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Chapter 11: Artificial intelligence-powered transformation across retail, government, and enterprise institutions

11.1. Introduction

Despite the massive economic disruptions and changes caused by COVID-19, an ongoing technological revolution continues in the world of information technology. Data analysis innovations such as big data technologies, advanced analytics, artificial intelligence, and AI-powered automation have changed the world of business processes and decision-making. Growing sections of enterprise functions are becoming data-driven, thereby increasing productivity, enhancing innovation capabilities, and lowering cycle times and risks. Digital technologies allow these tried and tested best practices to be applied to a wider range of sectors and industries. High-performance computing technologies are enabling the development of AI systems that can lower the costs of executing various operations and executing more complex operations that had previously not been automatable (Eggers et al., 2017; Bughin et al., 2019; Davenport et al., 2020).

This disintermediation effect is leading to fundamental changes in the structure and functioning of the ecosystems of industries and sectors. With the widespread penetration of mobile and sensor technologies, enterprises and other organizations are now under constant observation by their stakeholders – customers, shareholders, partners, regulators, and so forth. This opens up the potential for organizations to eliminate sections of the value chain that do not provide high value, and to focus on high value, high visibility activities that shape trust and reputation in the community. In this chapter, we explore the potential of various AI-Powered transformation initiatives that can fundamentally impact various industry and functional domains – including areas of public policy, citizen services, security and defence, financial services, large-scale manufacturing, supply chain and logistics, trading and distribution, and customer services (Mathew et al., 2023; Mathew et al., 2023; Islam et al., 2025; Khajuria, 2025).

11.2. Understanding AI Technologies

This section introduces general AI technologies which will be used in subsequent sections when examining use cases in retail, government, and enterprise institutions. This section presents an overview of machine learning, natural language processing, and computer vision.

Fig 11.1: AI and Automation are Making Retail Experiences

AI is technology that uses algorithms to identify patterns in data, from which it draws inferences, enabling the delivery of a service or product that mimics human thought processes. For our purposes, we will focus on a few specific AI technologies that are popular and commonly known. AI is a class of algorithms that aim at mimicking human intelligence. AI in its more general form refers to algorithms that are programmed to maximize the success of a particular action based on extensive training data. For example, algorithms are developed that have the objective of maximizing winning poker hands by training on billions of poker hands. AI can, therefore, be supervised or unsupervised, given that humans assign perceived values to "success" in the case of a

supervised implementation. AI can be implemented by using vast amounts of structured data, but it can also be unstructured data such as playing games or running robots.

Machine learning (ML) is a subset of AI that can either be supervised or unsupervised. There are different forms of ML, but the focus today is on deep learning. Deep learning (DL) is the more recent and increasingly popular home of AI. DL is a subfield of ML that uses multiple layers to transform data; high-quality feature extraction is performed automatically. Previously, in ML, human experts would spend significant time to extract the important features of data in order to create algorithms that could be trained successfully. By using multiple layers and reducing the need for expert feature selection, DL enables a wider range of data types including computer vision and natural language processing to be a part of AI.

11.2.1. Machine Learning

Understandably, the wide array of new market innovations enables any organization to build AI applications for a broad set of use cases. Several suppliers incidentally exist catering to different features and functionality. Machine learning is broadly categorized into three types of functionality such as supervised learning, unsupervised learning, and semi-supervised learning. Semi-supervised learning uses a small amount of labeled data combined with a large amount of unlabeled data for supervised learning. It provides a middle ground between unsupervised and supervised learning.

Machine learning is the underlying technology that enables firms to fine-tune their algorithms for specific industry or country market segments through the utilization of available labeled data. Supervised machine learning requires large amounts of labeled data to train predictive models for specific tasks, which takes extensive resources and time. Unlabeled data is abundant in today's data-rich world. The recent breakthrough in deep neural networks and representation learning, combined with its ability to count on unlabeled data, has elicited an unparalleled interest in unsupervised learning, where many breakthroughs in vision and breakthroughs in natural language processing have happened. There's currently a supposition understood behind doors that massive models are required in NLP and other fields for really allowing companies to exploit their terabytes of unlabeled data.

Several other interesting breakthroughs have recently happened in both supervised and unsupervised directions. There are more prospects of Supervised Learning for critical tasks in NLP, vision, and speech, than any other tasks in either further unsupervised or self-supervised directions. There is a deep enjoyment of learning SL, and as one immodestly sees with submitted results for most of the widely studied neurally modeled SL tasks, there is excellent interest in such classic to expert users.

11.2.2. Natural Language Processing

In this section, we will cover Natural Language Processing technology, especially in the presence of large language models. The AI technology stack is transforming the way organizations deploy and use technology for efficiency and better customer service. NLP technologies supported the development of specialized chatbots that drive semi-automated responses to customer queries as well as cognitive automation solutions where LLMs are augmenting or fully automating business processes.

As a branch of artificial intelligence, NLP deals with the interaction between computer systems and human languages. It involves the ability of computers to read, understand, and derive meaning from human language inputs. NLP allows for a richer interaction between business organizations and their consumers. Its most common applications are sentiment analysis used to detect negative reviews about products and services, and chatbots.

NLP works by processing an input of human language to extract the intent and entities using different methods such as dependency parsing, chunking, named entity recognition, and part of speech tagging. These methods help convert the raw input of words into a structure that identifies the user's intent and the entities associated with the particular action. For example, the action of ordering food implies that the user wants to add items to the menu and that the action is applicable to a restaurant company. Also, talking about a particular food would imply that the entity is a food item to be added to the restaurant's menu.

11.2.3. Computer Vision

A key component of many AI applications is computer vision, allowing systems to understand visual inputs, such as photographs or videos. This capability can be employed to give computers supervision of members of various categories within an environment or to allow these computers to respond intelligently to human visual cues. With the advent of deep learning, new architectures that leverage large amounts of data have been developed, permitting AI algorithms to be applied to a variety of visual problems, including categorizations of behavior, identification of objects, and elucidations of poses.

