

EMPOWERING GREEN RETAIL

REPORT ON GREEN DIGITALIZATION



Hanshow

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In today's rapidly evolving digital landscape, the role of retail has transformed into a dynamic and interconnected customer journey. At Microsoft, we believe that digitalization not only empowers retail businesses to reach wider audience needs but also presents a profound opportunity to drive sustainability and uphold our commitment to the highest environmental, social, and governance standards.

Partnering with Hanshow's innovative solution team, we're witnessing the future of retail unfold. Hanshow's retail SaaS solution, built on the Microsoft Azure cloud platform, offers green visionary thinking for the centralized management of millions of IoT devices spread across hundreds of brick-and-mortar stores with lower carbon footprints and smarter operation efficiency. This paradigm shift is a testament to the potential of technology to reshape retail landscapes, enhancing connectivity and propelling the industry into a new era of innovation and customer-centricity.



— **Keith Mercier**
General Manager of Worldwide Retail and Consumer Goods, Microsoft



Hanshow is honored to collaborate with Microsoft, Intel, and E Ink in publishing this report on Green Digitalization. This white paper highlights the importance of digital technologies in promoting sustainability within the retail sector. By leveraging digitalization, retailers can reduce waste, improve energy efficiency, and optimize supply chain management, while also improving customer experiences and reducing costs. We believe that this white paper will serve as a valuable resource for businesses looking to drive green transformation and create a more sustainable future. Hanshow is committed to using our expertise and resources to drive positive change and encourage sustainable practices across industries.



— **Liangyan Li**
SVP, Head of Global Sales, Hanshow



Collaborating with Hanshow in the realm of sustainability and digitalization has been truly transformative for Intel. The global retail landscape is undergoing a profound shift driven by digitalization, where cutting-edge technologies like AI, computer vision, and IoT are becoming pivotal tools that empower retailers to enhance their operations, efficiency, and customer experiences. At Intel, we recognize the immense potential of these innovations in fostering sustainability within the retail industry.

Intel's partnership with Hanshow exemplifies our shared commitment to leveraging technology for sustainable progress. As the digitalization of retail gains momentum, more retailers are harnessing AI as a cornerstone for improving business operations, driving revenue growth, and gaining deeper insights into consumer preferences. Intel's collaboration with Hanshow revolves around integrating our advanced technologies to enhance these efforts, thereby enabling retailers to not only deliver unique shopping experiences but also contribute to environmental conservation.



— **Richard Zhang**
CTO & Senior Principal AI Engineer, Network & Edge BU, Intel China



E Ink's collaboration with Hanshow has had a truly significant impact on driving sustainability in the retail sector. In particular, the use of electronic shelf labels (ESLs) through dynamic pricing strategies has helped reduce food waste, printing paper waste and human errors when changing price tags and increase overall operation efficiency. This is where E Ink's partnership with Hanshow comes into play.

E Ink, a leading provider of sustainable ePaper technology solutions to ESL and digital retail partners such as Hanshow. We are proud to work with Hanshow on these sustainability initiatives. We recognize the far-reaching implications of integrating our cutting-edge ePaper technology into Hanshow's solutions. This partnership represents a major milestone as we collectively strive to improve environmental responsibility in the retail industry.

E Ink's collaboration with Hanshow goes beyond retail sustainability. We also aim to drive the evolution of smart cities. By advancing ePaper technology and its energy-saving innovations, we are collectively paving the way for a more sustainable urban future that encompasses retail, transportation, healthcare, and more.



— **Johnson Lee**
Chairman & CEO, E Ink



"In our quest for a sustainable retail future, let's embrace the fusion of green digitalization and innovative technologies. This report delves into the synergy of AI and IoT with sustainable practices, reflecting the retail sector's dedication to climate protection. It highlights the need to incorporate sustainability into supplier evaluations and consumer awareness, acknowledging the collective responsibility in navigating challenges like budget constraints and high energy costs.

As we strive for a greener tomorrow, EHI welcomes the efforts and offerings of Hanshow to reach the climate goals with their ESL and AI-driven solutions and the approach to integrate innovation and environmental responsibility."



— **Michael Gerling**
CEO of EHI Retail Institute

Green Digitalization Helps Retailers Grow Sustainably and Responsibly

EXECUTIVE SUMMARY

Emerging digital technologies, such as mobile payments, big data, cloud computing, artificial intelligence (AI), and the Internet of Things (IoT), represent a profound transformation of the retail industry. These technologies have not only revolutionized how the industry operates but also significantly influenced how consumers shop, sparking a series of further business innovations. This transformation is especially evident in brick-and-mortar retail, which continues to dominate the global retail market, despite the rapid growth of e-commerce in recent years. As of 2022, brick-and-mortar retail maintains an estimated value of 20 trillion U.S. dollars and holds a substantial market share of 78 percent of global retail.²

Luckily, many of these technologies are already environmentally friendly or quickly becoming so through sustainability efforts by the firms that develop them. Retail solutions that utilize these foundational technologies, in turn, are driving a greener and more sustainable operating model in the retail industry. With a sustainability mindset and new digital tools, traditional retailers can now not only improve efficiency, customer experience, and profitability, but also reduce energy use and carbon emissions, reduce

waste, foster inclusivity, and better support local communities and economies. In short, digitalization can be GREEN. While this endeavor presents formidable challenges, it offers equally significant opportunities given the central position of the retail industry in the world economy and the massive reach of its global supply chain. The imperative to take quick, decisive action is now clearer than ever.

Collectively, retailers and industry stakeholders have the capacity to foster sustainable economic growth, cultivate a society that prioritizes inclusivity and equality, and promote environmental stewardship for the benefit of both current and future generations. Indeed, traditional retailers can now leverage digital technologies to achieve both growth and sustainability - what is known as Green Digitalization.

Most importantly, stakeholders in the ecosystem – retailers, consumers, technology companies, governments, and non-governmental organizations – need to join hands and continue to drive technological, business, and social innovation and integration to further the retail industry's Green Digitalization and to create a sustainable future for all.



As of 2022, brick-and-mortar retail maintains an estimated value of **20** trillion U.S. dollars and holds a substantial market share of **78** percent of global retail.

01

GREEN DIGITALIZATION
IS BECOMING A MUST
FOR RETAILERS



The Covid-19 pandemic significantly changed the global retail industry and brought many new challenges and opportunities. Digitalization and sustainability are now two megatrends that retailers around the world, especially traditional retailers, must embrace. Digitalization and sustainability should be at the top of every retail CEO's agenda.

On the one hand, a barrage of internal and external forces has been reshaping the industry - including the rise of e-commerce and omnichannel retail, changing customer behavior, and growing supply chain complexity. These challenges, accelerated by the pandemic, have heightened the pressure on retailers' margins and make digitalization an imperative for them to improve efficiency and productivity to boost their bottom-line. According to McKinsey, between 2017-2022 retail margins shrank by two to three percent per year, or as much as five to six percent depending on the vertical.³ Retailers who fail to adapt are at risk of falling behind or even disappearing. Digital leaders, on the other hand, have seen average sales grow around five percent per year over the past eight years (2014-2022) - higher than digital followers (+2.6 percent) and digital latecomers (-0.4 percent), according to research by Retail Economics.⁴

On the consumer front, more and more customers are shopping online for better convenience, price, and selection. The number will further increase as digital natives become the mainstay of retail spending. They expect to be able to shop anywhere, anytime and demand seamless navigation across online and offline channels. The pandemic has undoubtedly accelerated and solidified this trend. As per recent Statista e-commerce data, from 2017 to 2022, worldwide offline sales decreased from 91.5 percent to 84.2 percent, while online sales increased from 8.5 percent to 15 percent, signaling a shift in shopping preferences.⁵

