ISBN: 978-628-96613-0-9. ISSN: 2414-6390. Digital Object Identifier: https://dx.doi.org/10.18687/LEIRD2024.1.1.491

Exploring the Relationship between Artificial Intelligence and Sales Management in Small Hardware Companies of Perú

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Abstract – The main objective of the study was to analyze the relationship between the use of Artificial Intelligence (AI) tools and Sales Management in six small businesses selling hardware items in Chiclayo, Peru, during the year 2023. The research was designed as quantitative. correlational, with a cross-sectional analysis. Using a sectional and non-experimental approach, 48 workers at these companies were surveyed to achieve the desired results, all of whom used some type of artificial intelligence algorithm to support sales prediction. The surveys applied used a Likert scale from 1 to 5 to evaluate the impact of AI tools on three key dimensions of Business Management: Innovation, Effectiveness and Competitiveness. The results showed a significant relationship and a moderate positive correlation between the use of AI tools and sales management, indicating that the implementation of these technologies has a notable impact on sales performance, although sales management in The hardware companies surveyed are at a mostly average level. . The adoption of AI technologies represents a promising opportunity to achieve optimal levels of management. Companies that invest in these technologies can expect significant improvements in innovation, efficiency and competitiveness, better positioning them to meet the challenges of the modern market.

Keywords – Artificial Intelligence, Sales Management, innovation, Efficiency, Business Competitiveness

I. INTRODUCTION

For some years now, artificial intelligence (AI) has revolutionized various fields, especially in monitoring and control. Different AI algorithms are helping companies achieve proper control, especially in sales management, as illustrated in this case study. However, in the Peruvian regional context, the question arises: is there a direct relationship between sales management and artificial intelligence?

There are international studies that explore how the use of AI is related to the sales process. For example, [1] examined the application of customer preference analysis using deep neural networks in Industry 4.0, focusing on the restaurant sector. Using an LSTM (Long Short-Term Memory) model calibrated with historical data from an online reservation system for three years, it was possible to predict sales of dishes, the findings showed that the LSTM model outperformed traditional methods such as XGBoost and ARMA in terms monitoring and control, allowing for more effective purchasing planning and labor optimization, resulting in greater customer satisfaction and better waste management, which provided a competitive advantage.

Furthermore, [2] addressed how AI-powered tools support management in different phases of the customer journey, analyzing 72 peer-reviewed articles, conference proceedings, and book chapters published between 1973 and 2020, this study identified four key activities in B2B customer journey management: analyze, design, engage and guide. Approximately 38% of these tools were found to use AI to improve the efficiency of B2B sales and marketing activities, suggesting that although the correlation with sales management is not strong, AI can transform traditional sales practices by optimizing processes and improving interaction with customers.

On the other hand, [3] evaluated AI models and applications of wireless networks in sales management in the new retail format, combining the fuzzy multi-criteria decision-making method with the particle swarm optimization algorithm, they analyzed the process of sales and monitored inventory availability in Chinese manufacturing companies through questionnaires, the results showed that the proposed model outperformed the existing fuzzy clustering method, with an accuracy rate of 99.78%, demonstrating a strong correlation between innovation in product management sales and competitiveness in the market thanks to the use of AI technologies.

Likewise, to understand the role of AI in sales management, the study conducted by [4] examined the application of AI techniques in quality management in pharmaceutical production, analyzing production and sales data of heparin sodium API from a Chinese pharmaceutical company, revealed that, following a risk incident in 2015, sales recovered significantly after implementing corrective measures assisted by AI, this evidenced that the improvement in quality management translated into a substantial increase in sales and income.

These results open a wide spectrum of studies in which artificial intelligence (AI) becomes a key piece for sales management. For example, [5] investigated the development of a decision support system for the economic management of large companies, focusing on the application of AI to improve operational efficiency, this study involved the design of hardware and software, using a model of backpropagation (BP)

neural network trained with AI to predict sales and adjust the learning rate to minimize error, the results indicated that the system had good fault tolerance, reliability, robustness and efficiency, with short response times and high decision accuracy, this demonstrated a direct relationship with sales management, as the system was specifically designed to predict sales and use these results to maximize business profits.

