



DIVISION OF
CORPORATION FINANCE

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

April 1, 2020

Ronald O. Mueller
Gibson, Dunn & Crutcher LLP
shareholderproposals@gibsondunn.com

Re: Amazon.com, Inc.
Incoming letter dated January 24, 2020

Dear Mr. Mueller:

This letter is in response to your correspondence dated January 24, 2020 concerning the shareholder proposal (the "Proposal") submitted to Amazon.com, Inc. (the "Company") by the International Brotherhood of Teamsters General Fund and the CtW Investment Group (the "Proponents") for inclusion in the Company's proxy materials for its upcoming annual meeting of security holders. We also have received correspondence from the Proponents dated February 14, 2020, February 27, 2020 and March 30, 2020. Copies of all of the correspondence on which this response is based will be made available on our website at <http://www.sec.gov/divisions/corpfin/cf-noaction/14a-8.shtml>.

Sincerely,

M. Hughes Bates
Special Counsel

Enclosure

cc: Cornish F. Hitchcock
Hitchcock Law Firm PLLC
conh@hitchlaw.com

April 1, 2020

Response of the Office of Chief Counsel
Division of Corporation Finance

Re: Amazon.com, Inc.
Incoming letter dated January 24, 2020

The Proposal urges the board to prepare a report on the steps the Company has taken to reduce the risk of “accidents,” including the board’s oversight process of safety management, staffing levels, and inspection and maintenance of Company facilities and equipment and those of the Company’s dedicated third-party contractors.

There appears to be some basis for your view that the Company may exclude the Proposal under rule 14a-8(i)(7). In our view, the Proposal focuses on workplace accident prevention, an ordinary business matter, and does not transcend the Company’s ordinary business operations. Although the Proponents’ last correspondence attempts to shift the focus of the Proposal to the Company’s efforts to mitigate health risks during the current coronavirus pandemic, the Proposal, which was submitted on December 6, 2019, focuses on workplace accidental injuries. As such, the Proposal’s focus remains on an ordinary business matter and does not address a matter that may transcend ordinary business. Accordingly, we will not recommend enforcement action to the Commission if the Company omits the Proposal from its proxy materials in reliance on rule 14a-8(i)(7).

Sincerely,

Dorrie Yale
Special Counsel

HITCHCOCK LAW FIRM PLLC
5614 CONNECTICUT AVENUE, N.W. • NO. 304
WASHINGTON, D.C. 20015-2604
(202) 489-4813 • FAX: (202) 315-3552

CORNISH F. HITCHCOCK
E-MAIL: CONH@HITCHLAW.COM

30 March 2020

Office of the Chief Counsel
Division of Corporate Finance
Securities & Exchange Commission
100 F Street, N.E.
Washington, D.C. 20549

Via: shareholderproposals@sec.gov

Re: Shareholder proposal to Amazon.com, Inc. from International
Brotherhood of Teamsters General Fund and CtW Investment Group

Dear Counsel:

I write on behalf of the International Brother of Teamsters General Fund and CtW Investment group to supplement our prior letters in light of recent developments that underscore the policy significance of this proposal.

In the few short weeks since our last letter, vast portions of the economy have shut down in response to the Covid-19 virus, a development that has spurred explosive growth in online retail sales, particularly at Amazon, which announced plans to hire another 100,000 employees in the United States, Canada and Europe. The Amazon Blog (16 March 2020), available at <https://blog.aboutamazon.com/operations/amazon-opening-100000-new-roles>

This development comes at a time when concern about Amazon's safety is even greater than at the time of our last letter. Indeed, as USA Today reported yesterday: "The demand for delivery has escalated amid a pandemic that has shuttered stores and led to tens of millions of Americans hunkering down at home. But it's also focused a spotlight on the conditions faced by workers who are filling orders, sorting boxes and dropping off packages virtually around the clock." Coronavirus fears spur Amazon workers in New York to walk off job until building is cleaned, USA Today (29 March 2020), available at <https://www.usatoday.com/story/money/2020/03/29/covid-19-concerns-lead-amazon-workers-staten-island-plan-walkout/2936635001/>

Amazon employees at least 13 plants have tested positive for Covid-19, and several facilities have closed as a result. Amazon is “at the front line of responding to outbreaks” of the virus, according to Reuters. Reuters, Factbox: Coronavirus cases reported at 13 of Amazon's U.S. warehouses (26 March 2020), available at <https://www.reuters.com/article/us-health-coronavirus-amazon-com-warehou/factbox-coronavirus-cases-reported-at-13-of-amazons-us-warehouses-idUSKBN21E07V>

In addition, workers at Amazon's Whole Foods subsidiary have called a strike for March 31st after numerous employees tested positive for Covid-19. Vice.com, Whole Foods Employees Are Staging a Nationwide “Sick-Out.,” available at https://www.vice.com/en_us/article/5dmeka/whole-foods-employees-are-staging-a-nationwide-sick-out. That article quoted one worker as saying:

“You can’t tell someone not to go to work if they’re sick, if they have to pay their rent in two days,” the Whole Foods worker in Chicago continued. “Our Whole Foods staff is on a skeleton crew right now. It’s the people who want to be working or the people who have no choice that are showing up. The portion of our workforce with any money in the bank is absent. Given the instability in our workforce, it gives me doubts that safety measures are carried out.”

See also ABC News, Amazon warehouse workers in New York walk off the job; Instacart and Whole Foods employees to follow (30 March 2019), available at <https://abcnews.go.com/Business/people-afraid-amazon-warehouse-workers-york-walk-off/story?id=69871849>

One can only imagine the damage to the currently fragile economy if there are significant virus-related disruptions in the nation's food supply and the availability of online retail items. Whatever “ordinary business” arguments may arise in other contexts or at other companies, the facts set forth in these articles and our prior letters show that there are serious questions about whether Amazon's safety practices are sustainable in the long run – and even in the short run.

As noted in our prior letters, the safety issues at Amazon have been festering for some time. The current crisis has accentuated the significance of the issues in our proposal, and Amazon shareholders deserve the opportunity to weigh in on the issue.

Very truly yours,



Cornish F. Hitchcock

cc: Ronald O. Mueller, Esq.

HITCHCOCK LAW FIRM PLLC
5614 CONNECTICUT AVENUE, N.W. • NO. 304
WASHINGTON, D.C. 20015-2604
(202) 489-4813 • FAX: (202) 315-3552

CORNISH F. HITCHCOCK
E-MAIL: CONH@HITCHLAW.COM

27 February 2020

Office of the Chief Counsel
Division of Corporation Finance
Securities & Exchange Commission
100 F Street, N.E.
Washington, D.C. 20549

By electronic mail: shareholderproposals@sec.gov

Re: Shareholder proposal to Amazon.com, Inc. from International Brotherhood of Teamsters General Fund and CtW Investment Group

Dear Counsel:

I write on behalf of the International Brotherhood of Teamsters General Fund and CtW Investment Group (collectively the “Proponents”) to supplement our letter of the 14th, which opposed the request for no-action relief filed by counsel for Amazon.com, Inc. (“Amazon” or the “Company”).

In a nutshell, the Proponents’s shareholder proposal asks the Amazon board to “prepare a report . . . on the steps the Company has taken to reduce the risk of accidents.” The supporting statement and our letter both cited a number of studies demonstrating that Amazon’s reports to the Occupational Health and Safety Administration (“OSHA”) shows injury rates more than twice the national warehouse rate, with the severity of the injuries causing employees to miss an average of 5.5 weeks of work.

We are filing this letter to cite a recent report showing that the problems with respect to Amazon’s safety record are not limited to the United States. The BBC last week reported that based on Freedom of Information requests, “240 reports of serious injury or near misses were sent to the Health and Safety Executive last year, and 622 over three years.”¹ *Hundreds of staff injured at Amazon UK warehouses, GMB claims*, BBC (18 February 2010). A copy of the

¹ The Health and Safety Executive (“HSE”) is OSHA’s U.K. counterpart.

article is attached and is available at <https://www.bbc.com/news/business-51539329>.

The BBC report notes that reported injuries must be serious enough to stop a worker performing their normal duties for at least seven days, or be on a list including fractures, amputation, crushing, scalping or burning.

The public interest in Amazon's record is underscored by Amazon's current advertising campaign in the U.K., which attempts to portray its U.K. workers in the U.K. as being very happy with their jobs. We submit with this letter a file containing one of those 30-second advertisements, which purports to interview some of these employees and ends by inviting viewers to "come see for yourself, book a tour" of an Amazon warehouse.

Amazon is reaching out to U.K. journalists, who are writing about the experience, and also using social media with messages such as "Entertain the kids this Easter break by taking them on a free Amazon fulfilment centre tour at one of 8 locations across England and Scotland." Hahn, *I Went on a Propaganda Tour of an Amazon Warehouse*, VICE.COM (27 November 2019) (containing the cited Twitter feed from @AmazonNewsUK). A copy of the article is attached and is available at https://www.vice.com/en_uk/article/vb5w99/amazon-fulfilment-centre-tour

The fact that Amazon feels the need to mount such an aggressive, high-profile campaign is further evidence that the issue in our proposal raises a matter of public concern that transcends ordinary business.

Moreover, what is noteworthy about this U.K. campaign is what Amazon does *not* say. As noted in our initial letter (at p. 8 n.2), Amazon has responded to criticism of its safety record by stating that its injury and accident rates in the U.S. are high because in 2016 Amazon "began to take an aggressive stance on recording injuries no matter how big or small which can result in elevated recordable rates and makes comparisons difficult." Valentic, *Amazon Responds to Criticism for High Injury Rates*, EHS TODAY (3 December 2019), available at <https://www.ehstoday.com/safety/article/21920501/amazon-responds-to-criticism-for-high-injury-rates>.

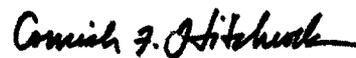
It is, of course, difficult to assess that claim without knowing what Amazon was required to report or how that record stacks up against competitors. What is significant about the current U.K. experience, however, is that Amazon appears to be offering no comparable explanation, *i.e.*, that the reason the accident and injury rates are so high is because Amazon is over-reporting accidents and injuries to the HSE. With nothing definitive and with what appear to be inconsistent reporting practices, the investor need for the report sought in our Proposal is magnified.

Conclusion

For these reasons and those stated in our earlier letter, we respectfully ask the Division to advise Amazon that the Division does not concur that the Proponents' proposal may be omitted under Rule 14a-8(i)(7).

Thank you for your consideration of these points. Please feel free to contact me if any additional information would be helpful.

Very truly yours,



Cornish F. Hitchcock

cc: Ronald O. Mueller
Louis Malizia
Tejal K. Patel

Hundreds of staff injured at Amazon UK warehouses, GMB claims

18 February 2020



Hundreds of workers have been seriously injured or narrowly escaped an accident at Amazon's UK warehouses over the last three years, new figures claim.

GMB union numbers show 240 reports of serious injury or near misses were sent to the Health and Safety Executive last year, and 622 over three years.

Amazon is currently running a TV advertising campaign highlighting contented staff.

It said critics were determined to present a "false picture".

The GMB obtained the figures via Freedom of Information requests.

For injuries to be included in the figures they need to be serious enough to stop a worker performing their normal duties for at least seven days, or be on a list including fractures, amputation, crushing, scalping or burning.

In one London warehouse a worker lost consciousness and appeared to stop breathing after injuring their head, the GMB said. In Manchester, one worker got caught in a gate and fractured their hand.

The data shows the number of reports to the HSE has increased every year, from 152 in the 2017 financial year to 240 in 2019. However the figures deal with a period during which the number of warehouses run by Amazon more than doubled from 10 in 2015 to 22 today.

- **Jeff Bezos pledges \$10bn to fight climate change**
- **Amazon to create 1,000 jobs at new warehouse**

Mick Rix, GMB national officer, said: "Amazon are spending millions on PR campaigns trying to persuade people its warehouses are great places to work. But the facts are there for all to see - things are getting worse.

"Hundreds of stricken Amazon workers are needing urgent medical attention. Conditions are hellish. We've tried over and over again to get Amazon to talk to us to try and improve safety for workers. But enough is enough - it's now time for a full parliamentary inquiry."

In December, GMB and the Trades Union Congress (TUC) were joined by members of the shadow cabinet for a demonstration outside Amazon's London offices. The unions and politicians said that Amazon should be paying millions more in taxes, claims denied by the online giant.

A spokesman for Amazon said: "Amazon is a safe place to work. Yet again, our critics seem determined to paint a false picture of what it's like to work for Amazon. They repeat the same sensationalised allegations time and time again.

"Our doors are open to the public, to politicians, and indeed to anyone who truly wants to see the modern, innovate and, most importantly, safe environment we provide to our people." Amazon has been running television commercials using warehouse staff to highlight a happy working environment.

Related Topics

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Life

I Went On a Propaganda Tour of an Amazon Warehouse

And all I got was an empty cardboard box.

By Jennifer Hahn

27 November 2019, 5:36am   



LEFT: THE AMAZON FULFILMENT CENTRE; RIGHT: THE AUTHOR HAVING A GREAT TIME AT THE AMAZON FULFILMENT CENTRE.

It's not news that the working conditions in Amazon's warehouses are terrible. Since as far back as 2011 – when 15 workers collapsed at an overheated Pennsylvania site – mounting evidence has veered from the grotesque (workers peeing in bottles because they're too afraid to take breaks) to the downright devastating (13 people have died in US warehouses since 2013).

Last month, employees in Essex compared their jobs to modern slavery, while in September 48-year-old Billy Foister became the latest addition to the Amazon fulfilment centre death toll, suffering a heart attack in an Ohio warehouse, where his body was allegedly left on the floor for 20 minutes while colleagues were told to get back to work (Amazon said they responded "within minutes").

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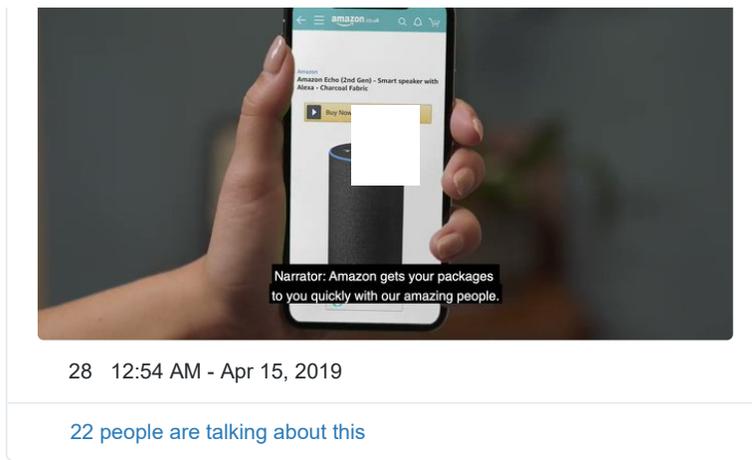
As such, it was surprising when I was recently brought face-to-face with a string of Amazon warehouse workers wearing smiles straight out of a hostage video as they assured me that, really, honestly, working at the company is so, so fun.



AmazonNewsUK
@AmazonNewsUK

Entertain the kids this Easter break by taking them on a free Amazon fulfilment centre tour at one of 8 locations across England and Scotland. [#AmazonFCTours](#) are suitable for anyone aged 6 and over (no upper age limit applies!) Book your visit at [aboutamazon.co.uk/amazon-fulfilm...](#)





Meet Sean: a really horrible dancer! And Lisa, who loves hiking. Then there's Jackie, who hugs each package as it's sent out for delivery. The adverts said I could meet people just like these zany, relatable characters (and definitely not paid actors) by signing up for a tour of an Amazon Fulfilment Centre. In a bid to counteract the annoying death stats, Amazon has this year held tours at more of its Fulfilment Centres than ever before, deploying the aforementioned multi-million pound ad campaign to get people hyped about the experience.

So, one rainy Saturday morning, I get out of bed and trek to a nondescript industrial park in Peterborough, for the pleasure of spending my precious free time being herded through a gigantic warehouse.

Within five seconds of stepping foot on Amazon soil, I'm approached by a security guard asking if I'm there for the tour. For the next two hours, my every move is monitored by a guide. We cannot take photos and are instructed to wear high-vis vests so they can find us if we get lost. "And we will find you," our lead tour guide, a tattooed girl in her late twenties, says with a smile.

In a group of 15 people that seems to be otherwise comprised of logistics geeks and parents who've clearly exhausted every other means of children's entertainment in a 50-mile radius, the tour plays out as a sort of "Good Employer" amusement park ride. We're ushered past a highlights reel of strategically placed attractions while our guide sends a series of pre-cooked zingers down a microphone that's tuned into our headphones.



Amazon Is Looking More and More Like a Nation-State

EDWARD ONGWESO JR

The walls leading to the main warehouse floor are lined with pictures from events held for children with cancer, or school trips who have visited the Fulfilment Centre. There's also a blackboard announcing "Recycling Week", which is designed to help employees do their bit for the environment. Because Susan throwing that crisp packet in the right bin is definitely going to offset Amazon's 44.4 million metric tons of carbon dioxide emissions.

From there, we pass the "HR pod" and a series of notice boards – one proclaims that workers are allowed to work "no more than 6 days a week, no more than 11 hours a day", while another assures us that it's been "227 days since the last recordable incident".

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I'm not sure what "incident" means, exactly. Maybe it refers to ambulance calls, of which there were more than 600 over the course of three years coming from Amazon UK warehouses (more than one every other day). Or perhaps it's specifically referring to calls made to emergency services for suicide attempts and mental health episodes, of which there were 189 from US warehouses between 2013 and 2018.

Although Amazon is keen to point out in statements that this is a good track record when compared to other transportation and warehousing businesses, Mick Rix, a national officer for the GMB union, says it's far from normal. "To see this many people with broken bones or knocked unconscious, and being taken to hospital... this does not happen in any other industry," he explains.

Mick has negotiated with similar corporate behemoths, like Hermes and ASDA Walmart, but Amazon stands apart as the one company that consistently refuses to engage with trade unions, even creating training videos for managers on how to spot and stop unionisation.



Back in the warehouse, any attempt to talk to an actual employee is futile. Apart from our three designated watchdogs, we can only see other workers from afar as we're led from the shipping station to the inbound area.

Finally, we arrive at the main attraction, an endless maze of shelves, laden with anything you could ever want, including enough protein powder to feed an army.

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This is the part of the process that generates the most complaints. To compile your Amazon package, those working as "pickers" need to scour these shelves for each item in your order.

Pickers have a certain quota they need to hit. The guide won't give me a specific number – saying it's determined by Amazon's omnipotent algorithm – but accounts vary from the low hundreds up to 320 products per hour, every hour, for ten hours a day.

Out of their two half-hour breaks per day, only one is paid. Outside of these designated times, according to a *Mirror investigation*, workers are discouraged from sitting down at any point. If they fall below their picking quota, the system will mark them for possible termination. At one point, around 300 associates were fired over the course of a year in a single warehouse in Baltimore for failing to meet productivity quotas.

According to Mick, workers say they sometimes walk up to 20 miles per day. In a survey of Amazon workers, carried out by GMB, 87 percent said they were in some form of constant pain during their work every day.

"People can't even talk to each other," Mick explains, "because if they do, the team leaders will tell them off for not working hard and fast enough." (In the past, Amazon has said the company "provides a safe and positive workplace for thousands of people across the UK" and focuses on "ensuring we provide a great environment for all our employees".)



Jeff Bezos Is So Powerful He Basically Dictates the Minimum Wage Now

ALLIE CONTI

Of course, none of this is mentioned during the tour. Instead, we stand in single file for half an hour as our guide explains in excruciating detail how the categorisation system works. When the tour finally continues, we're led past a banner that reads "work hard, have fun, make history" and a comically large Monopoly board, placed conspicuously in the path of the tour. "Oh, you noticed that?" our guide says.

She explains that every week during the team meeting, a lucky worker gets to roll the giant fluffy dice in the hopes of winning amazing prizes such as "an extra break" or – better yet – "swaggies". This, it turns out, is Amazon's

internal currency, which employees can spend in a special Amazon shop full of everything from hoodies to GoPros and shower speakers – all emblazoned with the Amazon logo.

Other perks of the job, we are told, include days where people can come to work wearing onesies or pyjamas. "I didn't know I had a boss that owned a Spongebob onesie, but I sure found out that day," the guide jokes in a tone that suggests she's delivered that line a hundred times before. There are also special pins rewarding good behaviour in what is essentially the grown-up equivalent of cub scout badges. Because who needs decent working conditions when you've got a lanyard full of patronising pins?

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At the last stop, the packing stations, we dive deep into the minutiae of how, exactly, Amazon parcels are put together, before everyone is invited to build their own cardboard box to take home as a souvenir – sort of like build-a-bear, but infinitely more bleak.

After a quick Q&A session in which no one asks a single difficult question, I am ejected on to the Peterborough dual carriageway. I leave with nothing but an empty cardboard box and the impression of a company that would rather invest the money it saves by paying barely any tax into a dumb propaganda campaign than it would making its warehouses bearable places to work.

"What they could actually do is sit down with our union," suggests Mick, "which has worked with lots of companies to make sure there are safe systems of work in place, that pick rates are monitored and measured. And their efficiency and productivity has increased, because at the heart of those changes was the inclusion of workers. There is a fundamental problem at the heart of this company, and it's that it does not respect workers."

HITCHCOCK LAW FIRM PLLC
5614 CONNECTICUT AVENUE, N.W. • No. 304
WASHINGTON, D.C. 20015-2604
(202) 489-4813 • FAX: (202) 315-3552

CORNISH F. HITCHCOCK
E-MAIL: CONH@HITCHLAW.COM

14 February 2020

Office of the Chief Counsel
Division of Corporation Finance
Securities & Exchange Commission
100 F Street, N.E.
Washington, D.C. 20549

By electronic mail: shareholderproposals@sec.gov

Re: Shareholder proposal to Amazon.com, Inc. from International
Brotherhood of Teamsters General Fund and CtW Investment Group

Dear Counsel:

I write on behalf of the International Brotherhood of Teamsters General Fund and CtW Investment Group (collectively the “Proponents”) in response to a letter from counsel for Amazon.com, Inc. (“Amazon” or the “Company”) dated 24 January 2020 (“Amazon Letter”) in which Amazon advises that it intends to omit the Proponents’ proposal (the “Proposal”) from the Company’s 2020 proxy materials. For the reasons set forth below, we respectfully ask the Division to advise Amazon that the Division does not concur with the Company’s position that the Proposal may be excluded from Amazon’s proxy materials.

The Proposal

The Proposal asks the Company to prepare a report as described below:

RESOLVED: That the shareholders of Amazon.com (“the Company”) urge the Board of Directors (“the Board”) to prepare a report, within 90 days before the 2021 annual meeting, at a reasonable cost and excluding proprietary and personal information, on the steps the Company has taken to reduce the risk of accidents. The report should describe the Board’s oversight process of safety management, staffing levels, inspections and maintenance of Company facilities and equipment and those of the Company’s dedicated third-party contractors.

The Supporting Statement, noting Amazon's size as the second largest private employer in the United States, characterizes the Company's emphasis on fast delivery guarantees as creating "a high speed, high stress work environment." A report examining Amazon's reports to the Occupational Health and Safety Administration ("OSHA") shows injury rates more than twice the national warehouse rate, with the severity of the injuries causing employees to miss an average of 5.5 weeks of work. Also cited is an OSHA warning letter from August 2019 regarding failure to provide adequate medical care in several instances.

These instances should raise concerns about sustainability, the Supporting Statement continues, as well as legal, regulatory and reputational risk. Moreover, Amazon's social responsibility report includes a section on employee safety, but does not cite a single comparable metric. Key comparable metrics would including total recordable incident rates, days away/reduced time rates, and severity rates, and these would permit investors to do comparative research. The Supporting Statement adds that the Bureau of Labor Statistics publishes detailed industrial data annually, thus allowing investors to benchmark Amazon's performance against others in the industry.

Discussion.

The Proposal does not relate to Amazon's "ordinary business" operations within the meaning of Rule 14a-8(i)(7).

Amazon proffers the expected objection that this proposal is a matter of ordinary business because it involves workplace safety, which is said to be the sort of issue that is most appropriately left to management as part of the day-to-day operations of the Company. Amazon also denies that the Proposal involves any kind of "significant social policy issue" that would transcend day-to-day ordinary business matters. Amazon's arguments are unconvincing.

At one level, the Proposal involves issues of sustainability, which the Division has repeatedly recognized as a significant policy issue. *E.g., Kohl's Corp.* (13 December 2013). Can Amazon continue to maintain its record of growth and profitability if it continues to impose significant costs on the Company's human capital?

At a second level – and as the Company appears to acknowledge – the Proposal raises the issue of board oversight. Indeed, the Amazon Letter notes (at 4 n.3) that the board's Leadership Development and Compensation Committee is responsible for "overseeing strategies and policies related to human capital management, including workplace environment and safety." If that is so, it is a fair question to ask how effectively the committee is fulfilling its responsibilities, given the statistics cited in the Supporting Statement.

At a third level, on which we will focus this discussion, the Proposal deals with a significant social policy issue, namely, the “digital transformation” of the nation’s economy and the social costs of that transformation, as companies move towards greater reliance on digital technology.

Amazon is cited by academics, researchers, journalists and consultants as the exemplar of this transformation, as evidenced by a wave of books and articles in recent years about Amazon’s digital strategy and its implications for other sectors of the economy. A partial list would include:

- Thomas M. Siebel, *DIGITAL TRANSFORMATION: SURVIVE AND THRIVE IN AN ERA OF MASS EXTINCTION* (2019) (by the founder of Siebel Systems);
- David L. Rogers, *THE DIGITAL TRANSFORMATION HANDBOOK: RETHINK YOUR BUSINESS FOR THE DIGITAL AGE* (2016) (by a Columbia Business School professor);
- Center for Digital Transformation at University of California (Irvine) Merage School of Business, *Amazon is Showing Us the Way* (2017), available at <https://www.centerfordigitaltransformation.org/amazon-is-showing-us-the-way/>;
- Nukon, *What Amazon can teach us about digital transformation in manufacturing* (28 September 2017), available at <https://www.nukon.com/blog/what-amazon-can-teach-us-about-digital-transformation-in-manufacturing>;
- Petro, *Is Digital Transformation The Key To Competing With Amazon?*, *FORBES* (10 June 2018), available at <https://www.forbes.com/sites/gregpetro/2018/06/10/is-digital-transformation-the-key-to-competing-with-amazon/#2d9e5fde26e6>
- Hackernoon, *Cloud Is Not a Digital Transformation Strategy (Unless You Are Amazon)* (21 July 2017), available at <https://hackernoon.com/cloud-is-not-a-digital-transformation-strategy-unless-you-are-amazon-aec1c470cf8f>.

The transformation, led by Amazon, is most apparent in the retail sector, which is making the transition from traditional brick-and-mortar retail stores to online retailing. We are thus witnessing an economy in which many shopping malls are no longer viable and are closed down. See, e.g., *The Retail Crisis: the Impact on Regional Shopping Malls*, *ABF JOURNAL* (7 November 2017), available at https://www.abfjournal.com/%3Fpost_type%3Darticles%26p%3D66276.. In their place is arising a warehouse economy, for online and traditional retailers alike.

In many respects, this transformation is figurative, but in some cases, it is

literal, as dead malls are repurposed to serve as warehouses. A report by CBRE (a leading commercial real estate firm) found that since 2016 developers have started 24 projects across the country to convert former retail space into warehouses, with old malls being torn down and converted into warehouse space in Baltimore, Atlanta, Chicago, Detroit and several Ohio cities, while former Toys 'R' Us and Sam's Club locations were subject to retrofitting for industrial needs. *Retail real estate finds new life as warehouse space* (30 January 2019), SUPPLY CHAIN DIVE, available at <https://www.supplychaindive.com/news/Retail-real-estate-finds-new-life-warehouse-space/547265/>

This transformation in retail has produced a large, unmet demand for warehouse space. It is estimated that e-commerce retailers need three times as much warehouse space as brick-and-mortar retailers, and companies such as Wal-Mart, Alibaba, Wayfair, Overstock and QVC will need to invest heavily in new warehouses if they want to match the reach of Amazon. *Why Retailers Are Closing Malls but Building More Warehouses*, FISCAL TIMES (24 June 2017), available at <https://www.thefiscaltimes.com/2017/06/24/Why-Retailers-Are-Closing-Malls-Building-More-Warehouses>. However, according to an industry publication, CBRE estimates that available warehouse space has come up short by about 170 million square feet every year since 2015. *Online retailers are transforming warehouse construction*, CONSTRUCTION DIVE (7 August 2019), available at <https://www.constructiondive.com/news/online-retailers-are-transforming-warehouse-construction/560064/>

As the retail sector moves increasingly into the warehouse sector, the experience at Amazon – and the desire of competitors to emulate its success – takes on considerable policy significance. On the one hand, this transformation may provide warehouse jobs to replace jobs lost in traditional retail. A 2017 study by the Progressive Policy Institute concluded that during the prior decade, e-commerce companies added more than 400,000 jobs, while brick-and-mortar retailers lost the equivalent of 140,000 full-time jobs. *How Ecommerce Creates Jobs and Reduces Income Inequality*, available at https://www.progressivepolicy.org/wp-content/uploads/2017/09/PPI_ECommerceInequality-final.pdf.

However, this change is not an unalloyed plus for every displaced retail worker, as the likelihood of finding a replacement job is dependent on geography and other circumstances.¹

¹ As one article put it, the “likelihood of someone who lost their job working the Macy’s makeup counter landing a job packing boxes at an Amazon warehouse largely depends on where they live (or their ability to move).” *Amazon is lifeline for retail workers*,

More significantly, to the extent that Amazon and other retailers replace traditional brick-and-mortar vendors, a key to their success is speed – the ability to fulfill an order and deliver a package within two days, one day, or even the same afternoon. And here is where questions of the social costs and sustainability of existing practices are most profound.

The key points are well summarized in an October 2019 report from the University of California at Berkeley’s Center for Labor Research and Education and Working Partnerships USA entitled *The Future of Warehouse Work: Technological Change in the U.S. Logistics Industry* (the “Berkeley study”), which is attached as Exhibit 1 and is available at <http://laborcenter.berkeley.edu/pdf/2019/Future-of-Warehouse-Work.pdf>. This Berkeley study examined and sought to identify trends in the warehouse sector over the next decade, and the analysis highlights the significant policy issues that are raised by the Proposal at issue here.

Amazon and its emphasis on speed in fulfilling customer orders are reshaping the industry in significant ways. As the Berkeley study put, “e-commerce introduces additional demands for speed along with an entirely new set of labor-intensive warehouse processes, *id.* at 40, and “Amazon’s influence in the online retail arena is significant, particularly in the context of the company’s promises of increasingly faster delivery.” *Id.* at 45.

The Berkeley study identified significant social costs associated with this transformation. “The increasing pace of work in warehouses may introduce new health and safety hazards, as well as increased employee turnover due to overwork and burnout.” *Id.* at 8. “Currently, warehouse workers experience work-related

if they live in right city, BUSINESS WORLD (2017), available at <https://www.bworldonline.com/amazon-lifeline-retail-workers-live-right-city/>. In addition:

Many workers aren’t able to move seamlessly from traditional retailers to e-commerce. Struggling sectors such as clothing and department stores are dominated by female employees, who may be less likely to go into physically taxing warehouse jobs, noted Anastasia Christman, a senior policy analyst at the National Employment Law Project. And people in lower-income, urban communities who once worked at shops in their neighborhood — many of them people of color — may not have a ready way to get to the mammoth e-commerce warehouses located outside city centers, Christman said.

Johnson, *As Amazon Booms Retail Jobs Shift*, BOSTON GLOBE (12 August 2017), available at <https://www.bostonglobe.com/business/2017/08/12/amazon-booms-retail-jobs-shift/AAKEjq2kLsGgiMldh3ihRN/story.html>

injuries at a rate nearly twice that of other private industry workers—higher than construction, coal mining, and most manufacturing industries” *Id.* at 8-9. “Health and safety is one contributing factor to the high turnover rate in warehouses, and recent media reports have highlighted the array of health and safety risks in the industry. Amazon, in particular, has come under fire for the health and safety ramifications of high productivity requirements and the stress workers report feeling as they toil under exacting pressures to perform.” *Id.* at 28. According to the Bureau of Labor Statistics, “warehouse workers experienced work-related injuries at a rate nearly twice that of all private industry workers—higher than construction, coal mining, and most manufacturing industries.” *Id.* The BLS chart is available at https://www.bls.gov/iif/oshwc/osh/os/summ1_00_2017.htm

The Berkeley study is one of a number of reports issued in recent months that examine the social costs of Amazon’s practices and their effect on the workforce. Other studies include the following:

- The Center for Investigative Reporting undertook an in-depth study of Amazon’s practices and posted a report on the Center’s Reveal website (which the Supporting Statement cites) entitled *Behind the Smiles: Amazon’s internal injury records expose the true toll of its relentless drive for speed* (25 November 2019), which is attached as Exhibit 2 and is available at <https://www.revealnews.org/article/behind-the-smiles/>. The data and conclusions are in line with the Berkeley study discussed above.

The Center’s study amassed internal injury records from 23 of Amazon’s 110 fulfillment centers nationwide and found that the rate of serious injuries for those facilities was more than double the national average for the warehousing industry: 9.6 serious injuries per 100 full-time workers in 2018, compared with an industry average that year of 4. Its rate of serious injuries – those requiring job restrictions or days off work – was more than four times the industry average. Moreover, Amazon’s “aggressive production demands have overwhelmed its safety teams’ efforts to protect workers, according to five former Amazon safety managers, who oversaw safety at fulfillment centers around the country and spoke on condition of anonymity because they feared retaliation.” A former OSHA Administrator is quoted as saying that “serious injury rates this high should not be acceptable to any employer.”

The Center report concluded: “The root of Amazon’s success appears to be at the root of its injury problem,” namely, “the blistering pace of delivering packages to its customers.” The Center’s report became the basis for a longer and more in-depth article in THE ATLANTIC (November 2019) by Will Evans, *Ruthless Quotas at Amazon Are Maiming Employees*, which is attached as Exhibit 3 and is available at <https://www.theatlantic.com/technology/archive/2019/11/amazon-warehouse-reports-show-worker-injuries/602530/>.

- In December 2019 a coalition of non-profit and labor organizations known as the Athena Coalition issued *Packaging Pain: Workplace Injuries in Amazon's Empire*, which is attached as Exhibit 4 and is available at <https://www.amazonpackagingpain.org/>. The report focused on data from OSHA safety records (OSHA 300 and 300A logs), which painted a grim picture of conditions at the Company's fulfillment Centers. In brief:

- In 2018, the Total Recordable Injury Rate (TRIR) at Amazon facilities in the sample was 10.76 per 100 workers. This is three times as high as the injury rate across all private employers (2.8 recordable injuries per 100 workers) and more than twice as high as the injury rate in the notoriously hazardous general warehousing industry (5.2 recordable injuries per 100 workers).

- Workers at Amazon suffered the most serious injuries at rates five times the national average for all private industries. The injuries suffered by workers at Amazon are so serious that workers had to be removed from their job at Amazon--88.9 percent of workers who were injured had to miss work or be placed on restricted duty.

- These injuries are severe. Workers injured at Amazon were forced to miss an average of five-and-a-half weeks of work to recover from their workplace injuries.

- Weekly injury rates (the number of injuries per week) spike during the peak holiday shopping season between Black Friday and Christmas. Injury rates begin to climb dramatically throughout the peak shopping season before spiking at two-and-a-half times the company's weekly average in the 50th week of the year—approximately two weeks before Christmas.

- The overwhelming majority of injuries recorded in Amazon's OSHA 300 Logs include musculoskeletal injuries, such as sprains, strains and tears. These injuries accounted for almost 75 percent of the injuries recorded in the logs. The body parts most commonly injured are workers' backs, shoulders, knees, wrists, ankles and elbows. These types of injuries are often caused by workers assigned tasks involving ergonomic hazards including forceful exertions, repetitive motions, twisting, bending, and awkward postures.

- Over the past five years, federal inspectors from the Occupational Safety and Health Administration (OSHA) have issued 67 citations at Amazon's facilities, levying fines totaling \$262,132. This enforcement activity, however, likely only scratches the surface of safety violations at Amazon facilities. Over the past half-decade, 78 percent of Amazon's facilities have not received a single visit from OSHA inspectors.

The issues discussed in these reports have received extensive media coverage, and not just in this country, but internationally as well. See, e.g.,

- Gibson, *Most dangerous time to work in Amazon warehouses? Right about now*, CBS NEWS (17 December 2019), available at <https://www.cbsnews.com/news/amazon-warehouse-jobs-most-dangerous-time-of-year-to-work-is-holiday-shopping-season/>

- Sainato, *I'm not a robot: Amazon workers condemn unsafe, grueling conditions at warehouse*, THE GUARDIAN (5 February 2020), available at <https://www.theguardian.com/technology/2020/feb/05/amazon-workers-protest-unsafe-grueling-conditions-warehouse;>

- Kekatos, *One in 10 Amazon warehouse workers get strains, sprains and tears on the job each year - and their risks DOUBLE during the holiday season, report finds*, DAILY MAIL (17 December 2019), available at [https://www.dailymail.co.uk/health/article-7803187/Amazon-warehouse-workers-injury-risks-double-holidays.html;](https://www.dailymail.co.uk/health/article-7803187/Amazon-warehouse-workers-injury-risks-double-holidays.html)

- Tobias, *Injuries at Fresno's Amazon warehouse double California's industry average*, FRESNO BEE (19 January 2020), available at [https://www.fresnobee.com/news/local/article238941159.html.](https://www.fresnobee.com/news/local/article238941159.html)²

But the Amazon story we recount here – though troubling in its own right – acquires greater policy significance because the issue involves more than just one company. The broader economic transformation we discussed above is already rippling through the industry and will continue to do so. As the Berkeley study put it (at 39): “Warehouse operators are under increasing pressure to move goods quickly and accurately,” with warehousing having had to increase the speed and frequency of replenishment processes because of shortened timelines, “which translates into the need for faster receiving, accelerated picking, and greater throughput.” *Id.*

If anything, the Berkeley study continued, the health and safety problems may only get worse, particularly if companies adopt new “wearable” technologies, more sophisticated labor management software, more granular tracking of worker

² An industry publication reports that Amazon responded to the criticism by stating that its injury and accident rates are as high as they are because in 2016 the Company “began to take an aggressive stance on recording injuries no matter how big or small which can result in elevated recordable rates and makes comparisons difficult.” Valentic, *Amazon Responds to Criticism for High Injury Rates*, EHS TODAY (3 December 2019), available at <https://www.ehstoday.com/safety/article/21920501/amazon-responds-to-criticism-for-high-injury-rates>. This statement is difficult to evaluate in the absence of data to show what the rates would have been if Amazon had made reports according to applicable regulations. Thus, one cannot tell if Amazon’s figures would be at, below or above industry peers.

productivity and new algorithms that “can dynamically urge workers to increase speed, and identify efficiency, accuracy, and movements at the individual worker level,” although “such close monitoring of workers and uncompromising electronic management could corrode working conditions and employee morale.” *Id.* at 58.

An industry publication aimed at environmental, health and safety professionals agrees, forecasting “a logistics technology race that, rather than immediately replace worker jobs, will likely make them more repetitive, physically stressful, and fast-paced.” Paoletta, *Modern Warehouse Safety Problems: We’re entering a new era of health and safety risk for warehouse workers*,. EHS TODAY (5 December 2019), available at <https://www.ehstoday.com/safety/article/21920504/modern-warehouse-safety-problems>. The article reports that the number of warehouse fatalities doubled in only two years (2015-2017) and that “warehouse workers everywhere will be at a higher risk for injury in 2020 as companies struggle to implement safety protocols that match the pace of modernization.”

The policy significance of the digital transformation and its social costs is indicated not only by the extensive news coverage just cited, but by the interest of elected officials. Only last week 15 United States Senators wrote to Amazon urging the adoption of steps to address the problems cited in the studies discussed above. That letter, dated 7 February 2020 and attached as Exhibit 5, is available at <https://assets.documentcloud.org/documents/6772867/AmazonWorkerSafetyLetterFeb72020.pdf>.

This letter is only the latest communication from elected officials. In July 2019 Senator Sanders and 12 House members urged the Department of Labor to immediately investigate chronic violations of workplace safety at all Amazon warehouses, “owing to the breadth and severity of past violations as well as mounting public revelations of brutal and hazardous working conditions.” *Sanders and Omar Lead Group of Dozen Lawmakers Calling for Investigation of Amazon Workplace Abuse* (16 July 2019), available at <https://www.sanders.senate.gov/newsroom/press-releases/sanders-and-omar-lead-group-of-dozen-lawmakers-calling-for-investigation-of-amazon-workplace-abuse>. Several months later, two of those officials requested detailed information from OSHA regarding injury reports at Amazon facilities over the past three years. *Citing Trump Administration Inaction, Sanders and Omar Pursue Oversight Effort on Amazon Workplace Abuse* (19 December 2019), available at <https://www.sanders.senate.gov/newsroom/press-releases/citing-trump-administrati-on-inaction-sanders-and-omar-pursue-oversight-effort-on-amazon-workplace-abuse>.

What does Amazon’s no-action request have to say about any or all of this?

The Company does not address these points, but instead serves up generic

arguments that could be offered by any company in just about any industry. It appears that Amazon views “workplace safety” as an issue that is inevitably and intrinsically a matter of “ordinary business,” regardless of the company and regardless of the context..

Amazon relies heavily on *Chemours Co.* (17 January 2017) and *Pilgrim’s Pride Corp.* (25 February 2016), and we acknowledge that the proposals in both cases used language similar to that in the Proposal at issue here. These citations ignore the context, which in this situation is all important.³

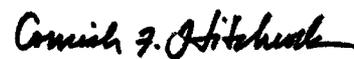
Chemours is a chemical company spun off by Dupont in 2015, and Pilgrim’s Pride is in the poultry industry. In neither case did the proposal or the proponent in those cases place the topic of workplace safety in a broader context, as we have done here. Moreover, neither Chemours nor Pilgrim’s Pride was an industry giant that was leading a significant transformation of its industry or the broader economy in the same way that Amazon is remaking the U.S. economy, with consequences that are being felt – and will continue to be felt – far and wide.

Conclusion

For these reasons, we respectfully ask the Division to advise Amazon that the Division does not concur that the Proponents’ Proposal may be omitted under Rule 14a-8(i)(7).

Thank you for your consideration of these points. Please feel free to contact me if any additional information would be helpful.

Very truly yours,



Cornish F. Hitchcock

cc: Ronald O. Mueller
Louis Malizia
Tejal K. Patel

³ The other letters cited by Amazon are equally generic and have no distinguishing features of the sort we have described in this letter. *CNF Transportation Inc.* (26 January 1998); *Union Pacific Corp.* (25 February 2008); *PetSmart, Inc.* (24 March 2011).

EXHIBIT 1

The Future of Warehouse Work: Technological Change in the U.S. Logistics Industry



Beth Gutelius
Nik Theodore

a report from the
UC Berkeley Center for Labor Research and Education
and Working Partnerships USA

October 2019

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PARTNERSHIPS**
USA

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About the Authors

Beth Gutelius, Ph.D., is associate director of the Center for Urban Economic Development at the University of Illinois at Chicago and senior researcher at the Great Cities Institute.

Nik Theodore, Ph.D., is a professor in the University of Illinois at Chicago's Department of Urban Planning and Policy, as well as the director of the Center for Urban Economic Development.



**Center for Urban
Economic Development**



**Great Cities
Institute**

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Executive Summary

Are “dark” warehouses, humming along without humans, just around the corner? Predictions of dramatic job loss due to technology adoption and automation often highlight warehousing as an industry on the brink of transformation. The potential elimination of many blue-collar jobs is a pressing issue for policy makers and raises important questions about how workers will fare in the economy of the future.

In contrast to reports focusing only on the number of jobs that could be lost, our research offers an in-depth, detailed look at the range of ways in which warehouse work and the industry as a whole might change with the adoption of new technology over the next five to 10 years. The findings in this report are based on in-depth industry research and extensive interviews with a broad set of stakeholders, including industry analysts and consultants, third-party logistics (3PL) operators, retailers, brands, and technology providers. Specifically, we sought to find out:

1. What key industry dynamics are playing a role in technological change?
2. How will adoption of new technologies impact warehouse facilities and operations, as well as the overall organization of the industry?
3. What tasks and processes are the highest priorities for technological application, and how might adoption of new technologies impact jobs in warehousing?