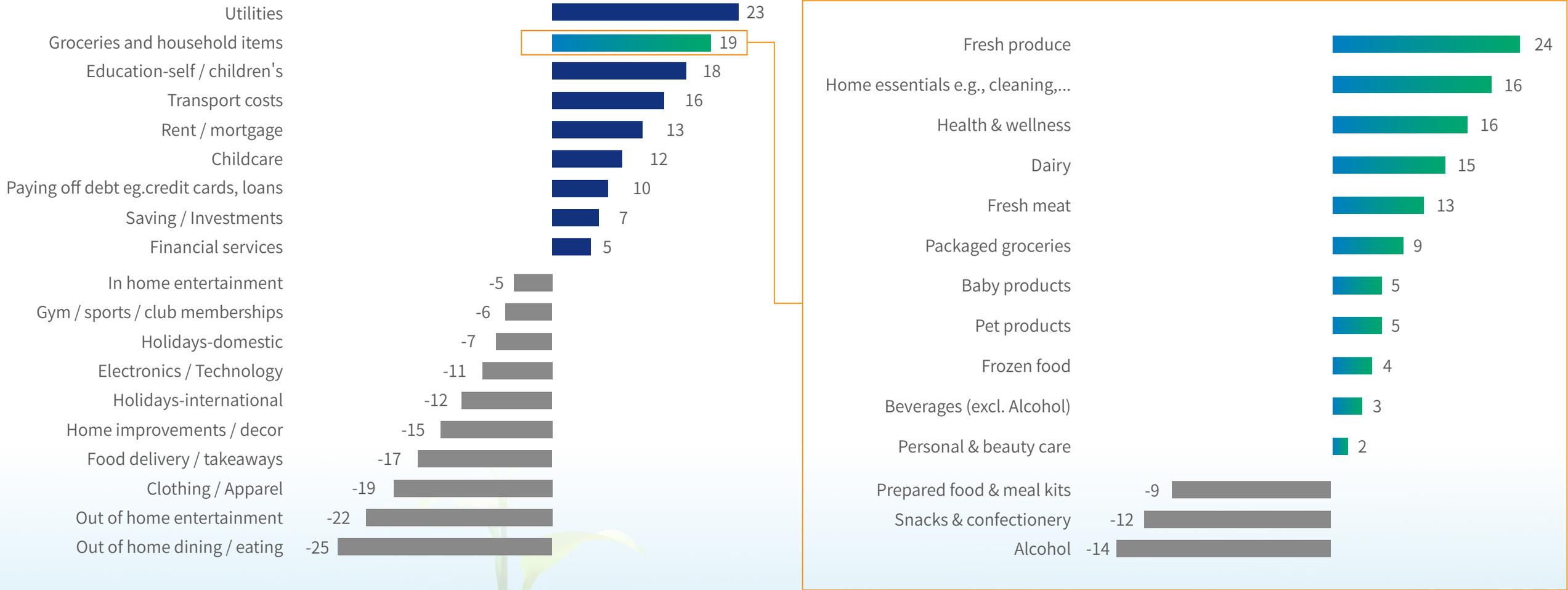
Competitively, traditional retailers are facing an intensifying threat from pure digital players and more digitally equipped peers. In most markets, omnichannel retailers are growing at a much faster pace than traditional retailers and quickly eroding the latter's market share. According to McKinsey, although offline commerce has begun to bounce back post pandemic, online channels have enjoyed markedly higher growth in recent years: mature categories grew about 12 percent in 2021 (1.4 times faster than offline), and nascent categories rose six percent (seven times faster than offline).⁶

Structural labor shortage due to an aging population is another issue confronting retailers in many economies. Based on data from the World Health Organization (WHO), between 2015 and 2050, the proportion of the world's population over 60 years old will nearly double from 12 percent to 22 percent.⁷ By embracing digitalization, retailers can better meet this challenge through process automation and improved employee productivity.

On the macro level, weak economic outlook⁸ and stubborn high inflation are denting consumer confidence and purchasing power, suppressing overall retail demand. As per NIQ survey results, the global consumer-packaged-goods (CPG) price inflation rate was 9.8 percent as of June 2023 - although trending down from its peak, it is still much higher than post-GFC (Global Financial Crisis) level;⁹ and 62 percent of surveyed customers think they are currently living in a recession (vs. 59 percent in mid-2022).¹⁰ The spending shift from goods to services post pandemic is worsening the situation. Based on Deloitte's 2023 Retail Industry Outlook Survey, real personal consumer expenditure (PCE) on durable goods is expected to contract by 1.8 percent in 2023.¹¹ In contrast, services PCE is expected to rise by 3.6 percent in 2023.¹¹ Consumers are under pressure and trading down and spending less on non-essentials (figure 1).



Figure 1. All forms of discretionary spending under consumer scrutiny Spending intentions for next 12 months - net change in spending (pt. change)



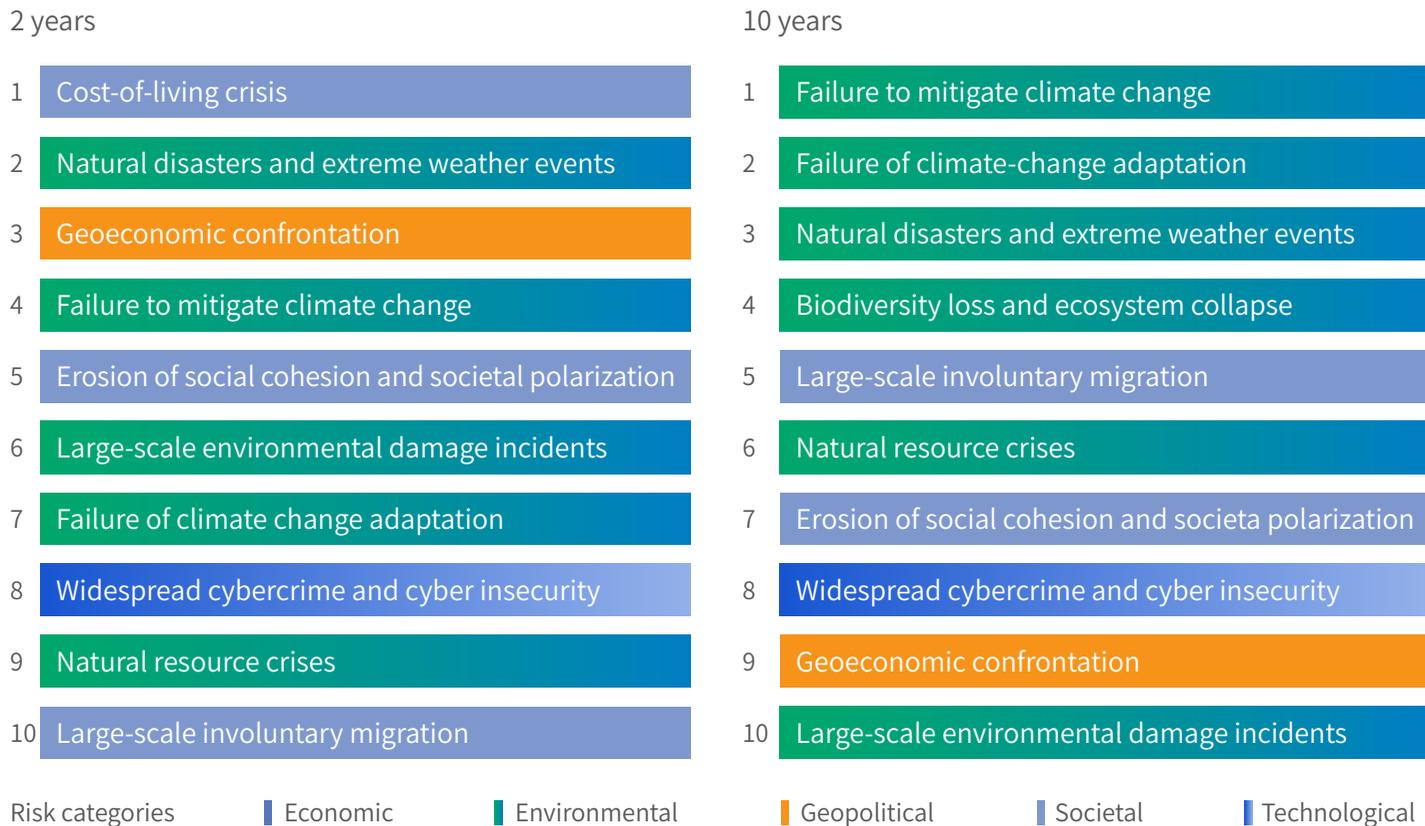
Source: NielsenIQ 2023 Consumer Outlook Survey, Dec 2022 Change in spending calculated by subtracting % of respondents who are spending less from % of respondents who are spending more