These types of findings support studies such as the one conducted by [6], who investigated the effectiveness of predictive sales models for smart vehicles, based on online public opinion data and the online search index, with a focus on the influence of Key Opinion Leaders (KOLs), used the LSTM (Long Short-Term Memory) deep learning algorithm to optimize the models, applying it to the analysis of historical sales data, Weibo online public opinion and Baidu search index of consumers and KOLs active on social media platforms in China, findings revealed that incorporating online public opinion data and search index substantially improved the accuracy of sales predictions compared to data-only models. of historical sales, this verified the correlation of AI with sales management by demonstrating that optimized predictive models could help companies establish a reasonable production scale, thereby improving economic efficiency and reducing losses in production planning. production.

Furthermore, authors such as [7] investigated the effects of the anthropomorphization of artificial intelligence assistants (AIAs) in the home, such as Alexa, on the relationships between consumers and these devices. The study consisted of an online survey of AIA users. in the United Kingdom, with an initial sample of 389 participants, of which 238 completed both phases of the study. The results revealed that anthropomorphizing AIAs could both improve consumer satisfaction and psychological well-being and raise concerns about data privacy and threaten human identity, they found a correlation with sales management, suggesting that managers could empower consumers by providing them with appropriate information and encouraging them to act on their personal information, this could influence customer satisfaction and loyalty, key aspects in sales management.

Studies highlight the growing importance of artificial intelligence (AI) in sales management, revealing how this technology can transform various areas of the sector. For example, the research of [8] explored financial risk management in the context of AI and machine learning (ML). The study reviewed models used in financial institutions, from rules-based approaches to more complex AI/ML models applied in areas such as credit risk management, fraud detection and regulatory compliance in banks and financial institutions in Germany. The findings underlined the need for effective risk governance for these models, highlighting the importance of testing and validation frameworks to ensure the transparency and explainability of the models, recent European AI legislation such as the Artificial Intelligence Act (AIA) , also reinforces the connection between AI and sales management, indicating a strong relationship between the implementation of AI and improvement in sales and financial risk management.

Another study, conducted by [9], investigated the prediction of food sales in markets using an artificial intelligence-based method known as TOR, this study combined AI, business intelligence and neural networks to evaluate data from individual customers, although it is not specified the country in which the study was carried out, the results showed that the TOR AI model achieved a low mean squared error and low variance, indicating high precision in sales predictions, this performance superior to other models of Machine learning enabled more effective inventory management and personalized promotions, demonstrating how AI can optimize sales management and increase operational efficiency.

Additionally, the study by [10] analyzed the performance of the industrial supply chain through the use of AI, conducting a systematic review of previous literature to identify the contributions of AI to supply chain management, four were discussed. Main aspects: the most used AI approaches, the techniques with potential for its application, the subfields of supply chain management that have benefited from AI and those with high potential for improvement, the findings indicated that supply chain management inventories, customer satisfaction, profitability and customer base identification are key elements for competitive sales management in the supply chain, with accuracy, specificity and sensitivity rates of 94.12%, 92.15% and 89.14%, respectively, the results suggest that AI is an effective tool for industrial managers seeking to optimize the performance of supply chain systems and improve efficiency in sales management.

Along the same lines, the study conducted by [11] investigated the application of artificial intelligence technology in the asset management of startups in China, focusing on deep learning, they used a backpropagation neural network (BPNN), the authors developed an evaluation system based on 19 indicators to measure the asset quality of startups, the findings suggested that startups should invest cautiously, improve inventory efficiency, increase investment in research and development (R&D), optimize the quality of points of sale and increase the proportion of high-quality intangible assets, these results demonstrated a significant correlation between AI in asset management and sales management, since efficient asset management can directly influence on startups' ability to generate revenue and maintain healthy cash flow.

Furthermore, the study of [12] examined how volume discount contracts can coordinate the supply chain in situations of unexpected events, leading to information asymmetry on sales costs and risk aversion on the part of suppliers. , a Conditional Value at Risk (CVaR) model was built to measure supplier risk aversion under conditions of symmetric and asymmetric information, simulations revealed that retailers can obtain excessive profits by hiding private information, which harms suppliers and to the supply chain as a whole, the results indicated that suppliers with different attitudes towards risk must implement differentiated strategies to face the asymmetry

of sales cost information, the stability of the system was negatively affected by the increase in asymmetry of information, highlighting the importance of transparency in sales costs and effective coordination between suppliers and retailers for efficient sales management in uncertain environments.