An example of computer vision within autonomous vehicles comes from a company that has developed an electric vehicle that uses a series of cameras to observe the vehicle's environment. Captured images enter the computer vision systems and are analyzed in various ways. Images that are determined to involve driving hazards, such as pedestrians or heavier and speeding automobiles in the oncoming lane, activate alerts for the vehicle user or directly initiate evasive maneuvers if the user does not respond in a timely

manner. Another example of AI computerized visual input is the use of cameras within video games and even gaming chat-rooms. A series of hardware-scheduled programs automatically run in the background, making it possible to detect subtle movements in the user's face, such as smiles, frowns, and eye blinks. This recognition process monitors the face expression in real time and sets up avatars and game scenes that anticipate behavior in the comfort of the user's home.

11.3. AI in Retail

Retailing transformed for the digital age employs AI to respond to changing consumer preferences while enabling the retailer to keep inventory low with optimum supply chain and logistics capabilities while constantly communicating with the consumer online for personalized products that form the basis for consumer purchases. AI in retailing is focusing on enhancing the customer experience through better personalization of offerings and continuously engaging with customers through all touchpoints in the customer journey – sometimes criticized as 'creepy' marketing but becoming acceptable to consumers as they appreciate the relevance of the communications received in their lives. AI in retail uses sophisticated customer interaction tools while increasing customer loyalty and providing a seamless omnichannel experience whether in-store or on digital platforms. Customer analytics powered by general and product-specific LLMs determines customer profiles, preferences, and behaviors, as well as the most effective engagement communications. With a trove of data available and one of the world's best data platforms in the warehouses and storefronts, retailers are able to provide customers with purchase information they are likely to need, and deliver it quickly with cutting edge logistics networks.

Equally important is inventory management, from the warehouse to store shelves, requiring a deep understanding of seasonal and local demand, plus enabling other retailers to compete against major players. Sophisticated algorithms enable such retailers to use products bookmarked, hashtagged, browsed, purchased and even returned by customers to determine the next likely purchase, and continuously program their supply networks to keep the target product in stock without delays. LLMs accelerate demand forecasting using public and proprietary datasets of consumer sentiment, sales history, digital shelf performance, competitive pricing, and public events.

11.3.1. Customer Experience Enhancement

It is no longer feasible to create the same store experience for every customer or customer segment. Instead, retailers today must tailor their customer experience to meet the needs and preferences of different customer segments. Research shows that predictive and

prescriptive analytics improve the identification of promising customer segments as well as the design of highly relevant, personalized promotions. Retailers looking to personalize the customer experience can leverage AI to analyze customer data stored in supply chain systems or customer relationship management tools in order to generate insights into customer intent. An AI-driven tool offers immense potential for personalized marketing at scale, leading to improved conversion, higher brand loyalty, and more significant customer lifetime value.

Additionally, well-designed AI systems can dynamically personalize each interaction through the course of a customer's journey. They can do this throughout the customer lifecycle, from attracting new customers, to enhancing their experience during fulfilment and service, and even extending customer lifetime value through retention and re-engagement initiatives. In the pre-purchase phase, companies can improve messaging and drive higher traffic and conversions through online media including display advertising, paid search, paid social, or owned channels. Furthermore, they can drive more sales through their online ecommerce platforms by increasing the relevance of website content for visitors. During the purchase phase, AI can drive incremental sales by optimizing how products are presented to customers both online and in-store. Furthermore, AI can utilize personalized recommendations to drive cross-selling and upselling through marketing campaigns or product search results.

11.3.2. Inventory Management Optimization

Artificial Intelligence tools can process vast amounts of information without the oversight of human decision-makers. It has already proven invaluable in solving problems with logistics and inventory management. AI looks at large data sets to determine trends in how much inventory is appropriate and how to manipulate and monitor inventories that are viewed as too thin or too fat. Most sectors of the retail economy must cope with inventory problems as stores must maintain sufficient sales stock for daily customers, while at the same time, controlling the costs of storage and insurance against damage. For e-Commerce retailers, optimization of inventories is even more critical because products are not on the sales floor where customers can witness the available offerings. All retail businesses are also subject to the vagaries of external shocks such as new tariffs or shifts in exchange rates that can affect the cost and availability of imported products. Sharp changes in demand or supply that go unrecognized by inventory managers can lead to stockouts or surpluses. In practice, inventory management optimization is how much product to order, when to order it, and how often those orders should occur. Inventory optimization models are constructed around maximizing order-fill rates, minimizing order-costs, and minimizing carrying

costs, such that the overall business strategy of the organization is functioning efficiently.

AI is used in retailing to estimate demand and order lead times. Order lead times are the delays suffered from the time an order is placed until it arrives at the seller's dock and is ready to be transported to the customer. Larger and larger order lead times are required by e-Commerce retailers due to last order backlogs, so that optimization strategies must be regularly updated. AI works by improving the identification of key factors that determine order quantities, such as demand seasonality or the curtailment of a product's product lifecycle if it suffers the continual reduction of customer interest. Machine learning algorithms develop optimization models that are updated regularly to improve prediction accuracy. Such models then seek to identify the optimal order quantity for a particular product, in order to minimize costs. Products that the retailer sells, from shoes to groceries, also have different behaviors with some experiencing highly volatile demand, while others are much steadier.

11.3.3. Sales Forecasting

Sales forecasting is a foundational component in the way a retailer designs its business processes. An accurate retail forecast drives decisions and activities across a retail organization. At the corporate level, forecasts set expectations for revenue performance. This enables critical decisions to be made around profit targets, capital investment budgets, and growth expectations. At the operating level, forecasts guide purchasing, workforce scheduling, promotion planning, and many other activities. Retail is a unique business in which many companies experience similar buying patterns, profit landscapes, and cycles of growth. Forecasting is the only process that routinely attempts to aggregate large numbers of demand signals coming from scattered locations and then project them into the future at the category, department, company-unit, and company-wide levels.

The forecasting process provides one central view of demand that balances competing perspectives within the organization. It is one of the most visible processes in the entire company. Retail budgets and targets are based upon the forecast. Gambling away hundreds of millions of dollars on the stock market is one level of risk, but guessing wrong on the retail forecast is another. Financial officers will remind you that more is at stake in an incorrect forecast than engaged in a gamble. A large error in a gamble may ruin a single person, while a large retail forecasting error often results in losses at every level of the supply chain. Many hands are involved in a planning mistake. Clearly, a forecasting error represents more than a numbers game. But, what will computers do with the forecast? All of these functions rely on the ability to accurately project consumer

demand: purchasing and procurement, production, distribution centers, replenishment, retail sales and capacity planning.