Many accounts of technological change portray firm decision making as purely based on a desire to automate to reduce labor costs. While labor cost reduction plays an important role, our research found a multifaceted set of factors shaping firms’ decisions about how to apply new technologies in warehouses. One set of trends—tight labor markets, rising real estate costs, and increasing speed requirements—are pushing warehouse operators to explore new technologies. On the other hand, variability and unpredictability, outsourcing dynamics, inertia, and the state of technological innovation are factors that may slow the process of technology uptake.

As a result, we project that the industry likely won’t experience dramatic job loss over the next decade, though many workers may see the content and quality of their jobs shift as technologies are adopted for particular tasks. Employers may use technology in ways that decrease the skill requirements of jobs in order to reduce training times and turnover costs. This could create adverse effects on workers, such as wage stagnation and job insecurity. New technologies potentially can curtail monotonous or physically strenuous activities, but depending on how they are implemented, may present new challenges for worker health and safety, employee morale, and turnover. Additionally, electronically mediated forms of monitoring and micro-management threaten to constrain workers’ autonomy and introduce new rigidities into the workplace.

These changes will have a greater impact on communities with high concentrations of warehouse workers. Warehouses typically are clustered near major transportation arteries and population centers—for example, the Inland Empire in California and the Chicago region. Two-thirds of front-line warehouse workers are people of color, most of them Black or Latinx, who stand to be disproportionately affected by technological change. Women are more likely to work in the growing e-commerce sector than in traditional warehouses, so they may benefit from growing employment opportunities, but also face lower wages and increasing pressure from changes in working conditions.

Findings

Technology Meets Shifting Industry Dynamics

1. **The warehousing industry is characterized by slim profit margins and cost-sensitive competition, which leads to a cautious approach to technology adoption.**

Viewed mainly as a cost center, warehousing is a low-margin industry with high levels of volatility and risk. Cost-based, risk-averse competitive dynamics lead warehouse operators to reduce exposure to cost wherever possible. This is one main reason the industry has lagged in its adoption of new technologies.

Broadly speaking, warehouse operators have thus far moved cautiously into risky experiments with new technologies, relying instead on streamlining current processes and on workforce experimentation. Our research suggests that this trend will continue—the cost sensitivity of the dominant business model will moderate the rate of technological experimentation and uptake, though larger firms may be able to leverage volume and a strong financial position to adopt new technologies. Absent a major shift in how warehousing activities are valued, the dynamics that have created barriers to innovation and contributed to the sector's status as a laggard are likely to persist over the next five to 10 years.

2. **E-commerce is driving experimentation with new technologies.**

With double-digit sales growth each year, few shifts in consumption patterns have had a greater impact on the warehousing industry than the rise of e-commerce. Online shopping is leading the transformation of the warehousing industry and is poised to have substantial effects on jobs and workers, not least in the realm of adoption of new technologies. E-commerce order picking requires more labor and, given the prompt delivery expectations of consumers, the order fulfillment process is accelerated. This results in a growing need for workers in warehouses, and an increasing interest in technologies that can streamline work processes and improve efficiencies.

Additionally, Amazon's influence in the online retail arena is substantial, particularly in the context of the company's announcements of increasingly faster delivery promises. Whereas a few years ago, consumers were content for an order to arrive in a few days, the delivery window has steadily narrowed with the growing prevalence of Amazon's Prime subscription. The combination of labor-intensive order picking and the speed with which these orders must be shipped has made e-commerce a leading driver of growth in warehousing employment, and is motivating experimentation with new technologies to support the order fulfillment process. This includes technologies that de-skill or potentially displace workers, such as automated picking processes, as well as technologies that speed up, control, or streamline human labor, such as electronic productivity monitoring.

3. Technology uptake likely will be uneven.

Across firms, within firms, and across technologies, adoption likely will vary significantly. Our research confirmed that warehouses are in disparate stages of their techno-strategy development, and that most firms are cautiously exploring new innovations. The business profile of a company, including the specific activities occurring in warehouse facilities, amount of goods being moved, and product markets, all help determine the propensity for technology adoption.

Within firms, a broad set of tasks and activities potentially could be high priority for applications of new technology and automation. Firms must make choices about which activities take precedence, leading to a variegated landscape of technological sophistication across activities in a warehouse. Our research documented that even firms at or near the leading edge of innovation in one area often lag behind in other areas. In one example, a large parcel company had made significant investments in a high-throughput conveyor and automated radio frequency barcode scanning system, but managers still were using spreadsheets and a whiteboard to schedule workers to handle package volumes. Another indication of unevenness is in the market penetration of warehouse management systems (WMS)—a common type of software used in the industry. Using a WMS is a fundamental building block for the adoption of many other technologies, and yet it is estimated that at least one-third of warehouses in the United States do not use such a system.

We project there will continue to be uneven uptake across technologies, in large part because the new technologies tend to be specialized to particular warehouse activities. The modularity of some new technologies, as well as alternative models of leasing, changes the capital investment and risk assessment scenarios in ways that could facilitate firms' technology experimentation and uptake.

4. Technology potentially will have large impacts on third-party logistics firms and outsourcing in the warehousing industry.

Outsourcing is a significant trend in the warehousing sector that affects the pace and forms of technology adoption. New technologies also have the potential to change firms' behavior with respect to outsourcing, which typically takes two forms: (1) outsourcing warehouse management

and operations to third-party logistics firms (3PLs), which offer a wide range of logistics-related services, and (2) outsourcing of warehouse hiring to temporary staffing agencies.

3PLs and temporary staffing agencies are navigating an uncertain landscape of strategies. Some are exploring new roles that leverage technology, while others appear to be taking a wait-and-see approach without significantly altering their value propositions. One 3PL company, for example, coped with a tenfold increase in holiday shopping volume by switching its facility to a highly manual process during peak season and hiring hundreds of extra workers, because the conveyor system could not accommodate the influx of orders. Other warehouse operators reported exploring the use of on-demand staffing platforms, which could simplify hiring processes for the benefit of employers and workers. However, using such tools also may encourage employers to reduce the number of direct hires and increase reliance on temporary workers, who tend to be paid less and have fewer protections on the job.

Also, 3PL contracts often are short (three to five years), which makes a return on investment difficult to achieve for warehouse operators taking on major investments in new technology. Many 3PLs have avoided such investments because of the possibility of losing the customer at the end of a contract, thus eliminating any potential gains. Despite these disincentives, some large 3PLs like DHL and XPO are piloting technologies to better meet the needs of their customers. Similarly, the president of a mid-sized 3PL said his company was exploring how it might commingle smaller e-commerce startups in a single facility and implement automation across all of them in order to speed up order fulfillment.

Impacts on Tasks, Jobs, and Workers

1. New technologies are likely to lead to work intensification.

The highest priority for companies in the short term is to identify and implement technologies that support more efficient order fulfillment. This includes applying labor-saving technologies to high-volume e-commerce order picking and frequent, small-batch replenishments to retail stores that keep limited inventory on hand. The labor-intensive nature of picking individual items to assemble orders—so-called “each picking”—requires large numbers of workers, so warehouse operators place great value on finding ways to reduce headcount and/or increase throughput by reorganizing this activity.

Our research suggests that even though some technologies could alleviate the most arduous tasks of warehouse work (such as heavy lifting), this likely will be coupled with attempts to increase the workload and pace of work, with new methods of monitoring workers. Amazon, for example, introduced MissionRacer, a video game that pits workers against one another to assemble customer orders fastest.

The increasing pace of work in warehouses may introduce new health and safety hazards, as well as increased employee turnover due to overwork and burnout. Currently, warehouse workers

experience work-related injuries at a rate nearly twice that of other private industry workers—higher than construction, coal mining, and most manufacturing industries. According to The New York Times, pregnant workers at a warehouse in Memphis managed by the 3PL XPO were denied requests for light duty and subsequently suffered miscarriages. Warehouse employees also often toil in facilities that are not climate controlled, which exacerbates the hazards created by work speed-up.

2. New technologies have the potential to de-skill some jobs.

Some warehouse technologies are designed to simplify aspects of warehouse work by breaking a job into subtasks and, where possible, removing the skills required of the workforce. Across all occupations in warehouses, viable technologies are likely to replace some human-performed decision-making tasks with machines, significantly changing the composition and quality of jobs. In some cases, the de-skilling appears to be motivated by a desire to shift labor strategy, including expanding the size of the potential labor market, increasing the use of temporary workers, reducing the workforce in certain occupations, and enhancing worker productivity.

Training workers to perform higher-skilled tasks is one potential avenue for adaptation to technological change, but this strategy appears to be underutilized in warehousing. Instead, labor reallocation likely will dominate in the short and medium term, supported by processes of de-skilling and work intensification. For example, the Kiva robotic picking system simplifies the role of humans in picking, reducing training and skill requirements, and making it easier for companies to hire temporary labor rather than direct employees.

3. New technologies are poised to transform how workers are managed.

Algorithmic management introduces new forms of workplace control, where the technological regulation of workers' performance is granular, scalable, and relentless. Newly available devices—such as “wearable” warehouse technologies, autonomous mobile robots, and increasingly sophisticated labor management software—allow close tracking of workers' movements, including walk speed, routes, bottlenecks, and break time.

These technologies have the potential to improve efficiency by urging workers to increase speed and accuracy. These same technologies also can function as a form of surveillance over workers, reducing the little autonomy they already have and further intensifying the pace of their work. Without interventions to ensure the transparency and fairness of the algorithms used in these technologies, the conditions of work in warehouses may be heading toward more rigid forms of monitoring and management.

4. In the short to medium term, new technologies likely will not cause widespread job loss.

With continued growth in demand, aggregate employment levels in the warehousing industry will likely continue to rise over the next five to 10 years. That said, job growth may be tempered by the increased use of labor-saving technologies in e-commerce warehouses in particular, such as autonomous mobile robots, autobaggers and autoboxers, and sensors or RFID tags applied to goods. Honeywell, for example, has developed robotic unloading machines that reduce the offloading time and concomitantly the role of workers in the process.

Many workers may see the nature of their working conditions shift as technologies are adopted for particular tasks over the next five to 10 years. Over the long term, in the absence of major shifts in the economy or context of firms' technological adoption strategies, the increasing use of technology points to a labor reduction.

5. Technology is likely to have uneven impacts across demographics and occupations.

Because of the overrepresentation of workers who are young, male, Latinx and Black in the warehousing industry, these groups of workers will be affected disproportionately by technological change. In particular, Latinx and Black workers are overrepresented in the industry compared with the total U.S. workforce: both groups are employed in warehousing at twice the rate of all other industries. Latinx workers alone compose the largest single race/ethnic group in front-line warehousing jobs, at 35%. Black workers make up one-quarter of the workforce in both warehousing and e-commerce. Overall, workers of color constitute 66% of warehousing industry workers and 55% of workers in e-commerce, even though workers of color account for just 37% of the total U.S. labor force.

Other groups also will experience specific consequences from technological change in warehouses. Some technologies will disproportionately impact the employability of older workers, such as engineered productivity standards that penalize workers for not reaching exacting targets, or newer forms of technology for which older workers do not have training or experience. Women are more likely to be employed in e-commerce warehouses versus traditional warehouses, so the growth in e-commerce offers new employment opportunities for female workers. However, jobs in e-commerce warehouses typically have lower wages and less predictable schedules, and they are even more vulnerable to pressure to increase speed.

Finally, technological change will have different effects at the occupational level. Front-line occupations such as order pickers will likely see the content and quality of their jobs change with the application of new technologies that reduce low-value activities like walking and such automatable tasks as boxing orders. Forklift drivers may work alongside partially automated forklifts, and shipping clerks might see their work increasingly replaced by artificial intelligence.

Conclusion

Our findings raise a number of questions for policy makers, worker organizations, and industry leaders in the warehousing sector:

- How can policy makers, equipped with forward-looking information, help to plan and prepare for changes in job quality and the potential unequal distribution of the costs and benefits of technology adoption?
- How can workers be included in the process of technology implementation to improve employment and operational outcomes?
- What measures can be put in place to track the physical and psychological impacts of technologies on workers, and to mitigate any negative effects on workers' health and safety?
- How can policy makers involve employers in systematically identifying within-industry job opportunities for displaced warehouse workers, including on-the-job training?

In short, how the gains from technological change will be distributed is a pressing question for all of the industry's stakeholders. While large retailers may be able to leverage their sizeable order volumes and strong financial positions to secure first-mover advantages through early adoption of new technologies, many 3PLs and smaller firms will face challenges, primarily the cost-based competition that is prevalent in the warehousing industry. Consequently, widespread automation of the warehousing industry is unlikely in the near to medium term. Experimentation with a variety of new technologies—including but not limited to those that may de-skill and intensify work—appears to be led by the widespread desire to compete with Amazon and other major online retailers.

Technologies are neither inherently good nor bad, just as the effects on employment are not inevitable. Ultimately, warehouse operators have latitude in determining how new technologies will be implemented. For example, when the wholesale retailer Boxed introduced cutting-edge automated processes into its warehouses, it retrained existing workers to fill new roles around these processes instead of laying them off.

The warehousing industry could realize significant operational improvements through technological advances—and it is imperative that productivity gains be shared, that workers be involved in identifying which efficiencies should be prioritized and what hazards are being introduced, and that experimentation unfolds with regard for more than just productivity increases and cost-cutting. Absent this, the process of technological change in warehousing likely will resemble a win-lose proposition, where the short-term benefits are captured by the industry and the long-run costs are borne by workers.

Glossary

The meaning and usage of many common terms vary significantly across the industry. The definitions given here are intended only to help the reader understand how we will use these terms in this report, which may differ from specific legal or regulatory definitions and/or informal usage within particular firms or industry segments.

3PL – Third-party logistics company, which offers outsourced logistics services, including warehousing.

Lead Firm – The most powerful company driving a supply chain, often with forward and backward linkages to other firms through contracting.

Lead Time – The time between when a store replenishment order is placed and the moment it is needed.

SKU – Stock keeping unit, an alphanumeric identifier for a product that helps in inventory management.

Throughput – The amount of goods moving through a warehouse.

WMS – Warehouse management system, or software that allows a warehouse to control and administer operations.

SECTION ONE:

Introduction

There's a certain meditative quality to watching robots stack boxes in a warehouse—and judging from the 3.5 million views one YouTube video by robotics company Boston Dynamics¹ has garnered, many people are drawn to this preview of society's potential future. So-called “dark” warehouses might be full of these robots, toiling alongside stacks of goods and conveyor belts that swiftly carry packages across cavernous buildings and sort goods to their final destinations, all under the supervision of just a handful of human workers. In some ways, this is a desirable vision of the future, because it suggests that the problem of monotonous, manual work in warehouses has been solved by technology, leaving humans to take on the tasks that require higher cognitive functioning. In this scenario, could the technologically enhanced future of warehouse work mean increased efficiency, lower costs, and less grueling work—a win for everyone?

This research sought to examine this question, and the short answer is: without proactive measures, perhaps not. Instead, the potential gains from implementing new technologies in warehouses could be captured by the industry—while the losses fall to workers.

Warehouse operators stand to gain substantial efficiencies through the adoption of new technologies, and e-commerce is the driving force behind experimentation. Despite the growing range of available technologies, however, the warehousing industry faces significant impediments to widespread uptake, and adoption will be uneven across firms in the industry. As a result, in the short to medium term, the industry likely won't experience dramatic job loss, even as many workers may see the content and quality of their jobs shift as technologies are adopted for particular tasks. Technology and automation potentially could reduce monotonous or physically strenuous activities, but depending on how they are implemented may present new challenges for worker health and safety, employee morale, and turnover. As some occupations undergo de-skilling, employers benefit from reduced training times and turnover costs. The effects on workers, however, could entail wage stagnation and job insecurity. And electronically mediated forms of monitoring and micromanagement threaten to constrain workers' autonomy and introduce new rigidities into the workplace.

The labor market impacts likely will be uneven: workers who are young, Latinx and Black, and male are overrepresented in the front-line warehouse workforce and thus may be disproportionately affected by technological adoption. But technologies are neither inherently good nor bad, and the outcomes of employment change are not inevitable. Our research suggests that policy makers, worker organizations, and industry leaders alike must pay careful attention to the distribution of gains and losses from technological change to ensure broadly shared prosperity.

What is the “Future of Work?”

Warehousing is just one sector in which new technologies are forecasted to upend the status quo. More broadly, the uncertainty roiling around the so-called “future of work” has entered the mainstream. Over the last five years, debates about how work is changing largely have been waged by management consultants, in think tanks, among academics, and, to a lesser extent, in policy circles. What became clear, especially as popular media began to cover the shifts in the economy and the organization of industries, was that Americans instinctively feel greater insecurity is more and more a fact of life—whether that comes in the form of fissured work or technology-induced unemployment. The advent of ridesharing platforms and other forms of “gig” work have led to much hand-wringing that more traditional forms of employment are being consigned to a bygone era, though there is little evidence of seismic shifts toward “alternative” work arrangements.²

Technological change long has been a subject of human fascination, by turns exciting and alarming us with its potential for societal transformation. The application of new technologies to reorganize human labor has been a central theme of the future of work conversation, and media attention has brought the topic to readers and viewers in all corners of the country. What began as quasi-apocalyptic predictions about impending mass job losses³ has shifted, in a welcome development, to somewhat more nuanced discussions of the content of work, and which tasks and workers might be most affected by technological change.⁴ Still, most aggregate studies of the impacts of technology on jobs hover in their analysis at 30,000 feet, which obscures the conditional, lurching processes through which technological change usually occurs. The view from this elevation unintentionally has promoted a narrative of inevitability, with technological change foreshadowing a putative “end of work.”

The Future of the Warehouse

Instead of adhering to the notion of a fated future, this research takes seriously the ways in which technological change is *produced* by a range of actors and processes. Warehousing often is cited as one industry that will be revolutionized by automation, perhaps in part because it for so long has been a laggard in technological adoption—especially when compared with its sister sector, manufacturing.

Section One: Introduction

The warehousing industry is responsible for the storage, flow, and rerouting of goods to consumers or stores. The looming possibility of dark warehouses and other forms of automation that replace workers in warehouses dominates popular media reports about the industry. Yet there are many forms of technology that have the potential to change tasks and jobs in the warehousing sector without drastically reducing the need for workers in the short to medium term. This report explores a range of possible changes in the content and quality of work that might be borne of new technological applications in the warehouse.

Warehousing is an essential, if often invisible, element of the economy: it is the circulatory system through which goods move. Employment in the sector has been rising steadily since 2001, and growth has been particularly brisk over the last few years. From 2014 to 2017, employment rose by 37%, a phenomenon that largely can be attributed to e-commerce, for which sales grew by 52% over the same period. Wages, however, have not seen such growth. Rather, according to the U.S. Bureau of Labor Statistics, inflation-adjusted average wages actually have fallen since 2001.

The industry also is undergoing significant change. The rise of e-commerce has increased demand for fast, efficient warehouse operations, even as it also introduces new levels of complexity in assembling and shipping orders. Retailers with a brick-and-mortar footprint have struggled to develop new direct-to-consumer fulfillment strategies as they endeavor to satisfy changing consumer expectations regarding product selection, cost, and delivery timetables—fueled by Amazon’s sophisticated logistics infrastructure. An array of order fulfillment strategies has emerged. For example, some firms have added a “buy online, pick up in store” option, or BOPIS, filling online orders from brick-and-mortar store inventory and offering quick-turnaround pickup at the store itself. This new order delivery channel blurs the boundaries of the warehousing industry and highlights the considerable change under way in the sector.

Growing online sales have increased demand for warehouse workers and, at the same time, have produced a surge of interest among warehouse operators in how new technologies could help make the e-commerce order fulfillment process more efficient and less labor-intensive. While the industry historically has been slow to adopt new technologies, it appears to be reaching a decision point: tight labor markets, the emergence of e-commerce, and the capabilities of new technologies are converging to push firms to more seriously explore automation. Absent major shifts in the economy, the future likely portends considerably more widespread technological adoption, but in most cases it probably will proceed in a piecemeal fashion, applied to particular warehouse activities.

Research suggests that policy makers, worker organizations, and industry leaders alike must pay careful attention to the distribution of gains and losses from technological change to ensure broadly shared prosperity.

Research Questions

In an effort to understand the choices of and constraints facing warehousing industry actors, this study set out to assess short- and medium-term (over the next five to 10 years) technological change in the distribution function of global supply chains, and its potential impacts on the organization of employment and work tasks. Data collection focused on three main questions:

1. What key industry dynamics are playing a role in technological change?
2. How will adoption of new technologies impact warehouse facilities and operations, as well as the overall organization of the industry?
3. What tasks and processes are the highest priorities for technological application, and how might adoption of new technologies impact jobs in warehousing?

Data and Methods

This report relies on primary data collected through interviews with industry leaders and analysts, as well as attendance at logistics conferences and industry trade shows. Twenty-nine interviews were conducted between November 2018 and March 2019 in person and by telephone. Interviewees with a variety of perspectives were consulted, including management consultants, third-party logistics (3PL) operators, retailers, brands, and technology providers. Industry trade publications such as Supply Chain Quarterly, WERCWeekly, and SupplyChain 24/7 provided a wealth of information on the state of technological advance in warehousing. Finally, supplementary analysis drew on data from such government sources as the Bureau of Labor Statistics (BLS) and the U.S. Census Bureau.

To be clear, what was outside the scope of this analysis was quantitative modeling of potential future job losses in the sector. Other studies have offered projections of the impacts of technological change on employment levels, and these are discussed herein. Rather, the intent of this research was to get close to the ground, gathering perspectives from across the industry in order to examine the political economy of technological change.

Section 2 presents information on the warehousing industry. Section 3 offers a framework for understanding technological change and its impacts on workers. Section 4 lays out leading technologies and discusses the contextual factors that shape decision making about new technologies. Section 5 provides findings on the current trends and future impacts of technological change on the warehousing industry as a whole, and Section 6 builds on this with an analysis of how work is likely to change. Section 7 concludes with suggestions for policy and practice.

SECTION TWO:

The Warehousing Industry

Some background on the warehousing industry and its workforce will help lay the groundwork for understanding the opportunities and challenges the industry faces, as well as the pathways technological change might take in the coming years. This section presents an overview of the structure of the industry, followed by workforce demographics, the distribution of occupations, and worker pay.

Structure of the Industry

Warehousing involves the storage, flow, and rerouting of goods through physical buildings. The industry employs just more than 1 million workers who collectively earn wages approaching \$50 billion annually.⁵ According to County Business Patterns (2016), there are just more than 15,000 warehousing establishments in the United States, the majority of which are small, employing fewer than 20 workers. However, while establishments with 100 or more workers account for just 12% of total establishments, they account for the lion's share of employment—73% of all warehouse workers work in these facilities.

The central function of warehouses is the efficient calibration of goods production and consumption—a critical component of the U.S. economy. Figure 2.1. shows warehousing in the context of a simplified modern supply chain.

Figure 2.1
Simplified Supply Chain



There are a few key features of the warehousing industry that are useful to point out.

Changing Warehouse Operations

Shifts in consumption patterns and the organization of supply chains have led to significant change in the warehousing industry, forcing distribution centers from a storage function to one where, ideally, goods are in near-constant movement. A “traditional” warehouse is shorthand for distribution centers that deal mainly in pallets and cases (full boxes of goods). For these facilities, goods arrive at the warehouse on a pallet or in boxes packed directly on the floor of a shipping container. During the time these goods are in the warehouse, they will remain either palletized or in cases. These arrangements improve the efficiency of moving and storing bulk goods: for example, 4,000 calculators can be moved in a single forklift trip. Traditional warehouses are more likely to be receiving and shipping full pallets or cases of goods to a retail store or other business.

The basic categories of warehouse activities include:

- **Receiving:** Unloading goods and preparing them either for storage or transshipment. This can also include returns.
- **Put-away:** Moving goods to their next location within a warehouse.
- **Storage:** Holding goods until they are needed.
- **Picking:** Selecting and assembling orders per item, case, or pallet. This also may include final assembly, labeling, or packaging.
- **Shipping:** Preparing orders for shipment and loading goods.

While these activities still remain central to warehouse operations, the profile of the industry has shifted over the last decade as online shopping has gained retail market share.

E-commerce Warehouses

With double-digit year-over-year sales growth, few shifts in consumption patterns have had a greater impact on the warehousing industry than the rise of e-commerce. According to the U.S. Census Bureau, just more than 10% of retail sales in the second quarter of 2019 were conducted online.⁶ E-commerce distribution centers comprise 20% of new industrial leasing activity,⁷ which reflects the current phase of expansion and the need for more space to fulfill online orders. The e-commerce segment is expected to grow in the coming years, and will continue to drive demand for efficient warehousing operations.

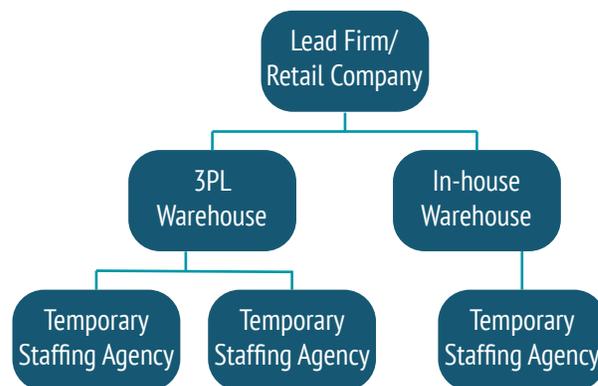
The rise of e-commerce has introduced a new set of activities into warehouse operations, both because of the nature of online orders and the speed with which they must be processed.

E-commerce customer orders consist of “eaches,” or quantities of one, for multiple products stored within a warehouse. Items for a single order likely will be located in different areas of the facility, and they must be consolidated in one place to be packed and shipped together, a process called each-picking order assembly. Furthermore, customers expect the shipment to arrive quickly—Amazon has set high expectations among consumers for fast, cheap delivery. For these reasons, the e-commerce picking process is far more labor intensive and time sensitive than traditional warehouse activities involving the bulk transfer of products.

Outsourcing

Two forms of outsourcing are prevalent in warehousing: 1) contracting for warehouse operations, and 2) contracting for labor. Companies often pursue a mix of in-house and outsourced warehouse operations (Figure 2.2). Over the last 15 years, third-party logistics companies, or 3PLs, have proliferated as lead firms that do not consider warehousing to be a core competency have sought outsourcing options; in 2017, revenues in the contract warehouse sector topped \$40 billion.⁸ The lack of systematic, representative data makes it difficult to track long-term changes in warehouse outsourcing,⁹ however, according to one study, 66% of shippers now outsource their warehousing needs.¹⁰

FIGURE 2.2
Stylized Map of Warehouse Outsourcing



3PLs provide a number of services and value-added activities for part or all of their customers’ distribution needs—for example, Walmart contracts with 3PLs to manage the distribution of oversized goods like tires, while keeping fulfillment of other retail goods in house.¹¹ In another case, a grocery store chain like Meijer might contract with a 3PL to provide final brand labeling on canned goods. On balance, though, the most common activities to be outsourced are transactional, repetitive operations, such as unloading containers of goods.

Section Two: The Warehousing Industry

The leading 3PLs aren't necessarily household names: while DHL is well known, other major players like XPO Logistics, Kuehne + Nagel, GEODIS, and CEVA Logistics are not. Yet they play an important role in providing logistics services to their clients, which include retailers, grocery chains, consumer electronics companies, and brands.

Competition in the 3PL market is cutthroat, and a key determinant for whether one 3PL wins a contract over another is price. In a 2017 survey, 77% of lead firms reported that "lowest cost" was the single most important factor in selecting a 3PL provider.¹² And while 3PLs often offer a comprehensive suite of services for clients, there is little evidence that lead firms are, on the whole, seeking higher value-added services. Instead, transactional activities compose the bulk of 3PLs' contracts. As a result, 3PLs operate in highly competitive, price-sensitive markets where the primary value proposition is one of reducing costs (as opposed to differentiating service offerings). Furthermore, lead firms' contracts with 3PLs tend to last for just three to five years before being rebid, making strategic partnerships between companies more difficult. These factors, in turn, have ripple effects on how work is organized and, ultimately, on the feasibility of introducing new technologies into warehouses.

One key capacity offered by 3PLs is management of warehouse labor, including the outsourcing of workforce needs to temporary staffing agencies that provide just-in-time staffing for warehouse facilities. Temporary staffing agencies have assumed a central role in helping warehouses manage market volatility, and several logistics-related occupations are among those with the highest temp penetration rates.¹³ For example, according to the BLS, laborers and hand material movers are the largest warehouse occupation, making up 44% of front-line workers; laborers are also the largest occupational category in temporary help services, with more than one half-million workers. The two largest employing industries for the laborers occupation are temporary staffing, which employs 18% of all laborers, and warehousing, where 10% work.¹⁴

In warehousing, there are powerful inducements to hold down the cost of labor, and the negative short- and long-term effects on workers, in particular sizable wage differentials between temporary and direct-hire employees, are well documented.¹⁵ These wage differentials raise important questions concerning the labor strategies of warehouse operators and the workforce systems they adopt, even as technological change appears poised to unsettle existing staffing arrangements.

Geographic Concentration of Warehouses

Warehouses often are clustered near major transportation arteries and population centers. Over the last decade, warehouse developers and operators have sought inexpensive land for new, large-scale distribution center projects, which often meant siting buildings in suburban or exurban areas. For example, the Riverside-San Bernardino-Ontario, California, Metropolitan Area, also known as the Inland Empire, is roughly 60 miles east of Los Angeles and home to the highest concentration of warehousing employment in the country (Table 2.1.). Because of the clustering of

warehouses in particular geographic areas, any shifts in employment caused by new technologies will have greater impacts in these areas. Online shopping and customer expectations for fast delivery, however, have increased demand for smaller, last-mile e-commerce distribution centers near densely populated areas.¹⁶ This trend is shifting the geography of warehouses toward urban cores.

TABLE 2.1
Top Ten MSAs for Warehousing Industry Employment, 2018

Metropolitan Statistical Area	Warehousing Industry Annual Average Employment (2018)
Riverside-San Bernardino-Ontario, CA	68,673
Chicago-Naperville-Elgin, IL-IN-WI	51,006
New York-Newark-Jersey City, NY-NJ-PA	49,945
Dallas-Fort Worth-Arlington, TX	44,273
Atlanta-Sandy Springs-Roswell, GA	31,165
Los Angeles-Long Beach-Anaheim, CA	27,271
Columbus, OH	26,213
Indianapolis-Carmel-Anderson, IN	26,121
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	23,942
Phoenix-Mesa-Scottsdale, AZ	20,103

Source: Quarterly Census of Employment and Wages

The Warehouse Workforce

As we discuss later in this report, there are significant technological changes on the horizon in the warehousing industry. As a result, many workers may find their occupations reshaped and the quality of their jobs undermined. The makeup of the existing warehouse workforce is analyzed below.

The fortunes of the warehousing industry are closely tied to consumer spending and the strength of the national economy. The industry has been in a period of sustained growth. According to BLS data, with the exception of a dip during the 2007–09 Great Recession, employment growth has been strong since 2001, with a marked increase recently—the industry experienced 37% employment growth between 2014 and 2017 (Figure 2.3).¹⁷ Much of this increase can be attributed to the rise of e-commerce sales, which grew by 52% over the same period;¹⁸ BLS predicts employment will continue to grow by 21% between 2016 and 2026.¹⁹

Section Two: The Warehousing Industry

Typically, when an industry experiences this level of employment growth, rising labor demand leads to rising wages. In the warehousing industry, however, inflation-adjusted wages actually have fallen since 2001 (Figure 2.3.). This may provide *prima facie* evidence that, in key locales, warehouse facility operators are exerting monopsony power within their local labor markets. The concentration of warehouse facilities in distinct geographical areas, such as Southern California's Inland Empire, Will County in exurban Chicago, and the Lehigh Valley in Pennsylvania, appears to be providing employers the latitude to set wages at lower levels than would be reached if job market competition prevailed. This appears to have contributed to wage stagnation in the industry. The spatial concentration of employment in these regions means that warehouse operators dominate many local labor markets, with few employment opportunities outside the even-lower-paying service sector. In such cases, the warehousing industry has considerable latitude in setting wage rates, especially given that unionization rates in the industry also have fallen—from 14% in 1990 to just 6% in 2018.²⁰

FIGURE 2.3
Trends in Overall Warehousing Industry Employment and Real Annual Earnings, 2001-2017



Source: Quarterly Census of Employment and Wages

Warehouse Occupations

Table 2.2. presents data on the five largest occupations in warehousing, also referred to in this report as front-line workers, which represents direct-hire workers in facilities classified under the Warehousing and Storage industry code (NAICS 493). The following occupations are the largest in the industry:

- Laborers and Freight, Stock, and Material Movers, Hand
- Industrial Truck and Tractor Operators (Forklift Drivers)
- Stock Clerks and Order Fillers
- Packers and Packagers, Hand
- Shipping, Receiving, and Traffic Clerks

Median hourly wages for these workers range from \$13.71 to \$16.96; the median hourly wage for laborers, who account for roughly a third of all workers in warehouses, is \$15.85. Yet because of the way data on the industry are compiled, this table presents an incomplete picture of employment and wages. In addition to direct-hire employees, warehouse operators also rely, to varying degrees across facilities and times of the year, on workers supplied by temporary staffing agencies; these workers are not included in Table 2.2. Also absent are workers in common warehouse occupations employed in e-commerce warehouses (NAICS 45411, Electronic Shopping and Mail-Order Houses; this industry category captures some, but not all e-commerce facilities, with the remainder included in NAICS 493).

TABLE 2.2
Employment and Hourly Median Wages for the Five Largest Occupations in the Warehousing Industry, 2018

Occupation	Employment	Hourly Median Wage
Laborers and Freight, Stock, and Material Movers, Hand	329,540	\$14.58
Industrial Truck and Tractor Operators (Forklift Drivers)	183,350	\$16.96
Stock Clerks and Order Fillers	99,770	\$15.35
Packers and Packagers, Hand	68,340	\$13.71
Shipping, Receiving, and Traffic Clerks	59,880	\$15.85

Source: Occupational Employment Statistics

Difficulties accurately counting warehouse workers have led to vast variations in employment estimates: on the low end, BLS estimates 1 million workers,²¹ while a recent McKinsey report estimates 4 million.²² The blurred boundaries of the industry also appear to inflate the wages

Typically, when an industry experiences this level of employment growth, rising labor demand leads to rising wages. In the warehousing industry, however, inflation-adjusted wages actually have fallen since 2001.

typically reported for the industry. Some workers in e-commerce, and those employed through temporary staffing agencies, earn less per hour than direct hires in the warehousing industry. For example, according to BLS, shipping and receiving clerks, stock clerks, and packers in e-commerce warehouses earn between 6% and 15% less per hour than the same occupations in traditional warehouses.²³ In short, 1 million warehouse workers is likely a conservative estimate of total employment, and \$13.71 to \$16.96 is probably higher than the overall median wage of all warehouse workers.

Warehouse Worker Characteristics

Analysis of data from the American Community Survey (2013–2017) on the five largest warehousing occupations shows the U.S. warehouse workforce is more likely to be young, Latinx and Black, and male than

the rest of the working population. Because there are significant differences in the workforces employed, the data on worker characteristics are presented separately for the warehousing industry (NAICS 493) and the warehousing segment of e-commerce (NAICS 45411), hereafter referred to as warehousing and e-commerce.

Male workers are overrepresented in the industry: while 47% of the U.S. workforce is male, 72% of workers in warehousing and 56% in e-commerce are male (Table 2.3.). And although male workers compose the majority of the workforce in both segments of the industry, female workers are much more likely to be employed in e-commerce than in warehousing—44% of workers in the e-commerce segment are women, compared with just 28% of workers in traditional warehousing.

Latinx and Black workers are overrepresented in warehousing jobs: both groups are employed in warehousing at a rate roughly double that of all other industries. Despite accounting for only 17% of the overall U.S. labor force, Latinx workers compose the largest single racial/ethnic group of front-line workers in warehousing (35%). Similarly, Black workers account for roughly one-quarter of workers in both warehousing and e-commerce, but account for just 12% of the overall labor force. Conversely, Whites are underrepresented in the industry. The proportion of White workers in warehousing and e-commerce is 34% and 45%, respectively, despite accounting for 63% of the overall labor force. Overall, workers of color make up 66% of warehousing industry workers and

Section Two: The Warehousing Industry

55% of workers in e-commerce, whereas workers of color are just 37% of the total U.S. labor force. Warehouse workers tend to be young: workers younger than age 35 make up 56% of warehouse workers and 64% of e-commerce workers.

TABLE 2.3
Demographic Characteristics of Workers in the Five Largest Warehouse Occupations in Warehousing and Electronic Shopping Industries, U.S. Total*

	Percentage of Workers in Warehousing Industry**	Percentage of Workers in Electronic Shopping Industry***	Percentage of Workers in U.S. Workforce, All Sectors
Gender			
Male	72%	56%	47%
Female	28%	44%	53%
Race/Ethnicity			
Black, Non-Latinx	25%	26%	12%
Hispanic or Latinx	35%	19%	17%
Asian, Non-Latinx	3%	6%	6%
White, Non-Latinx	34%	45%	63%
Other, Non-Latinx	2%	4%	3%
Age			
18–24	27%	38%	16%
25–34	29%	26%	24%
35–44	19%	16%	22%
45–54	16%	13%	23%
55–64	9%	7%	15%

Source: American Community Survey 2013–2017

*The largest warehouse occupations are Laborers and Freight, Stock, and Material Movers, Hand; Industrial Truck and Tractor Operators (Forklift Drivers); Packers and Packagers, Hand; Stock Clerks and Order Fillers; and Shipping, Receiving, and Traffic Clerks

** North American Industrial Classification System (NAICS) 493

*** NAICS 45411

Note: Columns may not add to 100% due to rounding.

While female workers are more likely to work in e-commerce than warehousing, the proportion varies significantly by occupation. Table 2.4. shows the gender composition of the five largest occupations in warehousing and e-commerce. In nearly every occupation, women make up a higher percentage of e-commerce workers than warehousing industry workers.

TABLE 2.4
Common Warehouse Occupations in the Warehousing and Electronic Shopping Industries by Gender

	Percent of Workers in Warehousing Industry	Percent of Workers in E-commerce Industry
Laborers and Freight, Stock, and Material Movers, Hand		
Male	78%	70%
Female	22%	30%
Industrial Truck and Tractor Drivers (Forklift Drivers)		
Male	93%	82%
Female	7%	18%
Stock Clerks and Order Fillers		
Male	62%	52%
Female	38%	48%
Packers and Packagers, Hand		
Male	43%	44%
Female	57%	56%
Shipping, Receiving, and Traffic Clerks		
Male	69%	57%
Female	31%	43%

Source: American Community Survey 2013–2017

Warehouse Working Conditions

Front-line workers perform a variety of activities that allow for the movement of goods through warehouses. The main tasks of the five major occupations are as follows:²⁴

Laborers and Freight, Stock, and Material Movers, Hand

- Move freight, stock, or other materials to and from storage or production areas, loading docks, delivery vehicles, ships, or containers, by hand or using trucks, tractors, or other equipment.
- Sort cargo before loading and unloading.
- Attach identifying tags to containers or mark them with identifying information.
- Read work orders or receive oral instructions to determine work assignments or material or equipment needs.
- Stack cargo in locations, such as transit sheds or in holds of ships, as directed, using pallets or cargo boards.

Industrial Truck and Tractor Operators (Forklift Drivers)

- Move levers or controls that operate lifting devices, such as forklifts, lift beams with swivel-hooks, hoists, or elevating platforms, to load, unload, transport, or stack material.
- Inspect product load for accuracy and safely move it around the warehouse or facility to ensure timely and complete delivery.
- Manually or mechanically load or unload materials from pallets, skids, platforms, cars, lifting devices, or other transport vehicles.
- Position lifting devices under, over, or around loaded pallets, skids, or boxes and secure material or products for transport to designated areas.
- Weigh materials or products and record weight or other production data on tags or labels.

Stock Clerks

- Pack and unpack items to be stocked on shelves in stockrooms, warehouses, or storage yards.
- Store items in an orderly and accessible manner in warehouses, tool rooms, supply rooms, or other areas.
- Examine and inspect stock items for wear or defects, reporting any damage to supervisors.
- Receive and count stock items, and record data manually or using computer.
- Mark stock items using identification tags, stamps, electric marking tools, or other labeling equipment.

Packers and Packers, Hand

- Load materials and products into package processing equipment.
- Clean containers, materials, supplies, or work areas, using cleaning solutions and hand tools.
- Record product, packaging, and order information on specified forms and records.
- Examine and inspect containers, materials, and products to ensure that packing specifications are met.
- Measure, weigh, and count products and materials.

Shipping, Receiving, and Traffic Clerks

- Examine shipment contents and compare with records, such as manifests, invoices, or orders, to verify accuracy.
- Record shipment data, such as weight, charges, space availability, damages, or discrepancies, for reporting, accounting, or recordkeeping purposes.

Section Two: The Warehousing Industry

- Prepare documents, such as work orders, bills of lading, or shipping orders, to route materials.
- Confer or correspond with establishment representatives to rectify problems, such as damages, shortages, or nonconformance to specifications.
- Pack, seal, label, or affix postage to prepare materials for shipping, using hand tools, power tools, or postage meter.

The manual nature of much warehouse work is evident in the occupational descriptions above. Repetitive movements, awkward lifting and moving positions, and a fast-paced work environment, together put workers at risk of injury. Indeed, according to BLS, in 2017, warehouse workers experienced work-related injuries at a rate nearly twice that of all private industry workers—higher than construction, coal mining, and most manufacturing industries.²⁵ In one recent industry survey, 61% of respondents had a warehouse employee turnover rate greater than 10%, with major impacts on productivity and the cost of replacing workers.²⁶

Health and safety is one contributing factor to the high turnover rate in warehouses, and recent media reports have highlighted the array of health and safety risks in the industry. Amazon, in particular, has come under fire for the health and safety ramifications of high productivity requirements and the stress workers report feeling as they toil under exacting pressures to perform.²⁷ In addition, many warehouses are not climate controlled, leading to cold temperatures in winter months and sweltering conditions during the summer; at an Amazon warehouse in Pennsylvania, for example, workers so frequently experienced heat-related episodes, including fainting, that paramedics and ambulances were stationed outside.²⁸ According to one New York Times account, pregnant workers at a warehouse in Memphis managed by the 3PL XPO were denied requests for light duty and subsequently suffered miscarriages.²⁹ Such reports point to the challenges that warehouse workers face, which are often exacerbated by the frenetic pace of just-in-time distribution systems and high productivity standards that pervade the industry.

Worker Productivity and Management

Tracking worker productivity long has been a key feature of the warehouse. “Scientific labor management,” first introduced by Frederick Taylor in the 1900s, promised to apply principles of science to improvements in labor productivity. Management systems divide work into discrete subtasks, each of which is subject to time and motion studies of the workers performing the job. The results of these studies form the basis for “engineered labor standards,” which in warehouses often are codified in Key Performance Indicators (KPIs) such as volume moved per worker per hour and accuracy (KPIs also include other such nonlabor indicators as inventory accuracy and asset utilization). In unionized warehouses, the development of engineered labor standards are negotiated and agreed upon by both workers and management. No such agreements exist in nonunion facilities.

Industrial engineers conduct audits that assess and reassess warehouse processes for possible gains in efficiency. As the vice president of a large 3PL explained in an interview, “We have a whole engineering team that does nothing but continuous improvement. ‘Let’s look at the process, figure out how we change it and make it ever so slightly better. Get five seconds out of it.’ We don’t even want to think about technology [until we’ve done that].”

Taken together, data on the warehouse workforce offer an aggregate account of the workers who will be most affected by new technologies: these are front-line workers involved in all aspects of the movement and handling of goods in warehouses, exposed to health and safety risks that are exacerbated by high productivity standards. One important factor that shapes workers’ experiences of job quality, as well as the broad approach to technological change, is the cost-sensitivity of the warehousing industry.

Economics of the Industry

For all the emphasis on sophisticated, strategic approaches to goods movement that abound in business literature, warehousing largely still is seen as a cost to be contained—a “necessary evil.” Warehousing rarely adds an increment of value to the end product—and fast, free shipping and returns reinforce this point—so the dominant dynamic across the warehousing industry is one of low margins and cost cutting.

Two key features of modern supply chains shape the role warehouses and distribution centers play in the wider economy: volatility and risk management. Supply-chain volatility—such as that caused by fluctuations in consumer markets, shifting seasonal cycles, or natural disasters—makes flexibility to adapt to demand and supply instability paramount. Distribution centers are expected to buffer and help manage this volatility through a range of flexible, just-in-time systems.

