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Research Note

The Impact of AI Adoption on Value Chain Innovation and Market Competitiveness in the Printing Industry: A Case Study of HP Inc.

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Abstract: HP Inc. has strategically adopted AI technology to drive value chain innovation in the printing industry, enhancing market competitiveness by achieving sustainability, improving customer satisfaction, and transitioning from a hardware-focused to a SaaS-based business model. The printing industry faces complex challenges due to digital transformation, including declining physical print demand, increasing sustainability requirements, and intensified market competition. These changes have exposed the limitations of traditional hardware-centric business models and highlighted the need for new value creation and revenue model transformation. This study analyzes how AI technology contributes to value chain innovation and market competitiveness in the printing industry, focusing on the case of HP Inc. HP has maximized operational efficiency through AI-based printing solutions and transitioned from a hardware sales-driven model to a SaaS (Software-as-a-Service) model. AI enables real-time printer monitoring and predictive maintenance, minimizing downtime and reducing maintenance costs. Simultaneously, AI minimizes energy consumption and optimizes ink and paper usage, creating an eco-friendlier printing environment. HP's AI adoption has also significantly improved user experience through personalized settings and layout optimization.

Keywords: HP; Printing; MFP; AI; SaaS

1. Key Issues of the Study

1.1 Impact of Digital Transformation

The printing industry is experiencing limitations in its traditional hardware-centric business model due to declining demand for physical print output, the expansion of cloud-based document management systems, and increased use of digital documents.

1.2 Increasing Demand for Sustainability

The pressure for sustainability is rising, with demands to reduce energy consumption and the use of ink and paper. This trend highlights the need for eco-friendly solutions that meet ESG (Environmental, Social, and Governance) standards.

1.3 Intensified Market Competition

The global printing market is facing stagnation, and the limitations of a hardware-based revenue model are becoming apparent. This drives the need for a shift to SaaS (Software-as-a-Service) and service-based revenue models.

2. Analysis Results: HP's AI-Based Printing Strategy

2.1 Enhancing Efficiency through AI Adoption

By implementing real-time device monitoring and predictive maintenance, HP has minimized equipment downtime and maintenance costs. This automation technology can detect potential issues, such as low consumable levels or mechanical failures, in advance and notify the user or remotely resolve the issue to ensure operational continuity and improved efficiency.

2.2 Transition to a New Business Model

HP has shifted from a hardware sales-focused business model to a SaaS-based subscription model. This allows printers to be offered as a subscription service, providing value-added benefits such as regular software updates, AI-driven predictive maintenance, and usage-based billing. This approach reduces customers' initial investment burden while ensuring stable and predictable revenue generation for HP.

2.3 Strengthening Sustainability

AI optimizes ink, toner, and paper usage while improving energy efficiency, creating an eco-friendly printing environment. This minimizes resource waste and reduces carbon emissions, enhancing sustainability. Additionally, HP develops technologies to meet ESG compliance standards, providing eco-friendly solutions and fulfilling corporate social responsibilities.

2.4 Improving User Experience

HP leverages AI-based data analysis to learn user printing patterns, offering personalized printing settings and automatic layout adjustments for maximum convenience. Specifically, HP introduced the "Perfect Output" feature, which automatically removes advertisements and unnecessary elements when printing web pages, delivering cleaner and more efficient print results.

3. Strategic Recommendations: Short- and Long-Term Strategies

3.1 Short-Term Recommendations

3.1.1 Implementation of Smart Document Management Systems

By utilizing AI-powered OCR (Optical Character Recognition) technology, document collection, classification, and search functions can be automated. This reduces manual workload, minimizes data entry errors, and increases productivity.

3.1.2 Strengthening Data Security

AI-driven real-time threat detection and automated security updates can protect sensitive data in industries like finance, law, and healthcare. This prevents cyber threats and data breaches while ensuring regulatory compliance and a secure working environment.

3.1.3 Expansion of SaaS-Based Subscription Models

Reducing initial costs and offering personalized subscription services can lower the economic burden on customers while providing predictable and stable revenue for HP. This approach strengthens long-term customer relationships and builds a sustainable business model.