These findings have prompted additional research into the use of AI tools to manage the sales process in small businesses. In this context, the study of [13] addressed the prediction of sales by product category in an e-commerce store, this study involved the design, development and implementation of a Directed Acyclic Graph Neural Network (DAGNN) for deep learning, which integrates convolutional neural networks (CNNs) and BiLSTM layers, the network, trained with 3,743 samples of sales data in Romania's national currency, proved to be able to learn temporal dependencies and improve the accuracy of sales predictions by category, the DAGNN approach provided accurate predictions up to three months into the future, allowing for more effective planning of marketing and promotions activities, as well as better inventory management to avoid stockouts or surpluses.

Similarly, the study in [14] investigated the application of deep learning and Bayesian optimization techniques with the tree Parzen estimator to classify price data sets in the health drug supply chain, using a set of shipping price data from Kaggle, which included information on transportation modes such as air, land and sea, the study achieved an accuracy of between 61.28% and 63.33%, this hybrid approach proved to be effective in classifying price data of the supply chain, which could contribute to more efficient supply chain management in the healthcare industry, although accuracy in price classification is crucial for sales decision making and inventory management , improved predictive models could have a positive impact on sales management by providing valuable information on costs and shipping times, thus influencing pricing and negotiation strategies with suppliers and customers. Despite the various applications of artificial intelligence (AI) internationally, these tools are not yet deployed to their full potential in Peru. To a large extent, their use is limited to basic applications such as chatbots to improve sales, However, the positive impact that AI tools can offer, particularly algorithms designed to optimize sales management, has not been fully explored in the Peruvian context.

An example of the underutilization of AI is the research carried out by [15], who designed an explanatory model based on ontologies applied to a conversational chatbot. This model uses the XAIO technique, derived from existing ontologies in the fields of machine learning and explainable artificial intelligence, the evaluation of the model was carried out in two phases: a quantitative one, using the BLEU metric to measure the similarity of the responses generated with reference texts, and another qualitative one, through tests with users, the results showed that the model generated efficient textual explanations for the questions posed, obtaining an average BLEU value of 76.97, in addition, the usability of the system, measured using the SUS scale, reached an average score of 70.35, indicating a usability above average. These results suggest that greater understanding and adoption of explainable AI could facilitate its integration into sales management, overcoming current limitations.

In a similar vein, the study conducted by [16] collected secondary information and conducted in-depth interviews with hardware trade experts, the findings revealed a significant opportunity in the market to introduce innovative services such as TINKUY, a smart advertising platform. The study found that 47% of final consumers in hardware stores pay attention to advertising at the point of sale, mainly to take advantage of offers, review the advantages of products or out of simple curiosity. Among the most prominent sectors for advertising, foods were identified. , telecommunications, retail, health, education, insurance and financial, it was projected that the annual sales of the advertisers surveyed would reach 45%, with a turnover of more than 10 million soles, the research also highlighted the importance of after-sales management, with a support area designed to provide support and advice to customers 24 hours a day.

Finally, the study carried out by [17] focused on the implementation of chatbots and analyzed four key indicators: waiting time for attention, time to give a response, time to prepare a quote and cost to prepare a quote, the results showed that The implementation of the chatbot significantly reduced the waiting time for service from 3318.4 seconds to 14.9 seconds, the time to provide a response from 1695.4 seconds to 10.5 seconds, and also positively impacted the efficiency and cost of preparing quotes. These results indicate that the chatbot improved the sales process in the metalworking company, reflected in greater quality and speed in customer service.

It is worth noting that although the adoption of AI in Peru is underway, its full potential has not yet been realized, research suggests that while chatbots and basic applications have proven useful, the implementation of advanced algorithms and technologies of Explainable AI could offer even greater benefits in sales management, optimizing processes and improving efficiency in various sectors, the integration of these advanced approaches could make a significant difference in competitiveness and business performance in the Peruvian market.

II. METHODOLOGY

The primary aim of this study was to explore the relationship between the implementation of Artificial Intelligence (AI) tools and sales management in six companies within the hardware sector in Chiclayo, Peru, during the year 2023. This research is of significant importance as it provides a detailed insight into how modern technological advancements, particularly AI, are transforming traditional business processes in specific sectors and localized contexts.