At the same time, firms’ supply chain risk management strategies must contend with a varied set of economic, product market, and regulatory risks, including those arising from trade policies, fluctuations in currency valuations, and changes in consumer spending. All warehouses face volatility and risk, and some lead firms pursue outsourcing in an attempt to shift risk away from their own sphere of responsibility, including onto 3PLs and temporary staffing agencies.³⁰

In the context of low margins—according to one industry estimate, warehouse margins average just 3% to 6%³¹—firms’ options to manage volatility and risk are constrained. In the past, warehouse operators have relied on experimentation in labor strategies to contend with the challenges of volatility and risk inherent in supply chains—for example, using temporary workers to flex staffing levels up and down with fluctuations in consumer demand. While this trend persists, our research found that there also is increasing interest in using new technologies to address the fundamental business dynamics that shape the industry.

SECTION THREE:

A Framework for Technological Change

With society searching for clues about how work will change, predicting long-term technological unemployment has become fashionable. Think tanks and management consultancies produce aggregate accounts of technological change, often with contrasting conclusions ranging from apocalyptic to modest (mainly due to differing methodologies and assumptions). Unfortunately, most studies have focused narrowly on potential job losses, as opposed to the consideration of a broad spectrum of possible effects of technological change. This research seeks to counteract this tendency by exploring some of the varied ways in which technology potentially could affect employment arrangements, including altering the content and quality of jobs through de-skilling, work intensification, and algorithmic management.

The warehousing industry often is included among the sectors that will be transformed radically by technology, with studies forecasting that a substantial percentage of jobs and activities are automatable. Some examples include the following:

- According to the Brookings Institution, 92% of forklift drivers' tasks and 80% of packers and packagers' tasks are susceptible to automation, while only 7% of the tasks of a laborer are similarly susceptible.³²
- McKinsey Global Institute estimates that 57% of activities in transportation and warehousing are technically automatable.³³
- Bain & Company predicts that 70% of job roles in warehouses potentially could be lost through automation.³⁴

The Task Model

One common way to understand the relationship between technology and the content of jobs is the "task model" developed by Autor, Levy, and Murnane.³⁵ The task model suggests that for repetitive and easily programmed operations, new technology tends to replace human

Section Three: A Framework for Technological Change

labor, particularly as the cost of technology adoption declines. This, the authors point out, historically has been a key driver of technological change in the workplace. For other operations, the procedures necessary to complete a given task are not understood well enough to be programmed, and thus undertaken by a machine; these are nonroutine operations for which technology can complement human labor and result in increased worker productivity—but not fully replace human labor. Some tasks remain more productively completed by humans, at least until the ability to program the task content is achieved and the price point drops below the cost of labor.

One should not assume, however, that decisions regarding technology adoption are made solely on the basis of hoped-for efficiency or productivity gains, though this is typically how such decisions are framed by those developing new technologies and, often retrospectively, by those who have implemented technological change within their organization. Further, the price point of the technology, while important, is not the only factor influencing technology adoption. Firms' decisions about pursuing new technologies are made in the context of particular forms of governance—that is, these decisions are made in relation to how a given company is organized, the regulatory environment within which it operates, the labor and industrial relations framework through which employment is organized, its relationships to suppliers and end users, and the markets within which it competes. Attention, therefore, should be focused on the interaction of organizational structures and technologies, lest observers misrepresent how particular outcomes, like reductions in workforce size or changes in job quality, are produced. Variation among these interactions within firms' systems of governance helps explain divergences in techno-strategies at the firm level.

The task model would suggest that routine tasks are the highest priority for technology applications. However, this research points to a range of other factors that also shape this decision. The prevalence of manual, routine tasks in a warehouse increases the probability that these activities will, at some point, be candidates for automation, though when and how this occurs is difficult to predict. Herein lies the key weakness of aggregate accounts that predict sweeping job losses in industries and occupations. The specific content of a task shapes alternative methods of organizing the work—for example, the dexterity required to select a particular item for a shipping order constrains the application of (current) technologies to the task of order picking. The technical “automatability” of a task certainly impacts the trajectory of change—it represents the initial step of making it possible to apply a new technology to an activity. Moving from this stage to one of rising probability of technology adoption, and then on to a point where technology adoption pervades an industry, demands attention to industry dynamics and other contextual factors, which are difficult—if not impossible—to model quantitatively. The process of technological change is path dependent—that is, it occurs within a set of social and historical circumstances that carry “embedded interests and ideologies about what problems can or should be ‘solved’ by technology.”³⁶ The perils of quantitative modeling and the distinct lack of qualitative descriptions that endeavor to account for the range of factors shaping technological change were the impetus for this research.

SECTION FOUR: Warehouses and Technology

Leading Technologies in Warehousing

Warehousing has been a relative laggard industry in terms of adopting new technologies. Over the last 20 years, technological innovation was focused on eliminating data entry and reducing the amount of walking involved in a warehouse worker's activities. The key forms of technology included warehouse management software, radio frequency scanners, and industrial conveyor systems, though the uptake of these forms of automation across firms has been uneven.³⁷ The following are some of the leading and emerging technologies in warehousing today.

Software

Warehouse Management Systems

Warehouse management systems (WMS), the most common technology deployed across the industry, control day-to-day warehouse operations, including receiving and storage, staging orders, and administering product replenishment. WMS software usually stands as separate modules from, but integrated with, enterprise resource planning (ERP) systems, which send orders to the WMS. In the 1980s and 1990s, many firms developed their own WMS in house and, particularly for 3PLs, unique attributes of their WMS helped create a market niche.³⁸ Today, these legacy systems are being replaced by highly sophisticated off-the-shelf software packages, such as Manhattan, JDA, and HighJump. WMS software sometimes includes a labor management system module, which increases the ability of managers to plan labor allocation and track workers, and typically integrates engineered labor standards into metrics. Integration of WMS with various hardware systems is a key puzzle for technology developers, and can require a separate system to "translate" between the hardware and WMS, sometimes referred to as a warehouse execution system.

Hardware

Conveyors and Sortation Systems

Large-scale industrial mechanization arrived in warehousing in the 1990s. Conveyors and sortation systems were designed to carry boxes across large expanses and direct the goods to the proper shipping location, thereby reducing workers' time spent walking and sorting. Major capital investments were required to implement these systems, which are heavy, bolted to the floor, and inflexible. Decision making about the adoption of conveyor systems was based on 10-plus-year forecasts of demand volumes, so when first installed, they tended to have excess capacity; because they are costly, mechanized systems often take many years to realize an adequate return on investment. Newer forms of conveyor and sortation systems can incorporate automated scanning and goods sortation for shipment.

Radio Frequency Scanners

Handheld radio frequency (RF) barcode scanners are used to manage inventory and track the order-picking process, replacing the need for paper "pick lists." RF scanners also allow employers to monitor worker productivity. Hands-free RF scanners that attach to a worker's arm and are equipped with a barcode scanner on a finger are replacing handheld scan guns that can cause tendonitis and other ergonomic injuries.

Voice-Directed Systems

Workers using voice-directed systems wear a headset that provides instructions on what items to pick or put away and where they are located, and workers confirm the location and items by speaking standardized commands. Voice-directed systems can replace the need for a worker to read instructions from a list or scan items with a barcode scanner. According to a recent survey, voice-directed systems are one of the fastest-growing technologies in warehouses—roughly one-quarter of facilities reported using voice-directed picking in 2018, up from just less than 6% a decade prior.³⁹

Put Walls

Put walls are shelving systems with slots, each representing an e-commerce or store order. They are equipped with lights that direct a worker to put items in particular places. Orders are picked upstream and transported manually or via conveyor or mobile robots to the put wall for sorting into individual orders. Put walls are not highly automated and still require significant amounts of human labor to implement, but are relatively inexpensive and effective in streamlining the picking and order-assembly process.

Goods-to-Person Systems

Goods-to-person systems bring items to the worker for order picking. This can, for example, take the form of a shelf mounted on a robot that makes its way to the picking station, as in the case of Kiva robots in Amazon warehouses, or a hanging bag sorter that brings individual items to a worker via an overhead-mounted pouch. There is a range of automated storage and retrieval systems (ASRS), which combine storage with goods-to-person item delivery. Goods are stored in racking systems, and an automated shuttle retrieves goods and delivers them to the order picker. These systems allow for high-density storage, since they eliminate the need for wide aisles between racks for humans or forklifts, and are the most efficient automated systems currently available. However, they are costly, resembling older forms of mechanization in terms of the capital intensity of implementation and their inflexibility—they are set in place and only can accommodate goods of a fixed maximum size and weight. There are ASRS systems designed for each picking, case picking, and pallet in/out processes, though a single system would not be able to accommodate all three activities.

Autonomous Mobile Robots

Autonomous mobile robots (AMRs) are automated carts that travel around a warehouse, moving items for orders between picking and sorting or packing locations. Two subcategories exist: “relay” carts and “follow-me” carts. Relay AMRs can work with most picking processes; the order picker selects the items for the order, places them in the cart or tote, and the AMR delivers the tote to the next task station. A follow-me AMR leads a worker through the warehouse, setting the pace and directing the worker to select particular items. When the order picking is completed, the follow-me AMR transports the items to the next task station. AMRs are very effective in e-commerce fulfillment environments and in applications with sufficient order volumes. Some users report that the robots can double productivity levels, but higher productivity models cost more to implement, and without adequate volumes, AMRs will not achieve the expected results.

Robotic Picking

In most warehouses, the product-picking process still relies on human hands to select items. The optimal technological case for picking is robotic order picking, in which a robotic arm is equipped with hand-like or suction-cup grippers that can reach into a pick location, grasp an item, and place it into a tote. The backend data input relies on artificial intelligence (AI) to “learn” how to grasp different products, though variation in product sizes and shapes greatly complicates computer programming. Research and development is active in this area—some of the most popular technologies at the ProMat 2019 warehouse automation conference were products that make gains toward order-picking automation, and Amazon has long held an annual competition for precisely this technology. Gripper technology has progressed significantly, and although the robotic arms on which they are mounted have come down in price, the products still are mostly in a development phase.

There are exceptions, however. For example, where products are relatively uniform and arrive at the robotic arm in standardized packaging, such as in The Gap's e-commerce apparel warehouse operation, this automation has proven viable. Yet even in the case of apparel, the technology is not universally practicable, highlighting the variation that will shape technology adoption. As one interviewee, a distribution manager of a mid-sized apparel retailer, pointed out, for a business where the product must look a certain way upon delivery—for example, high-end dresses that need to arrive wrinkle-free—some of the technologies that drop, clasp, or suction goods run counter to the desired end look.

It is important to highlight that the AI that informs the robotic grippers still relies on human intervention. One leading robotic picking machine flags cases in which the gripper cannot determine how to grasp an item, and off-site staff takes over and guides the machine. It's not hard to imagine this manual task—machine learning that relies heavily on human teaching—becoming the purview of dispersed gig workers, blurring the line between warehouse worker and tech worker. AI, in other words, requires intelligence that is not so artificial.

Automated Guided Vehicles

Automated guided vehicles (AGVs) are technology-enabled material moving vehicles, usually a forklift or “tugger,” that transport goods along preset routes in a facility. Some are fully automated, while others are a hybrid system that also can be human-operated. Guidance technology has greatly improved—whereas AGVs used to require physical infrastructure in the form of markers in the warehouse, many now use a laser-guidance system, which lowers implementation costs. Nevertheless, AGVs still are relatively expensive and may need to be “caged,” or separated physically from workers, which narrows their applicability in warehouse settings.

Sensors

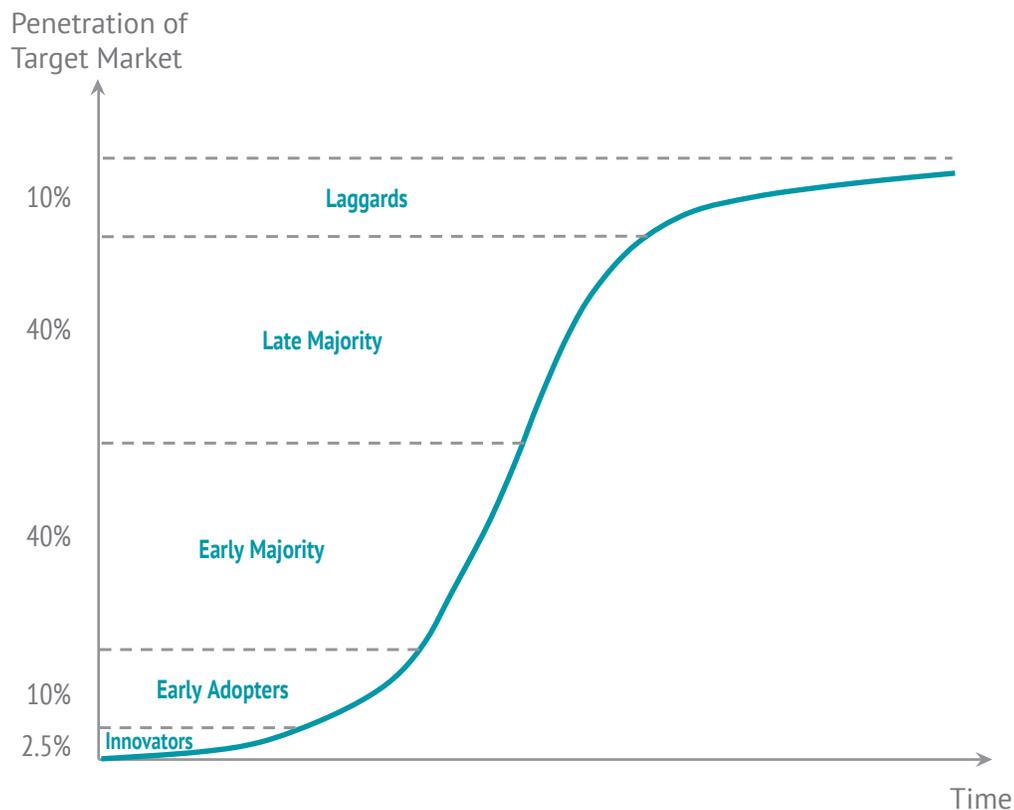
Sensors have many applications in the warehouse, from being able to dynamically track inventory to monitoring the movements of workers to controlling energy usage. Combined with other technologies, sensors can, for example, allow for autonomous palletizers to stack boxes on a pallet by determining the dimensions and proper stacking order. The Internet of Things (IoT), where vehicles, devices, or goods are embedded with sensors that can communicate automatically with each other, is seen to have significant potential to capture real-time data across the logistics system.

The wide range of innovations speaks to the potential opportunity for technology to be applied across warehouse activities. Depending on the source—trade literature, interviews with industry insiders, or technology developers—reports on the state of uptake among leading technologies vary. For example, two different surveys, conducted by Honeywell and the Warehousing Education and Research Council (WERC) three years apart, estimate that voice-directed picking is in use in 12% and 25% of facilities, respectively.⁴⁰ There is no shortage of new technologies available to warehouses—the question is how firms make choices about techno-strategy.

Technology Diffusion in Warehousing

In his landmark study of the diffusion of innovations, Rogers⁴¹ highlighted the role that complex social structures play in shaping the pathways of technology adoption. The extent and rate of adoption in an industry is related to multiple factors; chief among them is the relative advantages conferred by new technologies, the complexity of technology implementation, and the compatibility of a given technology with users' norms and systems. These factors help account for the marked unevenness of innovation adoption across a sector. The path of adoption of a given technological innovation most typically resembles an S-shaped curve, progressing from an innovator to early adopters to late adopters (the period in which the rate of innovation adoption slows; see Figure 4.1.). The warehousing industry appears to be in the lower left quadrant of the model, an industry just beginning the process of technology diffusion.

FIGURE 4.1
Diffusion of Innovation, Based on Rogers (1962)



Warehousing currently exhibits a highly uneven landscape of technological adoption. As will be elaborated below, despite several push factors that encourage warehouse operators to explore the use of new technologies, the uncertainties of future demand and questions regarding systems scalability, as well as (paradoxically, perhaps) the sheer pace of technological change,

have inhibited widespread implementation of costly automation systems. For many low-tech warehouse operators, increasing order volumes instead are met through evolving workforce strategies (e.g., adding new shifts, increasing overtime) rather than through mechanization and automation. As long as workers’ wages remain relatively low, many warehouse managers will opt to delay investments in new systems, especially given that the implementation of automated systems introduces new complexities into established operations. In addition, the fixed architectures of warehouse facilities and their distribution systems raise questions of whether existing facilities actually are compatible with some new technologies, which in many cases serves to limit the introduction of automation to the piecemeal adoption of technologies that can enhance worker productivity rather than eliminate the need for human labor.

The Context for Technology Uptake

This section analyzes the conditions surrounding firms’ consideration of new technologies. As noted above, the context within which warehouse operators make decisions about whether to deploy new technologies includes both push factors and constraints (Table 4.1.). The push factors might lead to increased interest in technological innovation, whereas constraints might decelerate the exploration process. Like decision making about technological uptake, these contextual dimensions do not operate as linear processes, nor do they create inevitable outcomes. The most influential push factors include *labor conditions*, *real estate costs*, and *increasing speed requirements*, while the most common constraints involve *variability and unpredictability*, *outsourcing dynamics*, *inertia*, and the *state of technological innovation*.

TABLE 4.1
Push Factors and Constraints for Technology Uptake in the Warehousing Industry

Context for Technology Uptake	
Push Factors	Constraints
Labor conditions	Variability
Rising real estate costs	Outsourcing
Increasing speed requirements	Inertia
	State of Technology

Push Factors

Labor Conditions

The most commonly cited problem warehouse operators encounter today is securing an adequate workforce, because of tight labor markets and Amazon. With unemployment at its lowest rate in nearly a half-century—3.5% in September 2019—the pool of available workers has dwindled. In a 2017 industry survey, 90% of warehouse operator respondents said they were struggling to hire

hourly workers.⁴² Compounding low labor availability is the reality that warehouse jobs are rarely work of first choice, given the manual nature of many of the activities.

While the so-called “Amazon effect” sometimes is exaggerated, the fact is that Amazon has had considerable impacts both on its direct retail competitors and on the warehousing industry as a whole—especially in the realm of labor markets. Amazon’s million-square-foot fulfillment centers employ thousands of workers, and often are co-located with other distribution centers in dense logistics clusters (for example, California’s Inland Empire, the Chicago region, and the Lehigh Valley in Pennsylvania all host Amazon fulfillment centers along with myriad other retail and wholesale warehouses). The effects on local hiring dynamics have been significant. Most warehouse operators report having a difficult time finding and retaining workers, but they also indicate that Amazon’s tendency to absorb large numbers of workers exacerbates the problem, especially given the generally tight labor markets found in most parts of the country.⁴³ This problem becomes especially acute during the “peak season,” from October to December, when retailers are preparing for holiday and end-of-year shopping. For firms that experience peak-season surges in sales volumes, the demand for workers soars—sometimes doubling from normal staffing levels. Competition between warehouses for peak season hiring can be fierce, and the presence of Amazon intensifies local labor market competition.

“AI, in other words, requires intelligence that is not so artificial.”

However, because the industry is constrained by its operating margins, warehouse operators have few avenues through which they can compete for workers. Wage stagnation pervades the industry, and with little scope for raising wages, even during peak periods, warehouse operators have turned to late-career jobseekers, changed shift scheduling, offered small retention bonuses, and implemented other human resources practices that do not substantially increase total wage bills.⁴⁴

Difficulties in resolving these recruitment and retention challenges have spurred warehouse operators to experiment with an array of labor strategies: some have offered improved benefits packages, others have deepened their reliance on temporary staffing agencies to help manage variable labor demand, while still others have sought out “alternative” or previously overlooked labor pools, such as persons with disabilities⁴⁵ and older workers.⁴⁶ Crucially for the longer-term restructuring of warehouse industry labor markets, many warehouse operators also report that rising worker recruitment costs are prompting the exploration of how new technologies might increase productivity and/or reduce the number of workers required.

Regardless of whether historically tight labor markets are causing a tipping point that is prompting warehouse operators to more seriously consider new technologies, it is clear that

recruiting and retaining workers is a central challenge facing the industry. A critical, unanswered question is how a downturn in the economy might affect firms' posture toward technology adoption as a solution for their labor woes. If the economy weakens and unemployment rises, employers may well find enough relief to slow the process of seeking technological fixes for labor problems, thereby forestalling the need to make costly—and potentially risky—investments in technologies that are changing rapidly.

Rising Real Estate Costs

The three largest costs of running a warehouse are labor, equipment, and real estate; of these, real estate represents the most significant fixed cost. According to commercial real estate firm CBRE, average rents for warehouse space have risen every quarter for the last five years, while the amount of square footage available for rent has declined.⁴⁷ Vacancy rates—or the rate of available properties—dipped to a historic low of 4.3% in the third quarter of 2018.⁴⁸ Further, e-commerce warehouses require more space than traditional warehouses. According to one study, e-commerce facilities occupy up to three times more square footage than traditional warehouses, due to higher levels of inventory and a wider variety of stock keeping units, or SKUs.⁴⁹ As e-commerce expands, the demand for space will continue to increase.⁵⁰

Given the cost sensitivity of warehousing, rising real estate expenditures represent one more strain on the bottom lines of warehouse operators. The cost of commercial property and its availability varies across geographies, but suffice it to say that rising land and facilities costs exacerbate the problem of low margins in warehousing, and they encourage warehouse operators to attempt to curtail variable costs elsewhere.

Increasing Speed Requirements

Warehouse operators are under increasing pressure to move goods quickly and accurately. These pressures are driven by two dynamics. First, “lean logistics” gained popularity as a supply-chain management philosophy in the 1990s, the central goal of which is the elimination of waste. A major outcome of lean logistics programs is that companies hold lower levels of inventory across the supply chain, including at stores, and focus on turning inventory over more quickly. Lower inventory levels in stores, coupled with higher inventory turnover, results in reduced lead times, or the time between when a store replenishment order is placed and the moment it is needed.⁵¹ Warehouses, in turn, have had to increase the speed and frequency of replenishment processes because of shortened timelines, which translates into the need for faster receiving, accelerated picking, and greater throughput. Further, the shift toward stores with smaller real estate footprints and less backroom storage means that the process of fulfilling orders for brick-and-mortar stores entails more small-quantity picking than it has historically, which resembles labor-intensive e-commerce order assembly.

Second, as noted above, e-commerce introduces additional demands for speed along with an entirely new set of labor-intensive warehouse processes.⁵² One of the most potent effects of Amazon in the marketplace has been to shape consumer expectations for e-commerce order delivery. Whereas just a few years ago consumers were content for an order to arrive in three or four days, the delivery window has been steadily narrowing. Interviewees cited Amazon, and its Prime subscription in particular, as the driving force behind shorter package delivery times. To meet service-level agreements, many online orders must be filled within just hours of receipt. The standard timeframe in which customers expect to receive their orders, which is being set by Amazon's sophisticated logistics network, is two days and becoming shorter, as Amazon has introduced next-day and even same-day delivery windows.

At the same time, the Prime subscription has conditioned consumers to expect shipping to be free, or at very low cost. The same is true for order returns. Rising consumer expectations coupled with falling revenues for shipping has forced many companies, even those not directly competing with Amazon, to rethink their shipping policies and distribution strategies, including how technology could increase efficiency and curb logistics costs.

Constraints

Alongside the push factors listed above are a set of constraints and challenges that shape whether, and how, technologies become viable in particular facilities. These involve *variability and unpredictability*, *outsourcing dynamics*, *inertia*, and the *state of technological innovation*.

Variability and Unpredictability

Variability is a fact of life in distribution centers. Natural disasters delay shipments and new sales promotions send orders suddenly skyrocketing. Seasonal peaks, particularly during the months leading up to the year-end holidays, require considerable scalability as certain distribution centers see their throughput soar (especially for those servicing retailers). This dynamic has long challenged warehouse operators to find ways to staff for the busiest days of the year without sacrificing efficiency, and employers often turn to temporary staffing agencies to supply additional labor.

Supply-chain volatility existed before the rise of e-commerce—after all, store shelves have always required restocking based on varying consumer purchasing patterns, and businesses have always needed goods to arrive on time. But direct-to-consumer fulfillment adds to the complexity of scalable operations.⁵³ E-commerce tends to be highly unpredictable, though more or less so depending on the product segment, and the synchronizing, sequencing, and staging of orders based on the urgency and physical location of the product requires greater agility on the part of warehouse operators. In addition, the precise amount of year-over-year growth in e-commerce is difficult to predict; “It’s a nightmare,” in the words of one interviewee. For e-commerce and traditional fulfillment alike, the ability to forecast demand has been the Achilles heel of

efficient operations. Another interviewee, a senior supply-chain consultant, expressed it this way: “Companies have had inaccurate forecasts for so long, the catchphrase ‘the forecast is always wrong’ has become adopted within the culture, and people just accept the fact it’s going to be wrong.”

Until recently, the forms of automation available to distribution centers tended to be inflexible and difficult to scale. A conveyor system, for example, cannot hold more goods or run faster. For this reason, during peak periods an operator might add an extra shift to accommodate fluctuations, though this presents its own challenges in terms of staffing and worker recruitment. One interviewee with a 10-fold increase in holiday shopping volumes reported that his facility would switch to a highly manual process during peak season and hire hundreds of extra workers because the conveyor system simply could not accommodate the influx of orders. The workaround was to abandon the existing mechanized system and instead add to the workforce in order to contend with the sharp increase in order volumes.

Outsourcing

Outsourcing in logistics is pervasive, and according to some estimates, on the rise; in a recent survey, 58% of companies reported they were planning to increase outsourcing of logistics operations, compared with 27% planning to in-source these activities.⁵⁴ Outsourcing has its downside, however, and, most relevant to this topic, it can create strong disincentives to investing in new technology. There is a fundamental hurdle to overcome: firms historically have tended to outsource the most repetitive and transactional activities to 3PLs, and these also are some of the priority activities for automation. Instead of outsourcing, firms could choose instead to keep warehouse activities in house and adopt new, labor-saving technologies. 3PL contracts often are short (three to five years), which makes a return on investment difficult to achieve in that timeframe for warehouse operators undertaking major capital and technological investments.⁵⁵ Combined with the ever-present risk that technological investments made for one client may not be transferable to others, the technologies that would reduce staffing levels significantly often are beyond the reach of most 3PLs, especially those operating small and mid-sized facilities. The primary exception to this is the very largest 3PL companies, which are actively experimenting with new technologies, attempting to position themselves in a technical assistance role with a set of workable technologies on hand for clients, thus modifying their value proposition.

Inertia

The ways in which warehouses historically have been organized and operated can be difficult to alter, creating organizational inertia that can constrain the scope of technological change. First, existing systems of mechanization, such as industrial conveyors, required major capital investments to install, and companies understandably would like to use them as long as possible. In some cases, this means applying technologies to processes around the mechanized system or simply relying on existing technologies longer, even where newer options offer significant

efficiency gains. For most warehouse operators, operational inertia will limit the extent of technology adoption, at least in the short run.

Second, resistance to or lack of capacity for change within facilities can contribute to low levels of sophistication, in many forms. The primary way in which these constraints slow technological advances is that the most potentially powerful technologies require high-quality input data, which many companies are not collecting. A vice president at a large 3PL explained what he has been seeing in terms of clients' data sophistication: "You can't have artificial intelligence or leverage new technologies if you've got crummy data. So we see ... a digital divide emerging, between those [companies] that make the investments in systems and process management to ultimately have good and consistent data, and those that end up on the still-viable, but more basic, end of the spectrum."

Even those companies that have made substantial investments in technology may not be collecting and using data opportunistically. One interviewee, the head industrial engineer at a mid-size retailer that invested heavily in automated goods-to-person technology, reported that the company still lags behind in its data systems: "We don't use our information to be more proactive with our decisions. We still wait to visually see something, as opposed to using the data and the software to help us make better decisions quicker." The persistence of older methods of operating warehouses presents barriers to collecting and analyzing the data required to implement new technologies, or improve planning and execution.

State of Technological Advancement

Finally, the rate at which new technologies are being developed complicates decisions about when exactly a warehouse operator should invest in new systems, and which systems should be implemented. Some promising technologies have not yet reached the point where they can be reliably deployed in a live warehouse setting. Three examples from interviews are illustrative:

- The most advanced order-picking robots still are operating far below the precision level necessary for widespread use. According to an interviewee, "It's still hard to ask a robot to go to a shelf and identify and grab an item. The current breed of picking robots work with 60–70% accuracy, and warehouses need to operate at 99.9% accuracy."
- Robots still lack the intuition that, for example, allows a human forklift driver to calculate that in a situation in which there is high wind, a high stack, and low weight, the stack of boxes is likely to fall down—and intervene before it does so.
- Depending on the assortment of goods in a facility, robots are not adaptable to varying product profiles. As one interviewee, a warehouse manager, explained, "I struggle to find the robot that will be able to handle a bag of plaster of Paris, a bit for a jackhammer, a galvanized steel garbage can, a saw blade, and a five-gallon bucket of paint. Oh, by the way, what happens when that [plaster of Paris] bag ruptures? How does the robot know that the bag is ruptured?"

In some cases, combinations of different, mature technologies will be required in order for performance to reach the level of humans. To be sure, the research and development of these solutions is under way, but it is impossible to predict when they will converge in a way that substantially changes the landscape of adoption. Each year, available technologies become better and, in most cases, cheaper, but even these trends can convince companies to put off making investments, biding their time in order to take advantage of future product iterations or price cuts on existing technologies.

“I struggle to find the robot that will be able to handle a bag of plaster of Paris, a bit for a jackhammer, a galvanized steel garbage can, a saw blade, and a five-gallon bucket of paint.”

A further complicating factor is that many technology startups are seeking to be acquired by more established firms, raising questions about the support of the product or service over the long run. The trajectory of Kiva Systems serves as a warning: after purchasing the company in 2012, Amazon discontinued support for existing owners of Kiva robots in 2019, and those companies are now left with obsolete technology. As one interviewee—whose company had firsthand experience with Kiva’s robotic fulfillment systems—said, “Even if you [find] a startup that you think is perfect, you have to go in realizing it may be something else within five years.”

Taken together, the push factors are, at the very least, leading to increased interest on the part of warehouse operators in pursuing technologies that help ease the demands for workers, rising real estate costs, and increasing order velocity. On the other hand, the

constraint factors create obstacles to technological adoption that likely will moderate the speed of uptake. The ways in which each of these factors unfolds in companies helps determine the path and rate of technological change, and are difficult to account for in aggregate estimates of automation and its impacts on warehouse industry employment.

SECTION FIVE:

Technology Meets Shifting Industry Dynamics

This section presents analysis of the nexus of technology and the particular dynamics of the warehousing industry, based on interviews and other research conducted for this report. The first two findings refer to the current state of the industry—how the industrywide economic structure shapes techno-strategies, and how e-commerce is driving the leading edge of innovation. The second two findings present likely future impacts of technology adoption across the industry, absent major shifts in the economy due to recessions or other major disturbances.

1. The cost-sensitive economics of the industry are key to understanding firms' orientation toward technological adoption.

Section 2 reviewed the economic structure of warehousing: it is characterized by thin margins and cost-based competition and, at the same time, responsible for managing high levels of volatility and risk. Low margins can leave little room for investment in new technologies, despite the potential for efficiency gains. Outsourcing is one mechanism through which firms have tried to manage these dynamics, but contracting to a 3PL appears to complicate technology uptake (see further discussion below).

Broadly speaking, warehouse operators have moved cautiously into potentially risky experiments with new technologies, relying instead on experimentation within workforce systems and on streamlining existing processes. These trends likely will continue—the cost sensitivity of the dominant business model will moderate the rate of technological experimentation and uptake,

though some firms will find first-mover advantages a worthwhile prospect. Absent a major shift in how warehousing activities are valued by lead firms, the dynamics that have created barriers to innovation and contributed to the industry's status as a technological laggard are likely to persist over the coming five to 10 years.

2. E-commerce is driving experimentation with new technologies.

The rise of online shopping has had major repercussions on the warehousing industry. E-commerce order picking requires more labor and the order fulfillment process is accelerated, given consumers' delivery expectations. Additionally, Amazon's influence in the online retail arena is significant, particularly in the context of the company's promises of increasingly faster delivery.⁵⁶

The combination of labor-intensive order picking and the speed with which orders must be shipped has made e-commerce a leading driver of growth in warehousing employment and, interviewees report, has led to increasing interest in technologies to support the order-fulfillment process. With a fixed amount of space within a facility, warehouse operators are limited in the number of workers they can add before congestion creates inefficiencies. Further, in the context of a tight labor market, employers seek to ease their reliance on workers, where possible. Each picking requires a larger workforce, yet the complexity of the process and the limited availability of technologies for nonroutine aspects of the job make automation more difficult. However, because the likelihood that a given facility will adopt new technologies is related to the desire to reduce labor costs, it stands to reason that facilities with large numbers of order-picking workers likely would seek to become technological first movers. These enterprises likely will be leading experimenters and, if proven successful, innovations will diffuse to other operators.

Technological adoption has enabled the rapid expansion of e-commerce, as well as sharp increases in warehousing employment. The long-run impacts of technological change on employment, therefore, must be closely parsed; the warehousing industry likely will experience secular growth for the foreseeable future. At the same time, certain occupations or facilities may experience significant job losses due to automation, as e-commerce facilities lead the way in experimenting with and adopting labor-saving technologies.

3. Technology uptake will be uneven.

It appears that variation will be a key feature of technological change and automation in warehousing. Many factors shape the tendency for uneven technology uptake, and the circulation of ideas and innovations is propelled by a constellation of economic, social, and political forces. There are three main elements to this variation: *unevenness across firms*, *unevenness within firms*, and *unevenness across technologies*.

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Across firms, there are significant differences in approaches to seeking new technologies for warehouse operations. Two main factors help explain these divergences: the profile of the business, including the specific activities occurring in warehouse facilities, and the culture of the organization. A technology may make good economic sense, but not social sense, to an organization.

The first movers in technology adoption likely will be major retailers: firms with a large number of SKUs (500,000–1 million), high throughput, and that perform at least some of their own warehousing. The warehouse facilities that store and distribute these goods are large, employ hundreds or thousands of workers, and run multiple shifts. Those with a high volume of online orders likely will automate e-commerce fulfillment first, even if it's only that section of the operation. Finally, the product market(s) in which a firm is competing (e.g., apparel, pharmaceuticals, cosmetics) and, in particular, the techno-strategies of the firm's competitors, will shape the uneven landscape of uptake.

It's clear that warehouse operators are in disparate stages in their techno-strategy development, and the majority of firms are moving cautiously into automation. A senior executive at a leading 3PL offered this reflection on the uneven landscape of technology adoption: "Everybody's not on the same lap in an eight-lap race. When you talk about e-commerce, oftentimes we find [customers are] in completely different places." His remark suggests that even in the e-commerce realm, where there is the most widespread and enthusiastic interest in automation, companies are taking very different approaches. This is particularly true when comparing retailers with consumer packaged goods (CPG) producers, durable goods manufacturers, and 3PLs, where the former tends to be more advanced. One interviewee, a vice president at a large 3PL, offered this illustration of unevenness among firms: "I can go into one customer, take them an RF [scanning] gun, and they just think that's the most innovative thing they've ever seen; whereas the other customer wants drones running around the warehouse. People's definition of innovation is very different, and where they are in their maturity cycle of being able to adopt that innovation is very different."

It's clear that warehouse operators are in disparate stages in their techno-strategy development, and the majority of firms are moving cautiously into automation.

One indication of the unevenness of technology adoption in the industry is evident in the market penetration of warehouse management systems (WMS). WMS software, which tracks inventory and coordinates order processing for a facility, is the most common technology across the warehousing industry. Yet according to a recent study, 33% of warehouses do not use one.⁵⁷ Operating a WMS is widely considered to be a fundamental building block for the adoption of other technologies, and the study authors estimate that at least one-third of warehouses in the

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United States continue to operate using spreadsheets and paper, without an urgent aspiration to consider technologies that would integrate with the WMS.

Included in the two-thirds of warehouses that *do* use a WMS are those that have not upgraded their system for many years—recall that in many cases, the first WMS software was proprietary and developed in house. Consider the reflection offered by a 3PL vice president:

What shocks me [is] when we go into some of these big Fortune 100 [companies], and you see them running warehouse management systems that are 30 years old, and you just [ask], "How are you surviving?" To think about putting robotics into a facility where they're running a 30-year-old version of a WMS is just not feasible.

WMS adoption is one illustrative example of the uneven landscape and slow uptake of technologies in this industry, but the dynamic is not limited to software innovation. Long-available hardware similarly has had a slow adoption process, which speaks to the cautionary approach that pervades the industry. There are few indications this conservative posture will shift substantially in the near term.

Within firms, there is a range of activities that potentially could be targeted for the application of technology or automation. But firms must make choices about which processes should be prioritized, leading to a variegated landscape of technological sophistication across activities in a warehouse. Even firms at or near the leading edge of innovation in one area often lag behind in other areas. For example, a large parcel company had made massive investments in a state-of-the-art, high-throughput conveyor and automated RF scanning system, but managers still were using spreadsheets, a whiteboard, and countless staff hours to schedule workers to handle fluctuating package volumes.

Finally, *across technologies* there has been highly uneven uptake, in large part because the technologies tend to be specialized to the process for which they are designed. In addition, the political economy of technology development influences which viable product emerges as the market leader. A major obstacle for developers of new technologies is proving the products actually work in a live warehouse environment. Doing so requires convincing a warehouse operator to pilot a technology, which can be disruptive to the normal flow of operations. Yet, without a pilot phase, technologies lack the credibility needed to gain widespread acceptance.

New models of modularity and asset ownership may reduce barriers to adopting some technologies. Two key features set apart some of today's leading technological solutions from those of the past: modularity and leasing programs. Most prominent in the autonomous mobile robot (AMR) space, modular systems allow users to scale their use of AMRs to respond to fluctuating business cycles, adding robots as demand grows year seasonally or over time.

Modularity addresses central problems of past technological advances: it can reduce the initial capital outlay required, putting automation within reach of a new set of market actors, including

small and mid-sized firms and 3PLs. It also allows warehouse operators to increase capacity during high-volume periods and then scale back as demand falls. The latter approach historically has been addressed by adding seasonal labor, often through temporary staffing agencies. During the peak season, when many firms would wish to increase the number of robots in use, larger warehouse operators might be able to leverage their size to access additional robots more easily, potentially leaving smaller firms without the capacity to meet order volumes.

Robot leasing programs have been used in the manufacturing sector for years, but the so-called “robots-as-a-service” (RaaS) model is a more recent arrival to logistics. Companies rent the robots, paying by the amount of time used or per transaction, and thereby reduce the risk of obsolescence. The leasing entity retains responsibility for remote monitoring and maintenance of the robots.

“Even in cases where the activities occurring in a facility have a corresponding technological solution, and that solution is economically feasible for the enterprise, there will be significant divergences among firms in their adoption of new technologies.”

Taken together, these two features may be game changers—but only for those facilities in which modular, RaaS robots make sense. One interviewee, a vice president of a large 3PL, summed it up this way: “Newer, more flexible automation changes things: you can move it around between operations, and you’re leasing the equipment. You can think of [automation] differently, especially if it’s a technology where we have other sites where the technology could fit in.”

In short, these factors suggest that even in cases where the activities occurring in a facility have a corresponding technological solution, and that solution is economically feasible for the enterprise, there will be significant divergences among firms in their adoption of new technologies. It is this fact that complicates aggregate reports of technological change and forecasted impacts on jobs and workers. The unevenness is partly what makes predicting technological change so difficult.

That said, identifying leading firms, the latest processes, and cutting-edge technologies can help industry leaders and policy makers anticipate the effects of new technologies on jobs and workers. Across firms, it is important to understand which companies might be early adopters, and thus which workers likely will face the initial impacts of technology implementation. In the same vein, firms that choose to delay or not to adopt new technologies will have to find other ways to compete, which likely will have effects on the organization of work in

these facilities. Within firms, all things equal, it is high-priority processes, and the occupations involved in these processes, that will be affected first. And across technologies, tracking the products that are gaining attention and investment may be a predictor of emerging frontrunners and their specific impacts on jobs and workers.

4. Technology will have potentially large impacts on 3PLs and outsourcing in the warehousing industry.

Outsourcing is a significant trend in the warehousing sector, and the introduction of new technological capabilities undoubtedly will shift the landscape of subcontracting. This applies to the prevalent practices of both 3PL outsourcing and labor outsourcing to temporary staffing agencies.

3PL Outsourcing

Some interviewees noted a recent trend of companies that are new to e-commerce outsourcing their fulfillment to 3PLs. The motivation behind outsourcing is that companies newer to e-commerce have neither the logistics infrastructure nor a reliable estimate of demand—that is, the ability to forecast volumes is difficult for most internet shopping operations, but particularly so for those just launching an e-commerce channel without brick-and-mortar stores. Some of these companies have the intention to bring e-commerce fulfillment in house once a more accurate forecast of order volumes emerges. But, overall, 3PLs likely will continue to benefit from the expansion of e-commerce.⁵⁸

Yet, even as e-commerce has the potential to expand the use of 3PLs, the extent of warehouse outsourcing complicates the landscape of potential technological uptake. On one hand, there are strong disincentives for 3PLs to invest in new technologies—short contracts (generally three to five years, though interviewees suggested that their customers now are seeking even shorter contract terms) and cost-based competition are among the biggest. Many 3PLs have avoided investments in new technology because of the possibility of losing the customer at the end of the contract, which could make any investment obsolete. Short contracts also make it difficult to recover the costs of the initial investment.

Despite these disincentives, there is evidence that larger 3PLs regard technology as a key differentiator in the increasingly crowded contractor market. 3PLs are piloting robotics products in live warehouse environments, gaining expertise in emerging software and hardware solutions, and trying to carve out a role as technical assistance providers for customers. If successful, these strategies could increase barriers to entry in the 3PL market. The history of outsourced warehousing, however, suggests such higher value-added activities are rarely the driving force behind contracting decisions; in fact, as 3PLs have tried to move their customers up the value curve, most have met resistance.

Of course, some lead firms have bucked the outsourcing trend and kept their warehousing operations in house. For those that seek out outsourcing options, there appear to be three possible scenarios for the changing role of warehouse outsourcing:

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- **Scenario 1:** Lead firms use 3PLs with little automation for less efficient, lower value-added activities (e.g., nonconveyable products like canoes) and, where applicable, retain the more efficient processes in house with increasing levels of technology. It's conceivable the market of smaller 3PLs that are laggards in technology adoption increasingly may be matched with customers that also are lagging. This, in turn, may lead to worsening working conditions—smaller contractor firms are more likely to violate labor laws out of ignorance, lack of staff capacity, or in order to pad thin margins.⁵⁹
- **Scenario 2:** Lead firms seek out 3PLs that are adept with technology to learn about, identify, and implement systems appropriate to their business. Large 3PLs, like DHL and XPO, are actively piloting different technologies to better understand the kinds of operations for which each is appropriate. When a customer is interested in applying a new technology to a warehouse process, the 3PL helps them understand their options. Any customer-3PL relationship that involves technological innovation would benefit from longer contract terms, ideally more than five years.
- **Scenario 3:** Lead firms use 3PLs to run lead firm-owned facilities and technologies. As one interviewee explained, “The fully automated warehouses that I’ve been in are all customer-owned facilities. They may contract with a 3PL to run it, but that’s just a pure labor play for that 3PL.” Data from interviews and secondary sources suggest that firms are more likely to invest in technology tailored to their operations, but lead firms still could choose to outsource the management of these facilities to 3PLs.

3PLs also are experimenting with new organizational configurations and models of collaboration. One interviewee, the president of a midsized 3PL, said his company is exploring how it might commingle smaller e-commerce startups in a single facility and implement automation across all of them. Each startup on its own may have low volume, but by combining their operations, they each could experience faster fulfillment and benefit from “the automation effect.” The task of finding customers whose products, processes, and desired location are complementary might be daunting, but the intent is to allow smaller companies to compete in e-commerce markets at a lower cost.

New models of collaboration take different forms, though central to them is leveraging excess warehouse capacity. For example, the MonarchFX Alliance brings together large 3PL providers, some of whom are direct competitors, with proprietary robotics, inventory and distributed order management, and other technologies—all in an effort to offer customers a logistics infrastructure that can compete with Amazon. Emerging collaborations among 3PLs indicate the exigency of implementing cost-effective technologies in the context of subcontracted operations.

Labor Outsourcing

Temporary staffing is a common workforce strategy pursued by warehouse operators. The industry insiders interviewed for this research offered mixed arguments about the relationship between the adoption of new technologies and the deployment of temporary labor. Discussions centered on three issues:

- If firms don't use new technologies, such as autonomous mobile robots, they'll have to rely more heavily on agency-supplied temporary workers.
- Autonomous mobile robots may increase reliance on temps because automation enhances operators' ability to further de-skill core warehousing processes.
- Firms do not necessarily expect to reduce the need for seasonal labor through automation during the peak season.