Chart is from ref. material "NIQ-2023-Consumer-Outlook-Summary-Presentation" page 18

On the other hand, social, governance and environmental sustainability issues are another top concern confronting the retail industry. Sustainability has moved from "nice to have" to "must have". The urgency is evident in the latest *World Economic Forum Global Risks Perception Survey (2022-2023)* (figure 2).

Figure 2. Global risks ranked by severity over the short and long term

"Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period"



Source: World Economic Forum Global Risks Perception Survey 2022-2023

Chart is from ref. material "WEF_Global_Risks_Report_2023" page 6

The retail industry, with its massive size and vast and far-reaching supply chain, can be a major contributor to environmental and social problems. The production, transportation, and disposal of retail goods have significant impact on climate, air, water, and the natural environment. Recent research from Normative indicates that the retail industry accounts for roughly 25 percent of global greenhouse gas (GHG) emissions.¹² Moreover, as the retail sector is a large employer, it also has a social responsibility to ensure that its employees are kept safe, treated fairly, and that its supply chain is free from human rights abuses.

At the core of the global economy, the retail industry is expected to play an important role in curbing global warming and creating a more sustainable and inclusive society. Companies are hearing louder calls from governments, consumers, employees, investors, and other stakeholders to take more actions. For example, the European Union has set a target to reduce GHG emissions by 55 percent by 2030.¹³ Three-quarters of Gen Z said sustainability is more important than brand when making a purchase decision.¹⁴ Failure to address these issues will put businesses at risk of losing customers and employees, facing regulatory fines, disappointing investors, and damaging reputation, which in turn will hurt financial performance. An NYU Stern Center for Sustainable Business analysis of over 1,000 studies published since 2015 shows that strong corporate management of ESG is positively correlated with improved stock price performance.

In this era of rapid development, advances in modern technology can be an opportunity for businesses to leverage to create a greener future for current and subsequent generations. Retailers can lead the changes by operating more sustainably and by positively influencing other stakeholders in their extended value chain. Digitalization and sustainability can complement and reinforce each other and become the dual growth engines of retail. We call this synergy Green Digitalization.

A woman with dark hair tied back, wearing a light blue button-down shirt and a grey apron, is smiling while looking at a tablet computer. She is standing in a grocery store aisle with shelves of products in the background. The image is framed by a blue and orange graphic overlay on the left side.

02

GREEN DIGITALIZATION
EMPOWERS RETAILERS WITH
DUAL GROWTH ENGINES

This chapter leverages illustrative digital solutions (figure 3) and their demonstrated success to underscore that digitalization is not an obstacle but a profound opportunity for retailers, particularly those operating within the conventional brick-and-mortar paradigm. The harmonization of digitalization and sustainability creates a virtuous cycle, empowering retailers to enhance their operational efficiency, reduce costs, secure a competitive edge, and achieve financial growth, all while mitigating the adverse societal and environmental consequences inherent to their end-to-end operations. Evidence shows that Green Digitalization serves as a dual catalyst for growth within the realm of retail.

From improving the way stores operate, to engaging and influencing customers, to optimizing supply chain management and collaboration with suppliers and partners, retailers can make a tremendous difference through Green Digitalization – creating smarter and greener stores and more agile, adaptive, and sustainable supply chains, while promoting more responsible and sustainable consumption.

Figure 3. Overview of Featured Green Digitalization Tools & Solutions

Components of a Faster, Smarter and Greener Retail Value Chain	Agile, Adaptive & Sustainable Supply Chains	Smarter & Greener Omni-channel Stores	Responsible & Sustainable Consumption
Key Stakeholders	Suppliers & Partners	Retailers	Consumers
Carbon Impact (GHE Scope 1, 2, 3)	Scope 3	Scope 1 & 2	Scope 3
Example Green Digitalization Tools & Solutions	<ul style="list-style-type: none"> • Digital Supply Chain Solution (Microsoft Dynamic 365) <ul style="list-style-type: none"> • AI, machine learning • Cloud-based server • RFID, Blockchain • Robotics • IoT 	<ul style="list-style-type: none"> • Digital Commerce Solution (Microsoft Dynamic 365) • Green Store Solution (Hanshow, E ink, Microsoft, Intel) <ul style="list-style-type: none"> • Electronic Shelf Label (ESL) • ESL-based Precise Article Localization • Smart Shelf Management • Self-checkout Kiosk & Smart Trolley • Centralized, Cloud-Based SaaS Platform • Solar Power Solution (Hanshow) 	<ul style="list-style-type: none"> • Digital CRM • Digital communication • AR, VR experience • Digital tracking (QR code) • Online community • Virtual events

Green Digitalization Makes Stores Smarter and Greener

Directly controlled stores, online and offline, where a retailer's Scope One and Scope Two carbon emission¹ occurs, are their first sphere of influence, so we take stores as the starting point for discussion on Green Digitalization.

Operating a retail establishment, particularly in the grocery sector, has always been challenging. In today's business landscape, the difficulties have only intensified. Questions arise regarding the feasibility of meeting highly personalized preferences of countless customers across various shopping channels, managing an extensive assortment of tens of thousands of stock-keeping units (many of which are perishable), ensuring quality, preventing excessive waste, and striking the delicate balance between setting prices that align with customer expectations while preserving profit margins. Furthermore, addressing demand fluctuations without overstocking is a perpetual concern. All these considerations must align with the overarching objective of maintaining profitability and realizing environmental, social, and governance (ESG) goals.

In this complex milieu, Green Digitalization emerges as a transformative ally. Specific solutions, working in synergy, can enhance the intelligence and sustainability of retail establishments, thereby offering resolutions to these multifaceted challenges.



Omnichannel Capability with Digital Commerce

Arguably, digital commerce, including e-commerce, mobile commerce (m-commerce), social commerce, and livestreaming, should assume paramount importance in a traditional retailer's Green Digitalization strategy. In an increasingly digitalized world, traditional retailers have no choice but to build omnichannel capabilities.

There are various solutions a retailer can leverage to do this. *Microsoft Dynamics 365 Commerce* illustrates that omnichannel capabilities can not only help retailers achieve business growth but can also enable them to become green. However, it is important to note that challenges also exist, such as increased packaging waste and the environmental impact of last-mile delivery. Retailers need to be conscious of these challenges and take measures to minimize their impact.