To conduct this study, a quantitative correlational approach was employed, characterized by a cross-sectional and non-experimental design. This approach was selected for its

capability to effectively measure and analyze the relationship between variables within the established timeframe. The choice of a non-experimental design allowed for the observation of phenomena as they naturally occur, without intervention in the context, providing a more realistic and applicable view to real-world situations.

Data collection focused on a sample of 48 workers from six small companies, all directly involved in sales processes. It is noteworthy that the sample size was not very large, as only these six companies had successfully implemented some form of AI technology in their sales processes. This made the study population limited but highly relevant for analyzing the integration of AI into the sales dynamics of the local hardware industry.

The individuals selected to participate in the study used programs supported by AI algorithms that assisted them in sales predictions. The selection of these participants provided a representative sample to understand how AI integration is influencing sales dynamics. The survey administered to these workers utilized a Likert scale from 1 to 5, a common tool in quantitative research for measuring opinions or attitudes. This scale was fundamental in quantifying employees' perceptions regarding the impact of AI on their sales management practices.

The analysis of the survey data revealed a significant relationship between the use of AI tools and effective sales management. A moderate positive correlation was identified, suggesting that as the use of AI tools increased, the effectiveness in sales management also improved. This finding was evaluated across three key dimensions: Innovation, Effectiveness, and Competitiveness.

III. RESULTS AND DISCUSSION

As a first result, the study revealed that the small companies in question had adapted the LSTM (Long Short-Term Memory) algorithm to meet their specific needs. This algorithm, an advanced variant of recurrent neural networks (RNN), is widely recognized. for its effectiveness in handling time series data. Its ability to learn and remember long-term dependencies makes it particularly suitable for applications such as sales prediction, where it is crucial to understand complex, long-term patterns in the data. In these companies, the LSTM algorithm was effectively implemented in sales reports, thus allowing accurate and useful estimates for future planning.

Additionally, as part of our research, a survey was conducted among workers at these companies to evaluate three critical dimensions of sales management: Innovation, Effectiveness, and Competitiveness. The results obtained offered a comprehensive vision of these technologies in the work environment and business processes:

Innovation: The specific results for this dimension indicated how the introduction of new practices and solutions in sales operations has been influenced.

It examined whether the use of advanced technology fostered a work environment that encouraged creativity and the introduction of new ideas.

		F	%	% Válido
Válidos	Deficiente	11	22.92	22.92
	Regular	24	50	50
	Optimo	13	27.08	27.08
	Total	48	100	100

Pic. 1. Level of sales innovation in hardware companies

In the context of hardware companies, the results of the sales management innovation survey indicate a mixed picture. According to Figure 1, 50% of respondents rated innovation in sales management as average, while 23% considered it poor and 27% evaluated it as optimal, these results suggest that, although artificial intelligence tools (AI) are being implemented, their use has not been fully optimized to maximize potential benefits, this may be due to various factors, including lack of adequate training, technological limitations, or resistance to change within the organization.

On the other hand, in the Effectiveness dimension, the data show a slightly more positive perception of the use of AI. 58% of the results indicate that the level of effectiveness in sales management is regular, comparing this with the results of the Innovation dimension, it is observed that AI contributes more effectively to sales prediction, as detailed In Figure 2, the sum of the regular and optimal levels reaches an impressive 87% in terms of effectiveness for sales management.

This high percentage reflects that, despite the challenges in innovation, the implementation of AI in sales prediction has proven to be quite effective.

		F	%	% Válido
Válidos	Deficiente	6	12.5	12.5
	Regular	28	58.33	58.33
	Optimo	14	29.17	29.17
	Total	48	100	100

Pic. 2. Sales effectiveness level in hardware companies

In the Competitiveness dimension, the data collected reveals significant challenges in the implementation of artificial intelligence (AI) to improve sales management. According to the results shown in Figure 3, a worrying 56% of respondents point out that, although they can predict their sales using AI tools, these do not effectively contribute to improving their competitiveness in the market. This suggests that AI, as it is currently being used, is not providing the expected added value in terms of competitive advantage.

This finding is crucial because it highlights a disconnect between the ability to predict sales and the ability to use that data in a way that results in tangible competitive improvement.