11.3.4. Personalization Strategies

The recent wave of advances in AI technology have enabled retailers to embrace a plethora of personalization strategies that make their offerings, along with the entire customer journey, more attractive to consumers. Unlike one-size-fits-all marketing campaigns, personalization strategies lead to impactful customer experiences that can drastically improve conversion, cross-sell and upsell opportunities, and decrease return on investment. Such personalization can happen at several levels of a retailer's offering, including recommendations for products found in a customer's shopping basket, other products that the customer has bought in the past, categories of products of selected customers, product attributes selected by the customer, and other items browsed by the customer within the store.

At the lowest level of personalization, retailers can recommend products found in a customer's shopping basket, along with deals for cross-selling or upselling the items. At the mid-level, retailers can recommend other products that the customer has bought in the past. For example, coffee makers can be promoted by retailers to their customers who come in during the holidays, as it is a classic gift product. At the next level, retailers can recommend additional products related to product categories, such as those recommending children’s and baby products to pregnant women or those strongly recommending office supplies to business customers. Such recommendations can be supported by product attributes selected by the customer. For example, if a customer is looking for special cholesterol-free cooking oil, cooking oil with this special attribute can be part of all other promotional deals.

11.4. AI in Government

The COVID-19 pandemic suddenly shifted many interactions between the citizens and their governments online. Not only did this require rapid adaptation of existing infrastructures, but it also has created huge amounts of data that are ripe for machine learning. Pandemic-related data include the management and share of public health data, tracking of citizen's movement on mobile devices, coordination of responses to social crises caused by the lockdowns and impact on GDP and economic growth, tracking of unemployment and responses by people as they received government assistance, design and tracking of experimental development of vaccines, studies of the adaptation of citizens and businesses to the relaxation of public health measures, coordination of the release of resources between states in case of COVID-19 peaks, investment as companies

faced bankruptcy, production of supplies using national companies and resources, vaccine distribution programs, hosting electoral processes, decision and coordination for border closure and quarantine, studies about the adaptation of citizens and businesses to the relaxation of public health measures, and investment strategies of countries willing to restore economic growth.

Artificial Intelligence offers solutions to serve more efficiently and to better design the services offered by government. Machine learning models make it easier to implement warning systems related to air quality, transport congestion, or natural disasters. Natural Language Processing processes information from social media amassing millions of citizens messages. Efforts to translate citizen engagement into public service delivery are also under way. These initiatives leverage AI to serve citizens better and faster by translating requests submitted in multiple languages, classifying requests into categories that trigger appropriate automatic responses or assigning unhandled requests to agents equipped with AI chat services. This kind of citizen engagement can also assess satisfaction with public services.

11.4.1. Public Safety Applications

AI is also showing its worth within the public domain. Safety and security are the most important primary functions of any government. To that end, AI can be leveraged in a variety of ways. These systems can be used to send out alerts for situations such as natural disasters, road closures, extreme weather, etc. These types of applications more fluidly push data out to the public, rather than wait for a response. They help cut through the noise so that the alerts that relate to safety are visibly presented in a timely manner.

Another way that AI applications can help with public safety is to be part of the infrastructure monitoring the public. These types of systems pull in images from various sources and apply AI to watch for developing situations such as active shooter surveillance, search and rescue, and arrival probe detection. Related applications can be used at government-assisted housing projects and public housing to detect violence in and related to those areas.

Another step in public safety is the related area of traffic control. AI systems can review traffic camera data and work on prediction algorithms to determine timing and modification changes to traffic light signaling. While these can often be tied to simply volumes of cars, AI can also factor in other elements including times of day, weather factors, holidays, and areas of distraction or prediction.

11.4.2. Resource Allocation

Budgets of governments are often tightly constrained. This budgeting process can lead to resource allocation imbalance wherein significant needs that can be addressed in a governmental intervention are poorly provided. These include needs that fall outside the power of profitability considerations of the private sector, as well as the unprofitable solutions to problems—often major—that are essential if societies are to flourish sustainably and equitably.

Learning algorithms and predictive models hold the potential of creating property-destructive avenues to impact multiple issues concurrently. Important areas of governmental interventions that face major inefficiencies are education, security, humanitarian issues, health, and poverty. These inefficiencies are created by subjective decisions based on limited quantifiable information, ignoring potential impact alternative proposals via quantitative cost-benefit analyses, and issues being handled in isolation, typically lagging significantly behind the pace of their emergence and escalating consequences. Learning algorithms powered predictions are different. They model problems, map local and global influences, and predict positive and negative impacts of decisions based on actual field data. They are forward looking, can be produced almost on demand, and warn governments and potential benefactors, allowing intended solutions to be initiated before the problems escalate.

This capability of learning algorithms has the potential of innovating the trial and error nature of governmental resource allocation, allowing it to become fine-tuned and data informed responding. The spontaneous and unintended consequences of resource allocation, along with the impact of policy initiatives, can be assessed and predicted as part of the same mapping and predictive model. Reducing the evidence gap can lead to considerable savings of governmental funds and incentivizing optimal solutions.

11.4.3. Citizen Engagement

Governments around the world are making increasing use of AI technologies to facilitate deeper connections with their citizens. Chatbots are used to help explain to citizens how elections work, whether in a given state residents must register to vote and, if so, how to do it, and how to find their polling place. The state of Utah has taken a similar approach with its voter-information chatbot. Various governments are using or are planning to use conversational-chatbot programs to help facilitate the local-questions-and-answers services that residents normally expect when making inquiries of their governments—or indeed any service organization. AI has also provided information about COVID-19 vaccines and how to access them via other interaction mechanisms, including direct messages, SMS text messaging, and Messenger channels. More broadly, a public-private partnership has created a new AI tool to simplify government registrations and applications across key government services.

Citizen-engagement AI tools are meant to make important information about government services available more conveniently to residents. Chatbots can be made much cheaper and easier to access than telephone calls, that have traditionally been the way that citizens access help from government services. AI tools can also help streamline information delivery to citizens in emergency situations, however, by providing rapid responses to citizen outreach. For example, social media monitoring combined with AI chatbots can respond to citizen questions during wildfires and hurricanes, respectively—and they have successfully tested these capabilities against simulated emergencies. With these tools in place, more seamless citizen-inclusive assistance from government can become available more quickly, expanding the roles of AI in enhancing citizen engagement.