Microsoft Dynamics 365 Commerce is equipped with built-in functionality to deliver a seamless, unified shopping experience across all channels for the customer by integrating digital, in-store, and back-office operations. It gives retailers a competitive edge and offers them new opportunities for growth and innovation. Here are its key business benefits:

 Increased Revenue and Profitability	24/7 accessibility, expanded customer reach, and reduced overstocking and understocking are possible thanks to dynamic demand forecasting, real-time visibility of stock levels, and automatic replenishment.
 Customer Satisfaction	Customers can now shop anywhere, anytime. This consistent omnichannel experience fosters a sense of trust and reliability, while enhancing customer loyalty.
 Cost Savings	Costs associated with running a physical store are cut. These can include lower rent/real estate by decreasing the number and the size of brick-and-mortar stores, reduced staffing needs, more cost-effective online marketing, and decreased inventory management expenses. It can also alleviate labor shortages.
 Increased Flexibility and Adaptability	Digital commerce offers retailers the flexibility to adjust their operations easily to accommodate changing consumer demands and market dynamics, as well as unexpected shocks and disruptions, such as the Covid-19 pandemic.
 Informed Decision-Making	A 360-degree view of customer data and advanced data analytics capabilities help retailers make informed decisions on product offerings, pricing and promotion, and marketing communications, leading to better business results. For example, as consumers are trading down amid economic headwinds, many retailers spot the trend from sales data and raise the share of private label merchandise, so they can deliver more value for money to their customers while protecting profit margins. Some are also establishing online second-hand markets to facilitate product reuse.

Dynamic Pricing via Electronic Shelf Labels (ESLs)

The nature of retailing (especially food retailing) requires stores to make frequent price changes to many SKUs and to do so accurately and efficiently. The demand is increasing further given the velocity of change in today's marketplace. The traditional manual update is time-consuming and prone to errors, delays, and inconsistencies between different systems (i.e., between shelf label and cashier), which can cause serious consequences such as missed sales opportunities, lost profit margin, and customer complaints. The Electronic Shelf Label (ESL) can help address this challenge.

Hanshow's ESL solution allows price and other product related data, such as texts and images, to be presented digitally instead of being printed on paper by using ePaper technology from E Ink - a pioneer in the field. It can also serve as a building block IoT device for interaction with an expanded retail digitalization network.

ESLs can be updated remotely from centralized, cloud-based servers almost in real-time, enabling dynamic pricing responses to changing product conditions (especially fresh produce with a very short shelf-life), consumer demands, and competitive moves, leading to more sales and improved margin.

ESLs also reduce labor costs and improve efficiency by eliminating the need to manually execute price changes. They can also reduce customer dissatisfaction by eliminating pricing discrepancies between the shelf label and cashier. Additionally, they make the store look modern and sleek, creating a pleasant shopping environment for customers to linger in, which in turn can lead to more sales opportunities.

Hanshow's ESL solution has many advantages: high energy efficiency with low carbon emissions, outdoor readability, backlight free, blue light free, and less strain on the eyes. The device is highly recyclable with a battery life of up to 15 years. It utilizes ambient and/or external light sources and does not call for backlight sources that consume energy when showing any images. According to E Ink estimates, if 30 million 10" ESLs are installed on the market and each ESL display is updated four times a day, about 219 billion pieces of 10" paper can be saved over five years, meaning that about 15.2 million trees are spared from felling and about 8.37 million tons of carbon emissions are avoided.¹⁵



Efficiency & Productivity through ESL-Based Precise Geolocation

Locating an item among aisles in a store can be difficult for customers as well as employees, resulting in inefficiency, low staff productivity, and lost sales opportunities.

With the help of ESL-Based Precise Geolocation function, store staff can quickly find items, making restocking shelves and picking items for both in-store customers and online orders more efficient. It also reduces the risk of products being overlooked, expiring, or going to waste (especially perishable goods).

Customers can also use this function to swiftly locate items themselves instead of waiting for staff assistance. When integrated with shopping list apps, this function can guide customers via the optimal route to find all the items they need, minimizing aisle congestion and creating a streamlined shopping experience.



High On-Shelf Availability via Smart Shelf Management

On-shelf availability (OSA) has always been a top priority for retailers, especially grocers. Traditionally, grocers manage store OSA by manual observation, inspection, and replenishment at a pre-defined frequency. There are many issues with this approach: high labor cost, unintended errors and misses, and untimely response to out-of-stock (OOS) items, often resulting in significant lost sales and unhappy customers. A study by the IHL Group found that the OOS rate in the retail industry was as high as eight percent, accounting for 4.1 percent of lost revenue for an average retailer.¹⁶ After deploying *Hanshow Smart Shelf Management*, the product's out-of-stock (OOS) duration for a European retailer has dropped by 40 percent, from 2.5 hours to 1.5 hours, significantly improving product on-shelf availability (OSA).

Powered by Microsoft AI and Intel® Core™ processors, the *Hanshow Smart Shelf Management* solution is capable of automatically determining OOS items, incorrect item placements, and other shelving issues, so retailers can be promptly alerted of any abnormality and take appropriate action. This is done through identification, classification, and stock-taking of shelf items with the use of Visight, sPatrol robot, and various algorithm applications.

The solution can meet demanding performance requirements of workloads such as AI model inference through an edge server/Intel Video AI Box equipped with Intel® Core™ processors, while accelerating depth estimation performance through the OpenVINO™ toolkit. The Intel® Core™ processors come integrated with Intel® Iris® Xe Graphics for complex AI workloads and hardware acceleration via Intel® Media SDK for faster video transcoding, image processing, and media workflows. According to internal test data from Hanshow, the optimizations provided by the OpenVINO™ toolkit improve the recognition performance of the solution's depth estimation algorithm to 40 FPS, fully meeting the application requirements.

With this powerful solution, retailers can greatly improve store OSA and better meet customers' shopping needs. The sPatrol robot can also help retailers be more vigilant against organized retail theft - a growing problem that costs retailers worldwide hundreds of billions of dollars every year, especially during economic downtimes such as now. According to the NRF's latest National Retail Security Survey, retailers in the United States, on average, saw a 26.5 percent increase in ORC (organized retail crime) incidents in 2021.¹⁷



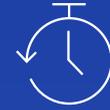
Easy & Fast Checkout via AI-Enabled Self-Checkout Kiosk & Smart Trolley

Long queuing time frustrates customers and sometimes makes them abandon a purchase all together.

Digitally equipped kiosks allow customers to quickly scan items, make mobile payments, and complete their shopping trips with no human cashier required. This is one of the quickest tools for increasing store operational efficiency. It can boost sales by minimizing the possibility of customers being deterred by long and slow checkout lines.

Smart trolleys are equipped with screens displaying in-store navigation and self-checkout functionality, bringing additional efficiency and convenience to store operations. After rolling out Smart Trolley in its stores, a Japanese retailer reduced queuing time by 74 percent and increased customers' return rate by 114 percent, a significant improvement.

These self-checkout options also reduce the number of hours store staff must wait at the register and allow them to provide personalized services to customers in need.



Japanese retailer reduced queuing time by

74 percent



and increased customers' return rate by **114** percent



Efficient, Flexible and Secure Device & Network Management through SaaS

As stores increase their level of digitalization through additional layers of IoT devices, systems, and networks, they can quickly become a complex and disconnected web of technologies that is difficult and costly to manage. Moreover, as digitalization expands, the amount of data retailers need to store and process are growing massive. These developments put tremendous stress on traditional retailers' local-based IT infrastructure and have become a hurdle for many retailers' further digitalization.

To help address above-mentioned challenges, Hanshow developed All-Star SaaS platform that enables retailers to integrate and manage all their IoT devices and networks in one centralized place, reducing management cost and complexity. Leveraging Microsoft's Azure cloud service, the Hanshow solution offers powerful data transmission, storage, and processing capability; additionally, as a modularized out-of-the-box solution, it can be tailored to retailers' specific needs and deployed quickly, saving on deployment time and cost. Last but not least, the Hanshow solution lowered the threshold of digital transformation and made it possible for even small and medium-sized retailers to embark on their digitalization journey.