		F	%	% Válido
Válidos	Deficiente	27	56.25	56.25
	Regular	19	39.58	39.58
	Optimo	2	4.17	4.17
	Total	48	100	100

Pic. 3. Level of sales competitiveness in hardware companies

After an exhaustive analysis of each of the dimensions of sales management, an evaluation of the general level of this variable in the hardware companies surveyed was carried out. The results obtained provide a global vision of how these companies are managing their sales and how effective their strategies are in this area.

According to Figure 4, 58% of the companies surveyed are classified as having a regular level of sales management. This percentage is significantly higher than the 10% that report poor management. However, there is still considerable room for improvement, given that only 31% reach an optimal level of sales management. This data is crucial because it indicates that, although most companies operate at an acceptable level, there is a clear opportunity for many of them to improve their processes and strategies to achieve superior performance.

The interpretation of these results suggests that, although sales management in these companies is not in a critical state, it does require significant improvements to reach and maintain an optimal level.

This optimal level is not only desirable, but necessary to ensure sustainability and growth in a competitive market.

		F	%	% Válido	% Acumulado
Válidos	Deficiente	5	10.42	10.42	12
	Regular	28	58.33	58.33	70
	Optimo	15	31.25	31.25	100
	Total	48	100	100	

Pic. 4. Sales management level in hardware companies

Detailed analyzes of the Innovation, Effectiveness and Competitiveness dimensions in sales management have revealed that it is crucial to focus on developing and optimizing tools that not only support these areas but also foster a more robust competitive approach.

This approach will maximize the benefits of technology and strengthen the position of hardware companies in the market. As observed in the results presented in the previous figures, although there are significant advances in the use of artificial intelligence (AI) tools for sales prediction, there is still room to better exploit these technologies to improve competitiveness.

To further understand the relationship between the use of AI algorithms and sales management in the hardware industry, a statistical analysis was conducted using Spearman's correlation coefficient (Spearman's Rho).

This method was selected for its ability to measure the intensity and direction of the association between two variables ranked in ordinal order.

The results of this statistical test, detailed in Figure 5, indicate a significant correlation between the implementation of AI algorithms and the observed improvements in sales management.

This finding is revealing and suggests that the adoption of advanced technologies not only contributes to sales forecasting accuracy, but also has the potential to drive innovation, increase operational efficiency and improve the competitiveness of companies in the sector.

			Inteligencia Artificial	Gestión de Ventas
Rho de Spearman	Inteligencia Artificial	Coeficiente de correlación	1,000	,663**
		Sig. (bilateral)	.	,000
		N	48	48
	Gestión de Ventas	Coeficiente de correlación	,663**	1,000
		Sig. (bilateral)	,000	.
		N	48	48

**. La correlación es significativa al nivel 0,01 (bilateral).

Pic. 5. Relationship between the variables Artificial Intelligence and Sales Management

The Spearman correlation coefficient obtained, with a value of 0.663, reveals a moderate positive relationship between the use of artificial intelligence (AI) and sales management in the hardware companies analyzed. This result is particularly relevant given that the associated significance value (Sig = 0.000) is considerably lower than the standard alpha significance threshold (0.05). This difference indicates that the correlation is not a product of chance, but rather reflects a statistically significant and reliable association between these variables.

This statistically significant correlation underscores that as hardware companies increase their adoption of AI technologies—using them to predict sales trends, optimize inventory management, and personalize offers—they are seeing tangible improvement in several key aspects of their operations. This includes not only greater efficiency in sales management, but also advances in innovation and an increase in competitiveness.

In a market that is increasingly dynamic and competitive, these advances are crucial to maintaining and improve the market position of companies.

In practical terms, this finding implies that investments in AI can directly translate into significant competitive and operational benefits.

Therefore, companies in the hardware sector should consider not only adopting, but also deeply integrating AI into their business processes.

IV. CONCLUSIONS

The implementation of algorithms based on LSTM (Long Short-Term Memory) in small companies in the hardware sector represents a significant effort towards technological adaptation. In the case of companies in Chiclayo, their adaptation was empirical, meaning they did not follow an ideal structure or any development technique, which opens up a range of future research opportunities to standardize these adaptations at the business level. These algorithms, which are a specialization of recurrent neural networks (RNN), are ideal for time series analysis because they excel at capturing long-term dependencies, which is crucial for sales forecasting. This capability allows companies to achieve greater precision in their sales reports, facilitating more informed and strategic decisions in business management.

