. Y., Xu, X., Klotz, E., & Newman, S. T. (2022). Intelligent manufacturing in the context of Industry 4.0. *Engineering*, 8(1), 12–23.