11.4.4. Policy Development

As governments increasingly recognize the importance of considering citizen feedback in the policy-making process, there is a growing interest in developing ways to harness citizen input at scale. Researchers are experimenting with tools such as sentiment analyses of public social media, machine-assisted coding of inputs to public comment dockets, and "chat bot" style public engagement functions to explore citizen feelings and attitudes on specific issues or draft policies. This model is then used to identify topics of each one of several thousands of comments on a recent criminal justice reform proposed policy as well as summaries of each of issues raised in the inputs, which are almost exclusive to specific citizens' groups. Researchers explore an unsupervised machine-learning assisted classification method to classify comments about proposed rules. Others identify salient issues in comments about the proposed revisions to regulations using a combination of analysis methods.

These approaches assist but do not replace citizen input; the human and contextual insights provided by ordinary members of the public still matter. In some cases, the incremental changes in sentiment and feedback can be identified from past expressed frustrations. Special tools that streamline public comment opportunities can simplify participation for some groups. AI-enabled systems that leverage existing interaction points used by citizens can leverage insight-rich input. Such systems include social chat bots that engage users and ask questions based on key topics while maintaining an ongoing conversation: collecting insights as users naturally express ideas.

11.5. AI in Enterprise Institutions

Enterprise Institutions have different goals than government and retail. Enterprise Institutions are focused on providing value to their shareholders and are less invested in

the social value of their investments. Enterprises are seen as the main employer in their communities and are expected to participate actively in community engagement and upliftment initiatives. Enterprises benefit from providing products and services at a cost that exceeds their investments, allowing them to extract value and provide returns to shareholders in the form of dividends. A focus on share price maximization brings its own set of responsibilities. Enterprises form the backbone of a capitalist economy and should, therefore, earn profits if they are to survive. Major areas of AI deployment in enterprises include Operational Efficiency, Data-Driven Decision Making, Risk Management, Talent Acquisition, and Management.

Operational efficiency is the single largest good AI is expected to bring to enterprise institutions. In manufacturing, AI is being incorporated into robotics systems and becomes the backbone of Industry 4.0 and Smart Settlements. AI systems have shown remarkable skills in detecting faults in the manufacturing process and automatically adjusting for them. Autonomous AI systems can also monitor the progress of work tasks. By understanding what work processes take, AI can help identify bottlenecks and optimize work assignments to improve throughput. In logistics, major shipping chains are investing in self-driving trucks and managing network operations and demand planning using AI tools.

Manufacturing and logistics occupy a significant portion of an enterprise institution's activity – more than 70% in traditional industrial companies and over 30% in customer-centric companies. For these reasons, enterprise AI investments for the first five years are going to be entirely centered around enhancing operational efficiency. Functions such as supply chain optimization and inventory management are areas where AI has already demonstrated tangible results.

11.5.1. Operational Efficiency

AI-powered automation is applied across discrete, specifically designed systems as a means for enterprises and governments to improve their operational efficiency. Not only is the sheer volume of tasks completed by robotic process automation without assistance from humans staggering, but it is also incredibly useful to the operationalization and implementation of ideas, projects, and tasks. AI takes on low-complexity and, as identified by systems, high-frequency tasks that have, in the past, required some levels of human oversight. In so doing, RPA reduces the volume of labor resources required for enterprise and government back-office operations.

Enterprise institutions have taken on a decentralized-ergo-distributed operating model as means to innovate and drive more localized-go to market-execution of ideas and projects. Such models require the periodic input of data to generate insights around

performance that drive accountability and funding resource allocations without overwhelming executive teams at headquarters. RPA has stepped in to help address the balance between that oversight and localized performance. Insights borne of financial and operational performance across different branches enable predictable, scalable action to boost underperformance through resource reallocation or through direct scrutiny, and then design of necessary actions to ameliorate performance degradation. Such oversight at headquarters, combined with RPA as a force-multiplier to help local teams, enables localized departures from or failure to meet expected performance criteria to be quickly resolved.

11.5.2. Data-Driven Decision Making

While deliberate decision making may be central to the way leaders operate, it is bolstered by data of various types. AI is particularly good at analyzing large quantities of data from disparate sources. Once integrated, the resulting data lakes can be tapped into by the enterprise whenever needed, including in decision making for operations. This reduces the burden on management for non-consequential issues. By tapping humans into the loop only for higher order decisions, this frees up capacities for deploying at higher unit value tasks that better justify the residual investments into human labor. Decision making is also expedited by automated or autonomous processes that deploy decision support AI. This is common for high value and regularized transactions. Proprietary decision support tools allow customers or partners to set criteria and interface with the enterprise without any human involvement. This eliminates the need for conducting interorganizational interactions during evenings or weekends, or from employees located across the world with large time zone differentials. Embedding AI decision support into partner or customer systems can also speed transactions up. For example, logistics operations can tap AI embedded in shipping clients or in suppliers' order entry or ERP systems for better pricing and scheduling of logistical operations.