Given the industry's cost constraints, temporary staffing agencies likely will remain a key means through which warehouse operators hold down labor costs. Further, new platforms for procuring temporary labor that promise to reduce the friction of finding workers are emerging. Similar to other forms of "gig" work, platforms like Wonolo aim to smooth labor supply and demand matching using algorithms. The potential expansion of temporary staffing arrangements, coupled with well-documented wage differentials between temporary and direct-hire workers, suggests that deleterious conditions could be on the horizon.

3PLs and temporary staffing agencies alike are navigating an uncertain landscape of change with different competitive strategies. Some are exploring new roles that leverage technology, while others appear to be taking a wait-and-see approach without significantly altering their value propositions. The structure of outsourcing, especially 3PL contract terms, constrains the options for 3PLs as they consider new technologies, and technological uptake among 3PLs has the potential to shift the contracting market in a number of ways. The trajectory of this change is, as yet, unclear, but will be shaped by the dynamics of unevenness prevalent across the industry.

SECTION SIX:

Impacts on Tasks, Jobs, and Workers

This section turns to the impacts of new technologies, and the dynamics discussed in Section 5, on tasks, jobs, and workers. Predicting technology's effects on the organization of work is difficult because of the unevenness with which these dynamics are likely to play out. Still, the purpose of this research is to draw on data collected from interviews and secondary sources to analyze unfolding trends and to speculate on potential repercussions, which are detailed below.

1. New technologies are likely to lead to work intensification, especially in each-picking environments.

Most warehouse work is strenuous. It entails manual processes that rely on strength and stamina, which takes a physical and mental toll on workers. It is possible in some cases that the priority tasks to be reorganized through technology adoption represent the most grueling aspects of the job. For example, removing walking or reducing the amount of lifting and twisting that workers must perform could offer significant ergonomic improvements and diminish the stress on workers' bodies. This research suggests, however, that even though some technologies promise to alleviate the need for the most arduous activities, this will be coupled with attempts to increase the pace of work and productivity in other tasks, with new methods of motivating and monitoring workers.

High-Priority Process: Each Picking

Warehouse workers' jobs include various tasks, some of which are higher priority for technological applications than others. First-order targets often are those that are the most labor-intensive and/or contribute the least amount of value to the final product. As was

discussed in Section 5, the highest priority in the short term is to apply labor-saving technologies to high-volume e-commerce order picking (and, because of the similarities of the process, frequent, small-batch replenishments to retail stores that hold limited inventory). The labor-intensive nature of picking individual items to assemble orders—so-called “each picking”—requires large numbers of workers, so warehouse operators place great value on reducing headcount or increasing throughput by reorganizing this activity. Workers involved in each picking likely will see significant impacts on the content and quality of their jobs, due to the introduction of software and hardware applications to particular subtasks, though only some of the process is automatable given current technologies.

There are three key areas in which technologies are changing the each-picking process: order-assembly planning, machine-directed picking, and goods-to-person picking.

Order-Assembly Planning

The process of planning order picking can be organized in one of three ways, which are dispatched by WMS software: discrete, batch, and waveless picking.

- With *discrete order picking*, all of the items for an order are picked at once and packaged. This process requires the most walking, since items might not be located near each other, and is thus the least efficient and most taxing on workers.
- *Batch picking* organizes the picking process so that workers select items that are located near each other for multiple orders. The batched items then are divided up and the orders are consolidated across batch picks. Because the orders are batched based on the proximity of products (i.e., instead of going to the same slot multiple times for an item, all the orders containing that item are batched together and picked at once), the picking sequencing is critical to efficiency. The complexity of this sequencing makes it more difficult to handle urgent orders—for example, a next-day delivery that needs to be picked within an hour of order placement.
- Finally, *waveless picking* was developed to combine the efficiencies of batching orders with the flexibility of adding new, high-velocity orders into the process without interrupting the flow of goods. Many of the leading WMS systems now have the capability to do waveless orders, and for high-volume e-commerce fulfillment, waveless picking is essential.

At first blush, the picking process appears to be a seamless, finely tuned activity. Yet interviewees conceded it is common for too much work to be released into a warehouse at a given time, leading to congestion at chokepoints in the order-assembly process. Congestion, in turn, lowers productivity, a problem that is out of workers’ control yet nevertheless impacts them. The picking process is a promising application for AI, which optimizes the flow of goods and people and, through machine learning, determines over time how to release orders more efficiently into the warehouse. As increasingly sophisticated AI enhances the planning process, workers may find

their jobs improved somewhat. In the meantime, until they are resolved, glitches in the process of releasing orders will continue to impact workers.

Machine-Directed and Goods-to-Person Picking

The hardware that might accompany the picking processes detailed above varies widely in terms of its technological sophistication, and the most prominent among them are largely labor complementing rather than labor substituting. Machine-directed picking systems replace paper pick lists with tech-enabled labor deployment, reduce walking, and serve to constantly orient workers toward their productivity rate. At the lower-tech end of the spectrum, a facility might implement voice-directed picking, in which a warehouse worker is directed to a pick location through a headset. Vision-directed picking, which uses virtual reality glasses to guide workers, is the next wave of innovation, though it is not widely in use given the cost of virtual reality glasses. Some autonomous mobile robots virtually tether a worker to a cart, keeping the worker at defined walking and picking speeds, always engaged with the technology and picking process, with constant feedback on their performance. Others are designed to shuttle goods between areas of the warehouse, again reducing walking and pacing the picking or packing rate. Goods-to-person systems deliver products to a workstation, which can offer a more ergonomic work environment while removing walking.

The common thread among technologies that address each picking is reducing low value-added activities coupled with the ceaseless reinforcement of workers' focus on their effort and efficiency. This research suggests that the main impact on workers as the content of their duties changes likely will be work intensification. Heightened pressures on workers occurs through twin processes.

The first constrains human interaction with co-workers. Linking workers to machine-directed order picking or goods-to-person systems effectively removes the opportunity for workers to interact with one other, even in cases where they might be helping one another perform tasks or solve problems.

The second process enables the micromanagement of work tasks at an unprecedented scale. Many new technologies applied to the picking process utilize algorithms that govern the sequencing of order assembly and picking rate. Algorithms track, analyze, and inform workers about their performance, measured against engineered labor standards as well as the performance of co-workers. Engineered labor standards, along with algorithmic management, point to what some have called "digital Taylorism," or scientific workforce management amplified by an order of magnitude. The time and motion studies that are conducted by engineers now are beginning to be augmented by machine

“The assumption that streamlining processes leads in a linear fashion to greater efficiencies, and thus cost reductions, may be fundamentally flawed.”

learning and data captured by new technologies, such as sensors that track the time it takes a worker to reach a pick location, scan a label, select a product, and place it in a bin. This data has the potential to increase pressure to work quickly, and in the context of the low margins that characterize this industry, productivity becomes paramount and improvements are focused on reducing cost.

Digital Taylorism is well under way in some parts of the warehousing industry. Amazon has attracted significant attention for the productivity rates the company expects of order pickers, and recent media reports detail the difficulty some workers have as they attempt to “make rate.”⁶⁰ Careful tracking of productivity has led to termination when employees are not reaching the target rate, and workers report feeling anxiety about the possibility of being terminated.⁶¹ In order to incentivize workers to maintain high productivity rates, Amazon introduced MissionRacer, a video game that pits workers against one another as they pick customers’ orders.⁶² The gamification of warehouse work is thus far limited, but is garnering increasing interest among warehouse operators seeking new ways to motivate workers.⁶³ While there is some evidence that gamification can ease the monotony of repetitive work, it also highlights the potentially nefarious impacts of competition on both workplace culture, and worker health and safety.⁶⁴

Rising productivity requirements also raise questions about the limits of the human body, and there are concerns that such close scrutiny over workers’ movements could have detrimental psychological impacts. The assumption that streamlining processes leads in a linear fashion to greater efficiencies, and thus cost reductions, may be fundamentally flawed. Gains could be counteracted by new health and safety hazards, as well as increased employee turnover due to overwork and burnout. The toll on workers is both physical and psychological, as increased performance metrics may push workers to exhaustion while heightening anxieties over the threat of being dismissed for missing performance targets. The unintended consequences of work intensification, therefore, could aggravate the challenge of recruiting and retaining workers, especially in tight labor markets.

2. New technologies have the potential to de-skill some jobs.

Most warehouse occupations call for a high school diploma or less. In terms of skills, forklift drivers require training and certification, which often can be completed onsite. Shipping and receiving clerks may need some computer skills, depending on the processes in place. The required level of training and educational attainment, however, belies some warehouse-specific experience and skills that can improve workers’ performance. For example, the commonly used RF scan guns have a small screen and a set of commands and keys that are not intuitive; and the layout of warehouses, including aisle or slot numbering, can be confusing to a newcomer.

Some technologies explicitly endeavor to simplify aspects of warehouse work. Kiva was one of the first technologies to focus on de-skilling. As one interviewee, whose retail company had purchased the Kiva system, noted, “[Kiva] was definitely [geared toward] job simplification, for the most part. Compared to using an RF scanner [where] you’ve got all these menu options, the Kiva was very simple, so you can hire temporary labor to fill in and be productive in a short period of time. That was a benefit, being able to shorten the training times.”

Other technology developers have followed suit. One such project explicitly markets their follow-me AMR, Chuck, as a way to simplify the picking process through a “fully directed workflow”: it leads workers across the warehouse, pacing them as they walk and pick, and streamlines the process of order selection. The shortened training time and simplified interface helps to reduce employee turnover costs and, as the technology company CEO stated at an industry conference, allows employers to rely more heavily on temporary staffing. De-skilling often puts downward pressure on wages and may facilitate the use of temporary workers. For workers, this may lead to wage stagnation and increases in job insecurity.

Other Processes Subject to Possible De-skilling

Beyond the each-picking order-assembly process, the content of other warehouse activities could be de-skilled in the near future. The system for receiving a truckload of goods into a warehouse involves multiple processes that are targets for AI. Shipping and receiving clerks verify that the goods on an inbound truck match what the vendor reportedly sent, and manage inbound and outbound documentation and allocation—a time-consuming process. For one interviewee’s company, a home improvement retailer, this task became a priority for automation, since much of it is repetitive and routine. “Almost all of our paperwork is now automated. It’s not as sexy as robots driving forklifts, but the reduction in workforce was eight or nine people across all the shifts.” Other interviewees echoed the eagerness for automating parts of the receiving process and the subsequent reduction in headcount such automation enables.

The application of AI to shipping and receiving tasks is gaining traction, especially at a time when inventory accuracy—knowing exactly how much product is on hand at any given moment—is becoming increasingly important. AI has many additional warehouse applications, including capturing and analyzing data on equipment utilization, slotting goods within the warehouse, and issuing pallet-building instructions, and the WMS is the most likely place for the AI to reside. All of these applications have the potential to shift decision-making tasks away from workers and reduce the skill content of certain positions. It’s possible that companies will invest in software and AI applications in order to forgo the expense of making large capital investments, instead using more cost-effective software enhancements to gain efficiencies and bide time until lower-cost hardware solutions can be identified. This likely would cause AI-induced de-skilling to occur more quickly than other forms of technological change.

Another occupation at risk of potential de-skilling is forklift drivers. Automated guided vehicles, or AGVs, are designed to replace traditional forklifts. One motivating factor for the use of AGVs is that forklift drivers often are some of the highest-paid nonsupervisory workers because of their specialized skill set. Yet AGVs can cost many times more than a standard forklift, making a satisfactory return on investment at this time difficult to achieve.

While there appears to be significant interest in how AGVs can improve productivity in warehouses, there are complications for the adoption of AGVs. Perhaps the most difficult to reconcile is that precision forklift movements have proven difficult to automate. One possible scenario is for AGVs to move products horizontally across a facility, and for humans to perform the precise vertical movements of placing or removing a pallet. This effectively would divide forklift driving into distinct subtasks, while removing skilled labor from the easier-to-automate activities.

Upskilling vs. Labor Reallocation

While it is possible, in principle, for new technologies to produce upskilling effects in the sector, there is little evidence of this occurring at this time. One example of upskilling could be cases in which robots that augment or replace workers need ongoing maintenance, and companies are able to shift work hours from more-manual, routinized activities to higher-skilled maintenance tasks. However, robots-as-a-service introduces a model in which the responsibility for monitoring and maintaining the robots lies offsite with the leasing entity, rather than the warehouse that uses the equipment. A similar dynamic holds true for robotic picking machines that require human intervention to learn how to grasp particular objects, but these jobs are offsite. In these cases, a pathway from less to more skilled work for workers whose jobs might change or be eliminated by robots is unlikely. Other technologies and ownership models might offer more opportunities for higher-skilled work to remain onsite.

In order for incumbent workers to move from less-skilled to more-skilled labor, training infrastructure is required, either through public-sector workforce development systems or within a company. For example, Amazon has proposed a large program to retrain 100,000 existing workers for higher-skilled technical jobs.⁶⁵ Most warehouse operators are unlikely to invest in retraining programs at scale, given the cost constraints of the industry, and thus a more probable outcome than the upskilling of low-skill job functions is limited labor reallocation to other tasks. Interviewees often pointed to the ability to shift workers from menial tasks to those that are less routine and require greater problem solving. At the same time, however, interviewees also conceded that the point of automation is to improve productivity and/or reduce headcount. Labor reallocation in warehousing appears likely to be little more than a provisional stage of technological advance.

3. New technologies are likely to transform how workers are managed.

Algorithmic management introduces new forms of workplace control, where the technological regulation of workers' performance is granular, scalable, and potentially relentless. Capturing worker productivity data has relied largely on widely used RF scan guns, but in the past productivity tended to be calculated at an aggregate level. Newly available products, such as "wearable" warehouse technologies, follow-me carts, and increasingly sophisticated labor management software, allow more granular tracking of workers' movements, including walk speed, routes, bottlenecks, and break time. Coupled with productivity algorithms, these systems can dynamically urge workers to increase speed, and identify efficiency, accuracy, and movements at the individual worker level. At the same time, however, such close monitoring of workers and uncompromising electronic management could corrode working conditions and employee morale.

Worker Monitoring

Sensors and wearable technologies are used to track twisting, bending, walking, and other movements—or breaks—of a worker. Amazon made headlines in 2018 when the company announced patents on a wristband for warehouse workers.⁶⁶ The wristbands, developed in the name of greater efficiency, track and guide workers' hands toward product locations by sending feedback to workers when their hand is in close proximity of the pick location. The digital scrutiny necessary to relay such fine-grained spatial information immediately raised questions concerning workers' rights to privacy and the extent of control a company should be able to exert over its employees.

The Amazon patent points to a device that is many steps beyond the current generation of hands-free RF scanners. Other wearable technologies, such as Modjoul's Smart Belt, include sensors that gather location and motion data into a dashboard for analysis and action. Exoskeletons, while not widely used today, would be worn by workers to support parts of the body likely to experience strain or undue exertion.⁶⁷ They conceivably could reduce exhaustion for workers, but their value may lie more in the data the devices capture about workers' precise bodily movements as they navigate their job tasks. Data collected from these devices would be invaluable to technology developers seeking fine-grained data inputs for the next generation of robots, while also shifting the ways in which employers manage their workforce.

Technologies such as sensors can collect sensitive data on workers' every move.⁶⁸ The data are valuable to warehouse operators, since they monitor worker productivity as well as safety hazards. Yet the same technologies that are augmenting worker movements also are surveilling them. The experience of workers with some new technologies is one of increasing atomization from each

other, removing opportunities for social interaction and on-the-job problem solving. Finally, new technologies are enabling increased worker monitoring and tracking, and the extent of data collection and storage, as well as decisions regarding future use, are not transparent to workers, raising significant privacy concerns.

Scheduling

Another form of algorithmic management is just-in-time scheduling. Well-established in other sectors, most notably retail, scheduling software like Kronos allows managers to dynamically flex workforce size up and down. For workers, algorithmic scheduling has led to greater insecurity in their work hours, leaving some to be essentially “on call” for their employer with no guarantee of being assigned shifts, or having little notice of changes in scheduling. There are, however, ways of using algorithmic scheduling such that the practice includes workers’ preferences for availability and gives workers adequate notice of changes to the schedule; these practices have been shown to improve worker productivity and sales.⁶⁹ While scheduling software is not in wide use today, based on interviews for this project, interest appears high in applying just-in-time scheduling in the warehouse.

The conditions of work in warehouses may be heading toward more rigid forms of monitoring and management. If warehouse workers had little autonomy under existing forms of management, a new regime of machine surveillance could make working conditions more unforgiving. With little transparency into the algorithms being used, employees may question whether the same standards are being applied across the workforce.

4. In the short to medium term, new technologies likely will not cause widespread job loss.

With continued growth in demand, aggregate employment levels in the warehousing industry likely will continue to rise over the next five to 10 years. That said, job growth may be tempered by the increased use of labor-saving technologies in e-commerce warehouses in particular. Many workers will see their working conditions shift as technologies are adopted for particular tasks. Over the long term, in the absence of major shifts in the economy or context of firms’ technological adoption strategies, the increasing use of technology points to a labor reduction.

Some warehouse technologies that are labor-replacing include:

- Automated storage and retrieval systems (ASRS), which are highly efficient but also costly, decreasing the size of the potential market that might adopt this technology; the main impact on workers of ASRS uptake is to reduce employment, since by design it replaces the need for order pickers.

Section Six: Impacts on Tasks, Jobs, and Workers

- Autobaggers and autoboxers that automatically package outbound orders; in a high-volume e-commerce operation, managers report the elimination of 20 to 30 packing workers through the application of automation to the packing process.
- Sensors or RFID tags applied to goods, which allow warehouse operators to track the location and quantity of inventory through a centralized dashboard, rather than relying on workers to count and track products.
- Similarly, drones that automatically perform inventory counts are the subject of widespread interest, but are active in very few warehouse environments at this time because of cost.⁷⁰

Section 4 of this report detailed a set of push factors and constraints that form the current context for technological advances in warehousing. The push factors include tight labor conditions, rising real estate costs, and increased speed requirements; whereas the constraints are the variability in the industry, outsourcing dynamics, inertia, and the state of technology. Significant shifts in any of these dynamics could shorten the timeline for labor replacement and thus job loss. For example, unloading containers requires significant manual labor, and major industrial equipment companies such as Honeywell have developed massive robotic unloading machines that substantially reduce the offloading time and all but eliminate workers from the process. But these technologies still are limited by variable conditions: all boxes in a container must be uniform in size and fall within particular weight parameters, circumstances that remain rare in warehouses today. Without standardization of goods within containers, or a leap forward in the technology's ability to deal with variability, these advances likely will be slow to proliferate.

Finally, the flip side of technologies applied to the above processes is that some products and activities are less amenable to technological applications. The most prominent category is "nonconveyables," or goods that are too big, heavy, awkward, or varied to move using a conveyor system. Examples include hot tubs and canoes, but also perishable foods like meat and some produce. Nonconveyables often are routed into separate inbound and outbound handling processes because they require manual handling, and some companies outsource the distribution of nonconveyables completely to shed the inefficient operation. Nonconveyable goods handling presumably will remain a largely manual process for the foreseeable future, not subject to reductions in employment opportunities.

Newly available products, such as “wearable” warehouse technologies, follow-me carts, and increasingly sophisticated labor management software, allow more granular tracking of workers’ movements, including walk speed, routes, bottlenecks, and break time.

5. Technology is likely to have uneven impacts across demographic groups and occupations.

Technological change, as was noted earlier, is often uneven in its effects across the labor force. Some technologies will disproportionately impact the employability of older workers, such as engineered labor standards that penalize workers for not reaching exacting productivity targets. Furthermore, new technologies could be especially detrimental to the earnings of certain groups of workers, especially in warehouses that use merit pay or bonuses for productivity as core elements of employee pay. Older workers also may find new workplace technologies more intimidating than their younger counterparts, given that younger workers are more likely to have encountered computerized systems at work or at school.

Women Warehouse Workers

Women are more likely to work in e-commerce fulfillment centers than in traditional warehouses, which expands the employment prospects available to women workers in a traditionally male-dominated industry. Table 2.3 showed that across all occupations, 44% of workers in the warehousing segment of the e-commerce sector are women, versus 28% of workers in traditional warehousing. Yet, as Section 2 showed, there is a wage penalty for some e-commerce occupations relative to traditional warehouses, which suggests that a shift of work hours to e-commerce in effect could reduce overall wages. For example, nearly half (48%) of e-commerce stock clerks and order fillers are women, yet stock clerks in e-commerce earn \$2.32 less per hour than their counterparts in the warehousing industry. Further research is required to determine whether the observed wage differentials reflect a gender bias in pay or whether the pay structure in e-commerce facilities is lower regardless of workers' gender.

In addition, e-commerce order volatility translates into greater scheduling instability, and perhaps extended periods in which nominally full-time workers are employed part time. Conversely, mandatory overtime, particularly on short notice, can be especially difficult for workers with child care responsibilities, which suggests that women would be disproportionately affected by scheduling uncertainty. In short, while e-commerce may offer new employment opportunities to women, some of the benefits of employment could be counteracted by the instabilities that are endemic to warehousing activities.

Summary Occupational Analysis

The following analysis focuses on the effects of technology on the five largest front-line occupations in warehousing, which account for nearly two-thirds of all workers in the industry. The variation in the demographic makeup of these occupations portends uneven exposure to

technological change. Bear in mind that for the industry as a whole, Latinx and Black workers are overrepresented compared with the total U.S. workforce: both groups are employed in warehousing at roughly twice the rate of all of other industries. Male workers also are disproportionately represented: while 47% of the U.S. workforce is male, 72% of workers in warehousing and 56% in e-commerce are male.

Laborers and Freight, Stock, and Material Movers, Hand Stock Clerks and Order Fillers Packers and Packagers, Hand

The three occupational categories above are used somewhat interchangeably for picking, packing, sorting, and shipping jobs in a warehouse. Warehouse workers who are involved in order picking might be counted in any of these occupations, and thus this report considers the effects of technology on order picking across the three categories. Together, these three occupations account for 43% of all warehousing industry jobs and 67% of front-line warehousing jobs.

Recent employment growth suggests that even though technology will be used increasingly in the order-picking process, significant net job losses in the industry are unlikely to occur over the next five to 10 years. This forecast relies, however, on the continued growth of e-commerce and the robust health of the U.S. economy. Further, depending on the widespread adoption of certain technologies, productivity improvements might slow employment growth. These three warehouse occupations may have the highest exposure to technological change because of their prevalence in e-commerce warehouses, coupled with warehouse operators' stated goal to apply technologies to the each-picking process. Conversely, order assembly still will require human pickers for some time to come. Although there is considerable excitement in the industry over the potential of robotic grippers, it likely will be many years before a dexterous robotic picking arm with near-perfect picking accuracy will be available at a sufficiently low price point for it to be widely adopted.

The demographics of workers in these occupations differ somewhat between the warehousing and e-commerce industries, so the workers most likely to be affected by technological change are worth specifying in detail. As Table 6.1 shows, workers in order-picking occupations in e-commerce are more likely than their counterparts in warehousing to be female, White and young. While warehouse workers are more likely to be male in both industries, female workers make up 45% of this workforce in e-commerce, compared with 34% in warehousing. White workers constitute the largest race/ethnic category in

E-commerce order volatility translates into greater scheduling instability, and perhaps extended periods in which nominally full-time workers are employed part time.

e-commerce (45%), while Latinx workers are the largest single race/ethnic group in warehousing (36%). Black workers account for roughly one-quarter of the workforce in both industries. Finally, young workers, particularly those ages 18–24, are the largest age group in both industries.

TABLE 6.1
Demographic Characteristics of Workers in Order-Picking Occupations*

	Percent of Workers in Picking Occupations in Warehousing Industry**	Percent of Workers in Picking Occupations in E-commerce Industry***
Gender		
Male	66%	55%
Female	34%	45%
Race/Ethnicity		
Black, Non-Latinx	26%	26%
Hispanic or Latinx	36%	19%
Asian, Non-Latinx	4%	6%
White, Non-Latinx	32%	45%
Other, Non-Latinx	2%	4%
Age		
18–24	29%	37%
25–34	28%	26%
35–44	17%	16%
45–54	15%	12%
55–64	8%	7%

Source: American Community Survey 2013–2017

*Order-picking occupations are Laborers and Freight, Stock, and Material Movers, Hand; Packers and Packagers, Hand; and Stock Clerks and Order Fillers.

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Depending on the technology implemented, workers in these three occupations may see their travel distances within warehouses decrease, since walking is a high-priority activity for the application of new technologies. This might improve the quality of these jobs somewhat by reducing the need for walking and cart pushing, though, as noted in the previous section, employees likely will experience work intensification alongside automation. Human dexterity will be required for the process of grasping of products and placing goods in either boxes or in totes to be moved to the next task station, so workers in order-picking occupations will continue to perform these tasks and likely see their productivity expectations rise. For workers packing orders into boxes and bags for shipping, autoboxing and autobagging technologies could reduce employment opportunities.

Industrial Truck and Tractor Operators (Forklift Drivers)

The most likely technology that would affect this occupational category is the automated guided vehicle (AGV), a well-developed but still costly solution. Forklift drivers require skill and certification, and often command slightly higher wages than other warehouse workers—in fact, forklift drivers are the highest-paid of front-line warehouse workers, and overwhelmingly male (Table 6.2). White and Latinx forklift drivers make up the largest race/ethnic groups in both warehousing and e-commerce, and Black workers account for roughly one-quarter of forklift drivers. Compared with other warehouse occupations, forklift drivers are more likely to be older.

Simple horizontal pallet moves are easily handled by AGVs, though vertical moves—lifting and placing a pallet on racking—require precision so that goods are not damaged. According to the industry insiders interviewed for this report, the current high cost of AGVs limits the feasibility of implementation in many warehouses. What may change is that companies will begin to capture more data from forklifts and drivers, with at least three possible applications: to understand equipment utilization rates, to inform and improve the next round of AGV development, and to increase the productivity of drivers.

TABLE 6.2
Demographic Characteristics of Industrial Truck and Tractor Operators (Forklift Drivers)

	Percent of Forklift Drivers in Warehousing Industry*	Percent of Forklift Drivers in E-commerce Industry**
Gender		
Male	93%	82%
Female	7%	18%
Race/Ethnicity		
Black, Non-Latinx	26%	25%
Hispanic or Latinx	34%	36%
Asian, Non-Latinx	2%	–
White, Non-Latinx	36%	35%
Other, Non-Latinx	2%	–
Age		
18–24	18%	40%
25–34	31%	17%
35–44	24%	19%
45–54	17%	18%
55–64	10%	6%

Source: American Community Survey 2013–2017

*NAICS 493 **NAICS 45411

Shipping, Receiving, and Traffic Clerks

With the advent of AI-assisted receiving processes, this occupation could undergo significant change (Table 6.3). Freight transportation is becoming increasingly digitized in light of demands for the real-time visibility of truck shipments, though here, too, adoption is uneven across the industry. As this digital capability improves, changes at the nexus of trucking and warehousing will follow, especially in the process of scheduling truck deliveries. WMS software increasingly will integrate AI into planning functions, and these advancements will infringe on what has been the purview of workers in this occupation, possibly leading to a reduction in staffing levels. Major change will depend on the extensive uptake of these technologies, which will be led by first movers who use the most advanced WMS systems and implement digital tracking across the freight-transportation function. Males constitute the majority of workers in this occupation in both industries, and thus have a higher exposure to job change or staffing reductions. White workers make up nearly half (47%) of shipping, receiving, and traffic clerks in e-commerce, and Latinx and White workers each compose 37% of this occupation in warehousing.

TABLE 6.3
Demographic Characteristics of Shipping, Receiving, and Traffic Clerks

	Percent of Shipping, Receiving, and Traffic Clerks in Warehousing Industry*	Percent of Shipping, Receiving, and Traffic Clerks in E-commerce Industry**
Gender		
Male	69%	57%
Female	31%	43%
Race/Ethnicity		
Black, Non-Latinx	20%	26%
Hispanic or Latinx	37%	19%
Asian, Non-Latinx	4%	5%
White, Non-Latinx	37%	47%
Other, Non-Latinx	3%	4%
Age		
18–24	27%	38%
25–34	30%	23%
35–44	18%	15%
45–54	16%	15%
55–64	8%	9%

Source: American Community Survey 2013–2017

*NAICS 493 **NAICS 45411

Section Six: Impacts on Tasks, Jobs, and Workers

Conversely, and with effects across all occupations, warehouse facilities that do not implement new technologies likely will experiment instead with evolving labor strategies to manage demand volatility and risk, as well as to improve efficiency. This could include the increased use of mandatory or voluntary overtime, temporary staffing arrangements, additional shifts, and incentives based on productivity.

SECTION SEVEN:

Conclusion

Technology adoption is not a risk-free undertaking, and there are a number of features of the warehousing industry that inhibit innovation. Lead firms are likely to be in the most advantageous position when it comes to experimenting with new technologies, and e-commerce is driving this trend. Large retailers like Amazon, for example, may be able to leverage both their sizeable order volumes and strong financial positions to secure first-mover advantages through early adoption of new technologies. Furthermore, because they manage their supply chains, and therefore set contracting arrangements, lead firms are not subject to short contract terms and other provisions that elevate the risks incurred when making substantial investments in new technologies. With this said, however, impediments still remain. For the foreseeable future, product variability will continue to present challenges to automation, as do fluctuating order volumes and the overall volatility of consumer demand. Large and small firms alike can face these constraints, and though lead firms certainly have incentives to make investments in logistics infrastructure, such constraints nevertheless serve to slow experimentation.

Most 3PLs face even greater challenges. Chief among these is the cost-based competition that is a defining characteristic of the warehouse industry. Cost-based competition holds down the margins of warehouse operators, and when combined with short subcontract terms, it renders technological experimentation a risky endeavor. Even under the best of circumstances, technological experimentation exposes warehouse operators to financial risks, and the need to secure an adequate return on investment plays a decisive role in technology-spending decisions (especially given that macroeconomic changes can sharply shift patterns of consumer spending). Short contract terms exacerbate these risks, and without the assurances provided by strategic, long-term partnerships with lead firms, a cautious approach to experimentation will prevail. Moreover, because securing upfront investment may prove challenging, especially given the low margins and the general absence of long-term contracts, most operators have taken a cautious approach, which has moderated the scope and pace of change.

For these reasons, widespread full automation of warehouse occupations is little more than a remote possibility over the near to medium term, despite the rapid technological advances that are being made. To the extent that technological adoption occurs within this timeframe,

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experimentation is more likely to occur among lead firms than in the 3PL market, though the possibility of diffusion from early-adopting lead firms to other operators remains.

Partial automation and labor augmentation, on the other hand—where a particular subset of occupational tasks or activities lends itself to a viable technological application—are far more realistic objectives. In the majority of cases, labor augmentation likely will be the most common path of short- and medium-term technological change, and has the potential to alter the content and quality of workers' jobs significantly. It is conceivable that workers will stand to benefit from ergonomic improvements as new technologies replace walking, lifting, repetitive motion, and other physically demanding activities. Where such improvements in health and safety are made, it is imperative that they are not compromised by work intensification. Advances in warehouse ergonomics, including reductions in strenuous, manual activities, could be accompanied by increasing demands on the pace of work and sharply rising workloads. Work intensification could lead to the introduction of new hazards on the job, arising from the presence of new technologies in the workplace or from worker fatigue.

Another possible outcome resulting from the implementation of new technologies is de-skilling. From the perspective of the warehouse operator, de-skilling can enable reductions in worker training time and turnover costs. Simplifying work tasks allows employers to expand the potential labor pool and increase the use of temporary workers. The impacts on workers, however, can be deleterious, leading to further wage stagnation and erosion of job stability.

Over the long run, especially as the technologies being implemented today are used to collect data that will inform the development of next-generation robotics, automation will become more widespread. But the negative effects on employment levels are not predetermined. In one prominent example of automation without worker displacement, Boxed outfitted its distribution center with leading-edge automated processes. Instead of laying workers off, the company trained them to fill new roles around the equipment. This was possible, however, because of the rapid growth of the business: automation allowed Boxed to handle increasing volumes without more workers, and this enabled the return on technology investments. However, even in this case, should growth slow or reverse, this strategy might not be sustainable.⁷¹

The findings from this research raise a number of questions for policy makers, worker organizations, and industry leaders.

Variation in adoption is likely to be an ongoing feature of technological change in the warehousing industry. As a result, effects on facilities and workforces will differ, requiring careful attention to avoid disproportionate impacts on workers who have higher exposure to job change and eventual job loss, especially workers of color (who are disproportionately represented in front-line warehousing occupations) and women (who are more likely to work in e-commerce).

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How can policy makers, equipped with forward-looking information, help to plan and prepare for changes in job quality and the potential unequal distribution of the costs and benefits of technology adoption? What new policies might promote job security to help support workers and their families as technologies change the nature of warehouse work?

A number of the new technologies covered in this report introduce workplace dynamics that have few precedents. The growing use of technology to monitor and manage workers raises ethical issues regarding data privacy, as well as concerns about workplace morale, as electronically mediated forms of supervision threaten to constrain workers' autonomy and introduce new rigidities into the workplace. These, in turn, could lead to increased employee turnover. Algorithmic transparency, data privacy, and worker surveillance are nascent issues that require serious attention by industry leaders, worker organizations, and policy makers. *How might including workers in the process of technology implementation improve employment and operational outcomes? What safeguards might be necessary in order to ensure workers' data are protected?*

Little is known about the range of effects new technologies will have on health and safety over the long run, and it is possible that technologies will have both positive and negative implications for jobs and workers. Workers might feel increased stress and anxiety as a result of electronic monitoring, ergonomic benefits might be coupled with new health and safety risks, and increasing productivity requirements might lead to exhaustion and overwork, possibly hampering employers' efforts to attract and retain workers. *What measures can be put in place to track the physical and psychological impacts of technologies on workers to mitigate any negative effects on workers' health and safety? How might developers' research and design efforts better incorporate an assessment of the full effects of new technologies on workers' well-being?*

Finally, proactive measures are necessary to support workers who are displaced by new technologies to transition to alternative employment opportunities. It is conceivable that, over the long term, the warehousing industry will offer fewer employment opportunities. Policy makers and employers can begin planning today for programs that will prepare workers for nonroutine and newly created jobs in warehousing or to support them as they move to other industries. *What efforts can ensure a safety net for labor market dislocations caused by the introduction of new technologies in order to ease the burden on displaced workers? How can policy makers involve employers in systematically identifying within-industry job opportunities for displaced workers, including on-the-job training?*

Warehouse operators stand to gain substantial efficiencies through technological advances. How these gains will be distributed, especially given the findings of this report, is a pressing question for policy makers, worker organizations, and industry leaders alike. Warehouse operators have latitude in determining how new technologies will be implemented. It is imperative that productivity gains be shared, that workers be involved in identifying which efficiencies should be prioritized and what hazards are being introduced, and that experimentation unfolds with regard for more than just productivity increases. Absent this, the process of technological change in warehousing will resemble a win-lose proposition, where the short-term benefits are captured by the industry and the long-run costs are borne by workers.

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Institute for Research on Labor and Employment
University of California, Berkeley
2521 Channing Way
Berkeley, CA 94720-5555
(510) 642-0323
laborcenter.berkeley.edu



2102 Almaden Rd. Suite 112
San Jose, CA 95125
(408) 809-2120
wpusa.org



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Working Partnerships USA is a community organization bringing together the power of grassroots organizing and public policy innovation to drive the movement for a just economy. Based in Silicon Valley, it tackles the root causes of inequality and poverty by leading collaborative campaigns for quality jobs, healthy communities, equitable growth and vibrant democracy. WPUSA builds the capacity of workers, low-income neighborhoods and communities of color to lead and govern.

EXHIBIT 2

EXHIBIT 3

Ruthless Quotas at Amazon Are Maiming Employees

This holiday season, Amazon will move millions of packages at dizzying speed. Internal injury reports suggest all that convenience is coming at the expense of worker safety.



Paul Kuroda / Reveal

Story by Will Evans

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This story is a collaboration between The Atlantic and [Reveal](#) from the Center for Investigative Reporting. [Sign up](#) to read more stories from Reveal.

WHEN CANDICE DIXON showed up for her first day of work at an Amazon warehouse in Eastvale, California, she stepped into a wonder of automation, efficiency, and speed. Inside the sprawling four-story

building in Southern California's Inland Empire, hundreds of squat orange robots whizzed across the floor, carrying tall yellow racks.

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As a stower, her job was to stand in a spot on the floor, like hundreds of others in that million-square-foot warehouse, and fill an unending parade of merchandise racks. Another worker, known as a “water spider,” would bring her boxes upon boxes of goods—jars of protein powder, inflatable unicorn pool floats, laptops, makeup, Himalayan sea salt, vibrators, plastic toy cars. She'd grab each item out of a box, scan it, lift it onto the rack, and scan its new location. She'd use a stepladder to put things on the top of the rack. For heavy items—she remembers the cases of pet food in particular—she'd have to squat down to hoist them in, then pop back up to grab the next item. As soon as she'd filled a rack, she'd press a button, and one robot would zip it away while another robot would bring a new one to fill.

The moment an Amazon customer clicked “place your order,” a robot would haul one of those racks to a picker, who would grab the right item for the order and send it on a series of long conveyors to a packer, who would stuff it in one of those familiar, smiling cardboard boxes.

The clock was always ticking on Amazon's promised delivery time. Dixon had to scan a new item every 11 seconds to hit her quota, she said, and Amazon always knew when she didn't.

Dixon's scan rate—more than 300 items an hour, thousands of individual products a day—was being tracked constantly, the data flowing to managers in real time, then crunched by a proprietary software system called ADAPT. She knew, like the thousands of other workers there, that if she didn't hit her target speed, she would be written up, and if she didn't improve, she eventually would be fired.

Amazon's cutting-edge technology, unrelenting surveillance, and constant disciplinary write-ups pushed the Eastvale workers so hard that in the last

holiday season, they hit a coveted target: They got a million packages out the door in 24 hours. Amazon handed out T-shirts celebrating their induction into the “Million Unit Club.”

Rachel de Leon / Reveal

But Dixon, 54, wasn't around for that. She started the job in April 2018, and within two months, or nearly 100,000 items, the lifting had destroyed her back. An Amazon-approved doctor said she had bulging discs and diagnosed her with a back sprain, joint inflammation, and chronic pain, determining that her injuries were 100 percent due to her job. She could no longer work at Amazon. Today, she can barely climb stairs. Walking her dog, doing the dishes, getting out of her chair—everything is painful. According to her medical records, her condition is unlikely to improve.

So this holiday-shopping season, as Amazon's ferocious speed is on full display, Dixon is at a standstill. She told Reveal in mid-October that her workers'-compensation settlement was about to run out. She was struggling to land a new job and worried she'd lose her home.

“I'm still too young to feel like I'm 90 years old,” Dixon said, sitting in the living room of her Corona, California, home, which was decorated with inspirational sayings (“You never know how strong you are until being strong is the only

choice you have”). “I don’t even know how I’m going to make it in a couple of months.”

AMAZON’S FAMOUS SPEED and technological innovation have driven the company’s massive global expansion and a valuation well over \$800 billion. It’s also helped make Amazon the nation’s second-largest private employer behind Walmart, and its CEO, Jeff Bezos, one of the richest humans on Earth. Now an investigation by Reveal from the Center for Investigative Reporting has found that the company’s obsession with speed has turned its warehouses into injury mills.

Reveal amassed internal injury records from 23 of the company’s 110 fulfillment centers nationwide. Taken together, the rate of serious injuries for those facilities was more than double the national average for the warehousing industry: 9.6 serious injuries per 100 full-time workers in 2018, compared with an industry average that year of 4.

While a handful of centers were at or below the industry average, Reveal found that some centers, such as the Eastvale warehouse, were especially dangerous. Dixon’s was one of 422 injuries recorded there last year. Its rate of serious injuries—those requiring job restrictions or days off work—was more than four times the industry average.

[Austin Murphy: I used to write for ‘Sports Illustrated.’ Now I deliver packages for Amazon.]

“According to Amazon’s own records, the risk of work injuries at fulfillment centers is alarmingly, unacceptably high,” said David Michaels, the former head of the federal Occupational Safety and Health Administration, who is now a professor at George Washington University’s public-health school. “Amazon needs to take a hard look at the facilities where so many workers are being hurt and either redesign the work processes, replace the top managers, or both, because serious-injury rates this high should not be acceptable to any employer.”

Amazon officials declined repeated interview requests. Instead, a company spokesperson, Ashley Robinson, provided a written response to some of Reveal’s questions. Robinson said Amazon’s injury rates are high because it’s aggressive

about recording worker injuries and cautious about allowing injured workers to return to work before they're ready.

“We know that by making a conservative choice to *not* place an injured associate back into a job, we are elevating restricted and lost time rates as a company, but with the intent to benefit the associate,” Robinson wrote.

Many workers said that was not their experience. They spoke with outrage about having been cast aside as damaged goods or sent back to jobs that injured them further. Dixon said she had doctor orders not to pull or lift heavy objects and to alternate between sitting and standing, but she wasn't given a chair and heavy boxes kept coming her way.

“For Amazon,” Dixon said, “all they care about is getting the job done and getting it out fast and not realizing how it's affecting us and our own bodies.”

The company does instruct workers on the safe way to move their bodies and handle equipment. But several former workers said they had to break the safety rules to keep up. They would jump or stretch to reach a top rack instead of using a stepladder. They would twist and bend over to grab boxes instead of taking time to squat and lift with their legs. They would hoist extra-heavy items alone to avoid wasting time getting help. They had to, they said, or they would lose their jobs. So they took the risk.

Then, if they got hurt, they would lose their jobs anyway. Even some workers who loved the pace, camaraderie, and compensation at Amazon's fulfillment centers told Reveal that they were quickly replaced as soon as their bodies broke down.

The problems Reveal uncovered go far beyond common sprains, strains, and repetitive stress injuries. When a gas leak inundated the Eastvale warehouse where Dixon used to work, managers wouldn't slow down, several workers said, even though they were dizzy and vomiting. They were told that they'd have to use personal time off if they wanted to leave.

And when disaster struck at one Indiana warehouse, Amazon's economic might may have helped the company evade accountability. When a maintenance worker

was crushed to death by a forklift there, state officials in Indiana, which then was jockeying for Amazon's second headquarters, sided with the company over their own investigator. "When you order something from Amazon and you've worked inside Amazon, you wonder, 'Hey, is ordering my package going to be the demise of somebody?'" said one former safety manager, who had worked at multiple Amazon facilities.

THE ROOT of Amazon's success appears to be the root of its injury problem, too: the blistering pace of delivering packages to its customers.

Amazon's busiest season, which the company calls "peak," begins with the run-up to Black Friday. Amazon said it shipped Prime members more than a billion items last holiday season. This year, Amazon has a new promise: free one-day delivery for Prime members.

It's also crunch time for the human body. Employees face the exhaustion of mandatory 12-hour shifts, and warehouses are crammed with seasonal workers unaccustomed to the grind. The company's 2018 logs show that weekly injury counts spiked at two distinct moments when Amazon offered special deals: Cyber Monday and Prime Day.

[Read: What Amazon thinks you're worth]

Robinson, the Amazon spokesperson, said total injuries do go up during those peak times, but that's only because the company brings on more workers then. Robinson said the rate of injuries historically has stayed steady, or even decreased, at peak times. Amazon declined to provide data to back up that claim.

As ever-increasing production targets flow down from corporate, regional managers lean on warehouse directors, who put pressure on the supervisors, who oversee all those water spiders, stowers, pickers, and packers. And the key to advancement is great production numbers.

"It incentivizes you to be a heartless son of a bitch," said a former senior operations manager who had leadership roles at multiple facilities.

The former senior operations manager described going from the omniscient ADAPT system to an Amazon competitor, where he had to search occasionally

updated Excel spreadsheets to find productivity numbers.

Marc Wulfraat, president of the supply-chain and logistics consulting firm MWPVL International, described Amazon as more aggressive than any other industry player in what the company expects from workers. “And they will not waste time hanging on to people who can’t perform,” he said.

The Amazon tenure of Parker Knight, a disabled veteran who worked at the Troutdale, Oregon, warehouse this year, shows the ruthless precision of Amazon’s system. Knight had been allowed to work shorter shifts after he sustained back and ankle injuries at the warehouse, but ADAPT didn’t spare him. Knight was written up three times in May for missing his quota.

The expectations were precise. He had to pick 385 small items or 350 medium items each hour. One week, he was hitting 98.45 percent of his expected rate, but that wasn’t good enough. That 1.55 percent speed shortfall earned him his final written warning—the last one before termination.