Backed by Microsoft Azure, the Hanshow solution is also more environment-friendly and provides retailers with a better low-carbon IoT device and network management option. Compared to local infrastructure solutions, Microsoft Azure improves energy efficiency by up to 93 percent and carbon reduction efficiency by 98 percent.

Green Stores Powered by Solar Energy

With its massive scale, the retail industry consumes an enormous amount of energy to power its facilities and daily operations. Transitioning to green energy sources such as solar energy can make a tremendous contribution to addressing climate change. Many leading retailers have already acted. For example, Walmart has set ambitious goals to power its facilities with 100 percent renewable energy by 2035 and to achieve zero-emissions in its global operations by 2040.¹⁸ The company has been investing in rooftop solar power installations, contributing significantly to these goals.

Many technology companies are developing solar energy solutions to help retailers transition to green energy and reduce energy consumption. *The Hanshow Solar Energy Solution* is an example which includes:

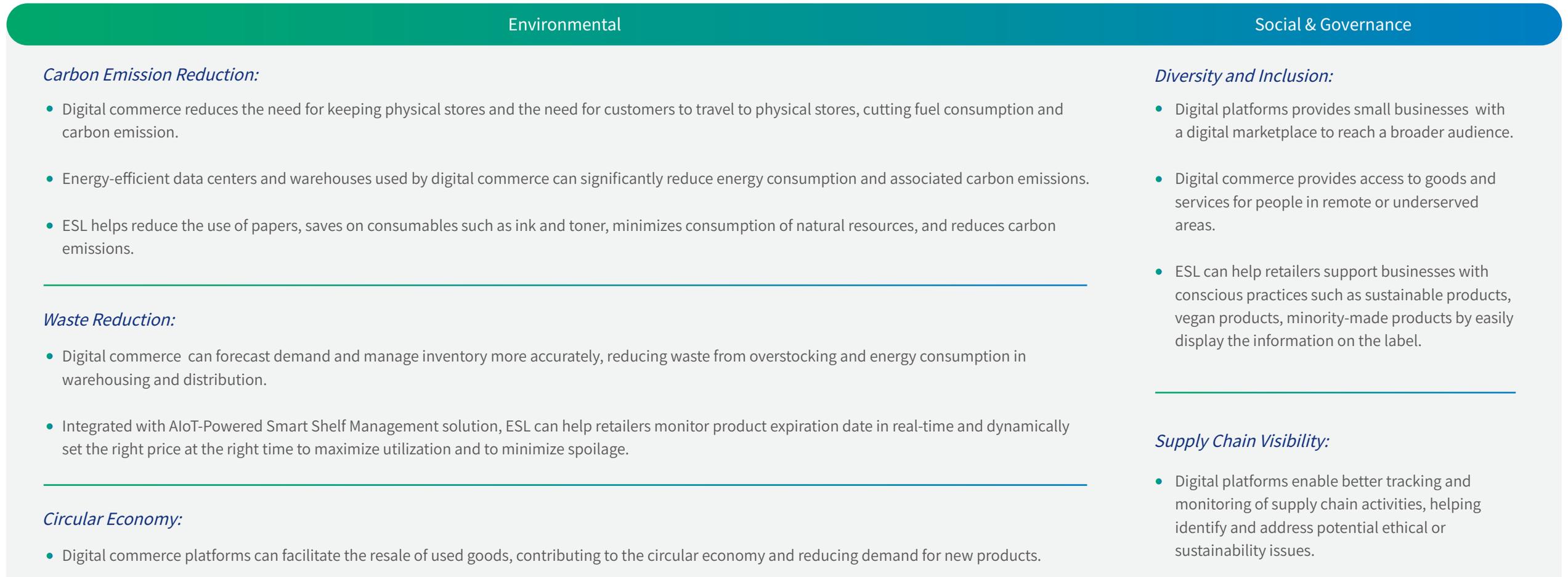
Solar Power Generation helps retailers install photovoltaic panels to generate electricity to power its facilities and operations.	Energy Storage helps retailers install a power conversion system (PCS) and battery cabinets so energy produced from solar panels or other green energy sources can be stored safely and efficiently for future use.	Smart EV Charging Products and Solutions a one-stop solution for charging hardware, software, and services for retailers, for example, charging facilities, electric delivery trucks, and store computer systems.	Energy Management System cloud-based and AI powered solution that helps businesses manage energy consumption efficiently.
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Much has been said about how these digital solutions make a store smarter. They can also lead to greener operations (figure 4).

These social and environmental contributions, in turn, will help retailers win more customers, attract talent, and stand out from the competition. Green Digitalization can truly become a dual engine that propels retailers' continuous growth.

Figure 4. The ESG Benefits of Green Digitalization Solutions for Omnichannel Store Operations



Green Digitalization Enables More Agile, Adaptive, and Sustainable Supply Chains

A retailer's second sphere of influence on ESG is its extended supply chain network. Most of retail's carbon impact occurs in its extended supply chain, with Scope 3 emissions¹ accounting for more than 90 percent of its total GHG emissions, as per an estimate by the British Retail Consortium.¹⁹

A typical retailer relies on a global network of hundreds of suppliers and their respective supply chains to keep its business going. In today's turbulent operating environment, coupled with increasing complexity due to omnichannel operations and hyper-personalization of consumer needs, the traditional supply chain management system can no longer sufficiently support retailers' evolving business needs. Retailers need to leverage digital supply chain solutions powered by big data, advanced analytics, AI, automation, robotics, and IoT to make more informed decisions, respond quickly to changes, optimize operations, and enhance customer and supplier satisfaction. According to findings from a recent Deloitte survey, eight out of 10 retail executives said they plan to make moderate to major investments to modernize their supply chain in 2023.²⁰

By adopting a digital supply chain solution such as *Microsoft Dynamics 365 Supply Chain Management*, retailers can be more efficient and productive in their supply chain management. With Microsoft's cloud-based, data-driven, AI-powered, full-visibility ERP solution, retailers will also be more agile and adaptive to changes and disruptions, while reducing carbon impact and ensuring inclusivity and ethical operations of their suppliers and partners.



Improved Efficiency & Productivity:

Advanced algorithms and predictive modelling enable retailers to analyze historical data, market trends, and customer behavior, leading to more accurate demand forecasting and inventory planning. Real-time data from various sources, including social media and IoT devices, helps retailers quickly identify shifts in consumer demand and adjust their plans accordingly. This reduces understocking and overstocking, leading to more sales and cost savings.

Digital tools help optimize delivery routes and reduce transportation costs while ensuring on-time deliveries. This is important for customer experience, as 70 percent of customers are less likely to continue doing business with a retailer that fails to inform them of delays.

The Warehouse Management System (WMS) module optimizes warehouse operations, from order picking to storage, improving accuracy, efficiency, and productivity. Digital technologies like robotics and automated conveyor systems increase throughput and reduce labor costs.

Automation of routine processes such as order processing, invoicing, and inventory management reduces paperwork and labor costs, leading to overall improvement in efficiency. It also frees workers from tedious and laborious tasks so they can focus on more meaningful work.

Sustainability efforts increase and costs are reduced by enabling a circular economy with product take-back programs and used parts recovery from manufactured items.

Increased Agility and Adaptability:



The solutions support omnichannel operations by providing full inventory visibility and fulfillment across channels, such as buying online for store or roadside pickup.



Unified real-time data, advanced analytics, and AI allow retailers to track product movement and detect potential supply chain risks and disruptions early on, so they can take timely measures to mitigate, increasing resilience and competitiveness.



By running critical manufacturing and warehouse processes 24/7 on the Cloud or at the Edge, retailers can scale effectively and ensure business continuity even in remote locations.