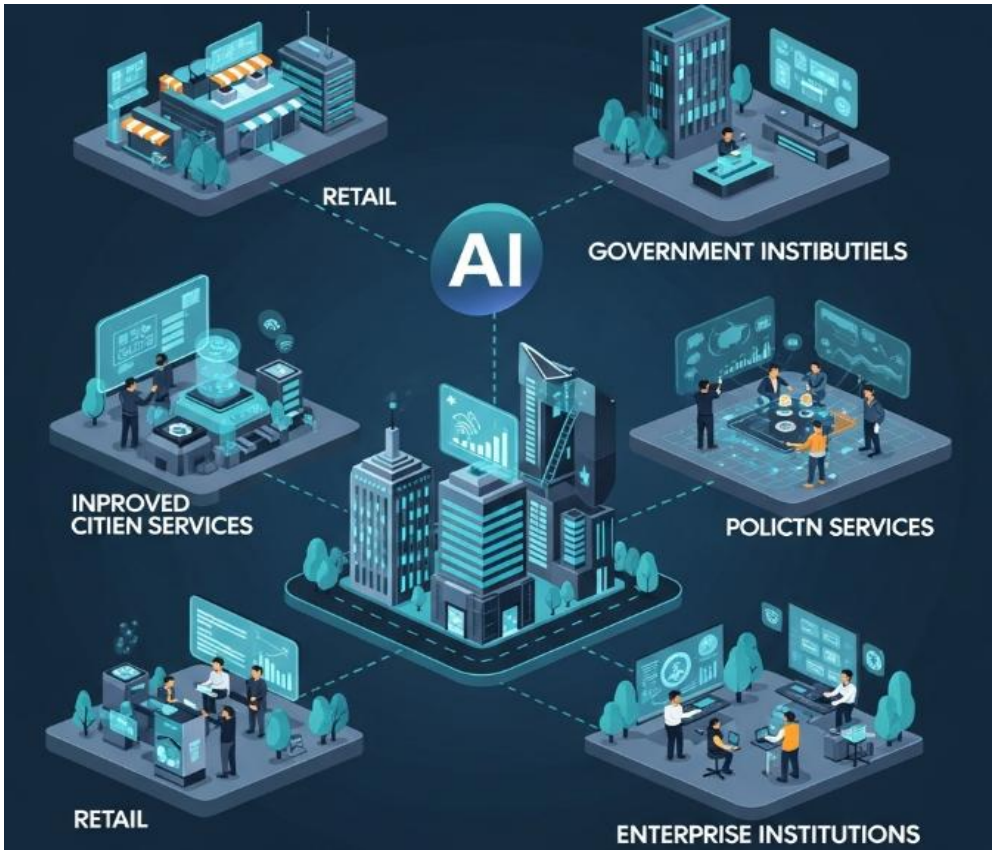

Fig 11.2: AI and Automation are Making Retail Experiences

11.5.3. Risk Management

The importance of risk management has escalated in recent years, following the COVID-19 pandemic and the rise of social unrest, prompting businesses to rethink their strategies for economic resilience. Still in doubt about whether to decentralize production closer to the market to minimize the risk of supply chain disruption, or seek centralized production to achieve lower production costs, business leaders are realizing that risk management is no longer just the responsibility of a dedicated function, but must involve all organizational levels. AI-enabled risk management solutions can help organizations identify relevant risk information, analyze it to differentiate between business-as-usual or catastrophic events, trigger alerts, and recommend appropriate courses of action. The firm has identified six major categories of AI-enabled risk management solutions, including fraud, modern slavery, IT, outsourcing, brand, and cyber risks.

Models for the detection of fraud and bribery risk have been around for decades, with many organizations deploying them to comply with laws and regulations in their

jurisdictions. At present, a growing number of firms is deploying AI- or ML-based models to help monitor and classify large transaction volumes to detect code-of-conduct policy breaches, including financial fraud and bribery. AI solutions can help organizations estimate, manage, and avoid potential modern slavery risks in their supply chains, thanks to the ability of natural language processing and image classification technologies to analyze a wide variety of unstructured data, including factory-size data, geographical and climate data, publicly available supplier reviews, news, and social media and blog posts, to assess different signs of forced labor.

11.5.4. Talent Acquisition and Management

Talent acquisition is a perennial pain point for organizations across all professions and industries, a well-documented challenge exacerbated by both the great resignation and shortage of labor narratives. AI can help organizations rethink their talent strategy and approach, bringing focus to the efficiency and effectiveness of workforce utilization. Many AI applications will help reduce bias in hiring, scheduling, and assessment processes. Especially in the public sector, it has been requested that organizations enhance data processes and controls to help avoid both inadvertent and malicious bias. AI doesn't "decide," but it can be built to help indicate risk and mitigation or correction paths.

AI can be used to ingest assessments of an organization's performance, business outcomes, and talent pools and to analyze that data against attrition and retention trends. It can diagnose why employees leave and why newly acquired candidates fail to thrive. Organizations can use these diagnostic insights and predictive indicators to use data for developing customized upskilling and career-pathing journeys for employees based on their interests and experiences and an everchanging business landscape. The data can also indicate when people are likely to pivot, as well as where they are heading, so organizations can align transitions and development with organizational needs to eliminate projected attritions or to utilize contractors.

For many organizations, using freelancers and gig workers has been their answer for engaging scarce talent. AI supports that approach by matching external resources with internal need-based requirements. Bots and agents can help organizations organize these sourcing and scheduling needs and get outsourcing or internal transition processes running. Taken together, these factors contribute to enhanced employee engagement, improved retention, and the efficient utilization of resources that make up the labor pool for an organization.

11.6. Challenges of AI Implementation

Governments have an important role in accelerating AI deployment. By supporting the construction of a connected AI fabric that breaks down data silos, stimulating the creation of ethical AI that safeguards privacy, avoids bias, and centers on impact, and building AI that is collaborative, governments can drive both the resilience agenda and transformative objectives more widely across the economy. They can also encourage AI deployment in strategic sectors through transfer budgets and funding initiatives for AI-based projects.

While the potential benefits of AI deployment are significant, there are important challenges that governments, and institutions in each sector, need to keep in mind when setting the frameworks to support transformation. These include concerns around privacy of citizen data, the risk of biased outputs from AI systems, the need to bring together core government legacy and external third-party data, and existing skill gaps in the wider workforce. While our conversations underlined that none of these challenges should prohibit AI investment in any way, if governments, and the enterprise sectors, want AI to achieve maximum efficiency, the issues should be considered and responded to as part of the overall investment strategy.

Further, as with all new technologies and capabilities, successfully implementing AI requires careful execution. Governments need to be cautious about how they deploy AI systems, and can look to the private sector for lessons learned. There have been algorithms that have backfired, such as those used for criminal sentencing. These systems perpetuated rather than reduced discrimination. If not properly implemented, AI can also amplify antisocial behavior through inadequately supervised chatbots and ad-driven social media that take advantage of the vulnerabilities of children and other groups. And, of course, data privacy breach problems have been raised by facial recognition technology.

11.6.1. Data Privacy Concerns

Data privacy represents one of the most significant concerns around the adoption of AI technologies. Combining data from multiple sources into a single AI system allows for the generation of new insights that can be incredibly powerful for businesses. However, this process also risks exposing sensitive data that can violate data privacy laws, handling and processing regulations. The first security regulation attempted to more definitively delineate how AI systems can and cannot use data to improve their decision-making processes. As AI technologies have become more mainstream, new privacy legislation is in the works that will impose many of the same rules – and potential business fines – as existing regulations. Additionally, AI is less predictable and less human-centered than

other forms of technology, and many organizations are thus concerned about how their own data is being used and where it may be going after it is input into an AI interface.