“You are expected to meet 100 percent of the productivity performance expectation,” the warning reads. Days later, the company informed him he was being fired because of an earlier confrontation over workers’-compensation paperwork.

Robinson said Amazon has performance expectations “like most companies.”

“We measure actual performance against those expectations,” she said. “Associate performance is measured and evaluated over a long period of time—at least six weeks—as we know a variety of things could impact the ability to meet expectations in any given day or hour.”

The company’s aggressive production demands have overwhelmed its safety teams’ efforts to protect workers, according to five former Amazon safety managers, who oversaw safety at fulfillment centers around the country and spoke on condition of anonymity because they feared retaliation.

One of them, a former senior safety manager, said it’s well known internally that the injury rates are too high, but there’s no way Amazon will slow down. “It’s not

a conversation that can be had,” the former manager said. “We’re never going to fix safety at Amazon, because we’re never going to fix what the real issue is.”

AMAZON IS FOND of showing off its industry-changing innovation: The fleets of robots, it claims, not only speed up production; they also make employees’ jobs easier and safer. Instead of having to walk miles of warehouse floor every day, pickers stand in one spot as robots come to them.

But injury records and interviews with three of the former Amazon safety managers suggest the introduction of the robots led to even more injuries. Of the records Reveal obtained, most of the warehouses with the highest rates of injury deployed robots. One robotic facility in Kent, Washington—which a senior operations manager boasted was “the flagship of fulfillment,” as one of the few centers in 2016 to ship a million packages in a day—logged 292 serious injuries last year, for a rate of about 13 serious injuries per 100 workers.

(Jason Raish)

After Amazon debuted the robots in Tracy, California, five years ago, the serious-injury rate there nearly quadrupled, going from 2.9 per 100 workers in 2015 to 11.3 in 2018, records show.

Jonathan Meador watched the transition from his position loading boxes into big-rig trailers. The robots at the Tracy warehouse were so efficient that humans could barely keep up. Suddenly, the pickers and packers were expected to move more products every minute, and more boxes shot down the conveyor belt toward Meador.

“Before robots, it was still tough, but it was manageable,” he said. Afterward, “we were in a fight that we just can’t win.”

The Oregon facility where Knight worked opened with robotics in August 2018 and had the highest serious-injury rate Reveal found: nearly 26 per 100 employees, more than six times the industry average.

New warehouses sometimes are rushed to open before they’re ready, said two of the former safety managers, leading management to skimp on training and start operations without full safety teams in place.

Robinson declined to comment on the elevated injury rates at robotic warehouses. But she said Amazon doesn’t launch new buildings until they are “ready and safe for employees.”

I NJURY RECORDS are supposed to be one way of holding companies accountable for their safety culture. The U.S. Department of Labor under the Obama administration proposed posting them online, but under President Donald Trump, the agency has reversed course and also fought public-records requests. And Amazon has resisted making its own safety records public.

Reveal filed multiple requests to OSHA for injury records from Amazon facilities in more than a dozen states, many of which were released with critical information redacted; Reveal has filed suit to challenge those redactions.

Still, by law, employers must provide complete injury records to any current or former employee who requests them. Reveal reached out to Amazon warehouse workers past and present and explained how to request records for their work site, ultimately receiving 2018 records for 23 fulfillment centers in 14 states. Two of the injury logs came from a collaboration of worker advocacy groups, including New York Communities for Change and Make the Road New York.

Reveal now is seeking to compile the remaining injury logs. (If you’ve worked for Amazon, here’s how you can get the records and share them with Reveal.)

In at least a dozen cases, Amazon either ignored these employee requests or provided only partial records, in apparent violation of federal regulations.

Amazon told some workers that they were entitled only to the records for the time period they worked there; an OSHA spokesperson, Kimberly Darby, said that's incorrect. And when Amazon did provide records, warehouse managers used identical language to call them confidential and request they be kept secret. Yet OSHA guidance says, and Darby confirmed, that employers are not allowed to restrict workers from sharing the records. Some workers said they felt intimidated by the notice, fearing they might get sued by Amazon for sharing the records with a news organization.

Several years ago, according to three of the former safety managers, Amazon had a policy for systematically hiding injuries. A former safety specialist in a warehouse confirmed their account. He said higher-ups instructed him to come up with justifications for not recording injuries that should have been counted by law.

After OSHA cited Amazon for failing to record dozens of injuries at a New Jersey warehouse in 2015, Amazon changed the practice, and the former safety managers said the company became more diligent about counting injuries. (OSHA requires companies to record work-related injuries on official logs only when they result in days away from work, job restrictions, or medical treatment beyond first aid.)

Robinson said that Amazon never had a policy for underreporting injuries but that in 2016, it implemented a policy change after recognizing the challenge of ensuring “consistency and accuracy.”

“Amazon took the decision to shift to a fully transparent reporting model as we would rather over-report and lead in this space for our associates’ safety than optimize for optics,” she said.

The former senior safety manager said some warehouse managers still found ways to avoid directing workers to the on-site health clinic—such as sending them to the break room instead—so their injuries wouldn't get recorded. A few workers said supervisors would get upset if they reported injuries or sought medical treatment.

The logs Reveal obtained are scattered with lacerations and concussions and fractures, but most of the injuries are labeled as sprains and strains. The pain from these injuries can be debilitating. About a third of the injured workers had to take off more than a month to recover.

A handful of the injuries were far worse.

IN SEPTEMBER 2017, Amazon announced a search for a second headquarters, saying it would invest more than \$5 billion and bring as many as 50,000 jobs to whichever city won the sweepstakes.

Indiana Governor Eric Holcomb got the news while on a trip to Japan. He returned home on a Friday night and spent the weekend in deliberations. On Monday, he announced his state would join the bidding war. He put the Indiana Economic Development Corporation in charge of putting together a package of local and state incentives.

“We are doing what Amazon has asked us to do: coordinating efforts with all interested regions of the state to put our best bid forward,” he said in the statement.

He had tough competition. Arlington, Virginia, offered \$550 million in cash and a helipad. Atlanta dreamed up an exclusive airport lounge with free parking for Amazon executives. Maryland’s Montgomery County dangled \$6.5 billion in tax incentives.

The efforts of Indiana state officials to vie for Amazon’s interest were about to intersect with the life of one local Amazon employee, 59-year-old Phillip Lee Terry.

Terry had been at Amazon for about two years. He started as a picker in a Plainfield fulfillment center, then moved to the maintenance department. He had a background in an unrelated field—marketing—but quickly took on the task of handling complicated industrial equipment.

Terry made a surprisingly strong impact on his co-workers, even at a big, busy warehouse. He’d chat them up and make them laugh whenever he could, said Jennie Miller, who worked picking orders with Terry.

“There’s only kind of a few people that you ever meet in your life that have those kinds of sparkling personalities,” she said.

On September 24, just a few days after he’d been eating ice cream and watching college football with his grandkids, Terry showed up for work and was sent to do maintenance on a forklift. He walked under the machine’s forks and metal platform to work on it with a wrench. Suddenly, the 1,200-pound piece of equipment dropped down and crushed him.

His body lay there for nearly two hours before a co-worker noticed the pool of blood.

The next day, a safety inspector with Indiana OSHA headed to Amazon to investigate.

Safety was the family business for John Stallone. His father had worked his way up to become director of enforcement for the Alaska state branch of OSHA. Years ago, when Stallone joined the U.S. Air Force and served in Afghanistan, his father told him that wherever his career took him, to always get involved in safety work. And so he did, volunteering on safety committees in the military, then working in industrial safety in oil and gas fields. On a shelf near his front door, he keeps a collection of hard hats from his safety work around the globe.

As he surveyed the site of the accident, Stallone quickly figured out the problem: A tall pole, lying just feet away, should have been used to prop up the forklift during maintenance. In a recording he made of his inspection, Stallone asked an Amazon manager whether there was any written documentation of Terry being trained on that.

“No, sir,” the supervisor says on the recording. He told Stallone that Terry had been informally trained by a co-worker.

Stallone interviewed a co-worker of Terry’s, who put the blame on Amazon’s safety culture coming in second to production demands.

“The safety issues I’ve brought up have been dismissed and not dealt with,” the worker said in a signed statement. “I want to see the safety culture in Amazon

change and ensure the maintenance workers have the appropriate amount of training. There's no training, there's no safety, it's 'Get 'er done.' ”

Stallone (Rachel de Leon / Reveal)

Stallone repeatedly pressed Amazon to provide records showing Terry had been trained on that piece of equipment. In the end, he found that Amazon failed to provide adequate training, exposing Terry to a fatal hazard.

Indiana OSHA issued four serious safety citations, for a total fine of \$28,000. Stallone sought more, but he was getting pushback. On November 20, 2017, Stallone joined his boss, Indiana OSHA Director Julie Alexander, as she called Amazon officials. He secretly recorded the conversation, which is legal in the state, and shared the recording with Reveal.

During the call, Alexander told the Amazon officials what she'd need from them in order to shift the blame from the company to “employee misconduct,” according to the recording.

And she walked them through how to negotiate down the fines. “We sometimes like to consider grouping citations to lower the penalty amounts,” she said.

She suggested Amazon could partner with her agency as a “leader in safety” to kick off a program promoting best practices in the logistics industry.

After hanging up with Amazon, Alexander said: “They’re wanting to probably take this offer and go back and look and say, ‘Hey, we’re partnering with Indiana. We’re going to be the leader.’”

She told Stallone, “I hope you don’t take it personally if we have to manipulate your citations.”

Amazon had said it would appeal the citations and had further information that it would share in confidential settlement negotiations. Alexander wondered what it could be. Then she speculated out loud that the information might be about Terry himself, saying, “I’m guessing the guy was probably on drugs or something.”

By this point, a coroner had found nothing in his blood except nicotine and caffeine.

Stallone said he was disgusted. But the pressure to placate Amazon didn’t stop there.

Some days after the conference call with Amazon officials, Stallone said Indiana Labor Commissioner Rick Ruble pulled him into his office. The governor was there, too, standing by the commissioner’s desk, according to Stallone.

He recalled that Holcomb told him how much it would mean to Indiana if the state won the Amazon headquarters deal. Then, Stallone said, the commissioner told him to back off on the Amazon case—or resign.

Later, in early December, while the Amazon citations still were being appealed, Stallone said he was called into a meeting by his supervisors and told that he was going to be terminated over alleged job-performance issues. Stallone and a colleague with knowledge of the matter told *Reveal* that the job-performance claims were baseless and likely a pretext, levied in retribution for his pressing for the safety citations against Amazon. The meeting took place just three months after Stallone had received two awards at a staff retreat for his safety work.

Stallone said he resigned that same day; the governor’s office asserts that he was fired. Indiana state personnel records list his departure as a termination for failing to “successfully complete [a] probationary period.”

On December 6, 2017, shortly after his departure, Stallone sounded the alarm to a federal OSHA official. In an email he shared with Reveal, Stallone told the federal official that “someone higher than Director Alexander” wanted the Amazon case to go away “in the hopes it would keep Indianapolis in the running for their new HQ location.”*

The governor’s office denied the meeting with Stallone and the labor commissioner took place, with Press Secretary Rachel Hoffmeyer writing, “The Governor never gets involved in Department of Labor cases.”

The same day Stallone sent his whistle-blower email, Amazon’s corporate offices in Seattle gave a \$1,000 campaign contribution to Indiana’s governor. It was years before Holcomb would next face reelection, and Amazon hasn’t donated to him before or since.

A year after Terry’s death, Indiana officials quietly signed an agreement with Amazon to delete all the safety citations and fines. The agreement said Amazon had met the requirements of an “unpreventable employee misconduct defense.” The official record now essentially blames Terry for his own death.

At that point, Indianapolis was one of 20 finalists for the Amazon headquarters deal. Three and a half weeks after the citations were deleted, Amazon held a small-business roundtable event in Indianapolis. Holcomb was there, sitting next to a company representative.

“Our tax and regulatory climates are very—not just attractive, but enticing,” he told a local TV reporter at the event. “And we want to grow together.”

Ultimately, Indiana didn’t win the big sweepstakes; Amazon chose Arlington for its second headquarters. Federal OSHA declined to investigate Stallone’s complaint.

[Derek Thompson: Amazon’s HQ2 spectacle isn’t just shameful—it should be illegal]

The governor’s office and Indiana labor officials declined interviews. The Indiana Labor Department, which oversees the state OSHA, responded to questions about Stallone’s account of the meeting and Alexander’s statements by email,

writing that, “The allegations are nothing short of bizarre and fantastical—in addition to being absolutely false.”

In a later statement, the department said it couldn’t prove Amazon should have known Terry wouldn’t properly prop up the forklift. A Labor Department spokesperson, Stephanie McFarland, said Amazon produced proof that Terry was properly trained, including a video of Terry handling the equipment the right way another time. But the agency did not provide any documentation of Amazon’s evidence or any records that would corroborate the department’s account.

Two of the former Amazon safety managers who were aware of Terry’s death at the time faulted Amazon for failing to use formally trained maintenance professionals. One of them, the former senior safety manager, said Amazon had a systemic problem, vividly recalling a report from another warehouse in which a maintenance worker also had failed to properly brace a forklift while working on it, months after Terry’s death.

“If there was any misconduct there, it’s putting a person that has little to no experience [to work] on this piece of equipment,” said the other former safety manager, who has worked at multiple facilities. “Whoever allowed that to happen—that’s the misconduct.”

Ashley Robinson, the Amazon spokesperson, would not comment on the circumstances surrounding Terry’s death, citing privacy concerns.

Stallone was so troubled by the incident that he attended Terry’s funeral.

(Courtesy of the Terry family)

“Someone died on the job because they don’t have a good safety culture,” Stallone said. “I think Amazon was given a pass, and they were able to walk away from this fatality incident with no blood on them.”

More than two years later, Terry’s son, Zach, still thinks about his dad each day.

“I have a lot of anger built up because of everything that’s happened,” he said. “He wasn’t an accident. He was the patriarch of our family.”

CANDICE DIXON REMEMBERS her excitement when the Amazon warehouse opened in Eastvale in March 2018. The new fulfillment center would help make Amazon the Inland Empire’s largest private employer, offering a decent wage and health benefits—with no experience necessary. That fall, an Amazon executive, Dave Clark, chose the Eastvale warehouse to make the announcement that Amazon’s new minimum wage would be \$15 an hour. The hundreds of workers crowded around him broke into cheers and applause.

But the jobs, Dixon soon found, came with a brutal work pace. She and other Eastvale workers said nothing was allowed to stand in the way of Amazon’s delivery targets.

On New Year’s Day 2019, the smell of gas wafted through the giant warehouse and workers started to fall ill.

A call came in to the local 911 dispatcher just after midnight on January 2, five and a half hours into the night shift.

“There’s a lot of people sick,” an Amazon worker said.

The person on the line, Christina Van Vorce, a robotics floor monitor, had been smelling gas since the start of her shift. Some workers had been moved to another part of the building, and others were sent briefly to a break room, but the warehouse had not been evacuated, according to accounts by Van Vorce and four others at work that night. After seeing pickers throwing up into trash cans, Van Vorce clocked out to dial 911. She told the dispatcher she didn’t want Amazon to know she had called.

“Where I was at on my floor, pretty much everyone on that side felt sick,” she can be heard saying in the recording. “Two associates that I know for sure that were vomiting. One girl almost completely passed out. She had to be taken by a wheelchair. And then everyone else has got, like, headaches and the burning in the chest and the nose.”

The dispatcher said everyone should evacuate the building. Robinson told Reveal that Amazon shut down the site for about an hour and a half while a maintenance team repaired the leak. But Van Vorce told the dispatcher that management wouldn’t stop operations.

“They’re trying to tell us we have to use our personal time if we want to leave,” she says in the 911 recording.

Another worker called 911 with a similar report, saying she and her co-workers smelled gas and she had clocked out with a headache, but management wouldn’t evacuate. The fire department arrived and found that wind had damaged a gas line, funneling gas into the building.

One current Eastvale worker, who spoke on condition of anonymity, fearing retaliation, said a friend drove her to a hospital in Upland, where she spent several hours on oxygen, an account the friend confirmed. The friend said she herself ended up out of work for weeks with dizziness and headaches. Amazon’s injury logs did record one worker’s “respiratory irritation” that day.

Robinson said that before firefighters arrived, gas was shut off to the building and its safety team “assessed we had fresh air entering the building and there was no risk” to workers. She insisted that no one was hospitalized.

Van Vorce and other workers said Amazon docked their personal time off for leaving work during the leak, though Robinson told Reveal that was against company policy. She confirmed that anyone docked time off got it reversed if they complained.

“It was all about numbers,” Van Vorce said in an interview. “They didn’t want to stop production.”

If Amazon’s Eastvale leadership wouldn’t pause production for a gas leak, they certainly didn’t pause for something as mundane as a trip to the bathroom.

Bathroom visits are tracked carefully at Amazon fulfillment centers, according to multiple current and former workers and managers, with each gap in scanning labeled as “time off task.” Too much time off task can trigger a write-up, and workers describe being caught between wanting to stay hydrated and trying to avoid long treks across a giant warehouse to the bathroom.

Robinson said Amazon ensures every worker has access to a restroom a “short walk” away “whenever needed.” But she did not address whether workers are docked for such trips as time off task. It was that threat that sparked some workers to devise workarounds.

Adam Kester, who worked as a picker at a fulfillment center in Phoenix until last year, said he and other workers would bring customers’ orders into the bathroom with them to scan midway through. “It sounds disgusting,” he acknowledged.

Kristi Shrum, who worked as a stower until 2018 at another Amazon warehouse in Southern California, said she sometimes would have friends scan items for her while she went to the bathroom to make it look as though she were working. Still, she said she got multiple urinary tract infections.

“You have to hold your pee or not make your rate. Which one you want to do?” Shrum said. “I had to make my rate.”

Faith Gerdon of Anaheim said she developed urinary tract infections while working as a stower at the Eastvale warehouse last year. At one point, she got so upset that she told her supervisor, “I’m happy to bring puppy pads and pee here on the floor.”

As Eastvale—a member of last year’s Million Unit Club—again gears up for the frantic holiday season, Gerdon won’t have a chance to earn all that overtime.

Last December, injuries to both of her thumbs and wrists put her off work, according to Amazon’s logs. She hasn’t worked since.

Amazon CEO Jeff Bezos, meanwhile, is focused relentlessly on his customers.

“We are ramping up to make our 25th holiday season the best ever for Prime customers—with millions of products available for free one-day delivery,” he said in an October 24 press release about Amazon’s most recent earnings report. “Customers love the transition of Prime from two days to one day—they’ve already ordered billions of items with free one-day delivery this year.”

Rachel de Leon, Byard Duncan, Melissa Lewis, Katharine Mieszkowski, and Hannah Young contributed reporting.

* These three paragraphs were updated after Indiana’s State Personnel Department released information from the Indiana OSHA safety inspector John Stallone’s personnel record to Reveal. The circumstances of Stallone’s departure from his job became a matter of public dispute November 29, when Indiana Governor Eric Holcomb issued a cease-and-desist letter to Reveal and the *Indianapolis Star* in response to the publication of this story.

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EXHIBIT 4

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PACKAGING PAIN

Workplace Injuries in Amazon's Empire



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Executive Summary

Over the past two decades, Amazon has built a massive eCommerce empire that has transformed the way that many products get from factories to our living rooms. The company has established a massive logistics network that is capable of getting products from our computer screens to our front doors in two days, one day or even an afternoon, setting a new standard for the eCommerce industry.

But as Amazon sets the standard for delivery and fulfillment in the eCommerce industry, it also undeniably sets the standards for employment practices and working conditions in the industry. That is alarming news for the millions of workers in the warehouse and logistics industry. Inside Amazon’s fulfillment centers, delivery stations and other warehousing operations, tens of thousands of workers are paying for the cost of free two-day shipping with their bodies.

While journalistic reports of unsafe working conditions at Amazon’s warehouses have been widely published in recent years, some of the most troubling accounts of Amazon’s health and safety practices don’t come from whistleblowers or workers; these troubling accounts can be found in the company’s own internal documents.

This report relies on data from OSHA 300 and 300A logs collected from Amazon warehouses around the country to develop a systematic understanding of health and safety performance at the company’s facilities and identify solutions for making these workplaces safer for workers.

Amazon’s own internal data paints a very troubling picture about what is happening inside the company’s fulfillment centers:

- In 2018, the Total Recordable Injury Rate (TRIR) at Amazon facilities in the sample was 10.76 per 100 workers. This is **three times as high as the injury rate across all private employers** (2.8 recordable injuries per 100 workers) and **more than twice as high** as the injury rate in the notoriously hazardous general warehousing industry (5.2 recordable injuries per 100 workers).
- Workers at Amazon suffered the most serious injuries at rates five times the national average for all private industries. The injuries suffered by workers at Amazon are so serious that workers had to be removed from their job at Amazon—**88.9 percent of workers who were injured had to miss work or be placed on restricted duty**.
- These injuries are severe. Workers injured at Amazon were **forced to miss an average of five-and-a-half weeks of work to recover** from their workplace injuries.
- **Injury rates spike during the peak holiday shopping season** between Black Friday and Christmas. Injury rates begin to climb dramatically throughout the peak shopping season before spiking at two-and-a-half times the company’s annual average in the 50th week of the year—approximately two weeks before Christmas.
- The overwhelming majority of injuries recorded in Amazon’s OSHA 300 Logs include musculoskeletal injuries, such as sprains, strains and tears. These injuries accounted for almost 75 percent of the injuries recorded in the logs. The body parts most commonly injured are workers’ backs, shoulders, knees, wrists, ankles and elbows. These **types of injuries are often caused by workers assigned tasks involving ergonomic hazards** including forceful exertions, repetitive motions, twisting, bending, and awkward postures.
- Over the past five years, federal inspectors from the Occupational Safety and Health Administration (OSHA) have **issued 67 citations at Amazon’s facilities, levying fines totaling \$262,132**. This enforcement activity, however, likely only scratches the surface of safety violations

at Amazon facilities. Over the past half-decade, **78 percent of Amazon’s facilities have not received a single visit from OSHA inspectors.**

Federal law requires that, *“each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.”*¹ Amazon’s own data clearly shows that the company is breaking the law and as a result, workers are being injured in fulfillment centers around the country at shockingly high rates. These injuries are forcing workers to miss weeks of work while they recover and, in too many cases, experience pain for the rest of their lives. And the vast majority of these injuries are preventable.

Amazon must take immediate action to eliminate hazards in its warehouses and other facilities and make its workplaces safe for workers. The company must,

- Identify and address ergonomic hazards in fulfillment centers and other facilities and implement safer workstation designs and practices **to reduce the risk of injury to workers;**
- **Reduce the speed of work** and increase break times to address the hazards of fast-paced, stressful, repetitive work in its workplaces;
- Provide **adequate medical care** for employees who are injured on the job.
- Share readily available information on injuries and illnesses with workers to allow them to **better understand the risks to which they are being exposed;**
- Ensure that senior management, the Board of Directors and shareholders all **take responsibility for creating safe workplaces;** and
- Engage with **worker-led health and safety committees** to identify and eliminate hazards in its facilities.

Each of these solutions could dramatically improve health and safety outcomes for the hundreds of thousands of workers in Amazon’s fulfillment centers and warehouse facilities. If done well, many of these changes would cost very little in comparison to the company’s annual revenues and could actually improve the efficiency and reliability of the company’s fulfillment networks. Workers are being hurt at an alarming rate and there is no good reason for Amazon to further delay taking meaningful action to fix these hazards and make work safer.

¹ “OSH Act of 1970 | Occupational Safety and Health Administration,” accessed November 26, 2019, <https://www.osha.gov/laws-regs/oshact/section5-duties>.

Introduction

Amazon is rapidly transforming key aspects of our society and our economy, from the way that we shop to the way that we store and access information to the way that we work. Over the past two-and-a-half decades, the company has built out a mammoth logistics and fulfillment network aimed at moving goods from customers’ computer screens to their front doors faster than ever before. With more than 100 million subscribers to its Prime service, Amazon has made two-day shipping the standard across the eCommerce industry and is working to deliver some products in a day or less as competitors race to catch up.

Amazon has invested billions in artificial intelligence (AI) and robotics to automate its warehousing and distribution network, but it still relies on hundreds of thousands of workers to pull orders, make deliveries, and keep its distribution network running. With more than 200,000 employees in the U.S. and 640,000 around the world, Amazon is the country’s second-largest private-sector employer behind only Walmart.

While workers in Amazon’s fulfillment centers fill essential roles that cannot efficiently be performed by robots, this has not stopped Amazon executives and engineers from treating workers like robots. In the company’s fulfillment centers—massive warehouses stretching over several football fields where customer’s orders are picked and prepared for shipment—workers’ tasks are assigned, and their movements are closely monitored by Amazon’s automated systems.

The system tells workers where to walk and which items to pull. It also monitors each workers’ individual productivity and whether or not they are meeting “rate” by pulling the number of packages that the system thinks workers should be pulling

each hour. The system tracks “time off task” or “TOT,” and automatically generates warnings when too much time elapses between scanning packages.²

For Amazon workers, rate is a constantly moving goal with new algorithms being introduced to speed up rates and force workers to work faster. In at least one iteration of the rate program, the number of items each worker was expected to pull each hour would be increased as soon as 75 percent of the workforce was able to meet the rate. Under that version of the program the slowest 5 percent of employees would be placed on a training plan and possibly subject to discipline or firing.³

Amazon’s constant pressure on workers to move faster has also spread to city streets across the United States. In an effort to reduce delivery costs and improve delivery time, Amazon has established its own network of last-mile delivery drivers. While some of the drivers work for a contractor or other delivery company, all of these last-mile drivers are provided with a GPS device called a “rabbit” that allows Amazon to track deliveries, provide turn-by-turn instructions and monitor drivers’ progress. Amazon sets daily delivery loads for drivers—sometimes as high as 400 deliveries per day during the peak holiday season—and drivers are forced to scramble to keep up with the delivery rate. In interviews about their experience working as Amazon delivery drivers, current and former drivers almost universally reported speeding or violating other

² Colin Lecher, “How Amazon Automatically Tracks and Fires Warehouse Workers for ‘Productivity,’” *The Verge*, April 25, 2019, <https://www.theverge.com/2019/4/25/18516004/amazon-warehouse-fulfillment-centers-productivity-firing-terminations>.

³ Lecher.

traffic laws to keep up with their daily delivery quotas.⁴

Amazon sets the standard for delivery and fulfillment in the eCommerce industry and it also undeniably sets the standards for employment practices and working conditions in the industry. That is alarming news for the millions of workers in the warehousing and logistics industry. Behind the turnstiles of Amazon’s fulfillment centers, delivery stations and other warehouse and delivery operations, tens of thousands of workers are paying for the cost of free two-day shipping with their bodies.

As Amazon’s promise of free and fast delivery has become more and more ubiquitous, so too have reports of unsafe working conditions inside the company’s fulfillment centers. Amazon has topped the National Center for Occupational Safety and Health’s (NCOSH) “Dirty Dozen” list of employers who put workers and communities at risk for two years straight, with NCOSH reporting, *“Workers labor at a relentless pace, with constant monitoring of their activities. This high stress environment leads to physical and emotional ailments – but reports indicate that the company*

*does not provide adequate support to those suffering on-the-job injuries.”*⁵

Pressure inside some Amazon facilities is so intense that many employees have experienced mental health crises. Analyzing 911 records and police reports, researchers Max Zahn and Sharif Paget found at least 189 instances of emergency services personnel being called to Amazon facilities for suicide attempts, suicidal thoughts, or other mental-health episodes between October 2013 and October 2018. One former employee described their experience at an Amazon facility in Florida in stark terms: *“It’s this isolating colony of hell where people having breakdowns is a regular occurrence...[It’s] mentally taxing to do the same task super-fast for 10-hour shifts, four or five days a week.”*⁶

And when workers are injured on the job, many have reported that Amazon management forced them back to work too quickly after their injuries or failed to properly compensate them for their injuries. A 2018 investigation by the Guardian uncovered a number of cases where Amazon workers suffering from workplace injuries found themselves homeless, unable to work or without income.⁷

⁴ Hayley Peterson, “Missing Wages, Grueling Shifts, and Bottles of Urine: The Disturbing Accounts of Amazon Delivery Drivers May Reveal the True Human Cost of ‘free’ Shipping,” Business Insider, accessed August 15, 2019, <https://www.businessinsider.com/amazon-delivery-drivers-reveal-claims-of-disturbing-work-conditions-2018-8>.

⁵ National Council for Occupational Safety and Health, “The Dirty Dozen,” 2019, http://nationalcosh.org/sites/default/files/uploads/2019_Dirty_Dozen.pdf.

⁶ Sharif Paget and Max Zahn, “‘Colony of Hell’: 911 Calls from Inside Amazon Warehouses,” *The Daily Beast*, March 11, 2019, sec. tech, <https://www.thedailybeast.com/amazon-the-shocking-911-calls-from-inside-its-warehouses>.

⁷ Michael Sainato, “Accidents at Amazon: Workers Left to Suffer after Warehouse Injuries,” *The Guardian*, July 30, 2018, sec. Technology, <https://www.theguardian.com/technology/2018/jul/30/accidents-at-amazon-workers-left-to-suffer-after-warehouse-injuries>.

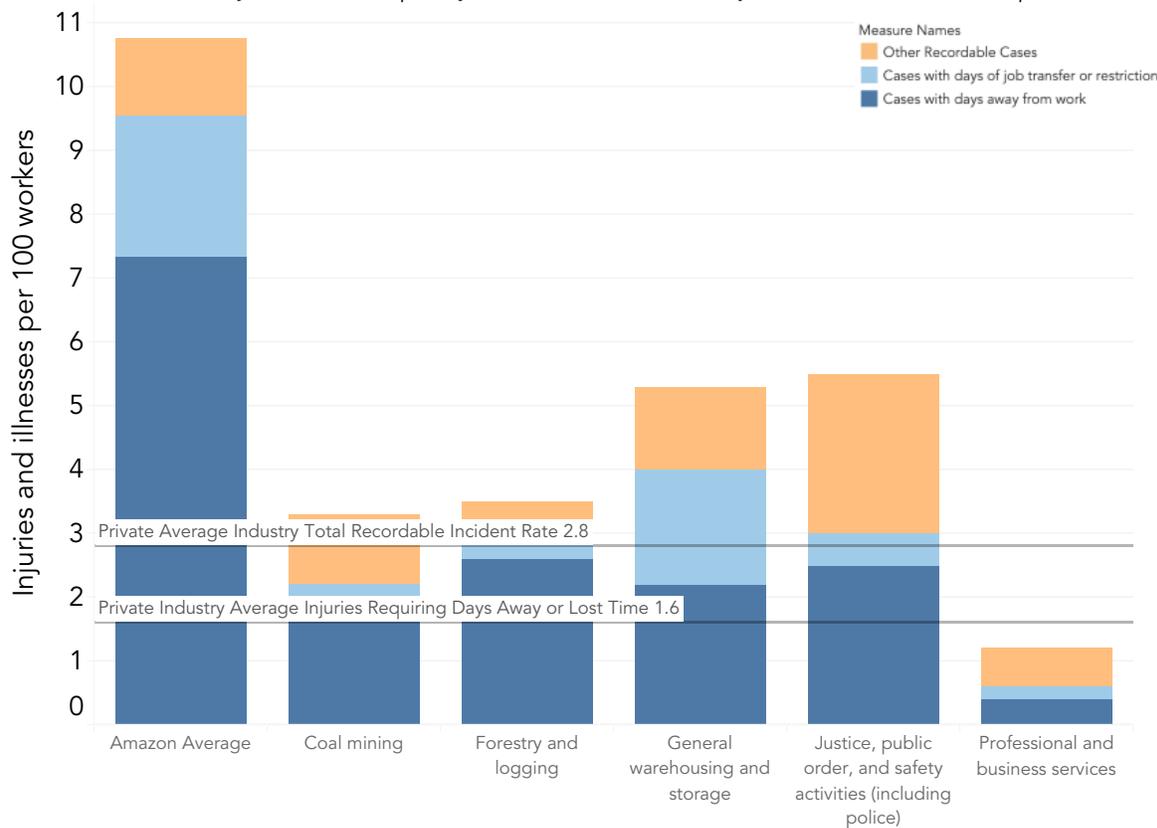
Amazon’s Internal Data Shows Alarming High Injury Rates

Some of the most troubling accounts of Amazon’s health and safety practices don’t come from whistleblowers or workers; they can be found in the company’s own internal documents. The Occupational Safety and Health Administration requires employers to maintain records of serious occupational injuries and illnesses using the “OSHA 300” log form to help regulators, workers, and employers to identify workplace hazards and work together to prevent injuries. By law, workers and former workers have the right to request their own copies of these logs so they can better understand the hazards that are present in their workplaces and work to protect themselves and their coworkers.⁸

Amazon’s own internal data paints a very troubling picture about what is happening behind the turnstiles at the company’s fulfillment centers. Every year, one out of every 10 Amazon workers suffers a recordable injury at work. These injuries are so severe the average injured worker is forced to miss six-and-a-half weeks of work to recover. The sheer number of workers impacted by this epidemic of workplace injury is staggering.

Injury rate at Amazon is three times as high as the national average

Workers at Amazon are injured more frequently than coal miners, lumberjacks, trash collectors and police officers



Injury rates at Amazon are based on OSHA 300A log data from all facilities in the sample for the year 2018—a total of 24 facilities from 15 states. Injury rates for other industries come from the BLS Injury, Illness, and Fatalities Data for 2018 https://www.bls.gov/iif/oshwc/osh/os/summ1_00_2018.htm

⁸ “1904.35 - Employee Involvement. | Occupational Safety and Health Administration,” accessed May 30, 2019, [https://www.osha.gov/laws-regs/regulations/standardnumber/1904/1904.35#1904.35\(b\)\(1\)\(iv\)](https://www.osha.gov/laws-regs/regulations/standardnumber/1904/1904.35#1904.35(b)(1)(iv)).

To develop this report, current and former workers at 28 Amazon facilities in 16 states requested Amazon’s internal injury records (OSHA 300 logs) from their managers to help better understand the hazards that they and their coworkers have been exposed to in their facilities.^{9 10}

Amazon’s internal records from these warehouses show injury and illness rates far above industry averages. In 2018, the Total Recordable Injury Rate (TRIR) at the Amazon facilities in the sample was 10.76 per 100 “full-time equivalent”¹¹ workers. This is three times as high as the injury rates across all private employers (2.8 recordable injuries per 100 employees) and almost twice as high as the injury rate in the notoriously hazardous general warehousing industry (5.2 recordable injuries per 100 employees) in the same year. Based on Amazon’s own internal numbers, workers at Amazon are more likely to be injured at work than police officers, solid waste collectors, lumberjacks or coal miners.¹²

Most alarming, in 2018 workers at Amazon suffered the most serious injuries at rates five times the national average for all private industries: 9.57 disabling injuries per 100 workers, compared to 1.6 for all private industry. That year 88.95 percent of workers who were injured had to miss work or be placed on restricted duty.¹³

Injuries Increase Dramatically During the “Peak” Holiday Shopping Season

The timing and frequency of injuries at Amazon facilities provides some insights on the factors that may be causing this high injury rate. Injury rates appear to be relatively consistent within Amazon facilities throughout the year until November and December, when Amazon workers suffer a steep increase in the number of injuries. This increase matches up with Amazon’s annual peak holiday season, which runs approximately from Black Friday (the Friday after Thanksgiving) to Christmas. During peak season, workers are forced to work longer hours with standard shifts extending from 10 hours per day to 11 or 12 hours per day. Amazon also places significant restrictions on workers using accrued time off during this four-to-six-week stretch.¹⁴

Injury rates climb quickly through peak season before spiking in the 50th week of the year—two weeks before Christmas. A portion of the increase in injuries is likely related to fluctuations in the number of hours worked and staffing levels within the facilities. But Amazon’s OSHA 300 logs show that in the 50th week of the year, injuries are occurring in the company’s facilities at more than two-and-a-half times Amazon’s annual average—an increase much greater than can be attributed to increased headcount inside the facilities.

⁹ Amazon classifies its warehouses in several different categories based on their size, function and equipment. In sortable fulfillment centers, workers work alongside robots to pick, pack and ship packages that are smaller than about 18 inches. In non-sortable fulfillment centers, workers pick, pack and ship bulky or larger-sized items that cannot be processed by robotic systems. At sortation (or “sort”) centers, workers sort orders by final destination and consolidate them onto trucks for faster delivery. <https://www.aboutamazon.com/amazon-fulfillment/our-fulfillment-centers/fulfillment-in-our-buildings/>

¹⁰ For a full listing of facilities included in the sample and an explanation of the methodology see the Technical Note in Appendix A of this document

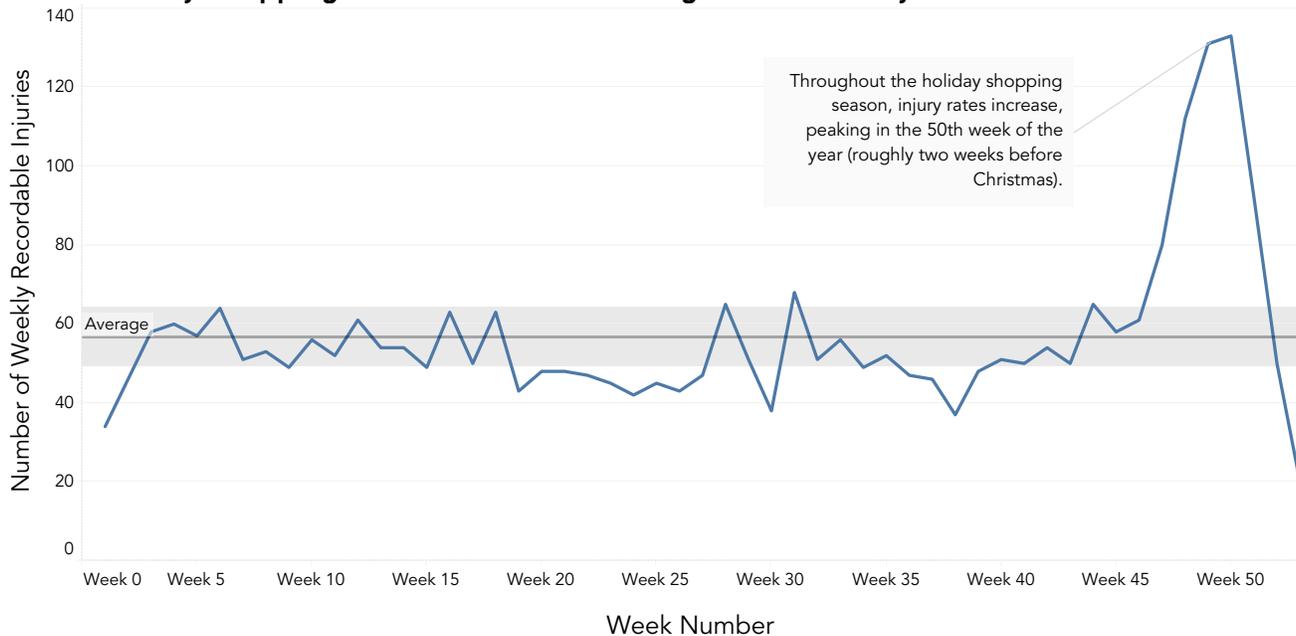
¹¹ Full time equivalent workers is calculated by dividing the total number of hours worked in each facility by 2,000.

¹² “TABLE 1. Incidence Rates of Nonfatal Occupational Injuries and Illnesses by Industry and Case Types, 2018,” accessed November 11, 2019, https://www.bls.gov/iif/oshwc/osh/os/summ1_00_2018.htm.

¹³ Ibid

¹⁴ Isobel Asher Hamilton and Aine Cain, “Amazon Warehouse Employees Speak out about the ‘brutal’ Reality of Working during the Holidays, When 60-Hour Weeks Are Mandatory and Ambulance Calls Are Common,” *Business Insider*, February 19, 2019, <https://www.businessinsider.com/amazon-employees-describe-peak-2019-2>.

The holiday shopping season is the most dangerous time of year for Amazon workers



This chart shows the trend of sum of number of weekly recordable injuries throughout the year. All data in the sample is included for all years 2014-2018. Sample includes OSHA 300 logs for two facilities for 2014, five facilities for 2015, seven facilities for 2016, ten facilities for 2017, and 12 facilities for 2018.

Nature and Severity of Injuries

The overwhelming majority of injuries reported in the Amazon OSHA 300 logs in our sample include musculoskeletal injuries, such as sprains, strains and tears. These injuries accounted for almost 75 percent of the injuries recorded in the logs. The body parts most commonly injured are workers’ backs, shoulders, knees, wrists, ankles and elbows. These types of injuries are often caused by workers assigned tasks involving ergonomic hazards including forceful exertions, repetitive motions, twisting, bending, and awkward postures. The risk of injury associated with these tasks increases dramatically with the pace of work. At Amazon facilities, the rate at which workers fill orders is carefully monitored, as is the amount of time employees spend resting or ‘off task.’ Amazon’s human resources management software automatically generates discipline notices and even dismissal letters for employees who fail to maintain the rate that management has set for workers.¹⁵

When workers are injured at Amazon facilities, they are typically sent to an “AmCare” onsite medical facility for first aid. The staff at AmCare—referred to by Amazon as “Onsite Medical Representatives,” are typically emergency medical technicians (EMTs), not physicians or registered nurses. EMTs are qualified to provide first-aid and determine whether or not a worker needs to be transported to a hospital. EMTs are not certified to diagnose or treat injuries that need more than first aid, nor are they certified to write prescriptions, give medications, order x-rays or lab tests.

In 2015 an OSHA inspection revealed that AmCare employees were providing medical care beyond the first aid treatment that they were qualified to offer. The OSHA area director overseeing the inspection

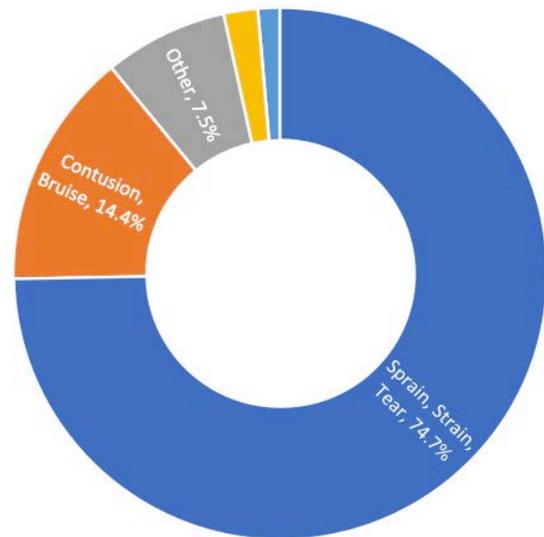
¹⁵ Lecher, “How Amazon Automatically Tracks and Fires Warehouse Workers for ‘Productivity.’”

was so alarmed by the situation that she sent a letter directly to Amazon CEO Jeff Bezos notifying him that her inspection revealed, “AMCARE personnel were providing medical care beyond what is allowed by their licensing and certification without the supervision of a board certified qualified medical professional licensed to practice independently.”¹⁶ When OSHA conducted an additional inspection of the Robbinsville facility in February of 2019, investigators learned that while care protocols had been updated, AmCare Onsite Medical Representatives were being allowed to treat workers for up to 21 days before referring a worker to a physician. The OSHA area director responsible for that investigation wrote that, “a delay in physician-supervised treatment of that duration is not consistent with the standard of medical care expected at a health care facility.”¹⁷

AmCare first aid staff attempting to provide medical care without the proper training or qualifications can lead to disastrous consequences for workers. In October 2019, Billy Foister, a 48-year-old Amazon fulfillment center employee went to AmCare complaining of chest pain. The AmCare staff diagnosed him with dehydration, gave him two beverages to drink and sent him back to work. A week later, Foister suffered a severe heart attack and died while working in the fulfillment center.¹⁸

Many of the sprains, strains and tears that are so common in Amazon facilities are considerably less dramatic than Billy Foister’s case. But if AmCare employees without appropriate medical training attempt to diagnose and treat workers suffering from musculoskeletal injuries, the outcomes can be devastating as well. When Amazon workers experience severe muscle or joint pain at work, the EMTs at AmCare provide first aid care—typically applying ice to the injury and offering over-the-counter pain relievers before sending them back to work—often in as little as 15 minutes. In an investigation into treatment of injuries at AmCare facilities conducted by The Intercept, two-thirds of AmCare staff interviewed reported that their bosses pressured them to send injured employees back to the warehouse when they likely needed additional medical attention.¹⁹

Sprains, strains and tears are the most common injuries suffered by Amazon workers



■ Sprain, Strain, Tear ■ Contusion, Bruise ■ Other
■ Cut, Laceration ■ Fracture

Nature of injury as percentage of all injuries in the sample. All data in the sample is included for all years 2014-2019. Sample includes OSHA 300 logs from two facilities for 2014, five facilities for 2015, seven facilities for 2016, eight facilities for 2017 and 11 facilities for 2018. Nature of injury is determined by performing a keyword match of the Narrative of Injury field from the OSHA 300 logs for the 11 injury "Nature of injury, illness" major categories that appear in the BLS Occupational Injury/Illness Classification System Manual (<https://www.bls.gov/iif/oshoiics.htm>).