3.1.4 Continuous Collection of AI Training Data

Ongoing data collection from printing activities can improve the accuracy of AI-driven predictive maintenance. This allows for more precise failure detection and proactive maintenance, reducing costs and maximizing equipment uptime.

3.2 Mid-to-Long-Term Recommendations

3.2.1 Expansion of Technology Integration

Integrating AI with IoT (Internet of Things), blockchain, and cloud technologies can provide more intelligent and automated document management solutions. This would enable real-time device status monitoring, data integrity assurance, remote collaboration, and enhanced security, maximizing both operational efficiency and data protection.

3.2.2 Reinforcement of Sustainability Goals

By leveraging AI to optimize energy consumption and minimize resource usage (paper, ink), companies can achieve ESG goals while promoting eco-friendly operations. This proactive approach supports responsible corporate citizenship and environmental sustainability.

3.2.3 AI Talent Development

Expanding collaboration with universities and research institutions can help foster AI expertise and promote innovative solutions. This cooperation would support talent cultivation, joint research projects, and faster adoption of advanced technologies, ultimately enhancing corporate competitiveness.

3.2.4 Efforts for Global Standardization

To ensure interoperability among various printing devices and software, establishing industry-wide standards for AI printing technologies is essential. This would reduce adoption barriers, promote wider use cases, and encourage market expansion.

4. Policy Recommendations

4.1 Promotion of AI-Based Eco-Friendly Technologies

By offering tax incentives and subsidies to public institutions and governments adopting energy-saving and waste-minimizing technologies, eco-friendly AI adoption can be encouraged. These incentives would reduce the initial investment burden for businesses and accelerate sustainable technology innovation.

4.2 Strengthening Data Protection Regulations

Standardizing AI-driven data encryption and access control in printing would prevent unauthorized data access and minimize data breach risks. This approach supports regulatory compliance in industries requiring high-security standards, such as finance, healthcare, and law.

4.3 Encouraging Technological Standardization

Establishing a collaborative body involving key industry players, technology providers, research institutions, and government agencies can promote standardization efforts. This would enhance technology compatibility, strengthen data security, and establish ethical AI usage guidelines, driving innovation and industry-wide cooperation.

5. Business Implications

5.1 Necessity for Business Model Transformation

Transitioning from a hardware-focused revenue model to a SaaS and subscription-based service model can ensure predictable revenue while strengthening long-term customer relationships. This model provides continuous software updates, AI-based predictive maintenance, and usage-based billing, enhancing both customer satisfaction and financial stability.

5.2 Increased Productivity through AI

The implementation of AI-driven automation and predictive maintenance allows real-time monitoring and early detection of potential issues, minimizing operational disruptions and maximizing device uptime. This results in reduced maintenance costs and enhanced operational efficiency.

5.3 Importance of Sustainability

Optimizing resource consumption and reducing energy usage through AI can simultaneously support environmental protection and ESG compliance. Minimizing ink, toner, and paper waste while maximizing energy efficiency helps companies reduce carbon emissions and achieve sustainable operations.

5.4 Securing Competitive Advantage

AI-powered personalized printing experiences can differentiate HP’s services. By learning user printing patterns and offering optimized settings and automatic layout adjustments, HP can enhance customer satisfaction and

brand loyalty, encouraging repeat purchases and long-term engagement.

5.5 The Need for Technological Convergence

The convergence of AI, IoT, cloud, and blockchain technologies can accelerate the digital transformation of the printing industry. This integration allows for real-time device monitoring, remote management, automated data protection, and predictive maintenance, enhancing both productivity and security in the office environment.

6. Conclusion

In conclusion, HP's AI-powered printing strategy effectively addresses the existing limitations of the printing industry while presenting new opportunities for sustainable growth. The adoption of AI technology goes beyond productivity improvement, serving as a powerful tool for business model transformation and eco-friendly operations. By strategically leveraging these technologies, companies can enhance their competitiveness while discovering new revenue streams.