More Effective Supplier Management:



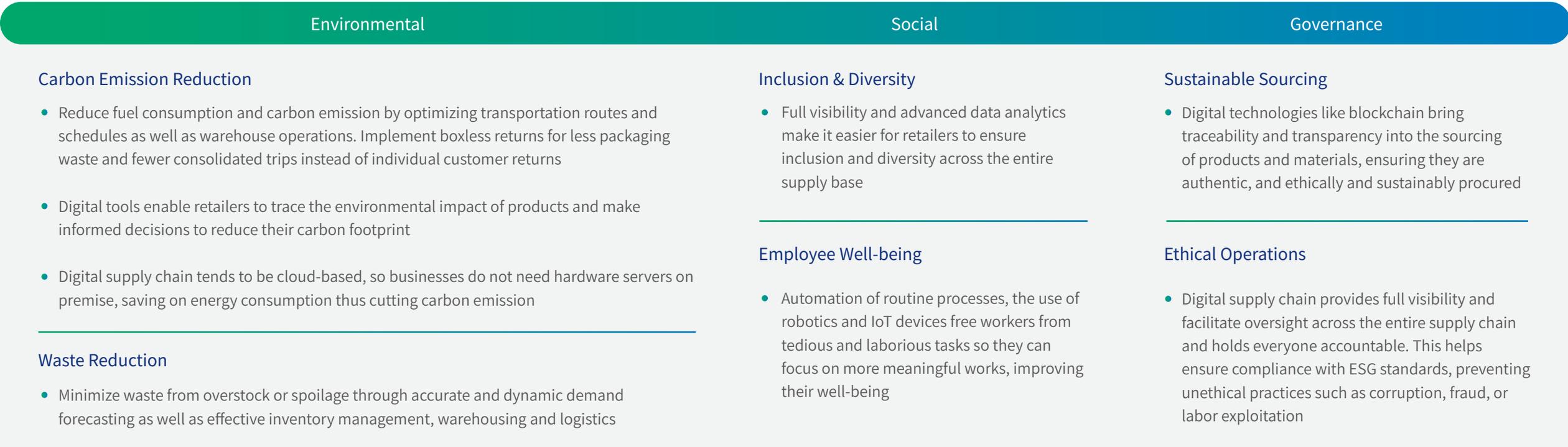
Digital platforms facilitate easy communication and collaboration, fostering stronger relationships with suppliers and helping all parties work together more efficiently.



Big data and real-time visibility enable retailers to monitor and manage supplier performance more easily and effectively.

In addition to the above-mentioned business benefits, a digital supply chain management solution can also afford retailers many social and environmental benefits (figure 5), helping them create more inclusive and sustainable supply chains. This, once again, demonstrates the dual impact of Green Digitalization.

Figure 5. The ESG Benefits of Green Digitalization Solutions for Supply Chain Management



Green Digitalization Promotes More Responsible and Sustainable Consumption

The remaining Scope 3 emissions in the retail value chain come from how customers purchase, consume, and dispose of products. The UN Environment Programme (UNEP) estimates that eight to ten percent of global carbon emissions are associated with food that is not consumed. In 2019, 931 million tons of food were wasted, of which around 61 percent occurs at the consumer level, while 690 million people are affected by hunger, and three billion are unable to afford a healthy diet.²¹

Responsible and sustainable consumption is necessary and beneficial for both people and the planet, contributing to improving food security, cutting pollution, saving money, reducing the pressures on nature and climate, and creating opportunities for economy and society. Retailers, given their central position in the value chain, can play a key role in promoting responsible and sustainable consumption. Here are some examples of how digital tools can help.

Offer Sustainable Choices:

Retailers can establish digital channels to reduce the customers' need to visit physical stores for their purchases, cutting related carbon emissions. Digital channels also allow retailers to reach a broader and more diverse customer base, including individuals with disabilities or those in remote areas, improving accessibility.

Businesses can offer more sustainability-oriented products, such as fair-trade products, plant-based products, locally sourced products, and products from small farms and minority-owned brands, promoting healthy living and social fairness.

Retailers can offer virtual try-on or augmented reality (AR) shopping to save customers time and provide more convenience.

Raise Awareness of Sustainability:



Retailers can use their websites, mobile apps, and even ESLs to provide detailed information about the environmental impact of their products. This may include materials used, energy efficiency, carbon footprint, and recycling instructions.



Retailers can use QR codes on product packaging to help customers understand the journey of a product from production to delivery. This can include details about sustainable sourcing, the use of recycled materials, and the overall eco-friendliness of the packaging. This increased transparency enhances trust and brand reputation.



Retailers can create engaging and informative content about sustainability, eco-friendly practices, and responsible consumption. This content can be shared on their website, social media platforms, or through email newsletters, reducing the need for printed materials.



Retailers can host virtual events, webinars, or workshops on sustainability topics to directly connect with customers and promote eco-friendly behaviors, such as saving energy, composting, or upcycling old products.

Promote Sustainable Behaviors:



Retailers can incorporate sustainability into their loyalty programs by offering rewards or discounts to customers who choose eco-friendly options, such as using reusable shopping bags, purchasing sustainable products, or opting for e-receipts instead of paper ones.



Retailers can gamify sustainable actions and encourage customers to participate in eco-challenges. For instance, a grocery store could launch a mobile app that tracks customers' eco-friendly purchases, rewarding them with points that can be redeemed for discounts or donations to environmental causes.



Retailers can create online communities where customers can share their sustainable practices, exchange ideas, and collaborate on local environmental initiatives. This fosters a sense of belonging and inspires others to take part in sustainability causes.

By engaging consumers through these digital means, retailers can not only build stronger relationships with their customers and amplify their sustainability contributions, but they can also enjoy substantial business benefits: favorable reputation and competitive differentiation, extended customer reach, increased customer loyalty and advocacy, bigger cost savings, and improved efficiency and adaptability, all leading to greater financial success. Green Digitalization synergy, once again, demonstrates how digitalization and sustainability can reinforce each other and become retailers' dual growth engines.

Guiding Principles for Green Digitalization

Digitalization and sustainability are on-going endeavors and there are common traits among the leaders in these efforts (figure 6).

Figure 6: Guiding Principles for Green Digitalization

- + Adopt an ecosystem view. Embed sustainability consideration in business decisions throughout the entire value chain.
- + Understand the organizational and people impact of digitalization. Make digital solutions work with people, rather than around or against them.
- + Take an integrated approach and make sure that all technologies and solutions work in tandem to achieve optimal results.
- + Enforce vigilant governance on data protection and customer privacy. Ensure compliance with regulations and best practices.
- + Make sure to evolve operating models and business processes with technology deployments to harness the most value.
- + Keep an eye on the impact in the design, manufacturing, application, and deployment of the technological solutions themselves.

The above examples discuss only a few Green Digitalization solutions across the retail value chain. Many more digital solutions are available in the marketplace. This report presents these representative examples of Green Digitalization to encourage retailers to consider digitalization not only as a tool for business growth but also an enabler of sustainable development. In recent years, we have witnessed a growing number of leading retailers putting Green Digitalization into practice and achieving remarkable business and sustainability results. In the following pages we would like to share the success stories of three such leading retailers, hoping to inspire more retailers to act and to jointly drive the retail industry's further Green Digitalization.



It is estimated that by 2024, the number of devices managed on Hanshow's cloud-based SaaS platform will exceed

100 Million,

another astonishing industry record.

Retailers in Action

The Inspiration: Trial of a refillable solution in a UK store

A leading UK-based supermarket partners with Avery Berkel and Hanshow to promote refillable solutions for supermarket shopping in the UK

Strategic Aims:

- To create innovative "Refill Zone" in the store to make operations more efficient and sustainable
- To improve the shopping experience for customers
- To promote zero-waste shopping among customers

The technologies offered by Avery Berkel and Hanshow empowers supermarkets to deliver on their commitment to zero-waste retail through its bring-your-own-container "Refill Zone".