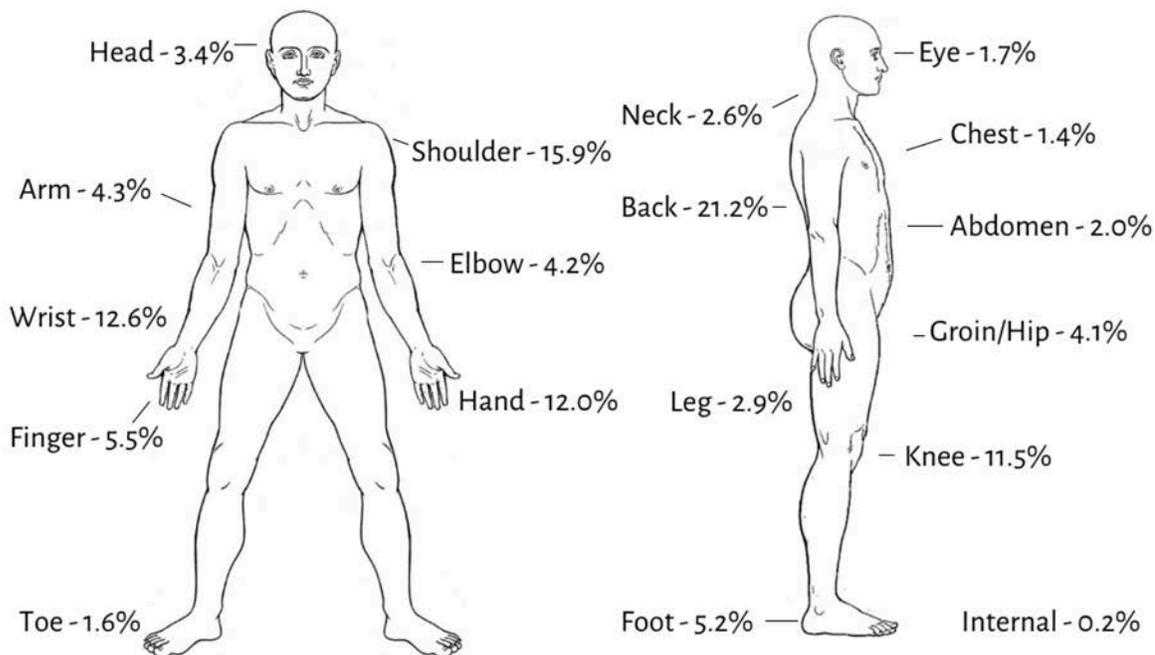
¹⁶ Occupational Safety and Health Administration, “OSHA Hazard Letter,” January 6, 2015, https://www.osha.gov/ooc/citations/Amazon_1074833_HAL.pdf.

¹⁷ Occupational Safety and Health Administration, “OSHA Hazard Letter,” August 19, 2019

¹⁸ Michael Sainato, “‘Go Back to Work’: Outcry over Deaths on Amazon’s Warehouse Floor,” *The Guardian*, October 18, 2019, <https://www.theguardian.com/technology/2019/oct/17/amazon-warehouse-worker-deaths>.

¹⁹ H. Claire Brown, “How Amazon’s On-Site Emergency Care Endangers the Warehouse Workers It’s Supposed to Protect,” *The Intercept* (blog), December 2, 2019, <https://theintercept.com/2019/12/02/amazon-warehouse-workers-safety-cyber-monday/>.

Where Amazon Workers are Getting Injured



Percentage of recordable cases involving injuries to each body part. Sample includes OSHA 300 logs from two facilities for 2014, five facilities for 2015, seven facilities for 2016, eight facilities for 2017 and 11 facilities for 2018. Body part is identified by keyword matching major body parts with the “Narrative of Injury” from OSHA 300 logs. Because some cases resulted in injuries to multiple body parts that total of percentages is greater than 100%.

First aid is not a substitute for professional diagnosis and treatment of repetitive trauma disorders that can cause debilitating and permanent muscle or joint injury. Conducting this type of diagnosis is outside of the scope of practice of EMTs that staff AmCare facilities and delaying visits to a qualified doctor who can provide competent diagnosis and adequate medical treatment can make such injuries worse.²⁰

Ice and over the counter pain relievers can help in masking pain and in getting workers back at their workstations. But that first aid does nothing to help workers actually recover and heal. Worse, it does nothing to address the hazards that caused the injury. When supervisors send workers back to work while still injured, force them to work long hours, and prohibit them from taking days off for weeks at a time, even small injuries can turn into much more severe injuries. Research has shown that when employers do not proactively address musculoskeletal injuries and reduce or eliminate ergonomic hazards, injured workers miss an average of 36 percent more days of work and are significantly less likely to return to work at all.²¹ Additionally, forcing injured workers to return to jobs with the same or similar ergonomic hazards like excessive pace, repetitive

²⁰ “National EMS Scope of Practice Model,” National Highway Traffic Safety Administration, February 2007, <https://www.ems.gov/education/EMSScope.pdf>.

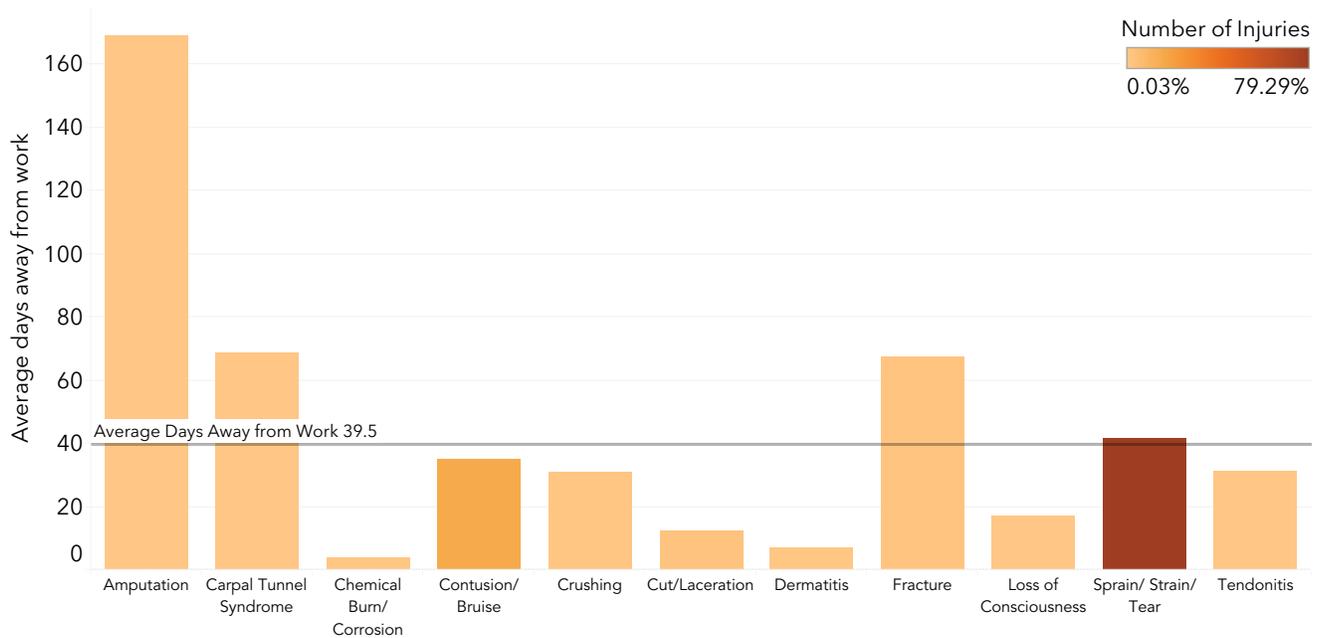
²¹ Bengt B. Arnetz et al., “Early Workplace Intervention for Employees with Musculoskeletal-Related Absenteeism: A Prospective Controlled Intervention Study,” *Journal of Occupational and Environmental Medicine* 45, no. 5 (May 2003): 499, <https://doi.org/10.1097/01.jom.0000063628.37065.45>.

continuous strain and stressful working positions, has been shown to increase risks of reinjury and raise barriers to workers being able to return to work at all.²²

This helps to explain the high rate of severity of the injuries recorded in Amazon’s OSHA 300 logs. Workers who suffered from recordable injuries were forced to miss an average of five and a half weeks of work. As shown above, workers experiencing sprains, strains and tears, the most common injury recorded in Amazon’s OSHA 300 logs were forced to miss an average of nearly six weeks of work.

The types of severe injuries that workers are suffering from—sprains, strains and tears to the shoulder, back, knee, wrist and foot—are injuries that can stay with workers for the rest of their lives leading to chronic pain and an elevated risk of reinjury and long-term disability. The prospect of suffering a life-long injury is particularly troubling for the younger workers who make up the majority of the warehousing and electronic shopping industry. According to U.S. Census data, 27 percent of workers in the warehousing industry are younger than 25 years old and 56 percent of warehouse workers are younger than 35 years old.²³

Injured workers miss an average of five-and-a-half weeks of work



Average number of days away from work for each nature of injury. All data in the sample is included for all years 2014-2019. Sample includes OSHA 300 logs for two facilities for 2014, five facilities for 2015, seven facilities for 2016, ten facilities for 2017, 12 facilities for 2018 and nine facilities for 2019 (partial year). Nature of injury is determined by performing a keyword match of the Narrative of Injury field from OSHA 300 logs for the 11 "nature of injury, illness" major categories that appear in the BLS Occupational Injury/Illness and Fatal Injuries Profile. Shading represents the frequency that each nature of injury appears in the sample.

²² Niklas Krause and Thomas Lund, "Returning to Work After Occupational Injury," in *The Psychology of Workplace Safety*, ed. Julian Barling and Michael Frone (American Psychological Association, 2004), 265–99.

²³ US Census Bureau American Community Survey 2013-2017.

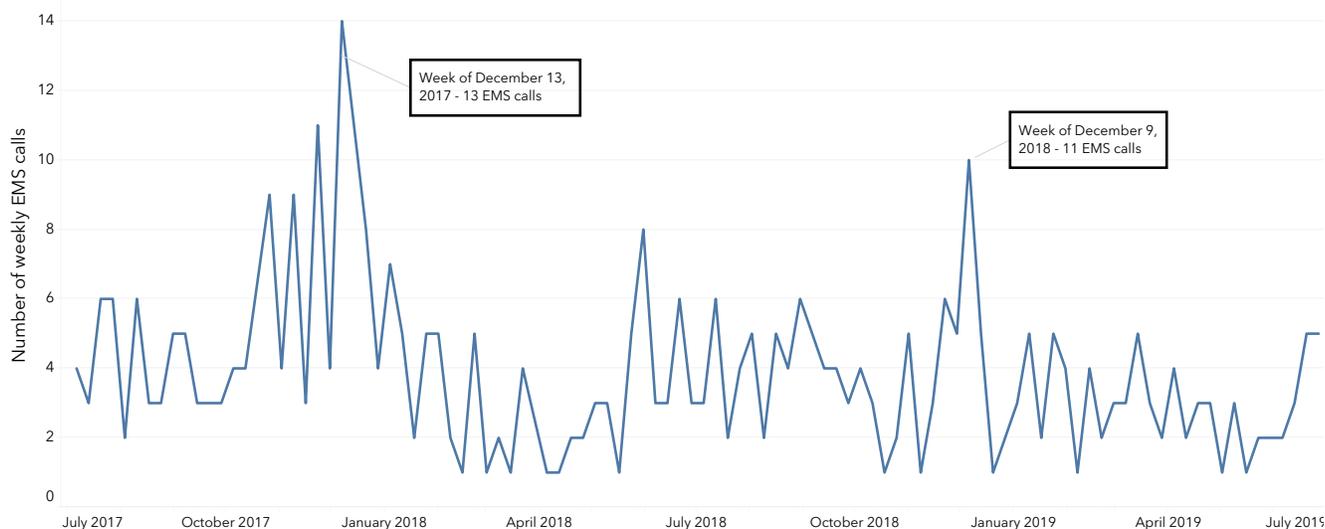
911 Logs Show Frequent Emergency Medical Service Dispatches to Amazon Facilities

In addition to the company’s own internal data, records of calls from Amazon facilities to local emergency responders offer another look at health and safety performance inside of Amazon’s facilities. The Boone County Public Safety Communications Center released two years of Computer Aided Dispatch (CAD) logs from July 1, 2017 to July 1, 2019 for six Amazon facilities in the town of Hebron, Kentucky in response to a Kentucky Open Records Act (KRS 61.870-61.884) request. Hebron, Kentucky is a major hub of operations for Amazon’s national distribution network including three fulfillment centers, one cross dock, two sortation centers and the new hub for Amazon Air Cargo operation at Cincinnati’s CVG airport.

The timing of calls for EMS services at the Amazon facilities in Hebron mimics the timing of injuries and illnesses recorded in the company’s other facilities included in the sample, with noticeable spikes in 911 calls during the peak season between Black Friday and Christmas each year.

911 calls from Amazon’s Boone County facilities increase dramatically during the peak holiday season

July 1, 2017-July 1, 2019

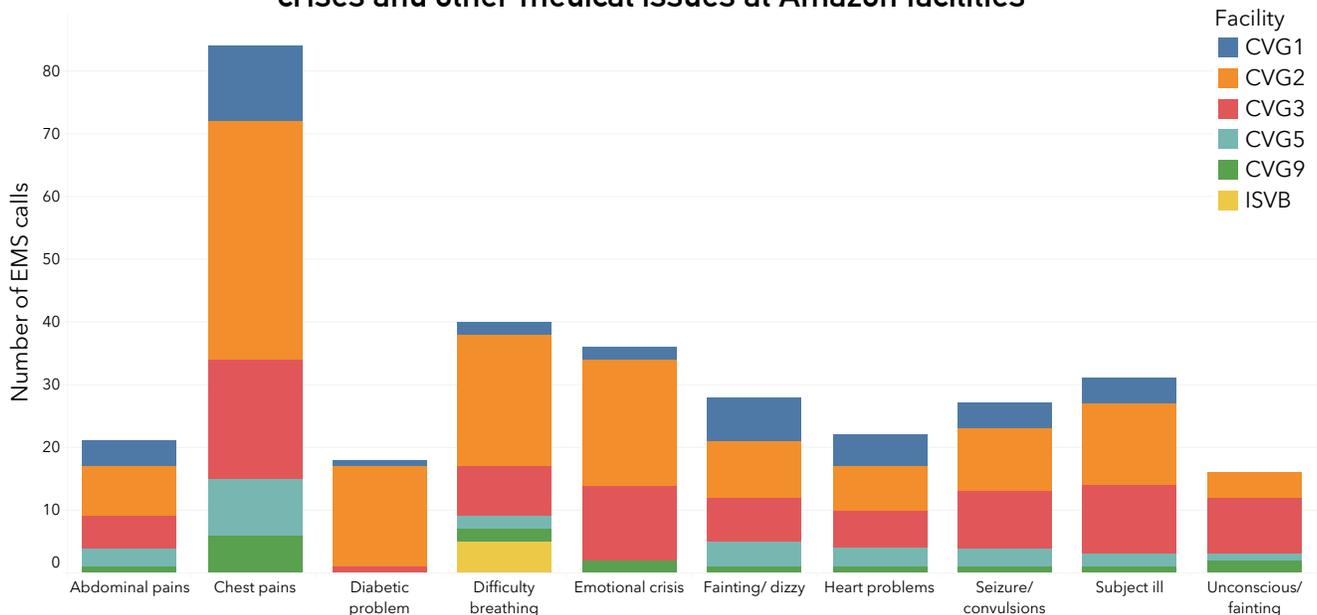


Records of 911 calls to Amazon facilities in Boone County, Kentucky from July 1, 2017 to July 1, 2019 provided by the Boone County Public Safety Communications Center in response to a Freedom of Information Act request. The data set includes records of 911 calls where EMS personnel were dispatched to six Amazon facilities in Boone County including CVG1 (Specialty Fulfillment), CVG2 (Fulfillment), CVG3 (Cross dock), CVG5 (Sortation), CVG9 (Sortation) and ISVB (Specialty Fulfillment).

Where the information reported in the Boone County 911 logs begins to show some important differences from Amazon’s OSHA 300 logs is in the types of incidents recorded. By far, the most frequent incident triggering a 911 call in Hebron during this two-year timespan was workers experiencing chest pain—EMS personnel responded to 84 calls about workers experiencing chest pain. Emergency personnel also

responded 40 times for reports of workers with difficulty breathing, 36 for workers in an emotional crisis, 26 times for workers who had fainted or were experiencing dizziness, and 27 times for seizures or convulsions.²⁴

EMS personnel respond to calls reporting chest pains, difficulty breathing, emotional crises and other medical issues at Amazon facilities



Records of 911 calls to Amazon facilities in Boone County, Kentucky from July 1, 2017 to July 1, 2019 provided by the Boone County Public Safety Communications Center in response to a Freedom of Information Act request. The data set includes records of 911 calls where EMS personnel were dispatched to six Amazon facilities in Boone County including CVG1 (Specialty Fulfillment), CVG2 (Fulfillment), CVG3 (Cross dock), CVG5 (Sortation), CVG9 (Sortation) and ISVB (Specialty Fulfillment). The ten most frequent types of incident are shown.

Interestingly, many of the frequent reasons for 911 calls are not the issues we find in Amazon’s OSHA 300 logs. These 911 calls — for chest pains, heart problems, emotional crises, dizziness, difficulty breathing, etc. — were likely not recorded in the OSHA 300 logs because Amazon decided they were not “work-related.” If this is the case, it could mean that a large number of serious medical incidents at Amazon’s warehouses are not being recorded in the company’s OSHA 300 logs.

There is no way to definitively determine whether the medical incidents that led to 911 calls in Hebron were work-related. But, it’s hard to believe that all of the 84 incidents where workers experienced chest pains, 40 incidents where workers experienced difficulty breathing, or 36 cases where workers experienced emotional crises were unrelated to the extremely fast-paced and injury-laden work in Amazon’s warehouse. It is possible that some of these incidents could have been caused by existing medical conditions that had nothing to do with the workplace. But it is also likely that the heavy physical labor, constant monitoring and incessant pressure to work faster contributed in important ways to a number of these incidents.

²⁴ Records of 911 calls to Amazon facilities in Boone County, Kentucky from July 1, 2017 to July 1, 2019 provided by the Boone County Public Safety Communications Center in response to a Freedom of Information Act request. The data set includes records of 911 calls where EMS personnel were dispatched to six Amazon facilities in Boone County including CVG1 (Specialty Fulfillment), CVG2 (Fulfillment), CVG3 (Cross dock), CVG5 (Sortation), CVG9 (Sortation) and ISVB (Specialty Fulfillment). The ten most frequent types of incident are shown.

OSHA Cites Amazon for Dozens of Violations but Only Scratches the Surface of the Company’s Distribution Empire

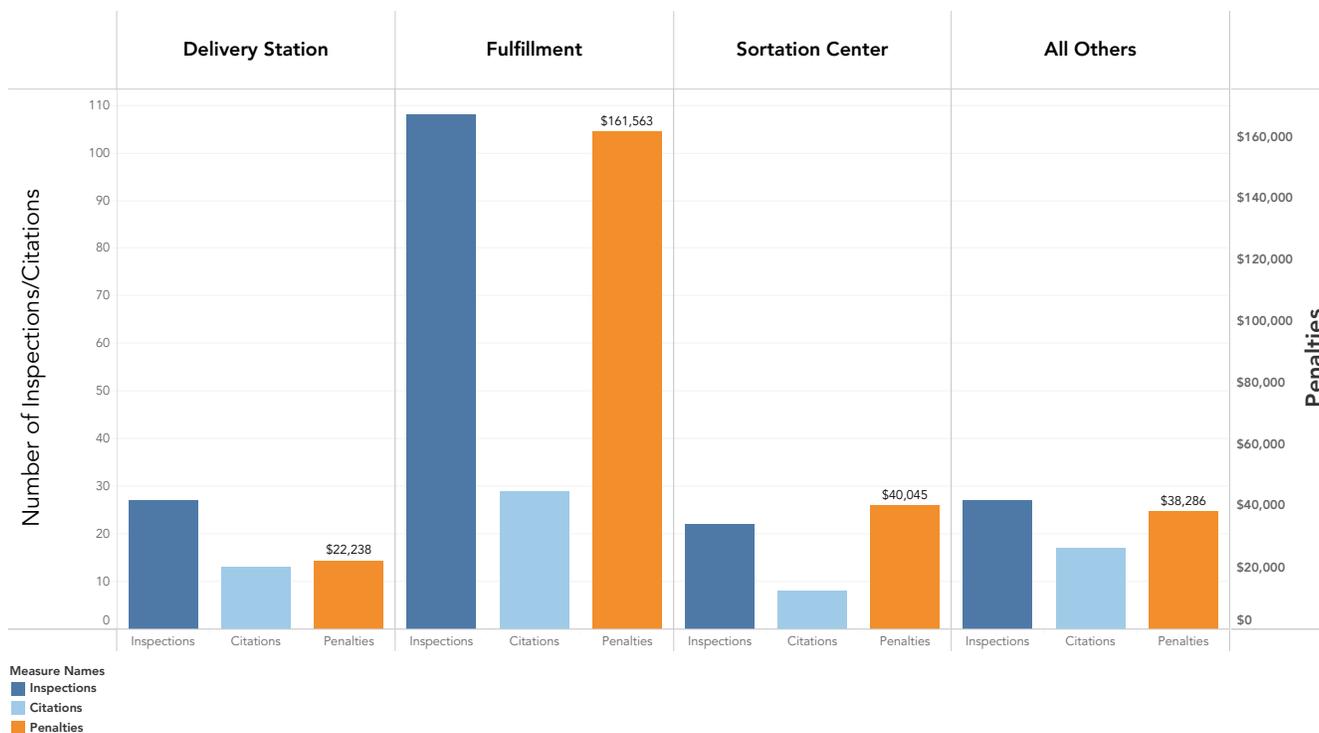
The high volume and elevated severity of illnesses and injuries experienced by Amazon workers are truly alarming. By any measure, the rate of injuries recorded in Amazon’s own records represent a significant public health concern. So why has Amazon been able to continue to injure workers year after year?

The federal agency responsible for overseeing health and safety in most of the workplaces in the United States is the Occupational Safety and Health Administration (OSHA). OSHA has the authority to set and enforce

workplace health and safety standards and a mandate to enforce those standards (as well as provide training, outreach, education and assistance to workers and employers).

OSHA has, in fact, inspected a number of Amazon sites and issued citations and fines to the company for violations of federal health and safety standards. Over the past five years, OSHA conducted 102 inspections at Amazon facilities issuing 67 citations and penalties totaling over \$262,132 (a sum of money that is roughly .0087 percent of Amazon’s profits in 2018 alone).

OSHA Inspections and Citations by Facility Type



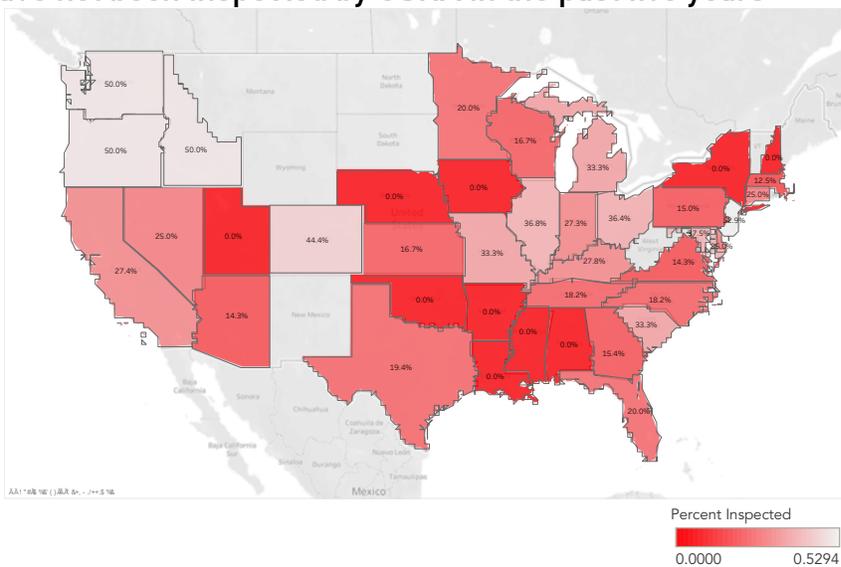
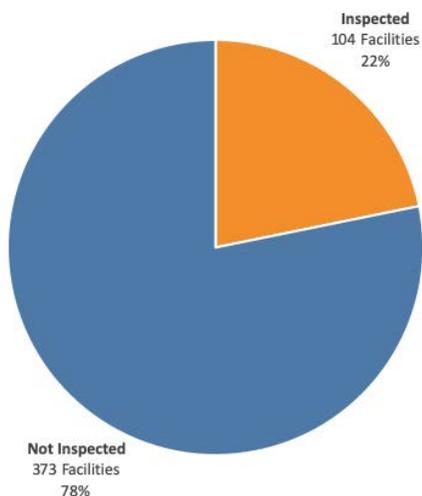
Data retrieved from OSHA inspection records of Amazon facilities from November 1, 2014-November 1, 2019 from the US Department of Labor Enforcement Data website <https://enforcedata.dol.gov> (accessed (November 4, 2019)).

While the number of OSHA citations issued at Amazon indicates that something is seriously wrong with Amazon’s health and safety practices, OSHA’s ability to effectively deter employers’ behavior that leads to health and safety violations is relatively limited—especially at huge employers like Amazon. OSHA, along with its state partners, has fewer than 2,000 inspectors to cover over 9 million worksites, and it is estimated

it would take OSHA over 100 years to investigate every workplace under its jurisdiction just once. The average penalty for any single serious violation is only \$3,580.²⁵

Over the past five years, OSHA has only conducted inspections at 22 percent of Amazon facilities. Nationwide there are 373 Amazon facilities that have not been inspected by OSHA at any time in the past half-decade.

78% of Amazon facilities have not been inspected by OSHA in the past five years



Graphs show a comparison of a master list of of Amazon facilities nationwide cross-referenced with a OSHA inspection records for facilities identified as Amazon facilities from 2014-present from the US Department of Labor Enforcement Data website <https://enforcedata.dol.gov> (accessed 10/15/19). The pie chart on the left represents the percentage of all Amazon facilities inspected. Because some facilities were inspected several times while other nearby facilities the map on the right shows the ration of facilities to inspections, which may overstate the portion of facilities inspected in the timeframe.

²⁵ AFL-CIO, “Death on the Job. The Toll of Neglect. A National and State-By-State Profile of Worker Safety and Health in the United States,” April 2019, https://aflcio.org/sites/default/files/2019-05/DOTJ2019Fnb_1.pdf.

Amazon Treats Workers as Disposable Parts in a Machine

For decades, Amazon leadership has cultivated a culture of treating workers as disposable parts in a big machine—pushing their minds and bodies alike until they are no longer useful and then letting them go. According to a survey by PayScale, Amazon has one of the highest employee turnover rates of any Fortune 500 company with a full half of its workforce working with the company for less than one year.²⁶ Current and former employees at every level describe a “churn and burn” culture at Amazon and even CEO Jeff Bezos proudly proclaims, “It’s not easy to work here.”²⁷

This churn and burn culture can be particularly acute in the company’s fulfillment network where the company makes around one-third of its annual sales during the holiday shopping season.²⁸ To prepare for the holiday peak season, Amazon dramatically increases hiring, recruiting more than 100,000 new workers each year. But by January, when the holiday rush is over, the company does not need nearly as many workers.²⁹ The hundreds of workers who are injured during the Peak season are no longer needed to keep products moving through the fulfillment system.

Amazon’s algorithms and tracking systems constantly monitor worker productivity throughout the workday. In distribution centers workers are required to keep up with a constantly-increasing “rate,” pulling hundreds of items each hour throughout their shifts. When workers fall behind, Amazon’s management software automatically generates warning letters, targets workers for

“retraining” and even discharges workers without the involvement of any human manager in the process.³⁰

The tracking system also monitors workers’ “Time Off Task” or “TOT” and generates written warnings when the system observes workers taking too much time between scanning items. When the system generates enough warnings for an employee in a six-month period, it will automatically generate a termination letter, once again, without any involvement from a human manager. Workers are scheduled for two 15-minute breaks and one 30-minute lunch break each 10 or 12 hour shift. Any additional breaks to use the restroom or rest from the relentless pace of the work are counted against worker’s time off task and rate. According to internal documents, in one fulfillment center Amazon fired a full 10 percent of its workforce in a single year based on these tracking metrics.³¹

Amazon also maintains a notoriously draconian no-fault attendance policy that assigns workers points for missing work—regardless of the reason. Calling in sick for one shift costs an employee 1.5 points. When employees reach six points, they face termination. During the peak season, which generally runs from the Friday after Thanksgiving through Christmas, employees are typically scheduled for mandatory overtime—up to 60 hours per week—and the company severely

²⁶ “Full List of Employee Tenure at Fortune 500 Companies,” PayScale, accessed September 30, 2019, <https://www.payscale.com/data-packages/employee-loyalty/full-list>.

²⁷ Jodi Kantor and David Streitfeld, “Inside Amazon: Wrestling Big Ideas in a Bruising Workplace,” *The New York Times*, August 15, 2015, sec. Business, <https://www.nytimes.com/2015/08/16/technology/inside-amazon-wrestling-big-ideas-in-a-bruising-workplace.html>.

²⁸ Amazon.com, Inc., “Form 10-K,” 2019, <https://ir.aboutamazon.com/static-files/ce3b13a9-4bf1-4388-89a0-e4bd4abd07b8>.

²⁹ Michael J. Coren, “Amazon’s Hiring More Humans, but Robots Are Handling the Holiday Crush,” Quartz, accessed October 29, 2019, <https://qz.com/1735219/amazons-robots-may-be-handling-the-holiday-crush/>.

³⁰ Lecher, “How Amazon Automatically Tracks and Fires Warehouse Workers for ‘Productivity.’”

³¹ Lecher.

restricts workers from using their accrued time off.³²

The relentless rate, combined with constant monitoring of time off task, strict attendance policy and forced overtime through the busy peak season together have a dramatic cumulative impact on workers’ bodies. As physical fatigue from the long hours sets in during the weeks just before and after the Christmas holiday, workers experience a dramatic spike in injuries

with injury rates climbing over two-and-a-half times the annual average. And those injuries are severe: In 2018, the OSHA 300 logs that Amazon workers were able to obtain for this report recorded 93 injuries requiring workers to miss 180 or more days of work (OSHA’s cap for recording lost time injuries), and 31 percent of those injuries occurred in the month of December alone.³³

³² Isobel Asher Hamilton and Aine Cain, “Amazon Warehouse Employees Speak out about the ‘brutal’ Reality of Working during the Holidays, when 60-Hour Weeks Are Mandatory and Ambulance Calls Are Common,” *Business Insider*, February 19,

2019, <https://www.businessinsider.com/amazon-employees-describe-Peak-2019-2>.

³³ Sample includes OSHA 300A logs from 10 Amazon facilities for the year 2018.

Roadmap to Improving Health and Safety at Amazon

In just over two decades, Amazon has transformed major portions of our economy. The company has changed the way that we pick out birthday presents for our loved ones, the way that companies store and understand data, and the way that we get many products from factories to our living rooms. Amazon has built an incredibly sophisticated and efficient logistics network that is capable of getting products from our computer screens to our front doors in two days, one day, or even an afternoon. And for these impressive accomplishments, Amazon’s executives and investors have taken home hundreds of billions of dollars.

In his 2019 annual letter to shareholders, Jeff Bezos reflected on how Amazon has always worked to create a culture of builders:

“From very early on in Amazon’s life, we knew we wanted to create a culture of builders – people who are curious, explorers. They like to invent. Even when they’re experts, they are ‘fresh’ with a beginner’s mind. They see the way we do things as just the way we do things now. A builder’s mentality helps us approach big, hard-to-solve opportunities with a humble conviction that success can come through iteration: invent, launch, reinvent, relaunch, start over, rinse, repeat, again and again. They know the path to success is anything but straight.”

The work that the builders of Amazon’s empire have done over the past two decades has objectively been nothing short of amazing. The company has created and then become a leader in at least a dozen businesses that didn’t even exist two decades ago. From AI-powered talking assistants in homes around the world, to a massive

cloud computing operation that powers the CIA, to two- or one-day delivery of millions of products, Amazon has found a way to create solutions to problems we didn’t even know we had. If Amazon can accomplish so much for its shareholders, there is no reason this company cannot make its fulfillment centers and warehouses safe for workers.

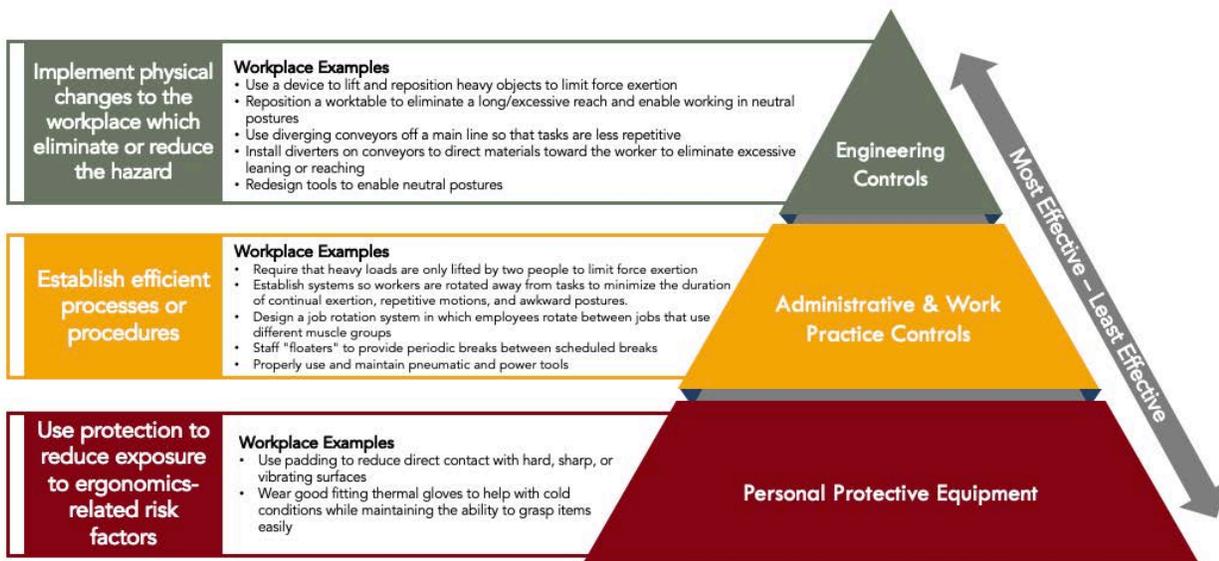
Amazon’s current approach to addressing ergonomic hazards assumes that workers are to blame for their own injuries. Managers lead stretching sessions at the beginning of shifts and instruct workers on how to lift and bend to supposedly reduce the risks of injury. But as Amazon’s records clearly show, stretching and lifting instructions are not preventing the injuries, because the injuries workers are experiencing are caused by unsafe conditions at work. Four decades of research shows that designing safer workplaces and establishing safer processes to organize the work are the most effective approaches for reducing injuries.³⁴

Amazon has a legal responsibility to eliminate ergonomic hazards in its warehouse facilities, and it must take this as seriously as it takes the work of designing the next version of Alexa. First and foremost, the company should investigate the underlying causes of these thousands of injuries and implement its workers’ recommendations for preventing additional crippling cases of back, shoulder, hand and joint injuries. It is stunning that given these high rates of disabling injuries, Amazon still has not taken responsibility for creating safe and healthy workplaces and focused its efforts on making meaningful physical changes to the workplace or changing work processes to eliminate hazards. Amazon must immediately make dramatic changes to make its warehouses and other

³⁴ Occupational Safety and Health Administration, “Ergonomics - Solutions to Control Hazards” (US Department of Labor, n.d.), <https://www.osha.gov/SLTC/ergonomics/controlhazards.html>.

facilities safer for the hundreds of thousands of workers employed in the company’s massive fulfillment operation.

Decades of Research Shows that the Most Effective Way to Reduce Injuries is to Eliminate Hazards



Amazon should build and manage safer workplaces

Many of the types of injuries that workers in Amazon facilities are suffering from most frequently—sprains, strains and tears, to the back, shoulder, knee, wrist and foot—often occur when workers are exposed to ergonomic hazards including forceful exertions, repetitive motions, twisting, bending and awkward positions and tasks. These ergonomic hazards emerge when workplaces and equipment are not designed to fit workers’ bodies and workers are forced to push, pull and lift objects, often while bending, twisting and stretching into awkward positions over and over again to complete their jobs.

Compared to other common serious and disabling workplace injuries like amputations, burns or broken bones, the injuries ergonomic hazards cause often aren’t sudden and dramatic; instead workers’ bodies gradually break down after days, weeks, and months of repetitive motions in unnatural positions. Negligent managers often blame workers themselves for failing to lift properly or complaining about painful conditions. But these kinds of injuries are the most common source of disabling worker injuries in the entire economy.³⁵

The data on injuries in Amazon’s fulfillment centers and other warehouses should be impossible to ignore. It is clear that there is something seriously wrong about the way these facilities are designed. Workers are humans, not

³⁵ Occupational Safety and Health Administration, “Ergonomics - Solutions to Control Hazards” (US Department of Labor, n.d.), <https://www.osha.gov/SLTC/ergonomics/controlhazards.html>.

robots, and work tasks should be designed to fit workers’ bodies, not force workers’ bodies to contort to fit Amazon’s equipment. Amazon should hire qualified ergonomists to collaborate with workers and engineers to identify and address the ergonomic hazards in fulfillment centers and other warehouse facilities. This could include redesigning workstations, tools, or equipment, or making changes in work methods, practices or techniques to reduce the amount of times workers are forced to twist, bend, or move into stressful postures.

Amazon must also implement administrative and work practice controls to establish safer processes and procedures in its workplace. Typically these controls include increasing the frequency or duration of breaks for workers exposed to ergonomic hazards; rotating employees to minimize the duration of continual exertion, repetitive tasks and awkward postures; and staffing jobs in a way that allows for heavy loads to be lifted by two workers to limit force exertion.

Amazon should reduce the speed of work so workers can safely perform their jobs

Combined with other ergonomic hazards like forceful exertions, repetitive motions, twisting, bending and awkward positions and tasks, the pace of work at Amazon is a risk multiplier. As pace increases, strain on joints and muscles increases, muscle fatigue sets in, and workers become much more susceptible to injury.

In fulfillment centers, Amazon pushes workers to work harder and faster by setting “rate,” or the number of tasks (for instance, pulling packages or stowing items) that supervisors require employees to perform in a shift. The company’s computers also constantly monitor workers’ “time-off-task” or the amount of time in between completing tasks. Workers are required to meet their rate goals and minimize time-off-task or face computer automated discipline or

discharge on a weekly basis. Amazon must identify and fix the hazards of fast-paced, stressful, repetitive work in its facilities, and make a commitment to preventing all injuries. No worker should be forced to sacrifice their health for a paycheck.

If workers cannot meet Amazon’s rate expectations without being injured, Amazon must reduce the rate workers are required to work and stop using rate as a tool for disciplining workers. The company should remove any rate-related discipline letters from employees’ records in any job where workers are reporting pain or injuries. Amazon managers and computer systems must provide allowances for fatigued workers to take extra breaks as needed to provide relief from arduous, hazardous workloads. These breaks must be provided with the assurances that workers will not suffer retaliation, discipline, or loss of pay—even if they would otherwise trigger warnings for “time off task.” Until Amazon can fix the underlying ergonomic hazards that are pervasive in its warehouses, such breaks will be an essential part of any effective effort to improve workplace safety at Amazon.

Further, both managers and computer systems for assigning and monitoring tasks must take into account workers’ needs for both rest breaks and reasonable workloads—based on the active input from workers, not just algorithms. If the current volume of work cannot be performed safely by the current workforce, Amazon should examine staffing levels and hire additional workers to meet demand.

Amazon should provide adequate medical care for employees who are injured on the job

When workers suffer injuries at Amazon facilities, they typically receive first-aid treatment from staff at AmCare, the company’s on-site medical units. Many of these facilities are staffed

by emergency medical technicians, not nurses or physicians. EMTs are well qualified to provide first aid but they do not have the training needed to diagnose or treat injuries and they are not licensed to practice medicine. If injuries, such as repetitive trauma disorders, are not treated early and managers force workers to return to work and be re-exposed to the same ergonomic hazards, those initial injuries can become aggravated and turn into much more severe medical problems.

Amazon should staff its AmCare with EMTs and nurses that operate under the direct supervision of a doctor. The company should also review the treatment protocols to ensure that workers are sent to see a physician if they report pain more than once to AmCare, to assure the injuries are being treated properly. Summaries of those protocols should be provided to workers who are treated at AmCare so they can be confident that the treatment or referrals that they are receiving are consistent with the protocols that have been established by a licensed physician. When AmCare staff encourages workers to seek appropriate treatment from qualified personal physicians or specialists, the company should provide the workers and their physicians with a full, detailed picture of both the work assignment and prior injury experience of workers in the same facility.

Amazon should share information on injuries with workers

OSHA requires employers to collect data on injuries and illnesses on 300 logs so workers, regulators, and employers can recognize patterns and fix hazards in workplaces. Yet, Amazon currently does not even record specific job titles for injured workers on those logs—every single employee is just listed as “Amazon Associate.” Without detailed information about where in the facility a worker was injured, it is more difficult for Amazon and workers to use these logs to identify hazards and prevent injuries.

Amazon must record more detailed information on worker titles on its OSHA 300 Logs to allow workers and Amazon to better understand the causes of injuries and make improvements. The company should also make sure that workers have access to this important information. While workers have a legal right to copies of those logs if they know to request them, few workers are notified that the logs even exist. Amazon should distribute OSHA 300 and 300A logs to every worker annually and provide training on reviewing and understanding the documents. The company should also provide comparisons of safety performance across different Amazon facilities as well as appropriate industry benchmarks along with these logs.

Amazon should take responsibility for creating safe workplaces at every level of the company—especially top management and the Board of Directors

Amazon’s own internal documents show alarming injury and illness rates across Amazon facilities with thousands of workers suffering from serious injuries every single year. Amazon’s senior leadership and Board of Directors has a responsibility to carefully oversee the company’s health and safety performance. An appropriate committee of the Board of Directors should review the company’s health and safety performance metrics quarterly and set company-wide goals for preventing workplace injuries and illnesses. A topic as important as the health and safety of the more than 600,000 people who work at Amazon is far too important to be relegated to junior executives or site-level managers.

Amazon’s shareholders also must have access to information on the company’s health and safety performance in order to assess the financial risks created by the company’s poor safety performance. Currently, Amazon does not disclose any metrics on health and safety performance that can be used to compare the

company’s performance against industry benchmarks and competitors.³⁶ Amazon should begin to publicly report on the company’s health and safety performance in its annual Environmental, Social and Governance (ESG) report to investors.

Disclosing data on the Total Recordable Incident Rates (TRIR) and Days Away, Restricted, or Transferred rates (DART) at the company’s facilities will allow investors to compare safety outcomes at Amazon’s facilities against industry benchmarks and competitors. But because these lagging indicators of safety performance tell little about the company’s efforts to prevent future injuries, Amazon should implement the recommendations in OSHA’s recent guidance document on “Using Leading Indicators to Improve Safety and Health Outcomes.”³⁷

This could include reporting information such as numbers of serious strain-and-sprain injuries investigated; the types of hazards found; the common causes of these hazards (such as excessive repetition/rate, packages stored at the wrong heights, excessive package weights given the reaches and postures involved, etc.); common solutions identified; the time taken to intervene and fix hazards after solutions found; and the results of systematic worker surveys about the usefulness of the changes. These are all common features of a data-driven, scientifically-based 21st century ergonomics program.

Amazon should listen to workers’ recommendations for improving safety

No one is better equipped to identify health and safety issues in workplaces than the

workers themselves. While Amazon does operate health and safety committees in some of its facilities, these committees have clearly been ineffective in eliminating the hazards that exist in the company’s fulfillment centers and warehouses. In facilities where workers choose to form their own, democratically elected health and safety committees, Amazon management should meet with those committees and take their recommendations seriously.