The “data economy” is fueled by organizations’ desires to unlock the potential of their data, but companies are increasingly unwilling to allow third parties access to their sensitive customer or organization information. In response, some tech vendors are implementing Federated Learning, a decentralized form of AI model training, which allows models to be trained using local copies of the data before the updates are sent to a central source. However, there are many technical challenges involved in Federated Learning, and it cannot be easily applied to every business use case. The technical requirements for advanced federated learning use cases are also prohibitive for many companies. Therefore, such organizations often have to weigh the potential benefits of third party data sharing with the risk of exposing sensitive data such as customer or organization information to loss, theft, or misuse. This consideration looms particularly large in government sectors, where such data may also involve national security issues.

11.6.2. Bias in AI Systems

AI systems leverage extensive historical data to develop predictive models. Given the complexities of human decision-making, the data that reflects those choices possesses inherent bias, which often mirrors the biases of the human decision-makers who generated them. To anticipate outcomes accurately, AI thus learns the bias inherent in those historical judgments. When a biased AI system is put into practice, namely, when machine predictions are employed to make decisions about real people, AI renders those biased predictions in the same way that human decision-makers once did. Bias enters into such implementations in two important ways. First, some AI systems are trained to mimic human judgment, relying heavily on biased historical data. Second, an increasing number of AI systems are trained to predict the likelihood of certain outcomes based on statistical correlations among a wide number of data fields. These outcomes may be anything from churn-rate predictions to identifying whether an applicant will pay back a loan. The determinants of those decisions, however, may wobble in ways that render the correlations unreliable.

The knowable elements of socially consequential predictions are also deeply complicated. Models that predict such things as whether a person is likely to commit a crime or not are often fraught with ethical and moral complexity, in addition to being socially consequential. It's also the case that even highly reliable models that predict whether someone is likely to commit a crime might yield very different ratings for people of different races. These ratings or predictions may also not be strongly correlated with actual outcomes, or the events may be very serious for some people and entirely trivial for others.

11.6.3. Integration with Legacy Systems

Organizations across sectors have legacy systems that include disparate data lakes and often run on outdated on-prem hardware and software. These outdated programs and systems create silos of data across verticals in an organization, making it hard for data analysis. Integrating AI with these older systems that operate on older software is often problematic, mainly because of the sheer volume of data integration that requires engineering support. Most organizations have not prioritized data integration, and some are still on early stages of maturity with respect to AI strategy and investment. Additionally, many systems are on-prem, making it harder to load the data into the cloud for AI pipelines.

Some organizations have created dedicated custom-made middleware that helps integrate data and perform near-real-time updates to the on-prem systems, but most are still in the dark.

Organizations have to work around the limitations of their legacy systems as they build their AI programs. Possible workarounds include defining clear business use-cases where AI can provide business uplift, even if the hierarchy of the data is disparate. Then, using a centralized decision architecture, it is possible to simply replicate the data on a centralized instance and use AI on the centralized model as the primary engine. With this architecture, the central AI model is only responsible for a single business output, relying on the legacy systems to execute the output. Most business decisions are business vectors such as sales uplift or fraud detection, whose lack of independence is not additive, operating as a single business output.

However, these workarounds create a centralized version of AI decision architecture with complex workflows necessary to send and receive data from the original systems, and it potentially limits the depth full vision and optimization capabilities of AI models to one business metric across multiple silos. As organizations invest more in cloud-based systems, these limitations will become less frequent.

11.6.4. Skill Gaps in Workforce

Digital transformation isn't just about cloud computing, data, and AI technology; it's about attracting and empowering people, a digital workforce. The challenge is that the pace of innovation within companies often exceeds what traditional education and engagement programs are able to deliver. A significant percentage of executives say their organizations do not have the skills to meet future business needs. Nearly half of current jobs are at risk of automation over the next two decades, and many workers may need new jobs by 2030. Communication, human complex skills, and creativity are among the most valuable skills that machines cannot easily replicate.

Resilient companies understand that taking care of talent is not just about hiring skilled people; they are focusing on reskilling, upskilling, and retaining key employees. Partners supporting organizations on their journey of digital adoption, specifically in their AI programs, are helping customers address skill shortages and gaps through localized workforce development programs, strategic partnerships with educational institutions, special training programs, certification and credential offerings, mentorship programs, and services that will accelerate talent transformation and modernization. But most importantly, organizations need to create an environment for retraining that promotes learning and development as business-as-usual, starting with executive priorities. Resilience will come through an ongoing commitment to people and by driving employee engagement and loyalty. The new AI workforce can also build trust and transparency in the use of AI systems, helping to overcome the skepticism of AI and increase adoption.

11.7. Future Trends in AI

AI is a tool that can be used for good or ill. Now that we're at a point where we believe we can honestly say that AI can create a meaningful impact, it's also time to pause and reflect, and think about our collective future. In this next section, we highlight a number of future trends for AI. These trends may not be complete, or represent an exhaustive list of everything we could think about, but they shine a light in the area we think there should be more focus around in the coming years.

Ethics in development is a focus currently, and there are multiple frameworks being proposed that use different tenets. For the foreseeable future, there will not be a comprehensive guide of what is ethical AI or what is unethical AI for all circumstances; instead, we will find that ethics will take the form of guardrails to navigate workflows and outputs. As such, organizations are increasingly investing in creating inertia around developing teams who have access to best practices. Best practices may fall into optimization principles, being clear about use cases, as well as feedback collection from users of the AI and those impacted by it. Some organizations are proactively investing in collecting feedback for AI-generated content, because they see this data is going to be critical for future iterations of fine-tuning LLMs.

AI has already been used for climate modeling and to optimize specific initiatives for lowering energy consumption in specific workflows. In the future, we will see applications served for managing supply and demand. At a smaller scale, AI can be used to help retailers create a better and more accurate match to demand than previous methods, reducing overstock or cash loss. And on the other side, AI can help regulate demand. This has been successfully used in different markets such as airline and hotel

bookings, and the technique uses dynamic steep surge pricing to disincentivize demand temporarily.