In a broader analysis of the adoption of artificial intelligence (AI) tools in sales management within the hardware sales sector, mixed results are observed across several key dimensions:

Innovation: Although 50% of companies are at a regular level of innovation in sales management, a concerning 23% are still at a deficient level, and only 27% have reached an optimal level. This indicates that, although there is an effort to integrate AI, the maximization of these technological resources has not been fully achieved, limiting its potential to drive innovation to higher levels. Integrating AI into innovation not only refers to the application of new technologies but also to the ability to reimagine business processes and models. An example of this could be using LSTM not only to forecast sales but also to optimize production processes based on demand predictions.

Effectiveness: The effectiveness dimension shows a notable improvement, with 58% of companies situated at a regular level and a combined aggregate of regular and optimal reaching 87% effectiveness. This suggests that, despite limitations in innovation, AI implementation has begun to yield significant results in the precision and management of sales operations, highlighting its value in improving business processes and outcomes. Effectiveness here is measured not only by the accuracy of sales predictions but also by how this information is used to optimize logistics and inventory management, reducing costs and improving delivery times.

Competitiveness: However, the outlook is less encouraging in terms of competitiveness, where 56% of respondents indicate a deficient level. The ability to predict sales, although valuable, does not automatically translate into a competitive advantage if it is not complemented with effective strategies that leverage this data to differentiate in the market. For instance, a company using AI predictions to adjust its marketing strategy could personalize its campaigns based on expected buying trends, thus achieving greater resonance with its target audience and differentiating itself from competitors.

General Sales Management: In general, sales management is mostly perceived as regular, reaching 58%. Although this exceeds the low percentage of poor management (10%), it is still below the desired optimal level (31%). This reflects that, while companies are on the path towards optimal sales management, they still have to overcome several obstacles and improve their use of AI technologies. To achieve optimal sales management, it is crucial that companies not only implement advanced technologies but also develop methods to effectively integrate these technologies into their business processes.

The exhaustive analysis of the results in the levels of Innovation, Effectiveness, and Competitiveness of the Sales Management variable reveals a significant correlation between the use of artificial intelligence (AI) tools and improvement in sales management in hardware companies. Using Spearman's correlation coefficient, a moderate positive relationship (coefficient of 0.663) has been identified between the use of AI and effectiveness in sales management, with a significance value (Sig = 0.000) that is less than the alpha significance level (0.05). This indicates a consistent and significant relationship between the implementation of AI technologies and improvement in sales management.

In practical terms, as hardware sales companies adopt more AI technologies to predict sales, optimize inventories, and personalize offers, there is a notable improvement in the innovation, efficiency, and competitiveness of their business operations. This finding supports the importance of investing in advanced technologies not only to enhance sales forecasting accuracy but also to boost operational efficiency and maintain a competitive edge in today's dynamic market. Successful AI implementation can enable companies not only to respond quickly to market demands but also to anticipate emerging trends, thus ensuring market leadership.

Therefore, the general conclusion is that, although sales management in the surveyed hardware companies is mostly at an average level, the adoption of AI technologies offers a promising path to achieve optimal management levels. Companies that invest in these technologies can expect significant improvements in innovation, efficiency, and competitiveness, which will better position them to meet the challenges of the modern market.

Moreover, the results suggest that AI integration not only enhances the technical aspects of sales management but also contributes to more informed and future-oriented strategic planning. AI tools enable hardware companies to analyze large volumes of historical sales data and market trends, facilitating the anticipation of future market needs and rapid adaptation to changes in demand. This not only improves companies' responsiveness but also strengthens their position in an increasingly competitive market.

However, for AI implementation to be truly effective, it is essential that companies focus not only on the technology itself but also on developing the necessary competencies within their teams. Continuous training and development of skills in AI and data analysis become crucial to maximizing the potential of

these tools. Additionally, it is important that AI implementation strategies are aligned with overall business objectives and that there is a commitment at the leadership level to foster a culture of innovation and adaptability.

Finally, as hardware companies continue to explore and expand their use of AI technologies, it is crucial that they do so with a well-defined strategy that includes training, cultural adaptation, and strategic alignment. With these components in place, companies will not only improve their sales management but will also be better equipped to thrive in the future.

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