Because efforts to improve safety often break down when they are perceived as punitive for workers, worker representatives on health and safety committees should not be asked to engage in monitoring or surveillance of their coworker’s behaviors for the purposes of discipline.

Health and safety committees should receive training on best practices for identifying and addressing workplace hazards to reduce the risk of injury. The committees should also be regularly provided with health and safety performance data and aggregated data on AmCare cases to help them understand facility-wide trends. Amazon should make qualified industrial hygienists, occupational physicians, ergonomists or other appropriate health and safety professionals available to these committees to support them in their work. If worker committees choose to consult their own health and safety professionals as advisors, those professionals should be invited into the facility to participate in inspections and join meetings between the worker health and safety committees and management.

³⁶ “Sustainability,” US About Amazon, accessed November 24, 2019, <https://www.aboutamazon.com/sustainability>.

³⁷ Occupational Safety and Health Administration, “Using Leading Indicators to Improve Safety and Health Outcomes,” June 2019.

Conclusions

Over the past 20 years, Amazon has proven that it has the capacity to do incredible things, transforming key aspects of our society. The company has shown that when it makes solving a problem a priority and dedicates the resources needed to rise to that challenge it can do truly amazing things. Amazon’s own internal data shows that workers are being injured in fulfillment centers around the country at shockingly high rates. These injuries are forcing workers to miss weeks of work while they recover and, in too many cases, experience pain for the rest of their lives. And the vast majority of these injuries are preventable.

Amazon must take immediate action to eliminate hazards in its warehouses and other facilities and make its workplaces safe for workers. The company must:

- Identify and address ergonomic hazards in fulfillment centers and other facilities and implement safer workstation designs and practices **to reduce the risk of injury to workers;**
- **Reduce the speed of work** and increase break times to address the hazards of fast-paced, stressful, repetitive work in its workplaces;
- Provide **adequate medical care** for employees who are injured on the job.
- Share readily available information on injuries and illnesses with workers to allow them to **better understand the risks to which they are being exposed;**
- Ensure that senior management, the Board of Directors and shareholders all **take responsibility for creating safe workplaces;** and
- Engage with **worker-led health and safety committees** to identify and eliminate hazards in its facilities.

Each of these solutions could dramatically improve health and safety outcomes for the hundreds of thousands of workers in Amazon’s fulfillment centers and warehouse facilities. If done well, many of these changes would cost very little in comparison to the company’s annual revenues and could actually improve the efficiency and reliability of the company’s fulfillment networks. Workers are being hurt at an alarming rate and there is no good reason for Amazon not to take meaningful action to fix these hazards and make work safer.

Appendix A – Technical Note

The data set examined in this report includes OSHA 300 and/or 300A logs from 28 Amazon facilities in 16 states around the United States obtained from Amazon by current and former employees and provided to workers’ rights organizations and media outlets in summer and fall of 2019. While federal regulations require employers to provide workers with 300 and 300A logs from their workplaces covering the previous five years regardless of when they worked at the facility, in many cases Amazon unlawfully restricted workers’ access to that data by only providing records for a small portion of that window. As a result, there is significant variation in the years covered in the logs.

Because this data set is a convenience sample, not a random sample, it is possible that the safety performance in the 28 facilities in this sample is not representative of Amazon workplaces as a whole. The safety performance and the injury experience reported across the sample is relatively consistent and the data set is sufficiently large, however, so there is no reason to believe that there is any sort of systematic sampling bias in this data set. The authors would welcome the opportunity to perform a similar analysis of safety performance and injury experience at all Amazon facilities and strongly encourage Amazon management to make that data publicly available.

Calculations of injury rates including total recordable incident rate (TRIR) and days away, transferred or restricted rates (DART) are based on data from OSHA 300A logs in the sample. Calculations of injury types, dates, and severity are based on data from OSHA 300 logs in the sample. Partial year data from 2019 is included in analysis of nature of injury and body parts injured but excluded in analysis of the timing of injuries.

Facility	2014	2015	2016	2017	2018	2019 (partial year)
ABE2 – Breinigsville, PA	300, 300A	300, 300A	300, 300A	300, 300A		
ABE4 – Easton, PA			300, 300A	300, 300A	300A	300, 300A
BDL5 – Wallingford, CT		300	300, 300A	300		
BFI3 – DuPont, WA					300A	
BFI4 – Kent, WA					300, 300A	300, 300A
BOS7 – Fall River, MA					300A	
BWI2 – Baltimore, MD					300A	
CHA2 – Charleston, TN					300A	
DEN2 – Aurora, CO				300, 300A	300, 300A	300
DEN3 – Thornton, CO					300, 300A	
DFW7 – Fort Worth, TX					300A	

Facility	2014	2015	2016	2017	2018	2019 (partial year)
EWR4 – Robbinsville, NJ					300A	
FAT1 – Fresno, CA					300A	
FTW3 – Fort Worth, TX					300A	
JFK8 – Staten Island, NY					300A	300A
IND5 – Indianapolis, IN	300	300	300	300		
LGA9 – Edison, NJ					300, 300A	
LGB3 – Eastvale, CA					300A	
MDW4 – Joliet, IL					300, 300A	300
MKE1 – Kenosha, WI		300, 300A	300, 300A		300A	
MSP1 – Shakopee, MN				300, 300A	300, 300A	
MSP5 – Shakopee, MN		300	300, 300A	300, 300A	300	
OAK4 – Tracy, CA					300A	
ONT6 – Moreno Valley, CA			300, 300A	300, 300A	300, 300A	300
PDX5 – Hillsboro, OR				300A	300A	
PDX9 – Troutdale, OR					300A	
SMF1 – Sacramento, CA					300A	
TPA2 – Lakeland, FL					300A	

EXHIBIT 5

United States Senate

WASHINGTON, DC 20510

February 7, 2020

Jeff Bezos
Chief Executive Officer
Amazon.com, Inc.
410 Terry Ave. North
Seattle, WA 98109

Dear Mr. Bezos:

We write to express our serious concern about the safety of Amazon's employees, particularly after the busy holiday season. Recent investigations into Amazon's safety records found that the injury rate of workers at Amazon facilities is much higher than the injury rate for private sector employers in the U.S. – and even for the warehouse industry generally. Any practice that puts profits before worker safety is unacceptable. We urge you to take immediate steps to protect your employees from workplace injuries. Your employees' lives and well-being depend upon your swift action.

Recent analysis of Amazon's own internal injury records by *The Atlantic*, *Reveal from the Center for Investigative Reporting*, and by a coalition of worker advocate organizations found disturbing injury rates at Amazon warehouses. In the article "Ruthless Quotas at Amazon Are Maiming Employees," published November 25, 2019 in *The Atlantic*, workers detail Amazon's strict quota requirements that force employees to fulfill orders so quickly they are either unable to complete tasks safely or must perform so many tasks that they pay the physical consequences for doing so. Workers report going to great lengths to meet their quotas – which you refer to as target performance expectations – because failure to meet it three times leads to an employee's termination. Pressure to meet their quotas is so great that workers report urinating in plastic bottles on the warehouse floor, or are even avoiding restroom breaks altogether. Some employees were even discouraged from evacuating a facility where a noxious gas leak occurred. Perhaps the most emblematic example of the company's seeming disregard for worker safety is the failure to notice a worker fatality for more than two hours at an Indiana facility.

The firsthand accounts included in *The Atlantic* article are part of a larger pattern of Amazon employees suffering workplace injuries. The recently published report "Packaging Pain: Workplace Injuries In Amazon's Empire" documents the extent to which workplace injuries are stunningly widespread throughout Amazon facilities. According to the report, Amazon workers are three times as likely to get injured than employees at other private employers. Moreover, Amazon employees are more than five times as likely to suffer a serious injury (involving days away from work, job restriction or transfer) than employees at other private employers – with almost nine out of ten injured Amazon workers forced to take time off of work or transfer. When such injuries are serious enough to force employees to miss work, they are so severe that Amazon employees miss an average of five and a half weeks of work. Amazon's worker injury numbers are also more than twice as bad in the pre-Christmas crunch period.

These reports make clear that by placing such a priority on speed and quota fulfillment, your company requires employees to risk their safety and health to perform and keep their jobs. The safety of workers should come first. To ensure it does, and consistent with the reports' conclusions, we urge you to immediately take the following action:

- Reduce workers' quotas and speed requirements, schedule frequent rest breaks during high production shifts, and eliminate the policy of terminating workers who do not meet their quotas three times;
- Cease including bathroom breaks as "time off task" and ensure workers are allowed and encouraged to hydrate and use the bathroom as needed;
- If Amazon provides worksite medical care, ensure it is staffed by licensed health care professionals operating within their legal scope of practice;
- Provide immediate referrals to a physician for workers who report to Amazon's on-site medical care that their symptoms are not improving and for workers who request medical care from a physician so they can see the doctor or urgent care provider of their choice and receive adequate medical treatment;
- Conduct a comprehensive ergonomic evaluation of all warehouse tasks involving manual material handling and implement changes to the physical workplace and to work practices that reduce or eliminate employee risk to ergonomic injuries;
- Implement a strong and enforceable company policy that prohibits supervisors and managers from discrimination or retaliation when workers report injuries or safety concerns;
- Ensure workers, who know their jobs and working conditions best, have a guaranteed way to raise safety and health concerns and provide recommendations to correct identified hazards and keep workers apprised in a timely fashion of action taken by management regarding their concerns; and
- Make public Amazon's summary record of serious injuries (OSHA 300 A) on Amazon's website for all of the company's worksites.

Amazon's dismal safety record indicates a greater concern for profits than for your own workers' safety and health. We urge you to overhaul this profit-at-all costs culture at your company and take the immediate steps identified in this letter to ensure Amazon's managers treat your workers fairly and do not require them to risk their own health and safety in the course of doing their jobs.

We request a written response to this letter, including detailed descriptions of the action the company is taking to adopt the policy changes outlined in this letter, by February 21st.

Sincerely,

Sherrod Brown
United States Senator

Bernard Sanders
United States Senator

Tammy Baldwin
United States Senator

Kirsten Gillibrand

Kirsten Gillibrand
United States Senator

Richard Blumenthal

Richard Blumenthal
United States Senator

Elizabeth Warren

Elizabeth Warren
United States Senator

Chris Van Hollen

Chris Van Hollen
United States Senator

Tina Smith

Tina Smith
United States Senator

Richard J. Durbin

Richard J. Durbin
United States Senator

Christopher Murphy

Christopher Murphy
United States Senator

Kamala D. Harris

Kamala D. Harris
United States Senator

Edward J. Markey

Edward J. Markey
United States Senator

Mazie Hirono

Mazie K. Hirono
United States Senator

Jeffrey A. Merkley

Jeffrey A. Merkley
United States Senator

Cory A. Booker

Cory A. Booker
United States Senator

EXHIBIT 1

The Future of Warehouse Work: Technological Change in the U.S. Logistics Industry



Beth Gutelius
Nik Theodore

a report from the
UC Berkeley Center for Labor Research and Education
and Working Partnerships USA

October 2019

UC BERKELEY
LABOR
CENTER

**WORKING
PARTNERSHIPS**
USA

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About the Authors

Beth Gutelius, Ph.D., is associate director of the Center for Urban Economic Development at the University of Illinois at Chicago and senior researcher at the Great Cities Institute.

Nik Theodore, Ph.D., is a professor in the University of Illinois at Chicago's Department of Urban Planning and Policy, as well as the director of the Center for Urban Economic Development.



**Center for Urban
Economic Development**



**Great Cities
Institute**

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The analyses, interpretations, conclusions, and views expressed in this report are those of the author and do not necessarily represent the UC Berkeley Institute for Research on Labor and Employment, the UC Berkeley Center for Labor Research and Education, the Regents of the University of California, Working Partnerships USA, or collaborating organizations or funders.

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Executive Summary

Are “dark” warehouses, humming along without humans, just around the corner? Predictions of dramatic job loss due to technology adoption and automation often highlight warehousing as an industry on the brink of transformation. The potential elimination of many blue-collar jobs is a pressing issue for policy makers and raises important questions about how workers will fare in the economy of the future.

In contrast to reports focusing only on the number of jobs that could be lost, our research offers an in-depth, detailed look at the range of ways in which warehouse work and the industry as a whole might change with the adoption of new technology over the next five to 10 years. The findings in this report are based on in-depth industry research and extensive interviews with a broad set of stakeholders, including industry analysts and consultants, third-party logistics (3PL) operators, retailers, brands, and technology providers. Specifically, we sought to find out:

1. What key industry dynamics are playing a role in technological change?
2. How will adoption of new technologies impact warehouse facilities and operations, as well as the overall organization of the industry?
3. What tasks and processes are the highest priorities for technological application, and how might adoption of new technologies impact jobs in warehousing?

Many accounts of technological change portray firm decision making as purely based on a desire to automate to reduce labor costs. While labor cost reduction plays an important role, our research found a multifaceted set of factors shaping firms’ decisions about how to apply new technologies in warehouses. One set of trends—tight labor markets, rising real estate costs, and increasing speed requirements—are pushing warehouse operators to explore new technologies. On the other hand, variability and unpredictability, outsourcing dynamics, inertia, and the state of technological innovation are factors that may slow the process of technology uptake.

As a result, we project that the industry likely won’t experience dramatic job loss over the next decade, though many workers may see the content and quality of their jobs shift as technologies are adopted for particular tasks. Employers may use technology in ways that decrease the skill requirements of jobs in order to reduce training times and turnover costs. This could create adverse effects on workers, such as wage stagnation and job insecurity. New technologies potentially can curtail monotonous or physically strenuous activities, but depending on how they are implemented, may present new challenges for worker health and safety, employee morale, and turnover. Additionally, electronically mediated forms of monitoring and micro-management threaten to constrain workers’ autonomy and introduce new rigidities into the workplace.

These changes will have a greater impact on communities with high concentrations of warehouse workers. Warehouses typically are clustered near major transportation arteries and population centers—for example, the Inland Empire in California and the Chicago region. Two-thirds of front-line warehouse workers are people of color, most of them Black or Latinx, who stand to be disproportionately affected by technological change. Women are more likely to work in the growing e-commerce sector than in traditional warehouses, so they may benefit from growing employment opportunities, but also face lower wages and increasing pressure from changes in working conditions.

Findings

Technology Meets Shifting Industry Dynamics

1. **The warehousing industry is characterized by slim profit margins and cost-sensitive competition, which leads to a cautious approach to technology adoption.**

Viewed mainly as a cost center, warehousing is a low-margin industry with high levels of volatility and risk. Cost-based, risk-averse competitive dynamics lead warehouse operators to reduce exposure to cost wherever possible. This is one main reason the industry has lagged in its adoption of new technologies.

Broadly speaking, warehouse operators have thus far moved cautiously into risky experiments with new technologies, relying instead on streamlining current processes and on workforce experimentation. Our research suggests that this trend will continue—the cost sensitivity of the dominant business model will moderate the rate of technological experimentation and uptake, though larger firms may be able to leverage volume and a strong financial position to adopt new technologies. Absent a major shift in how warehousing activities are valued, the dynamics that have created barriers to innovation and contributed to the sector's status as a laggard are likely to persist over the next five to 10 years.

2. **E-commerce is driving experimentation with new technologies.**

With double-digit sales growth each year, few shifts in consumption patterns have had a greater impact on the warehousing industry than the rise of e-commerce. Online shopping is leading the transformation of the warehousing industry and is poised to have substantial effects on jobs and workers, not least in the realm of adoption of new technologies. E-commerce order picking requires more labor and, given the prompt delivery expectations of consumers, the order fulfillment process is accelerated. This results in a growing need for workers in warehouses, and an increasing interest in technologies that can streamline work processes and improve efficiencies.

Additionally, Amazon's influence in the online retail arena is substantial, particularly in the context of the company's announcements of increasingly faster delivery promises. Whereas a few years ago, consumers were content for an order to arrive in a few days, the delivery window has steadily narrowed with the growing prevalence of Amazon's Prime subscription. The combination of labor-intensive order picking and the speed with which these orders must be shipped has made e-commerce a leading driver of growth in warehousing employment, and is motivating experimentation with new technologies to support the order fulfillment process. This includes technologies that de-skill or potentially displace workers, such as automated picking processes, as well as technologies that speed up, control, or streamline human labor, such as electronic productivity monitoring.

3. Technology uptake likely will be uneven.

Across firms, within firms, and across technologies, adoption likely will vary significantly. Our research confirmed that warehouses are in disparate stages of their techno-strategy development, and that most firms are cautiously exploring new innovations. The business profile of a company, including the specific activities occurring in warehouse facilities, amount of goods being moved, and product markets, all help determine the propensity for technology adoption.

Within firms, a broad set of tasks and activities potentially could be high priority for applications of new technology and automation. Firms must make choices about which activities take precedence, leading to a variegated landscape of technological sophistication across activities in a warehouse. Our research documented that even firms at or near the leading edge of innovation in one area often lag behind in other areas. In one example, a large parcel company had made significant investments in a high-throughput conveyor and automated radio frequency barcode scanning system, but managers still were using spreadsheets and a whiteboard to schedule workers to handle package volumes. Another indication of unevenness is in the market penetration of warehouse management systems (WMS)—a common type of software used in the industry. Using a WMS is a fundamental building block for the adoption of many other technologies, and yet it is estimated that at least one-third of warehouses in the United States do not use such a system.

We project there will continue to be uneven uptake across technologies, in large part because the new technologies tend to be specialized to particular warehouse activities. The modularity of some new technologies, as well as alternative models of leasing, changes the capital investment and risk assessment scenarios in ways that could facilitate firms' technology experimentation and uptake.

4. Technology potentially will have large impacts on third-party logistics firms and outsourcing in the warehousing industry.

Outsourcing is a significant trend in the warehousing sector that affects the pace and forms of technology adoption. New technologies also have the potential to change firms' behavior with respect to outsourcing, which typically takes two forms: (1) outsourcing warehouse management

and operations to third-party logistics firms (3PLs), which offer a wide range of logistics-related services, and (2) outsourcing of warehouse hiring to temporary staffing agencies.

3PLs and temporary staffing agencies are navigating an uncertain landscape of strategies. Some are exploring new roles that leverage technology, while others appear to be taking a wait-and-see approach without significantly altering their value propositions. One 3PL company, for example, coped with a tenfold increase in holiday shopping volume by switching its facility to a highly manual process during peak season and hiring hundreds of extra workers, because the conveyor system could not accommodate the influx of orders. Other warehouse operators reported exploring the use of on-demand staffing platforms, which could simplify hiring processes for the benefit of employers and workers. However, using such tools also may encourage employers to reduce the number of direct hires and increase reliance on temporary workers, who tend to be paid less and have fewer protections on the job.

Also, 3PL contracts often are short (three to five years), which makes a return on investment difficult to achieve for warehouse operators taking on major investments in new technology. Many 3PLs have avoided such investments because of the possibility of losing the customer at the end of a contract, thus eliminating any potential gains. Despite these disincentives, some large 3PLs like DHL and XPO are piloting technologies to better meet the needs of their customers. Similarly, the president of a mid-sized 3PL said his company was exploring how it might commingle smaller e-commerce startups in a single facility and implement automation across all of them in order to speed up order fulfillment.

Impacts on Tasks, Jobs, and Workers

1. New technologies are likely to lead to work intensification.

The highest priority for companies in the short term is to identify and implement technologies that support more efficient order fulfillment. This includes applying labor-saving technologies to high-volume e-commerce order picking and frequent, small-batch replenishments to retail stores that keep limited inventory on hand. The labor-intensive nature of picking individual items to assemble orders—so-called “each picking”—requires large numbers of workers, so warehouse operators place great value on finding ways to reduce headcount and/or increase throughput by reorganizing this activity.

Our research suggests that even though some technologies could alleviate the most arduous tasks of warehouse work (such as heavy lifting), this likely will be coupled with attempts to increase the workload and pace of work, with new methods of monitoring workers. Amazon, for example, introduced MissionRacer, a video game that pits workers against one another to assemble customer orders fastest.

The increasing pace of work in warehouses may introduce new health and safety hazards, as well as increased employee turnover due to overwork and burnout. Currently, warehouse workers

experience work-related injuries at a rate nearly twice that of other private industry workers—higher than construction, coal mining, and most manufacturing industries. According to The New York Times, pregnant workers at a warehouse in Memphis managed by the 3PL XPO were denied requests for light duty and subsequently suffered miscarriages. Warehouse employees also often toil in facilities that are not climate controlled, which exacerbates the hazards created by work speed-up.

2. New technologies have the potential to de-skill some jobs.

Some warehouse technologies are designed to simplify aspects of warehouse work by breaking a job into subtasks and, where possible, removing the skills required of the workforce. Across all occupations in warehouses, viable technologies are likely to replace some human-performed decision-making tasks with machines, significantly changing the composition and quality of jobs. In some cases, the de-skilling appears to be motivated by a desire to shift labor strategy, including expanding the size of the potential labor market, increasing the use of temporary workers, reducing the workforce in certain occupations, and enhancing worker productivity.

Training workers to perform higher-skilled tasks is one potential avenue for adaptation to technological change, but this strategy appears to be underutilized in warehousing. Instead, labor reallocation likely will dominate in the short and medium term, supported by processes of de-skilling and work intensification. For example, the Kiva robotic picking system simplifies the role of humans in picking, reducing training and skill requirements, and making it easier for companies to hire temporary labor rather than direct employees.

3. New technologies are poised to transform how workers are managed.

Algorithmic management introduces new forms of workplace control, where the technological regulation of workers' performance is granular, scalable, and relentless. Newly available devices—such as “wearable” warehouse technologies, autonomous mobile robots, and increasingly sophisticated labor management software—allow close tracking of workers' movements, including walk speed, routes, bottlenecks, and break time.

These technologies have the potential to improve efficiency by urging workers to increase speed and accuracy. These same technologies also can function as a form of surveillance over workers, reducing the little autonomy they already have and further intensifying the pace of their work. Without interventions to ensure the transparency and fairness of the algorithms used in these technologies, the conditions of work in warehouses may be heading toward more rigid forms of monitoring and management.

4. In the short to medium term, new technologies likely will not cause widespread job loss.

With continued growth in demand, aggregate employment levels in the warehousing industry will likely continue to rise over the next five to 10 years. That said, job growth may be tempered by the increased use of labor-saving technologies in e-commerce warehouses in particular, such as autonomous mobile robots, autobaggers and autoboxers, and sensors or RFID tags applied to goods. Honeywell, for example, has developed robotic unloading machines that reduce the offloading time and concomitantly the role of workers in the process.

Many workers may see the nature of their working conditions shift as technologies are adopted for particular tasks over the next five to 10 years. Over the long term, in the absence of major shifts in the economy or context of firms' technological adoption strategies, the increasing use of technology points to a labor reduction.

5. Technology is likely to have uneven impacts across demographics and occupations.

Because of the overrepresentation of workers who are young, male, Latinx and Black in the warehousing industry, these groups of workers will be affected disproportionately by technological change. In particular, Latinx and Black workers are overrepresented in the industry compared with the total U.S. workforce: both groups are employed in warehousing at twice the rate of all other industries. Latinx workers alone compose the largest single race/ethnic group in front-line warehousing jobs, at 35%. Black workers make up one-quarter of the workforce in both warehousing and e-commerce. Overall, workers of color constitute 66% of warehousing industry workers and 55% of workers in e-commerce, even though workers of color account for just 37% of the total U.S. labor force.

Other groups also will experience specific consequences from technological change in warehouses. Some technologies will disproportionately impact the employability of older workers, such as engineered productivity standards that penalize workers for not reaching exacting targets, or newer forms of technology for which older workers do not have training or experience. Women are more likely to be employed in e-commerce warehouses versus traditional warehouses, so the growth in e-commerce offers new employment opportunities for female workers. However, jobs in e-commerce warehouses typically have lower wages and less predictable schedules, and they are even more vulnerable to pressure to increase speed.

Finally, technological change will have different effects at the occupational level. Front-line occupations such as order pickers will likely see the content and quality of their jobs change with the application of new technologies that reduce low-value activities like walking and such automatable tasks as boxing orders. Forklift drivers may work alongside partially automated forklifts, and shipping clerks might see their work increasingly replaced by artificial intelligence.

Conclusion

Our findings raise a number of questions for policy makers, worker organizations, and industry leaders in the warehousing sector:

- How can policy makers, equipped with forward-looking information, help to plan and prepare for changes in job quality and the potential unequal distribution of the costs and benefits of technology adoption?
- How can workers be included in the process of technology implementation to improve employment and operational outcomes?
- What measures can be put in place to track the physical and psychological impacts of technologies on workers, and to mitigate any negative effects on workers' health and safety?
- How can policy makers involve employers in systematically identifying within-industry job opportunities for displaced warehouse workers, including on-the-job training?

In short, how the gains from technological change will be distributed is a pressing question for all of the industry's stakeholders. While large retailers may be able to leverage their sizeable order volumes and strong financial positions to secure first-mover advantages through early adoption of new technologies, many 3PLs and smaller firms will face challenges, primarily the cost-based competition that is prevalent in the warehousing industry. Consequently, widespread automation of the warehousing industry is unlikely in the near to medium term. Experimentation with a variety of new technologies—including but not limited to those that may de-skill and intensify work—appears to be led by the widespread desire to compete with Amazon and other major online retailers.

Technologies are neither inherently good nor bad, just as the effects on employment are not inevitable. Ultimately, warehouse operators have latitude in determining how new technologies will be implemented. For example, when the wholesale retailer Boxed introduced cutting-edge automated processes into its warehouses, it retrained existing workers to fill new roles around these processes instead of laying them off.

The warehousing industry could realize significant operational improvements through technological advances—and it is imperative that productivity gains be shared, that workers be involved in identifying which efficiencies should be prioritized and what hazards are being introduced, and that experimentation unfolds with regard for more than just productivity increases and cost-cutting. Absent this, the process of technological change in warehousing likely will resemble a win-lose proposition, where the short-term benefits are captured by the industry and the long-run costs are borne by workers.

Glossary

The meaning and usage of many common terms vary significantly across the industry. The definitions given here are intended only to help the reader understand how we will use these terms in this report, which may differ from specific legal or regulatory definitions and/or informal usage within particular firms or industry segments.

3PL – Third-party logistics company, which offers outsourced logistics services, including warehousing.

Lead Firm – The most powerful company driving a supply chain, often with forward and backward linkages to other firms through contracting.

Lead Time – The time between when a store replenishment order is placed and the moment it is needed.

SKU – Stock keeping unit, an alphanumeric identifier for a product that helps in inventory management.

Throughput – The amount of goods moving through a warehouse.

WMS – Warehouse management system, or software that allows a warehouse to control and administer operations.

SECTION ONE:

Introduction

There's a certain meditative quality to watching robots stack boxes in a warehouse—and judging from the 3.5 million views one YouTube video by robotics company Boston Dynamics¹ has garnered, many people are drawn to this preview of society's potential future. So-called “dark” warehouses might be full of these robots, toiling alongside stacks of goods and conveyor belts that swiftly carry packages across cavernous buildings and sort goods to their final destinations, all under the supervision of just a handful of human workers. In some ways, this is a desirable vision of the future, because it suggests that the problem of monotonous, manual work in warehouses has been solved by technology, leaving humans to take on the tasks that require higher cognitive functioning. In this scenario, could the technologically enhanced future of warehouse work mean increased efficiency, lower costs, and less grueling work—a win for everyone?

This research sought to examine this question, and the short answer is: without proactive measures, perhaps not. Instead, the potential gains from implementing new technologies in warehouses could be captured by the industry—while the losses fall to workers.

Warehouse operators stand to gain substantial efficiencies through the adoption of new technologies, and e-commerce is the driving force behind experimentation. Despite the growing range of available technologies, however, the warehousing industry faces significant impediments to widespread uptake, and adoption will be uneven across firms in the industry. As a result, in the short to medium term, the industry likely won't experience dramatic job loss, even as many workers may see the content and quality of their jobs shift as technologies are adopted for particular tasks. Technology and automation potentially could reduce monotonous or physically strenuous activities, but depending on how they are implemented may present new challenges for worker health and safety, employee morale, and turnover. As some occupations undergo de-skilling, employers benefit from reduced training times and turnover costs. The effects on workers, however, could entail wage stagnation and job insecurity. And electronically mediated forms of monitoring and micromanagement threaten to constrain workers' autonomy and introduce new rigidities into the workplace.

The labor market impacts likely will be uneven: workers who are young, Latinx and Black, and male are overrepresented in the front-line warehouse workforce and thus may be disproportionately affected by technological adoption. But technologies are neither inherently good nor bad, and the outcomes of employment change are not inevitable. Our research suggests that policy makers, worker organizations, and industry leaders alike must pay careful attention to the distribution of gains and losses from technological change to ensure broadly shared prosperity.

What is the “Future of Work?”

Warehousing is just one sector in which new technologies are forecasted to upend the status quo. More broadly, the uncertainty roiling around the so-called “future of work” has entered the mainstream. Over the last five years, debates about how work is changing largely have been waged by management consultants, in think tanks, among academics, and, to a lesser extent, in policy circles. What became clear, especially as popular media began to cover the shifts in the economy and the organization of industries, was that Americans instinctively feel greater insecurity is more and more a fact of life—whether that comes in the form of fissured work or technology-induced unemployment. The advent of ridesharing platforms and other forms of “gig” work have led to much hand-wringing that more traditional forms of employment are being consigned to a bygone era, though there is little evidence of seismic shifts toward “alternative” work arrangements.²

Technological change long has been a subject of human fascination, by turns exciting and alarming us with its potential for societal transformation. The application of new technologies to reorganize human labor has been a central theme of the future of work conversation, and media attention has brought the topic to readers and viewers in all corners of the country. What began as quasi-apocalyptic predictions about impending mass job losses³ has shifted, in a welcome development, to somewhat more nuanced discussions of the content of work, and which tasks and workers might be most affected by technological change.⁴ Still, most aggregate studies of the impacts of technology on jobs hover in their analysis at 30,000 feet, which obscures the conditional, lurching processes through which technological change usually occurs. The view from this elevation unintentionally has promoted a narrative of inevitability, with technological change foreshadowing a putative “end of work.”

The Future of the Warehouse

Instead of adhering to the notion of a fated future, this research takes seriously the ways in which technological change is *produced* by a range of actors and processes. Warehousing often is cited as one industry that will be revolutionized by automation, perhaps in part because it for so long has been a laggard in technological adoption—especially when compared with its sister sector, manufacturing.

Section One: Introduction

The warehousing industry is responsible for the storage, flow, and rerouting of goods to consumers or stores. The looming possibility of dark warehouses and other forms of automation that replace workers in warehouses dominates popular media reports about the industry. Yet there are many forms of technology that have the potential to change tasks and jobs in the warehousing sector without drastically reducing the need for workers in the short to medium term. This report explores a range of possible changes in the content and quality of work that might be borne of new technological applications in the warehouse.

Warehousing is an essential, if often invisible, element of the economy: it is the circulatory system through which goods move. Employment in the sector has been rising steadily since 2001, and growth has been particularly brisk over the last few years. From 2014 to 2017, employment rose by 37%, a phenomenon that largely can be attributed to e-commerce, for which sales grew by 52% over the same period. Wages, however, have not seen such growth. Rather, according to the U.S. Bureau of Labor Statistics, inflation-adjusted average wages actually have fallen since 2001.

The industry also is undergoing significant change. The rise of e-commerce has increased demand for fast, efficient warehouse operations, even as it also introduces new levels of complexity in assembling and shipping orders. Retailers with a brick-and-mortar footprint have struggled to develop new direct-to-consumer fulfillment strategies as they endeavor to satisfy changing consumer expectations regarding product selection, cost, and delivery timetables—fueled by Amazon’s sophisticated logistics infrastructure. An array of order fulfillment strategies has emerged. For example, some firms have added a “buy online, pick up in store” option, or BOPIS, filling online orders from brick-and-mortar store inventory and offering quick-turnaround pickup at the store itself. This new order delivery channel blurs the boundaries of the warehousing industry and highlights the considerable change under way in the sector.

Growing online sales have increased demand for warehouse workers and, at the same time, have produced a surge of interest among warehouse operators in how new technologies could help make the e-commerce order fulfillment process more efficient and less labor-intensive. While the industry historically has been slow to adopt new technologies, it appears to be reaching a decision point: tight labor markets, the emergence of e-commerce, and the capabilities of new technologies are converging to push firms to more seriously explore automation. Absent major shifts in the economy, the future likely portends considerably more widespread technological adoption, but in most cases it probably will proceed in a piecemeal fashion, applied to particular warehouse activities.

“Research suggests that policy makers, worker organizations, and industry leaders alike must pay careful attention to the distribution of gains and losses from technological change to ensure broadly shared prosperity.”

Research Questions

In an effort to understand the choices of and constraints facing warehousing industry actors, this study set out to assess short- and medium-term (over the next five to 10 years) technological change in the distribution function of global supply chains, and its potential impacts on the organization of employment and work tasks. Data collection focused on three main questions:

1. What key industry dynamics are playing a role in technological change?
2. How will adoption of new technologies impact warehouse facilities and operations, as well as the overall organization of the industry?
3. What tasks and processes are the highest priorities for technological application, and how might adoption of new technologies impact jobs in warehousing?

Data and Methods

This report relies on primary data collected through interviews with industry leaders and analysts, as well as attendance at logistics conferences and industry trade shows. Twenty-nine interviews were conducted between November 2018 and March 2019 in person and by telephone. Interviewees with a variety of perspectives were consulted, including management consultants, third-party logistics (3PL) operators, retailers, brands, and technology providers. Industry trade publications such as Supply Chain Quarterly, WERCWeekly, and SupplyChain 24/7 provided a wealth of information on the state of technological advance in warehousing. Finally, supplementary analysis drew on data from such government sources as the Bureau of Labor Statistics (BLS) and the U.S. Census Bureau.

To be clear, what was outside the scope of this analysis was quantitative modeling of potential future job losses in the sector. Other studies have offered projections of the impacts of technological change on employment levels, and these are discussed herein. Rather, the intent of this research was to get close to the ground, gathering perspectives from across the industry in order to examine the political economy of technological change.

Section 2 presents information on the warehousing industry. Section 3 offers a framework for understanding technological change and its impacts on workers. Section 4 lays out leading technologies and discusses the contextual factors that shape decision making about new technologies. Section 5 provides findings on the current trends and future impacts of technological change on the warehousing industry as a whole, and Section 6 builds on this with an analysis of how work is likely to change. Section 7 concludes with suggestions for policy and practice.

SECTION TWO:

The Warehousing Industry

Some background on the warehousing industry and its workforce will help lay the groundwork for understanding the opportunities and challenges the industry faces, as well as the pathways technological change might take in the coming years. This section presents an overview of the structure of the industry, followed by workforce demographics, the distribution of occupations, and worker pay.

Structure of the Industry

Warehousing involves the storage, flow, and rerouting of goods through physical buildings. The industry employs just more than 1 million workers who collectively earn wages approaching \$50 billion annually.⁵ According to County Business Patterns (2016), there are just more than 15,000 warehousing establishments in the United States, the majority of which are small, employing fewer than 20 workers. However, while establishments with 100 or more workers account for just 12% of total establishments, they account for the lion's share of employment—73% of all warehouse workers work in these facilities.

The central function of warehouses is the efficient calibration of goods production and consumption—a critical component of the U.S. economy. Figure 2.1. shows warehousing in the context of a simplified modern supply chain.

Figure 2.1
Simplified Supply Chain



There are a few key features of the warehousing industry that are useful to point out.

Changing Warehouse Operations

Shifts in consumption patterns and the organization of supply chains have led to significant change in the warehousing industry, forcing distribution centers from a storage function to one where, ideally, goods are in near-constant movement. A “traditional” warehouse is shorthand for distribution centers that deal mainly in pallets and cases (full boxes of goods). For these facilities, goods arrive at the warehouse on a pallet or in boxes packed directly on the floor of a shipping container. During the time these goods are in the warehouse, they will remain either palletized or in cases. These arrangements improve the efficiency of moving and storing bulk goods: for example, 4,000 calculators can be moved in a single forklift trip. Traditional warehouses are more likely to be receiving and shipping full pallets or cases of goods to a retail store or other business.

The basic categories of warehouse activities include:

- **Receiving:** Unloading goods and preparing them either for storage or transshipment. This can also include returns.
- **Put-away:** Moving goods to their next location within a warehouse.
- **Storage:** Holding goods until they are needed.
- **Picking:** Selecting and assembling orders per item, case, or pallet. This also may include final assembly, labeling, or packaging.
- **Shipping:** Preparing orders for shipment and loading goods.

While these activities still remain central to warehouse operations, the profile of the industry has shifted over the last decade as online shopping has gained retail market share.

E-commerce Warehouses

With double-digit year-over-year sales growth, few shifts in consumption patterns have had a greater impact on the warehousing industry than the rise of e-commerce. According to the U.S. Census Bureau, just more than 10% of retail sales in the second quarter of 2019 were conducted online.⁶ E-commerce distribution centers comprise 20% of new industrial leasing activity,⁷ which reflects the current phase of expansion and the need for more space to fulfill online orders. The e-commerce segment is expected to grow in the coming years, and will continue to drive demand for efficient warehousing operations.

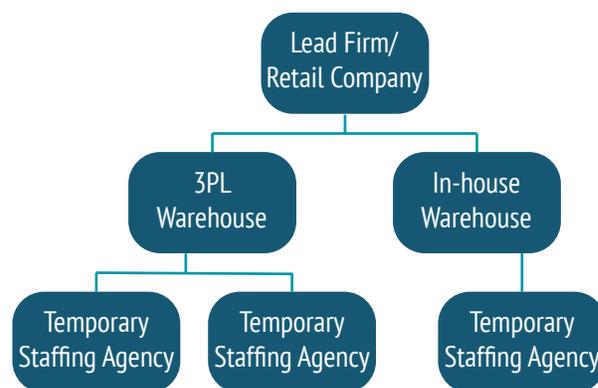
The rise of e-commerce has introduced a new set of activities into warehouse operations, both because of the nature of online orders and the speed with which they must be processed.

E-commerce customer orders consist of “eaches,” or quantities of one, for multiple products stored within a warehouse. Items for a single order likely will be located in different areas of the facility, and they must be consolidated in one place to be packed and shipped together, a process called each-picking order assembly. Furthermore, customers expect the shipment to arrive quickly—Amazon has set high expectations among consumers for fast, cheap delivery. For these reasons, the e-commerce picking process is far more labor intensive and time sensitive than traditional warehouse activities involving the bulk transfer of products.

Outsourcing

Two forms of outsourcing are prevalent in warehousing: 1) contracting for warehouse operations, and 2) contracting for labor. Companies often pursue a mix of in-house and outsourced warehouse operations (Figure 2.2). Over the last 15 years, third-party logistics companies, or 3PLs, have proliferated as lead firms that do not consider warehousing to be a core competency have sought outsourcing options; in 2017, revenues in the contract warehouse sector topped \$40 billion.⁸ The lack of systematic, representative data makes it difficult to track long-term changes in warehouse outsourcing,⁹ however, according to one study, 66% of shippers now outsource their warehousing needs.¹⁰

FIGURE 2.2
Stylized Map of Warehouse Outsourcing



3PLs provide a number of services and value-added activities for part or all of their customers’ distribution needs—for example, Walmart contracts with 3PLs to manage the distribution of oversized goods like tires, while keeping fulfillment of other retail goods in house.¹¹ In another case, a grocery store chain like Meijer might contract with a 3PL to provide final brand labeling on canned goods. On balance, though, the most common activities to be outsourced are transactional, repetitive operations, such as unloading containers of goods.

Section Two: The Warehousing Industry

The leading 3PLs aren't necessarily household names: while DHL is well known, other major players like XPO Logistics, Kuehne + Nagel, GEODIS, and CEVA Logistics are not. Yet they play an important role in providing logistics services to their clients, which include retailers, grocery chains, consumer electronics companies, and brands.

Competition in the 3PL market is cutthroat, and a key determinant for whether one 3PL wins a contract over another is price. In a 2017 survey, 77% of lead firms reported that "lowest cost" was the single most important factor in selecting a 3PL provider.¹² And while 3PLs often offer a comprehensive suite of services for clients, there is little evidence that lead firms are, on the whole, seeking higher value-added services. Instead, transactional activities compose the bulk of 3PLs' contracts. As a result, 3PLs operate in highly competitive, price-sensitive markets where the primary value proposition is one of reducing costs (as opposed to differentiating service offerings). Furthermore, lead firms' contracts with 3PLs tend to last for just three to five years before being rebid, making strategic partnerships between companies more difficult. These factors, in turn, have ripple effects on how work is organized and, ultimately, on the feasibility of introducing new technologies into warehouses.

One key capacity offered by 3PLs is management of warehouse labor, including the outsourcing of workforce needs to temporary staffing agencies that provide just-in-time staffing for warehouse facilities. Temporary staffing agencies have assumed a central role in helping warehouses manage market volatility, and several logistics-related occupations are among those with the highest temp penetration rates.¹³ For example, according to the BLS, laborers and hand material movers are the largest warehouse occupation, making up 44% of front-line workers; laborers are also the largest occupational category in temporary help services, with more than one half-million workers. The two largest employing industries for the laborers occupation are temporary staffing, which employs 18% of all laborers, and warehousing, where 10% work.¹⁴

In warehousing, there are powerful inducements to hold down the cost of labor, and the negative short- and long-term effects on workers, in particular sizable wage differentials between temporary and direct-hire employees, are well documented.¹⁵ These wage differentials raise important questions concerning the labor strategies of warehouse operators and the workforce systems they adopt, even as technological change appears poised to unsettle existing staffing arrangements.

Geographic Concentration of Warehouses

Warehouses often are clustered near major transportation arteries and population centers. Over the last decade, warehouse developers and operators have sought inexpensive land for new, large-scale distribution center projects, which often meant siting buildings in suburban or exurban areas. For example, the Riverside-San Bernardino-Ontario, California, Metropolitan Area, also known as the Inland Empire, is roughly 60 miles east of Los Angeles and home to the highest concentration of warehousing employment in the country (Table 2.1.). Because of the clustering of

warehouses in particular geographic areas, any shifts in employment caused by new technologies will have greater impacts in these areas. Online shopping and customer expectations for fast delivery, however, have increased demand for smaller, last-mile e-commerce distribution centers near densely populated areas.¹⁶ This trend is shifting the geography of warehouses toward urban cores.

TABLE 2.1
Top Ten MSAs for Warehousing Industry Employment, 2018

Metropolitan Statistical Area	Warehousing Industry Annual Average Employment (2018)
Riverside-San Bernardino-Ontario, CA	68,673
Chicago-Naperville-Elgin, IL-IN-WI	51,006
New York-Newark-Jersey City, NY-NJ-PA	49,945
Dallas-Fort Worth-Arlington, TX	44,273
Atlanta-Sandy Springs-Roswell, GA	31,165
Los Angeles-Long Beach-Anaheim, CA	27,271
Columbus, OH	26,213
Indianapolis-Carmel-Anderson, IN	26,121
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	23,942
Phoenix-Mesa-Scottsdale, AZ	20,103

Source: Quarterly Census of Employment and Wages

The Warehouse Workforce

As we discuss later in this report, there are significant technological changes on the horizon in the warehousing industry. As a result, many workers may find their occupations reshaped and the quality of their jobs undermined. The makeup of the existing warehouse workforce is analyzed below.