11.7.1. Ethical AI Development

What does it mean for a product to be Artificial Intelligence (AI) Driven besides the support of an A.I. model or framework? Despite AI being much more than ML, AI products are commonly seen through the Single ML Model lens. Impediments to AI development can occur at any stage of the AI product development cycle, be it in data collection, data processing, model building, model deployment, or model monitoring. Given the unique challenges associated with each of these steps, it is worth designing services and tools that help these limitations, independently or through pre-integrated development platforms that help across all stages. The onus lies with researchers and engineers to provide these capabilities; for this, the industry should invest heavily in coordinated research first.

Despite the possible and probable instances of errors or hazards, many applications of AI are deployed without a complete understanding of their capabilities and limitations. In a good number of cases, this may stem from a business or market reality, in which an AI application designed for workers has no great alternative and its users, who may understand that the AI system can fail and has limits, have to contend with those for their organization to make money. However, in critical areas such as healthcare and security, where lives are at stake, informing users of the limitations of AI is paramount. It is also critically important to reveal the limitations of AI when an AI agent operates independently. It is thus crucial to understand when a model is likely to fail, and doing so depends both on the model itself and the particular input to which the model is being applied.

If we are to take the industry's word for it, AI is about to revolutionize the way people, companies, and the world at large works. AI can, of course, address many tasks far faster and better than humans. Those of us who have spent time examining AI can see why it has taken off - none of us would want to go back to manually driving our cars, repairing our air conditioners, or seeing a doctor whose diagnosis is imperfect when a computer can see patterns in data that our brains miss. But AI's shortcomings are equally apparent. An AI driving a car, failing to see a child run into the street; an AI diagnosing a rare condition that a human doctor would recognize; an AI suggesting a work schedule that undermines morale at a critical moment - all of these scenarios illustrate possible failings in today's models.

11.7.2. AI and Sustainability

The deployment of AI in our most critical organizations and institutions is at a tipping point. As founders or leaders of retail, enterprise, or government institutions, it should be your intent to be an example for the numerous organizations to follow. Being exemplary requires you to achieve quantitative improvements in sales, operational efficiencies, capital requirements, and customer intimacy. It also means you will look to deploying AI-assisted methods to promote values and services that help reduce climate change and social inequity. Why treat these two areas as additive, or worse yet, secondary to your P&L when they are driving our most important challenges?

Bottom line, it is too simplistic to see investments in sustainability, circular economy practices and priority setting around social issues such as equity and diversity as detracting from other immediate goals. They are essential in contributing to a positive public perception and relationship, which is an enabling factor for retention, acquisition and growth outlined above. Research, analysis and dialogue needs to be part of the ongoing priorities and focus. Institute a process of monthly communications around how well you think you're doing. Other elements that require investment are the metrics and analyses, the creation of technical enablers and the constantly shifting set of external discussions and developments. Who would understand these constantly shifting external discussions? In short, it's an expensive, but necessary set of investments, requiring discussion and collaboration with many other areas of an organization.

Data and data hoarding is increasingly a foundation for market value and importance, important because it relates to targeted marketing and external perception. Organizations that know where to look and how to interpret the metric data are at a major advantage. However, AI and ML need to be trained and refined. Retargeting and making updates is always harder than initial training. Additionally, this area has the poorest success rates. Data-driven decisions about markets, competition and organization strategies require constant updating as the macro and micro world changes.

11.7.3. AI in Emerging Markets

Investments into generative artificial intelligence (AI) technologies have surged with the potential to transform and deepen the economic value of the digital economy. Developing economies are looking to AI to pull them into the growth orbit of countries like China or wealthier countries in Southeast Asia or Latin America. Many emerging economies wish to catch up, but they face headwinds in digitalization, lack of investment, and insufficient global integration which may slow efforts for AI adoption in emerging economies. AI is great for developing markets. More and more ingredients for AI systems – cloud infrastructure, commercial and open tools, pre-trained large

models, and lower cost of computing – can also benefit countries with less capacity to build systems from scratch. Demand for scalable labor productivity – augmentation, replacement, rescaling of labor – is greater in these countries. Genomic, protein folding, and climate science models have an oversized impact on developing countries and implementing them require up-skilling many more workers to enter STEM careers in developing countries.

However, several barriers must be overcome from developers in large emerging tech nations to small tech start-ups or policy decisions in doing AI with economy-wide impact. Developing countries should not follow the path of early-adopting countries in the demand for AI-augmented intelligence technology, rather for novel applications in healthcare, robots, geolocation, and public services. The dearth of home-grown AI products and services should catalyze home-grown startups, and homegrown market pioneers should have the confidence to take on global incumbents in addressing lemon market issues of rural information bottlenecks with GenAI varnishing, public sector use-statement of large models for risk monitoring, or leveraging condensed and local knowledge as leveling-up technology on top of existing agent landscape for compound AI.

11.8. Case Studies

To illustrate successful implementations of how AI can improve customer experience, these case studies will examine a few retail companies, something government agencies are doing to help their customers and constituents, and then wind up with how enterprises are transforming the experience they deliver to their employees.

The retail sector has been using AI-driven solutions to deliver personalized experiences, especially while suggesting, recommending, cross selling, or upselling products to customers. For example, a global beauty product company has developed a mobile app that uses AI to help customers search for specific cosmetic products to match the color and type of their skin. It also can look through the products that customers have purchased in the past and make tailored recommendations based on those purchases. When combined with what their beauty associates know about their customers, their mobile app is invaluable in giving customers the best experience possible.

Another interesting application of AI is being pioneered at a North American home improvement retailer. This company is heavily utilizing AI and robotics by deploying robots to collect data from the stores. A recent announcement detailed how they plan to deploy upright robots in its stores that will use machine learning software to determine if products are out of stock, in the wrong location, or incorrectly priced. While their associate employees can do this today, using AI will improve the speed and efficiency

of the process while allowing their employees to do higher value work focused on the customer experience.

Another company is using AI to improve the in-store experience. By leveraging robust analytics capabilities across their apps and website, they have a 360-degree view of customer information that allows them to understand their customers' possible intentions and needs so their store associates can service them better.