Value Created:

- Increasing productivity and efficiency by managing price and promotion digitally and dynamically.
- Reducing environmental impact by eliminating the use of paper labels and single use packaging.
- Promoting more sustainable shopping by using ESL to easily display the price discount of the refillable version of the same product allowing customers to buy the exact amount they need thus reduce unnecessary waste at home.

Actions Taken:

- Used ESLs instead of paper labels to digitally display and manage prices, promotions and other product information in real-time
- Incorporated the use of bring-your-own-container to enable shoppers to weigh and buy their own desired quantities.
- Launched the "Refill Price Promise" program which guarantees lower prices for refillable versions of the same product to help customers shop more sustainably

The solution enables supermarkets to reduce the cost and time of manual product updates, while allowing the retailer to make real-time changes to prices and promotions – prices on ESLs and scales are updated in tandem for price consistency.

The Inspiration: "Low-Carbon Smart Stores" by a Leading Chinese Retail Chain

The multi-format retail chain created over 200 low-carbon smart stores in China in 2021.

Strategic Aims:

- To provide seamless, consistent omnichannel shopping experience for the customer.
- To improve efficiency and productivity of store operations through digitalizing and standardizing routine works.
- To make store workers' jobs easier and more productive.
- To reduce the environmental impact of store operations

Value Created:

- Improved customer satisfaction and boosted product sales by providing customers with seamless, consistent omnichannel experiences throughout their shopping journey.
- Improved operational efficiency by digitalizing and standardizing various routine processes in the store, including product display, price update, on-line order picking, and product on-shelf-availability (OSA) management.

Reduced environmental impact by replacing all paper price tags with ESLs, and all paper signages with digital displays. ESLs and digital signages have been rolled out in 200+ of its stores across multiple formats.

Actions Taken:

- Deployed Hanshow's electronic shelf label (ESL) solution which is seamlessly integrated with its online and offline systems, providing seamless omnichannel experience for the customer.
- Integrated Hanshow's ESL system with its online order & offline pick-up app. When store order pickers come close, LED light on the ESL will flash rapidly, helping them quickly find the items for pick-up. There are seven different kinds of LED light indicating different order types, adding more efficiency.
- Rolled out an innovative "Green Signage" program that replaced paper-based price tags, advertisements, posters, and direction signs with digital displays.

The Inspiration: Customer-Friendly Smart Stores in Japan

A Japanese supermarket chain, has created 89 customer-friendly smart stores in Japan since 2018 by deploying smart shopping carts from Hanshow's affiliated company.

Strategic Aims:

- To provide the best shopping experience for customers.
- To increase store sales and reduce labor costs.

Actions Taken:

- Deployed 9,115 smart shopping carts equipped with built-in membership card reader and product barcode scanner across 89 stores. On average, 41.2 percent of store customers are using the smart shopping carts. The cart can:
 - alert customers on-the-spot in case he or she forgot to scan an item.
 - allow cashless checkout so customers do not have to queue up to pay.
 - free up store staff from cashier works.

Value Created:

- Created a stress-free shopping experience for customers through cashless checkout. Checkout time was reduced by 74 percent. Customers can also see immediately the total value of the items in the cart, so they can keep only what is really needed.
- Improved store sales – thanks to no-wait checkout, customer throughput during peak hours was increased by 1.7 times, and store visit frequency was increased by 13.8 percent, resulting in more store sales.
- Improved marketing effectiveness - based on the items already in the cart and the customer's location in the store, it can make targeted product recommendations on the screen which can lead to more sales opportunities.
- Reduced the number of hours staff has to spend at the register so they can spend more time attending to the customers. Labor cost was reduced by 20%.

Retailor Testimony:

The retailer's challenge lies in how to integrate the physical world, IT, and AI to create a shopping environment that is both convenient and enjoyable for our customers. At the core of the Group's retail digital transformation, and ultimately at the core of our business, is our unwavering commitment to best serving our customers. That is exactly why we have been actively pursuing retail and IT integration since the 1980s. --- Chairman of the Retailer

The adoption of "smart shopping carts" not only enhances customer convenience but also improves the operational efficiency of our dedicated staff. By advancing smart store technology, our overarching goal is to invigorate the entire retail industry. ---Executive Officer and General Manager of Public Relations Office of the Retailer



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03

LEVERAGING EMERGING
TECHNOLOGIES TO ACCELERATE
THE RETAIL INDUSTRY'S GREEN
DIGITALIZATION

The retail industry has always been evolving to meet changing consumer needs and market dynamics. In recent years, emerging technologies have been disrupting the retail landscape, reshaping the way businesses operate and interact with customers. AI, VR, robotics, and IoT are opening exciting opportunities for retailers to enhance their operations, improve customer experience, and drive sustainable growth.

This chapter examines the potential applications and benefits of some of the most promising emerging technologies that will accelerate the industry's Green Digitalization.

Artificial Intelligence (AI), Virtual Reality (VR) and Augmented Reality (AR)

Generative Artificial Intelligence (GenAI), differs significantly from traditional AI in its capabilities. Traditional AI is like a toolbox with many specialized tools, each of which can only do one specific thing. GenAI is more like a multifunctional robot. The bot is able to learn how to use different tools and flexibly handles a variety of tasks, from writing articles to solving math problems to simulating conversations

Retailers are increasingly optimistic about GenAI, recognizing its transformative potential in enhancing customer experiences and streamlining operations. They view GenAI as a tool for personalizing shopping, predicting trends, and managing inventory efficiently. Its ability to generate creative marketing content and provide intelligent customer service solutions is particularly valued. GenAI has big potential power in store sustainability operation, the scenario can be:

Inventory and Supply Chain Management: By predicting trends and analyzing consumer behavior, GenAI can optimize inventory levels, reducing overstock and stockouts. It aids in efficient supply chain management by forecasting demand and adjusting orders accordingly.



Visual Merchandising and Product Design: GenAI can create virtual product models and design patterns, helping retailers visualize merchandise before production. It can also suggest optimal store layouts and product placements based on consumer behavior analysis.

Dynamic Pricing and Discounts: Retailers explore optimizing pricing and discounts based on real-time demand, competitor pricing, and individual customer preferences. This could enhance sales while offering personalized deals.

Optimize Logistics and Delivery Routes: Retailers explore utilizing AI for route planning and fleet management to minimize fuel consumption and delivery times. This contributes to sustainability and operational efficiency.

Reduce Food Waste: Predicting and preventing food spoilage by analyzing historical data and real-time inventory levels using GenAI models can minimize waste and environmental impact.

Advanced Robotics

A robot is a mechanical or virtual device that can perform tasks autonomously or semi-autonomously, often mimicking human actions or responding to external stimuli. Robotics can be used in many ways: to automate labor-intensive tasks in warehouses, clean shop floors, deliver marketing messages in stores, and patrol stores to deter theft. Advances in technology enable them to do even more.

According to Amazon's June 22, 2022 news release "look back on 10 years of Amazon robotics", the e-commerce leader has been using robotics in its fulfillment centers since 2012 to meet customers' delivery time requirements while making work safer and more productive for its employees. For example, Amazon created *Cardinal*, a robotic work cell that uses advanced AI and computer vision to select one package out of a pile of packages nimbly and quickly, lift it, read the label, and precisely place it in a GoCart to send the package on the next step of its journey.

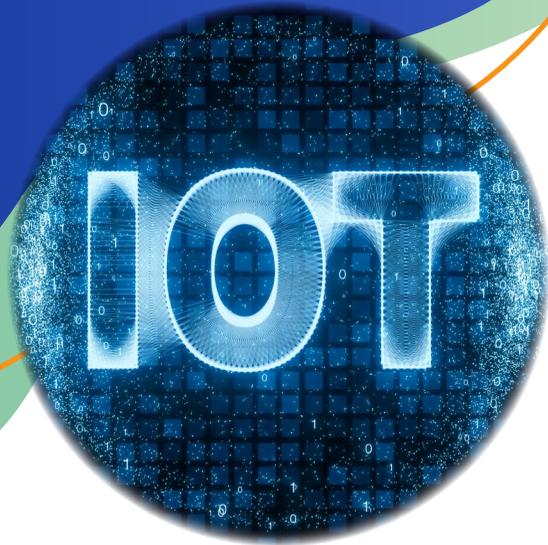
Cardinal reduces the risk of employee injuries by sparing workers from lifting and turning large or heavy packages or complicated packing in a confined space. *Cardinal* also helps shorten processing time by allowing package sorting to happen earlier in the shipping process and by converting batch-based manual work into continuous, automated work.

This is another great example of Green Digitalization where technology helps business achieve productivity and efficiency, while improving customer and employee experience by providing faster delivery times and a safer workplace.



Internet of Things (IoT)

IoT in retail implies deploying networks of interconnected devices and sensors in stores, warehouses, and logistics, providing retailers with real-time data about customer behavior, store operation, and supply chain management that can lead to more informed and timely business decisions. IoT can be used in numerous retail scenarios, such as waste reduction, inventory management, logistics optimization, and facility management.



Monitoring of Cold Chain

Grocers lose an average of \$70 million a year to perishable food spoilage alone, causing significant income erosion. In order to safeguard perishable goods, guarantee optimum freshness, and minimize waste, environmental sensors can be used in cold chains to monitor ambient conditions such as temperature, humidity, air quality, light intensity, and other environmental factors inside a storage facility, cargo container, delivery vehicle, or store.



Smart Buildings

This is an increasingly common use case for IoT; it is particularly beneficial for retail chains who tend to have many stores with long business hours and varying store traffic throughout the day. Store managers want to keep operating costs low, and IoT sensors allow them to remotely monitor who is in the building as well as equipment and resource use. Smart buildings enable them to configure the HVAC system (typically the largest energy consumer in a retail store), lighting, and other infrastructure to react automatically as people come and go. This keeps employees and customers comfortable, preventing wasteful power consumption and reducing reliance on manual adjustments.

As the retail industry continues to evolve, embracing emerging technologies becomes paramount for staying competitive and meeting customer expectations. As technologies continue to advance, retailers should expect to see even more innovative applications and widespread adoptions in the industry.

By leveraging these emerging technologies, retailers can elevate customer experiences, optimize operations, and drive business growth and sustainability. However, it is essential for retailers to stay conscious of the potential downsides of these technologies and ensure they are used responsibly. For example, retailers need to enforce strict governance on customer data and privacy protection, and provide re-training and up-training to workers who were displaced due to deployment of advanced technologies. In this way, retailers can enjoy the full benefits of true Green Digitalization, not just digitalization as an end in and of itself.

04

A CALL FOR
JOINT ACTION IN
ADVANCING THE RETAIL
INDUSTRY'S GREEN DIGITALIZATION



Green Digitalization will create a faster, smarter, and greener retail industry, but this is only possible with close collaboration between all stakeholders, including retailers, technology companies, consumers, investors, as well as governments and NGOs.

Retailers, having recognized the scale of the environmental and social impacts the industry makes and the urgency of addressing them, are taking actions. Leading retailers such as Walmart, Ahold, and Woolworths have created Chief Sustainability Officer roles dedicated to leading their sustainability efforts. In 2016, Walmart signed up to the Science Based Targets initiative (SBTi); today, 276 retailers have done so, and among them 104 have made commitments to near-term targets.²²

Technology companies, already supporting retailers in this arduous undertaking by providing them with Green Digitalization tools and by making their own operations greener, can do more with their expertise, resources, ability to develop cutting-edge solutions, and strong influence on policymaking. Here is what we would like to propose:

Champion Innovations in Sustainable Technologies

Continue to invest in R&D to develop and deploy innovative technologies that can improve sustainability and efficiency in the retail industry., use technologies such as IoT, AI, and advanced analytics to help retailers optimize their supply chains, reduce waste, save energy, and enhance customer experience.

Foster Openness, Inclusivity & Collaboration

Commit to building an open, transparent, and collaborative ecosystem to collectively solve the challenges facing the retail industry by sharing resources, knowhow, and best practices. Leverage respective strengths and expertise to develop comprehensive solutions to support retailers' Green Digitalization.

Increase consumer awareness on sustainability and green consumption by enabling retailers to provide more information about products' sources, production processes, and environmental practices so consumers can make greener choices.

Work with governments, industry, and non-profit organizations to develop and implement policies and standards that support sustainable growth and green consumption, participate in related initiatives, and contribute resources and insights to policy development.

Encourage all stakeholders, including consumers, retailers, supply chain partners, and communities, to participate in sustainability initiatives. Actively collect and incorporate their feedback to advance common goals.

Champion CSR and the Environment

Support environment-related initiatives, but also support community development projects to ensure that business activities have a positive social impact, advocate fair trade, safeguard worker rights, provide safe working conditions, and support workforce inclusion and diversity.

Enhance retailers' capabilities in sustainability and digitalization through education and training programs, share success stories, and provide tools and resources to help them leverage new technologies effectively to achieve their business goals.

Measure Success and Drive Continuous Improvements

Use tools and metrics to quantify sustainability achievements and share this information publicly, as well as strive to excel through continuous learning and improvement.

Stay Agile and Adaptive

Remain agile and flexible, closely monitor market trends and consumers' behavioral changes, and adjust strategies and technologies to best support the sustainable growth of the retail industry.

Gear Up for the Future

Prioritize investments in new technologies, developing talents, building partnerships, and participating in global sustainability initiatives.

END NOTES:

1. GHG scope definition:

- Scope 1 are emissions directly from a retailer's operations.
- Scope 2 are emissions from energy and fuels purchased to support a retailer's operations such as heating, lighting, refrigeration, and delivery fleet. As Scopes 1 and 2 are under a retailer's direct control, they are the priority in a retailer's sustainability efforts.
- Scope 3 are emissions that occur in a retailer's value chain, upstream to manufacturers and distributors, downstream to consumers and disposal. This scope typically accounts for the majority of retail value chain emissions, thus must also be tackled in order to achieve net zero and keep the climate to within a 1.5-degree change.

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About Hanshow

Hanshow is one of the global leaders in digital solutions for the retail industry. Since its founding in 2012, the company has independently researched and developed innovative software and hardware integration solutions, as well as integrated resources across the entire industry chain. Headquartered in Jiaxing, Zhejiang, Hanshow has research and management centers in Beijing, and branches in Shanghai, Shenzhen, and other locations worldwide, including France, Germany, the Netherlands, the United Kingdom, the United States, Australia, New Zealand, Singapore, and Vietnam.

About Intel

Intel (NASDAQ: INTC) is an industry leader that focuses on developing technologies that change the world, drive global progress, and enrich human lives. Driven by Moore's Law, Intel is dedicated to the continuous innovation of semiconductor design and manufacturing to provide customers with solutions to major challenges. By integrating intelligence with the cloud, network, edge, and various computing devices, Intel unlocks the potential of data and helps improve both business and society. For more information on Intel innovation, refer to our China News Center at newsroom.intel.com and our official website at intel.com.

About Microsoft

Microsoft (Nasdaq "MSFT" @microsoft) enables digital transformation for the era of an intelligent cloud and an intelligent edge. Its mission is to empower every person and every organization on the planet to achieve more.

About E Ink

E Ink is the originator, pioneer and commercial leader in ePaper technology. The company delivers its advanced display products to the world's most influential brands and manufacturers, enabling them to install extremely durable, low power displays in previously impossible or unimaginable applications and environments.

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