11.8.1. Retail Success Stories

Neiman Marcus, an upscale department store, introduced a chatbot on its website in 2017. Customers can use the chatbot to ask for outfit and accessory recommendations based on a range of criteria. Similarly, the luxury fashion brand Burberry utilizes technology to launch a chatbot on Messenger. The Burberry chatbot uses visuals to recommend items from the latest collection to the customer, thus offering a rich visual experience. In either case, chatbots can be used to increase product display space for wide-ranging catalogs, as well as appeal to the needs of online shoppers looking for interactive visual discovery experiences. Moreover, the ability to converse in natural, everyday language allows retailers to make online shopping feel more organic, like chatting with a friend who is an expert in fashion services. This encourages customer engagement and interaction, and ultimately leads to an increase in purchases.

Sephora's chatbot on Facebook Messenger goes a step further to improve personalized recommendations. The chatbot prompts the user to share what they're specifically looking for, within the beauty domain. The sophisticated algorithms recommend appropriate products and provide answers to queries. Sephora also personalized and expanded the discovery experience by partnering with users' favorite beauty influencers to host a series of exclusive classes on Messenger. The unique design showcases an informative interactive experience that feels both fun and helpful. Retailers can utilize social networks to create intelligent and conversational shopping advisors, and combine them with video-based buyable elements to build a rich, visual, and engaging shopping experience.

11.8.2. Government Innovations

In this sense, the government saw the need to comply with a Customer Service charter, which determines the maximum attention limits for different types of procedures, receiving assistance requests, complaints, and problems for their verification and, in some cases, solutions. We decided to develop an ANN-based virtual assistant capable of resolving 70% of the requirements and allowing natural language processing under the

voice modality in both Brazilian Portuguese and English. The virtual assistant started to be used in the IVB, enabling, according to a survey conducted with customers, an increase in satisfaction levels from 70% to 98%. The service runs on the website in which it conducts the dialogues through a text box. This design does not yet allow audio, but it is already structured to perform natural voice conversations.

The virtual assistant, named IVB, tries to speed up the resolution of questions ranging from mission, vision, and principles; news regarding the Government, events, and announcements; telephone numbers; location and opening hours; services; and grants, with the consultant on the other side. This has provided a more satisfactory experience for users. The IVB acts as a channel that should be used by citizens looking for answers to their questions or who want more information. In other words, it is a tool created to facilitate users' access to social media-related information, as well as mostly answering generic questions about the governmental services offered.

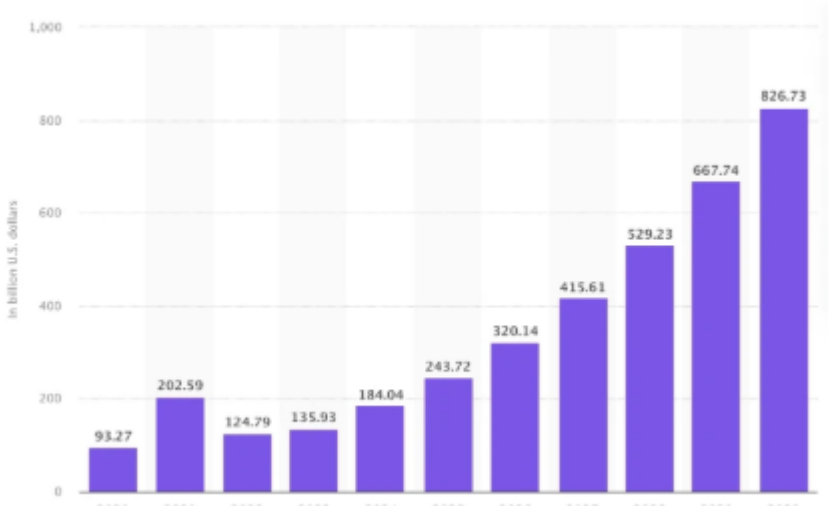

Fig : Key Developments to Watch

11.8.3. Enterprise Transformations

Recent enterprise case studies show how "no-code" use of AI provides solutions at a fraction of the time and cost. An important example here is of an enterprise-grade no-code AI platform that is used by engineers, operators, and supply chain and business owners to ensure AI is utilized optimally across the enterprise. It applies AI to any function using their structured and unstructured data; in addition to traditional MLOps and other requirements, it provides built-in interactive AI experience design, allowing anyone to auto-design efficient and engaging AI apps, workflows, and decisions, without any experience in AI, and at all stages of AI lifecycle. Because of its unique automation

design, development, testing, and deployment time is hours and days rather than months, or years. The writers are working with an enterprise that is facilitating multiple use cases across enterprises, to show how AI can be optimally utilized by organizations, including talent, IT, customer experience, data trust, cybersecurity, financial analysis, spending compliance, accounts payable, accounts receivable, tax, and others could achieve business outcomes using no-code enterprise AI. While the usage of AI in enterprises is similar to the usage of other IT initiatives done in the enterprise, the time to value for AI can be very fast, even for multilevel complex use cases. For example, the enterprise has a manufacturing customer where interactive AI automation was demonstrated in two days using no-code. The customer approved the use case, interviewing the employees who would be the end-users, and it is being embedded in AI apps to be operational as per their needs.

11.9. Conclusion

AI-driven change is happening in our world today. Our future economic roundtable discussions need to have more "working people" at the table and not just business and corporate interests. I see so many billions of dollars being put into possible jobs offsetting technologies, with a market for those particular technologies, which will not happen even in the next decade, if ever, as the employment needs for most jobs across the entire economy will disappear permanently.

These 'job offsetting' companies' CEOs and boards are saying they are going to help offset the impact of AI replacement of jobs, and yet I, and others I know, have worked in those areas for years, even decades, trying to solve those very same 'problems.' These are 'niche market' needs at best. Why are they trying to make our society pay for the search for new niche market technologies to help with job replacement, when the money could be far better spent developing private and public sector organizations that provide high-quality jobs everyone wants to fill? And, another third of funding should be made available to assist the companies that cannot offset lost labor costs due to AI job displacements.

There is no way that society will not help very wealthy companies offset high-quality high-paid jobs with support funding unless we all want to see a conflict like we have never seen before playing out across the society in every country. If the corporations that are driving most job displacement are allowed to remain in a position where they have no investment, then society has no choice but to redirect its funding to ensure smooth transitions.

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