The fortunes of the warehousing industry are closely tied to consumer spending and the strength of the national economy. The industry has been in a period of sustained growth. According to BLS data, with the exception of a dip during the 2007–09 Great Recession, employment growth has been strong since 2001, with a marked increase recently—the industry experienced 37% employment growth between 2014 and 2017 (Figure 2.3).¹⁷ Much of this increase can be attributed to the rise of e-commerce sales, which grew by 52% over the same period;¹⁸ BLS predicts employment will continue to grow by 21% between 2016 and 2026.¹⁹

Section Two: The Warehousing Industry

Typically, when an industry experiences this level of employment growth, rising labor demand leads to rising wages. In the warehousing industry, however, inflation-adjusted wages actually have fallen since 2001 (Figure 2.3.). This may provide *prima facie* evidence that, in key locales, warehouse facility operators are exerting monopsony power within their local labor markets. The concentration of warehouse facilities in distinct geographical areas, such as Southern California's Inland Empire, Will County in exurban Chicago, and the Lehigh Valley in Pennsylvania, appears to be providing employers the latitude to set wages at lower levels than would be reached if job market competition prevailed. This appears to have contributed to wage stagnation in the industry. The spatial concentration of employment in these regions means that warehouse operators dominate many local labor markets, with few employment opportunities outside the even-lower-paying service sector. In such cases, the warehousing industry has considerable latitude in setting wage rates, especially given that unionization rates in the industry also have fallen—from 14% in 1990 to just 6% in 2018.²⁰

FIGURE 2.3
Trends in Overall Warehousing Industry Employment and Real Annual Earnings, 2001-2017



Source: Quarterly Census of Employment and Wages

Warehouse Occupations

Table 2.2. presents data on the five largest occupations in warehousing, also referred to in this report as front-line workers, which represents direct-hire workers in facilities classified under the Warehousing and Storage industry code (NAICS 493). The following occupations are the largest in the industry:

- Laborers and Freight, Stock, and Material Movers, Hand
- Industrial Truck and Tractor Operators (Forklift Drivers)
- Stock Clerks and Order Fillers
- Packers and Packagers, Hand
- Shipping, Receiving, and Traffic Clerks

Median hourly wages for these workers range from \$13.71 to \$16.96; the median hourly wage for laborers, who account for roughly a third of all workers in warehouses, is \$15.85. Yet because of the way data on the industry are compiled, this table presents an incomplete picture of employment and wages. In addition to direct-hire employees, warehouse operators also rely, to varying degrees across facilities and times of the year, on workers supplied by temporary staffing agencies; these workers are not included in Table 2.2. Also absent are workers in common warehouse occupations employed in e-commerce warehouses (NAICS 45411, Electronic Shopping and Mail-Order Houses; this industry category captures some, but not all e-commerce facilities, with the remainder included in NAICS 493).

TABLE 2.2
Employment and Hourly Median Wages for the Five Largest Occupations in the Warehousing Industry, 2018

Occupation	Employment	Hourly Median Wage
Laborers and Freight, Stock, and Material Movers, Hand	329,540	\$14.58
Industrial Truck and Tractor Operators (Forklift Drivers)	183,350	\$16.96
Stock Clerks and Order Fillers	99,770	\$15.35
Packers and Packagers, Hand	68,340	\$13.71
Shipping, Receiving, and Traffic Clerks	59,880	\$15.85

Source: Occupational Employment Statistics

Difficulties accurately counting warehouse workers have led to vast variations in employment estimates: on the low end, BLS estimates 1 million workers,²¹ while a recent McKinsey report estimates 4 million.²² The blurred boundaries of the industry also appear to inflate the wages

Typically, when an industry experiences this level of employment growth, rising labor demand leads to rising wages. In the warehousing industry, however, inflation-adjusted wages actually have fallen since 2001.

typically reported for the industry. Some workers in e-commerce, and those employed through temporary staffing agencies, earn less per hour than direct hires in the warehousing industry. For example, according to BLS, shipping and receiving clerks, stock clerks, and packers in e-commerce warehouses earn between 6% and 15% less per hour than the same occupations in traditional warehouses.²³ In short, 1 million warehouse workers is likely a conservative estimate of total employment, and \$13.71 to \$16.96 is probably higher than the overall median wage of all warehouse workers.

Warehouse Worker Characteristics

Analysis of data from the American Community Survey (2013–2017) on the five largest warehousing occupations shows the U.S. warehouse workforce is more likely to be young, Latinx and Black, and male than

the rest of the working population. Because there are significant differences in the workforces employed, the data on worker characteristics are presented separately for the warehousing industry (NAICS 493) and the warehousing segment of e-commerce (NAICS 45411), hereafter referred to as warehousing and e-commerce.

Male workers are overrepresented in the industry: while 47% of the U.S. workforce is male, 72% of workers in warehousing and 56% in e-commerce are male (Table 2.3.). And although male workers compose the majority of the workforce in both segments of the industry, female workers are much more likely to be employed in e-commerce than in warehousing—44% of workers in the e-commerce segment are women, compared with just 28% of workers in traditional warehousing.

Latinx and Black workers are overrepresented in warehousing jobs: both groups are employed in warehousing at a rate roughly double that of all other industries. Despite accounting for only 17% of the overall U.S. labor force, Latinx workers compose the largest single racial/ethnic group of front-line workers in warehousing (35%). Similarly, Black workers account for roughly one-quarter of workers in both warehousing and e-commerce, but account for just 12% of the overall labor force. Conversely, Whites are underrepresented in the industry. The proportion of White workers in warehousing and e-commerce is 34% and 45%, respectively, despite accounting for 63% of the overall labor force. Overall, workers of color make up 66% of warehousing industry workers and

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55% of workers in e-commerce, whereas workers of color are just 37% of the total U.S. labor force. Warehouse workers tend to be young: workers younger than age 35 make up 56% of warehouse workers and 64% of e-commerce workers.

TABLE 2.3
Demographic Characteristics of Workers in the Five Largest Warehouse Occupations in Warehousing and Electronic Shopping Industries, U.S. Total*

	Percentage of Workers in Warehousing Industry**	Percentage of Workers in Electronic Shopping Industry***	Percentage of Workers in U.S. Workforce, All Sectors
Gender			
Male	72%	56%	47%
Female	28%	44%	53%
Race/Ethnicity			
Black, Non-Latinx	25%	26%	12%
Hispanic or Latinx	35%	19%	17%
Asian, Non-Latinx	3%	6%	6%
White, Non-Latinx	34%	45%	63%
Other, Non-Latinx	2%	4%	3%
Age			
18–24	27%	38%	16%
25–34	29%	26%	24%
35–44	19%	16%	22%
45–54	16%	13%	23%
55–64	9%	7%	15%

Source: American Community Survey 2013–2017

*The largest warehouse occupations are Laborers and Freight, Stock, and Material Movers, Hand; Industrial Truck and Tractor Operators (Forklift Drivers); Packers and Packagers, Hand; Stock Clerks and Order Fillers; and Shipping, Receiving, and Traffic Clerks

** North American Industrial Classification System (NAICS) 493

*** NAICS 45411

Note: Columns may not add to 100% due to rounding.

While female workers are more likely to work in e-commerce than warehousing, the proportion varies significantly by occupation. Table 2.4. shows the gender composition of the five largest occupations in warehousing and e-commerce. In nearly every occupation, women make up a higher percentage of e-commerce workers than warehousing industry workers.

TABLE 2.4
Common Warehouse Occupations in the Warehousing and Electronic Shopping Industries by Gender

	Percent of Workers in Warehousing Industry	Percent of Workers in E-commerce Industry
Laborers and Freight, Stock, and Material Movers, Hand		
Male	78%	70%
Female	22%	30%
Industrial Truck and Tractor Drivers (Forklift Drivers)		
Male	93%	82%
Female	7%	18%
Stock Clerks and Order Fillers		
Male	62%	52%
Female	38%	48%
Packers and Packagers, Hand		
Male	43%	44%
Female	57%	56%
Shipping, Receiving, and Traffic Clerks		
Male	69%	57%
Female	31%	43%

Source: American Community Survey 2013–2017

Warehouse Working Conditions

Front-line workers perform a variety of activities that allow for the movement of goods through warehouses. The main tasks of the five major occupations are as follows:²⁴

Laborers and Freight, Stock, and Material Movers, Hand

- Move freight, stock, or other materials to and from storage or production areas, loading docks, delivery vehicles, ships, or containers, by hand or using trucks, tractors, or other equipment.
- Sort cargo before loading and unloading.
- Attach identifying tags to containers or mark them with identifying information.
- Read work orders or receive oral instructions to determine work assignments or material or equipment needs.
- Stack cargo in locations, such as transit sheds or in holds of ships, as directed, using pallets or cargo boards.

Industrial Truck and Tractor Operators (Forklift Drivers)

- Move levers or controls that operate lifting devices, such as forklifts, lift beams with swivel-hooks, hoists, or elevating platforms, to load, unload, transport, or stack material.
- Inspect product load for accuracy and safely move it around the warehouse or facility to ensure timely and complete delivery.
- Manually or mechanically load or unload materials from pallets, skids, platforms, cars, lifting devices, or other transport vehicles.
- Position lifting devices under, over, or around loaded pallets, skids, or boxes and secure material or products for transport to designated areas.
- Weigh materials or products and record weight or other production data on tags or labels.

Stock Clerks

- Pack and unpack items to be stocked on shelves in stockrooms, warehouses, or storage yards.
- Store items in an orderly and accessible manner in warehouses, tool rooms, supply rooms, or other areas.
- Examine and inspect stock items for wear or defects, reporting any damage to supervisors.
- Receive and count stock items, and record data manually or using computer.
- Mark stock items using identification tags, stamps, electric marking tools, or other labeling equipment.

Packers and Packers, Hand

- Load materials and products into package processing equipment.
- Clean containers, materials, supplies, or work areas, using cleaning solutions and hand tools.
- Record product, packaging, and order information on specified forms and records.
- Examine and inspect containers, materials, and products to ensure that packing specifications are met.
- Measure, weigh, and count products and materials.

Shipping, Receiving, and Traffic Clerks

- Examine shipment contents and compare with records, such as manifests, invoices, or orders, to verify accuracy.
- Record shipment data, such as weight, charges, space availability, damages, or discrepancies, for reporting, accounting, or recordkeeping purposes.

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- Prepare documents, such as work orders, bills of lading, or shipping orders, to route materials.
- Confer or correspond with establishment representatives to rectify problems, such as damages, shortages, or nonconformance to specifications.
- Pack, seal, label, or affix postage to prepare materials for shipping, using hand tools, power tools, or postage meter.

The manual nature of much warehouse work is evident in the occupational descriptions above. Repetitive movements, awkward lifting and moving positions, and a fast-paced work environment, together put workers at risk of injury. Indeed, according to BLS, in 2017, warehouse workers experienced work-related injuries at a rate nearly twice that of all private industry workers—higher than construction, coal mining, and most manufacturing industries.²⁵ In one recent industry survey, 61% of respondents had a warehouse employee turnover rate greater than 10%, with major impacts on productivity and the cost of replacing workers.²⁶

Health and safety is one contributing factor to the high turnover rate in warehouses, and recent media reports have highlighted the array of health and safety risks in the industry. Amazon, in particular, has come under fire for the health and safety ramifications of high productivity requirements and the stress workers report feeling as they toil under exacting pressures to perform.²⁷ In addition, many warehouses are not climate controlled, leading to cold temperatures in winter months and sweltering conditions during the summer; at an Amazon warehouse in Pennsylvania, for example, workers so frequently experienced heat-related episodes, including fainting, that paramedics and ambulances were stationed outside.²⁸ According to one New York Times account, pregnant workers at a warehouse in Memphis managed by the 3PL XPO were denied requests for light duty and subsequently suffered miscarriages.²⁹ Such reports point to the challenges that warehouse workers face, which are often exacerbated by the frenetic pace of just-in-time distribution systems and high productivity standards that pervade the industry.

Worker Productivity and Management

Tracking worker productivity long has been a key feature of the warehouse. “Scientific labor management,” first introduced by Frederick Taylor in the 1900s, promised to apply principles of science to improvements in labor productivity. Management systems divide work into discrete subtasks, each of which is subject to time and motion studies of the workers performing the job. The results of these studies form the basis for “engineered labor standards,” which in warehouses often are codified in Key Performance Indicators (KPIs) such as volume moved per worker per hour and accuracy (KPIs also include other such nonlabor indicators as inventory accuracy and asset utilization). In unionized warehouses, the development of engineered labor standards are negotiated and agreed upon by both workers and management. No such agreements exist in nonunion facilities.

Industrial engineers conduct audits that assess and reassess warehouse processes for possible gains in efficiency. As the vice president of a large 3PL explained in an interview, “We have a whole engineering team that does nothing but continuous improvement. ‘Let’s look at the process, figure out how we change it and make it ever so slightly better. Get five seconds out of it.’ We don’t even want to think about technology [until we’ve done that].”

Taken together, data on the warehouse workforce offer an aggregate account of the workers who will be most affected by new technologies: these are front-line workers involved in all aspects of the movement and handling of goods in warehouses, exposed to health and safety risks that are exacerbated by high productivity standards. One important factor that shapes workers’ experiences of job quality, as well as the broad approach to technological change, is the cost-sensitivity of the warehousing industry.

Economics of the Industry

For all the emphasis on sophisticated, strategic approaches to goods movement that abound in business literature, warehousing largely still is seen as a cost to be contained—a “necessary evil.” Warehousing rarely adds an increment of value to the end product—and fast, free shipping and returns reinforce this point—so the dominant dynamic across the warehousing industry is one of low margins and cost cutting.

Two key features of modern supply chains shape the role warehouses and distribution centers play in the wider economy: volatility and risk management. Supply-chain volatility—such as that caused by fluctuations in consumer markets, shifting seasonal cycles, or natural disasters—makes flexibility to adapt to demand and supply instability paramount. Distribution centers are expected to buffer and help manage this volatility through a range of flexible, just-in-time systems.

At the same time, firms’ supply chain risk management strategies must contend with a varied set of economic, product market, and regulatory risks, including those arising from trade policies, fluctuations in currency valuations, and changes in consumer spending. All warehouses face volatility and risk, and some lead firms pursue outsourcing in an attempt to shift risk away from their own sphere of responsibility, including onto 3PLs and temporary staffing agencies.³⁰

In the context of low margins—according to one industry estimate, warehouse margins average just 3% to 6%³¹—firms’ options to manage volatility and risk are constrained. In the past, warehouse operators have relied on experimentation in labor strategies to contend with the challenges of volatility and risk inherent in supply chains—for example, using temporary workers to flex staffing levels up and down with fluctuations in consumer demand. While this trend persists, our research found that there also is increasing interest in using new technologies to address the fundamental business dynamics that shape the industry.

SECTION THREE:

A Framework for Technological Change

With society searching for clues about how work will change, predicting long-term technological unemployment has become fashionable. Think tanks and management consultancies produce aggregate accounts of technological change, often with contrasting conclusions ranging from apocalyptic to modest (mainly due to differing methodologies and assumptions). Unfortunately, most studies have focused narrowly on potential job losses, as opposed to the consideration of a broad spectrum of possible effects of technological change. This research seeks to counteract this tendency by exploring some of the varied ways in which technology potentially could affect employment arrangements, including altering the content and quality of jobs through de-skilling, work intensification, and algorithmic management.

The warehousing industry often is included among the sectors that will be transformed radically by technology, with studies forecasting that a substantial percentage of jobs and activities are automatable. Some examples include the following:

- According to the Brookings Institution, 92% of forklift drivers' tasks and 80% of packers and packagers' tasks are susceptible to automation, while only 7% of the tasks of a laborer are similarly susceptible.³²
- McKinsey Global Institute estimates that 57% of activities in transportation and warehousing are technically automatable.³³
- Bain & Company predicts that 70% of job roles in warehouses potentially could be lost through automation.³⁴

The Task Model

One common way to understand the relationship between technology and the content of jobs is the "task model" developed by Autor, Levy, and Murnane.³⁵ The task model suggests that for repetitive and easily programmed operations, new technology tends to replace human

Section Three: A Framework for Technological Change

labor, particularly as the cost of technology adoption declines. This, the authors point out, historically has been a key driver of technological change in the workplace. For other operations, the procedures necessary to complete a given task are not understood well enough to be programmed, and thus undertaken by a machine; these are nonroutine operations for which technology can complement human labor and result in increased worker productivity—but not fully replace human labor. Some tasks remain more productively completed by humans, at least until the ability to program the task content is achieved and the price point drops below the cost of labor.

One should not assume, however, that decisions regarding technology adoption are made solely on the basis of hoped-for efficiency or productivity gains, though this is typically how such decisions are framed by those developing new technologies and, often retrospectively, by those who have implemented technological change within their organization. Further, the price point of the technology, while important, is not the only factor influencing technology adoption. Firms' decisions about pursuing new technologies are made in the context of particular forms of governance—that is, these decisions are made in relation to how a given company is organized, the regulatory environment within which it operates, the labor and industrial relations framework through which employment is organized, its relationships to suppliers and end users, and the markets within which it competes. Attention, therefore, should be focused on the interaction of organizational structures and technologies, lest observers misrepresent how particular outcomes, like reductions in workforce size or changes in job quality, are produced. Variation among these interactions within firms' systems of governance helps explain divergences in techno-strategies at the firm level.

The task model would suggest that routine tasks are the highest priority for technology applications. However, this research points to a range of other factors that also shape this decision. The prevalence of manual, routine tasks in a warehouse increases the probability that these activities will, at some point, be candidates for automation, though when and how this occurs is difficult to predict. Herein lies the key weakness of aggregate accounts that predict sweeping job losses in industries and occupations. The specific content of a task shapes alternative methods of organizing the work—for example, the dexterity required to select a particular item for a shipping order constrains the application of (current) technologies to the task of order picking. The technical “automatability” of a task certainly impacts the trajectory of change—it represents the initial step of making it possible to apply a new technology to an activity. Moving from this stage to one of rising probability of technology adoption, and then on to a point where technology adoption pervades an industry, demands attention to industry dynamics and other contextual factors, which are difficult—if not impossible—to model quantitatively. The process of technological change is path dependent—that is, it occurs within a set of social and historical circumstances that carry “embedded interests and ideologies about what problems can or should be ‘solved’ by technology.”³⁶ The perils of quantitative modeling and the distinct lack of qualitative descriptions that endeavor to account for the range of factors shaping technological change were the impetus for this research.

SECTION FOUR: Warehouses and Technology

Leading Technologies in Warehousing

Warehousing has been a relative laggard industry in terms of adopting new technologies. Over the last 20 years, technological innovation was focused on eliminating data entry and reducing the amount of walking involved in a warehouse worker's activities. The key forms of technology included warehouse management software, radio frequency scanners, and industrial conveyor systems, though the uptake of these forms of automation across firms has been uneven.³⁷ The following are some of the leading and emerging technologies in warehousing today.

Software

Warehouse Management Systems

Warehouse management systems (WMS), the most common technology deployed across the industry, control day-to-day warehouse operations, including receiving and storage, staging orders, and administering product replenishment. WMS software usually stands as separate modules from, but integrated with, enterprise resource planning (ERP) systems, which send orders to the WMS. In the 1980s and 1990s, many firms developed their own WMS in house and, particularly for 3PLs, unique attributes of their WMS helped create a market niche.³⁸ Today, these legacy systems are being replaced by highly sophisticated off-the-shelf software packages, such as Manhattan, JDA, and HighJump. WMS software sometimes includes a labor management system module, which increases the ability of managers to plan labor allocation and track workers, and typically integrates engineered labor standards into metrics. Integration of WMS with various hardware systems is a key puzzle for technology developers, and can require a separate system to "translate" between the hardware and WMS, sometimes referred to as a warehouse execution system.

Hardware

Conveyors and Sortation Systems

Large-scale industrial mechanization arrived in warehousing in the 1990s. Conveyors and sortation systems were designed to carry boxes across large expanses and direct the goods to the proper shipping location, thereby reducing workers' time spent walking and sorting. Major capital investments were required to implement these systems, which are heavy, bolted to the floor, and inflexible. Decision making about the adoption of conveyor systems was based on 10-plus-year forecasts of demand volumes, so when first installed, they tended to have excess capacity; because they are costly, mechanized systems often take many years to realize an adequate return on investment. Newer forms of conveyor and sortation systems can incorporate automated scanning and goods sortation for shipment.

Radio Frequency Scanners

Handheld radio frequency (RF) barcode scanners are used to manage inventory and track the order-picking process, replacing the need for paper "pick lists." RF scanners also allow employers to monitor worker productivity. Hands-free RF scanners that attach to a worker's arm and are equipped with a barcode scanner on a finger are replacing handheld scan guns that can cause tendonitis and other ergonomic injuries.

Voice-Directed Systems

Workers using voice-directed systems wear a headset that provides instructions on what items to pick or put away and where they are located, and workers confirm the location and items by speaking standardized commands. Voice-directed systems can replace the need for a worker to read instructions from a list or scan items with a barcode scanner. According to a recent survey, voice-directed systems are one of the fastest-growing technologies in warehouses—roughly one-quarter of facilities reported using voice-directed picking in 2018, up from just less than 6% a decade prior.³⁹

Put Walls

Put walls are shelving systems with slots, each representing an e-commerce or store order. They are equipped with lights that direct a worker to put items in particular places. Orders are picked upstream and transported manually or via conveyor or mobile robots to the put wall for sorting into individual orders. Put walls are not highly automated and still require significant amounts of human labor to implement, but are relatively inexpensive and effective in streamlining the picking and order-assembly process.

Goods-to-Person Systems

Goods-to-person systems bring items to the worker for order picking. This can, for example, take the form of a shelf mounted on a robot that makes its way to the picking station, as in the case of Kiva robots in Amazon warehouses, or a hanging bag sorter that brings individual items to a worker via an overhead-mounted pouch. There is a range of automated storage and retrieval systems (ASRS), which combine storage with goods-to-person item delivery. Goods are stored in racking systems, and an automated shuttle retrieves goods and delivers them to the order picker. These systems allow for high-density storage, since they eliminate the need for wide aisles between racks for humans or forklifts, and are the most efficient automated systems currently available. However, they are costly, resembling older forms of mechanization in terms of the capital intensity of implementation and their inflexibility—they are set in place and only can accommodate goods of a fixed maximum size and weight. There are ASRS systems designed for each picking, case picking, and pallet in/out processes, though a single system would not be able to accommodate all three activities.

Autonomous Mobile Robots

Autonomous mobile robots (AMRs) are automated carts that travel around a warehouse, moving items for orders between picking and sorting or packing locations. Two subcategories exist: “relay” carts and “follow-me” carts. Relay AMRs can work with most picking processes; the order picker selects the items for the order, places them in the cart or tote, and the AMR delivers the tote to the next task station. A follow-me AMR leads a worker through the warehouse, setting the pace and directing the worker to select particular items. When the order picking is completed, the follow-me AMR transports the items to the next task station. AMRs are very effective in e-commerce fulfillment environments and in applications with sufficient order volumes. Some users report that the robots can double productivity levels, but higher productivity models cost more to implement, and without adequate volumes, AMRs will not achieve the expected results.

Robotic Picking

In most warehouses, the product-picking process still relies on human hands to select items. The optimal technological case for picking is robotic order picking, in which a robotic arm is equipped with hand-like or suction-cup grippers that can reach into a pick location, grasp an item, and place it into a tote. The backend data input relies on artificial intelligence (AI) to “learn” how to grasp different products, though variation in product sizes and shapes greatly complicates computer programming. Research and development is active in this area—some of the most popular technologies at the ProMat 2019 warehouse automation conference were products that make gains toward order-picking automation, and Amazon has long held an annual competition for precisely this technology. Gripper technology has progressed significantly, and although the robotic arms on which they are mounted have come down in price, the products still are mostly in a development phase.

There are exceptions, however. For example, where products are relatively uniform and arrive at the robotic arm in standardized packaging, such as in The Gap's e-commerce apparel warehouse operation, this automation has proven viable. Yet even in the case of apparel, the technology is not universally practicable, highlighting the variation that will shape technology adoption. As one interviewee, a distribution manager of a mid-sized apparel retailer, pointed out, for a business where the product must look a certain way upon delivery—for example, high-end dresses that need to arrive wrinkle-free—some of the technologies that drop, clasp, or suction goods run counter to the desired end look.

It is important to highlight that the AI that informs the robotic grippers still relies on human intervention. One leading robotic picking machine flags cases in which the gripper cannot determine how to grasp an item, and off-site staff takes over and guides the machine. It's not hard to imagine this manual task—machine learning that relies heavily on human teaching—becoming the purview of dispersed gig workers, blurring the line between warehouse worker and tech worker. AI, in other words, requires intelligence that is not so artificial.

Automated Guided Vehicles

Automated guided vehicles (AGVs) are technology-enabled material moving vehicles, usually a forklift or “tugger,” that transport goods along preset routes in a facility. Some are fully automated, while others are a hybrid system that also can be human-operated. Guidance technology has greatly improved—whereas AGVs used to require physical infrastructure in the form of markers in the warehouse, many now use a laser-guidance system, which lowers implementation costs. Nevertheless, AGVs still are relatively expensive and may need to be “caged,” or separated physically from workers, which narrows their applicability in warehouse settings.

Sensors

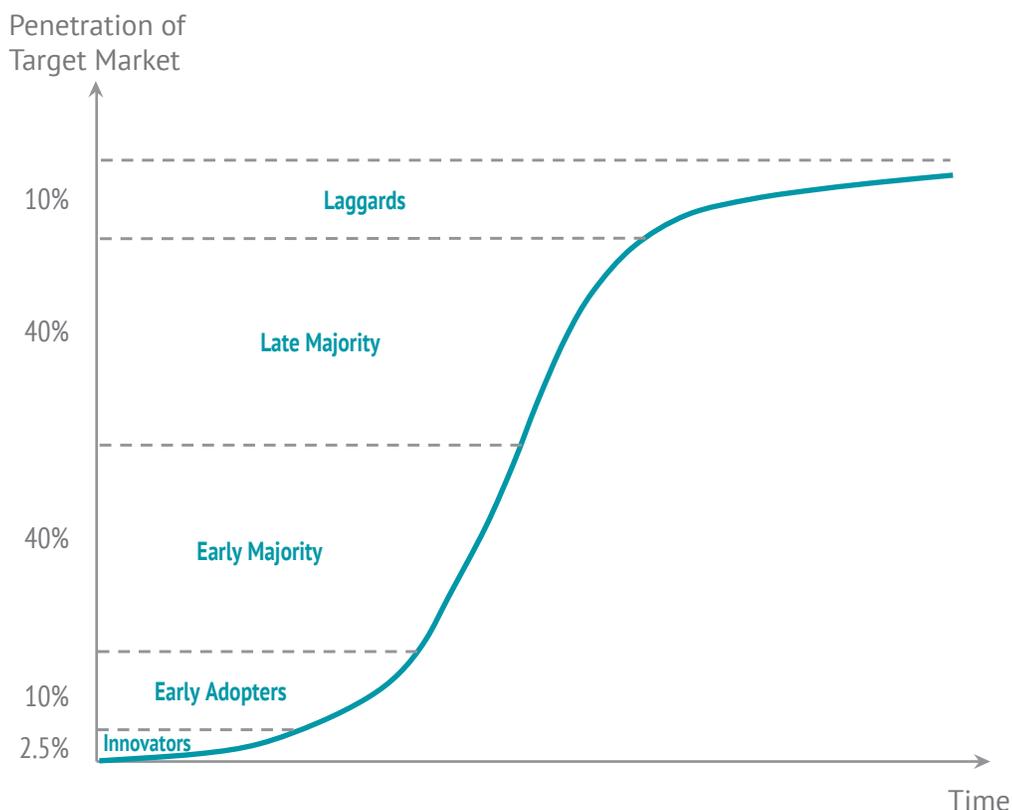
Sensors have many applications in the warehouse, from being able to dynamically track inventory to monitoring the movements of workers to controlling energy usage. Combined with other technologies, sensors can, for example, allow for autonomous palletizers to stack boxes on a pallet by determining the dimensions and proper stacking order. The Internet of Things (IoT), where vehicles, devices, or goods are embedded with sensors that can communicate automatically with each other, is seen to have significant potential to capture real-time data across the logistics system.

The wide range of innovations speaks to the potential opportunity for technology to be applied across warehouse activities. Depending on the source—trade literature, interviews with industry insiders, or technology developers—reports on the state of uptake among leading technologies vary. For example, two different surveys, conducted by Honeywell and the Warehousing Education and Research Council (WERC) three years apart, estimate that voice-directed picking is in use in 12% and 25% of facilities, respectively.⁴⁰ There is no shortage of new technologies available to warehouses—the question is how firms make choices about techno-strategy.

Technology Diffusion in Warehousing

In his landmark study of the diffusion of innovations, Rogers⁴¹ highlighted the role that complex social structures play in shaping the pathways of technology adoption. The extent and rate of adoption in an industry is related to multiple factors; chief among them is the relative advantages conferred by new technologies, the complexity of technology implementation, and the compatibility of a given technology with users' norms and systems. These factors help account for the marked unevenness of innovation adoption across a sector. The path of adoption of a given technological innovation most typically resembles an S-shaped curve, progressing from an innovator to early adopters to late adopters (the period in which the rate of innovation adoption slows; see Figure 4.1.). The warehousing industry appears to be in the lower left quadrant of the model, an industry just beginning the process of technology diffusion.

FIGURE 4.1
Diffusion of Innovation, Based on Rogers (1962)



Warehousing currently exhibits a highly uneven landscape of technological adoption. As will be elaborated below, despite several push factors that encourage warehouse operators to explore the use of new technologies, the uncertainties of future demand and questions regarding systems scalability, as well as (paradoxically, perhaps) the sheer pace of technological change,

have inhibited widespread implementation of costly automation systems. For many low-tech warehouse operators, increasing order volumes instead are met through evolving workforce strategies (e.g., adding new shifts, increasing overtime) rather than through mechanization and automation. As long as workers’ wages remain relatively low, many warehouse managers will opt to delay investments in new systems, especially given that the implementation of automated systems introduces new complexities into established operations. In addition, the fixed architectures of warehouse facilities and their distribution systems raise questions of whether existing facilities actually are compatible with some new technologies, which in many cases serves to limit the introduction of automation to the piecemeal adoption of technologies that can enhance worker productivity rather than eliminate the need for human labor.

The Context for Technology Uptake

This section analyzes the conditions surrounding firms’ consideration of new technologies. As noted above, the context within which warehouse operators make decisions about whether to deploy new technologies includes both push factors and constraints (Table 4.1.). The push factors might lead to increased interest in technological innovation, whereas constraints might decelerate the exploration process. Like decision making about technological uptake, these contextual dimensions do not operate as linear processes, nor do they create inevitable outcomes. The most influential push factors include *labor conditions*, *real estate costs*, and *increasing speed requirements*, while the most common constraints involve *variability and unpredictability*, *outsourcing dynamics*, *inertia*, and the *state of technological innovation*.

TABLE 4.1
Push Factors and Constraints for Technology Uptake in the Warehousing Industry

Context for Technology Uptake	
Push Factors	Constraints
Labor conditions	Variability
Rising real estate costs	Outsourcing
Increasing speed requirements	Inertia
	State of Technology

Push Factors

Labor Conditions

The most commonly cited problem warehouse operators encounter today is securing an adequate workforce, because of tight labor markets and Amazon. With unemployment at its lowest rate in nearly a half-century—3.5% in September 2019—the pool of available workers has dwindled. In a 2017 industry survey, 90% of warehouse operator respondents said they were struggling to hire

hourly workers.⁴² Compounding low labor availability is the reality that warehouse jobs are rarely work of first choice, given the manual nature of many of the activities.

While the so-called “Amazon effect” sometimes is exaggerated, the fact is that Amazon has had considerable impacts both on its direct retail competitors and on the warehousing industry as a whole—especially in the realm of labor markets. Amazon’s million-square-foot fulfillment centers employ thousands of workers, and often are co-located with other distribution centers in dense logistics clusters (for example, California’s Inland Empire, the Chicago region, and the Lehigh Valley in Pennsylvania all host Amazon fulfillment centers along with myriad other retail and wholesale warehouses). The effects on local hiring dynamics have been significant. Most warehouse operators report having a difficult time finding and retaining workers, but they also indicate that Amazon’s tendency to absorb large numbers of workers exacerbates the problem, especially given the generally tight labor markets found in most parts of the country.⁴³ This problem becomes especially acute during the “peak season,” from October to December, when retailers are preparing for holiday and end-of-year shopping. For firms that experience peak-season surges in sales volumes, the demand for workers soars—sometimes doubling from normal staffing levels. Competition between warehouses for peak season hiring can be fierce, and the presence of Amazon intensifies local labor market competition.

“AI, in other words, requires intelligence that is not so artificial.”

However, because the industry is constrained by its operating margins, warehouse operators have few avenues through which they can compete for workers. Wage stagnation pervades the industry, and with little scope for raising wages, even during peak periods, warehouse operators have turned to late-career jobseekers, changed shift scheduling, offered small retention bonuses, and implemented other human resources practices that do not substantially increase total wage bills.⁴⁴

Difficulties in resolving these recruitment and retention challenges have spurred warehouse operators to experiment with an array of labor strategies: some have offered improved benefits packages, others have deepened their reliance on temporary staffing agencies to help manage variable labor demand, while still others have sought out “alternative” or previously overlooked labor pools, such as persons with disabilities⁴⁵ and older workers.⁴⁶ Crucially for the longer-term restructuring of warehouse industry labor markets, many warehouse operators also report that rising worker recruitment costs are prompting the exploration of how new technologies might increase productivity and/or reduce the number of workers required.

Regardless of whether historically tight labor markets are causing a tipping point that is prompting warehouse operators to more seriously consider new technologies, it is clear that

recruiting and retaining workers is a central challenge facing the industry. A critical, unanswered question is how a downturn in the economy might affect firms' posture toward technology adoption as a solution for their labor woes. If the economy weakens and unemployment rises, employers may well find enough relief to slow the process of seeking technological fixes for labor problems, thereby forestalling the need to make costly—and potentially risky—investments in technologies that are changing rapidly.

Rising Real Estate Costs

The three largest costs of running a warehouse are labor, equipment, and real estate; of these, real estate represents the most significant fixed cost. According to commercial real estate firm CBRE, average rents for warehouse space have risen every quarter for the last five years, while the amount of square footage available for rent has declined.⁴⁷ Vacancy rates—or the rate of available properties—dipped to a historic low of 4.3% in the third quarter of 2018.⁴⁸ Further, e-commerce warehouses require more space than traditional warehouses. According to one study, e-commerce facilities occupy up to three times more square footage than traditional warehouses, due to higher levels of inventory and a wider variety of stock keeping units, or SKUs.⁴⁹ As e-commerce expands, the demand for space will continue to increase.⁵⁰

Given the cost sensitivity of warehousing, rising real estate expenditures represent one more strain on the bottom lines of warehouse operators. The cost of commercial property and its availability varies across geographies, but suffice it to say that rising land and facilities costs exacerbate the problem of low margins in warehousing, and they encourage warehouse operators to attempt to curtail variable costs elsewhere.

Increasing Speed Requirements

Warehouse operators are under increasing pressure to move goods quickly and accurately. These pressures are driven by two dynamics. First, “lean logistics” gained popularity as a supply-chain management philosophy in the 1990s, the central goal of which is the elimination of waste. A major outcome of lean logistics programs is that companies hold lower levels of inventory across the supply chain, including at stores, and focus on turning inventory over more quickly. Lower inventory levels in stores, coupled with higher inventory turnover, results in reduced lead times, or the time between when a store replenishment order is placed and the moment it is needed.⁵¹ Warehouses, in turn, have had to increase the speed and frequency of replenishment processes because of shortened timelines, which translates into the need for faster receiving, accelerated picking, and greater throughput. Further, the shift toward stores with smaller real estate footprints and less backroom storage means that the process of fulfilling orders for brick-and-mortar stores entails more small-quantity picking than it has historically, which resembles labor-intensive e-commerce order assembly.

Second, as noted above, e-commerce introduces additional demands for speed along with an entirely new set of labor-intensive warehouse processes.⁵² One of the most potent effects of Amazon in the marketplace has been to shape consumer expectations for e-commerce order delivery. Whereas just a few years ago consumers were content for an order to arrive in three or four days, the delivery window has been steadily narrowing. Interviewees cited Amazon, and its Prime subscription in particular, as the driving force behind shorter package delivery times. To meet service-level agreements, many online orders must be filled within just hours of receipt. The standard timeframe in which customers expect to receive their orders, which is being set by Amazon's sophisticated logistics network, is two days and becoming shorter, as Amazon has introduced next-day and even same-day delivery windows.

At the same time, the Prime subscription has conditioned consumers to expect shipping to be free, or at very low cost. The same is true for order returns. Rising consumer expectations coupled with falling revenues for shipping has forced many companies, even those not directly competing with Amazon, to rethink their shipping policies and distribution strategies, including how technology could increase efficiency and curb logistics costs.

Constraints

Alongside the push factors listed above are a set of constraints and challenges that shape whether, and how, technologies become viable in particular facilities. These involve *variability and unpredictability*, *outsourcing dynamics*, *inertia*, and the *state of technological innovation*.

Variability and Unpredictability

Variability is a fact of life in distribution centers. Natural disasters delay shipments and new sales promotions send orders suddenly skyrocketing. Seasonal peaks, particularly during the months leading up to the year-end holidays, require considerable scalability as certain distribution centers see their throughput soar (especially for those servicing retailers). This dynamic has long challenged warehouse operators to find ways to staff for the busiest days of the year without sacrificing efficiency, and employers often turn to temporary staffing agencies to supply additional labor.

Supply-chain volatility existed before the rise of e-commerce—after all, store shelves have always required restocking based on varying consumer purchasing patterns, and businesses have always needed goods to arrive on time. But direct-to-consumer fulfillment adds to the complexity of scalable operations.⁵³ E-commerce tends to be highly unpredictable, though more or less so depending on the product segment, and the synchronizing, sequencing, and staging of orders based on the urgency and physical location of the product requires greater agility on the part of warehouse operators. In addition, the precise amount of year-over-year growth in e-commerce is difficult to predict; “It’s a nightmare,” in the words of one interviewee. For e-commerce and traditional fulfillment alike, the ability to forecast demand has been the Achilles heel of

efficient operations. Another interviewee, a senior supply-chain consultant, expressed it this way: “Companies have had inaccurate forecasts for so long, the catchphrase ‘the forecast is always wrong’ has become adopted within the culture, and people just accept the fact it’s going to be wrong.”

Until recently, the forms of automation available to distribution centers tended to be inflexible and difficult to scale. A conveyor system, for example, cannot hold more goods or run faster. For this reason, during peak periods an operator might add an extra shift to accommodate fluctuations, though this presents its own challenges in terms of staffing and worker recruitment. One interviewee with a 10-fold increase in holiday shopping volumes reported that his facility would switch to a highly manual process during peak season and hire hundreds of extra workers because the conveyor system simply could not accommodate the influx of orders. The workaround was to abandon the existing mechanized system and instead add to the workforce in order to contend with the sharp increase in order volumes.

Outsourcing

Outsourcing in logistics is pervasive, and according to some estimates, on the rise; in a recent survey, 58% of companies reported they were planning to increase outsourcing of logistics operations, compared with 27% planning to in-source these activities.⁵⁴ Outsourcing has its downside, however, and, most relevant to this topic, it can create strong disincentives to investing in new technology. There is a fundamental hurdle to overcome: firms historically have tended to outsource the most repetitive and transactional activities to 3PLs, and these also are some of the priority activities for automation. Instead of outsourcing, firms could choose instead to keep warehouse activities in house and adopt new, labor-saving technologies. 3PL contracts often are short (three to five years), which makes a return on investment difficult to achieve in that timeframe for warehouse operators undertaking major capital and technological investments.⁵⁵ Combined with the ever-present risk that technological investments made for one client may not be transferable to others, the technologies that would reduce staffing levels significantly often are beyond the reach of most 3PLs, especially those operating small and mid-sized facilities. The primary exception to this is the very largest 3PL companies, which are actively experimenting with new technologies, attempting to position themselves in a technical assistance role with a set of workable technologies on hand for clients, thus modifying their value proposition.

Inertia

The ways in which warehouses historically have been organized and operated can be difficult to alter, creating organizational inertia that can constrain the scope of technological change. First, existing systems of mechanization, such as industrial conveyors, required major capital investments to install, and companies understandably would like to use them as long as possible. In some cases, this means applying technologies to processes around the mechanized system or simply relying on existing technologies longer, even where newer options offer significant

efficiency gains. For most warehouse operators, operational inertia will limit the extent of technology adoption, at least in the short run.

Second, resistance to or lack of capacity for change within facilities can contribute to low levels of sophistication, in many forms. The primary way in which these constraints slow technological advances is that the most potentially powerful technologies require high-quality input data, which many companies are not collecting. A vice president at a large 3PL explained what he has been seeing in terms of clients' data sophistication: "You can't have artificial intelligence or leverage new technologies if you've got crummy data. So we see ... a digital divide emerging, between those [companies] that make the investments in systems and process management to ultimately have good and consistent data, and those that end up on the still-viable, but more basic, end of the spectrum."

Even those companies that have made substantial investments in technology may not be collecting and using data opportunistically. One interviewee, the head industrial engineer at a mid-size retailer that invested heavily in automated goods-to-person technology, reported that the company still lags behind in its data systems: "We don't use our information to be more proactive with our decisions. We still wait to visually see something, as opposed to using the data and the software to help us make better decisions quicker." The persistence of older methods of operating warehouses presents barriers to collecting and analyzing the data required to implement new technologies, or improve planning and execution.

State of Technological Advancement

Finally, the rate at which new technologies are being developed complicates decisions about when exactly a warehouse operator should invest in new systems, and which systems should be implemented. Some promising technologies have not yet reached the point where they can be reliably deployed in a live warehouse setting. Three examples from interviews are illustrative:

- The most advanced order-picking robots still are operating far below the precision level necessary for widespread use. According to an interviewee, "It's still hard to ask a robot to go to a shelf and identify and grab an item. The current breed of picking robots work with 60–70% accuracy, and warehouses need to operate at 99.9% accuracy."
- Robots still lack the intuition that, for example, allows a human forklift driver to calculate that in a situation in which there is high wind, a high stack, and low weight, the stack of boxes is likely to fall down—and intervene before it does so.
- Depending on the assortment of goods in a facility, robots are not adaptable to varying product profiles. As one interviewee, a warehouse manager, explained, "I struggle to find the robot that will be able to handle a bag of plaster of Paris, a bit for a jackhammer, a galvanized steel garbage can, a saw blade, and a five-gallon bucket of paint. Oh, by the way, what happens when that [plaster of Paris] bag ruptures? How does the robot know that the bag is ruptured?"

In some cases, combinations of different, mature technologies will be required in order for performance to reach the level of humans. To be sure, the research and development of these solutions is under way, but it is impossible to predict when they will converge in a way that substantially changes the landscape of adoption. Each year, available technologies become better and, in most cases, cheaper, but even these trends can convince companies to put off making investments, biding their time in order to take advantage of future product iterations or price cuts on existing technologies.

“I struggle to find the robot that will be able to handle a bag of plaster of Paris, a bit for a jackhammer, a galvanized steel garbage can, a saw blade, and a five-gallon bucket of paint.”

A further complicating factor is that many technology startups are seeking to be acquired by more established firms, raising questions about the support of the product or service over the long run. The trajectory of Kiva Systems serves as a warning: after purchasing the company in 2012, Amazon discontinued support for existing owners of Kiva robots in 2019, and those companies are now left with obsolete technology. As one interviewee—whose company had firsthand experience with Kiva’s robotic fulfillment systems—said, “Even if you [find] a startup that you think is perfect, you have to go in realizing it may be something else within five years.”

Taken together, the push factors are, at the very least, leading to increased interest on the part of warehouse operators in pursuing technologies that help ease the demands for workers, rising real estate costs, and increasing order velocity. On the other hand, the

constraint factors create obstacles to technological adoption that likely will moderate the speed of uptake. The ways in which each of these factors unfolds in companies helps determine the path and rate of technological change, and are difficult to account for in aggregate estimates of automation and its impacts on warehouse industry employment.

SECTION FIVE:

Technology Meets Shifting Industry Dynamics

This section presents analysis of the nexus of technology and the particular dynamics of the warehousing industry, based on interviews and other research conducted for this report. The first two findings refer to the current state of the industry—how the industrywide economic structure shapes techno-strategies, and how e-commerce is driving the leading edge of innovation. The second two findings present likely future impacts of technology adoption across the industry, absent major shifts in the economy due to recessions or other major disturbances.

1. The cost-sensitive economics of the industry are key to understanding firms' orientation toward technological adoption.

Section 2 reviewed the economic structure of warehousing: it is characterized by thin margins and cost-based competition and, at the same time, responsible for managing high levels of volatility and risk. Low margins can leave little room for investment in new technologies, despite the potential for efficiency gains. Outsourcing is one mechanism through which firms have tried to manage these dynamics, but contracting to a 3PL appears to complicate technology uptake (see further discussion below).

Broadly speaking, warehouse operators have moved cautiously into potentially risky experiments with new technologies, relying instead on experimentation within workforce systems and on streamlining existing processes. These trends likely will continue—the cost sensitivity of the dominant business model will moderate the rate of technological experimentation and uptake,

though some firms will find first-mover advantages a worthwhile prospect. Absent a major shift in how warehousing activities are valued by lead firms, the dynamics that have created barriers to innovation and contributed to the industry's status as a technological laggard are likely to persist over the coming five to 10 years.

2. E-commerce is driving experimentation with new technologies.

The rise of online shopping has had major repercussions on the warehousing industry. E-commerce order picking requires more labor and the order fulfillment process is accelerated, given consumers' delivery expectations. Additionally, Amazon's influence in the online retail arena is significant, particularly in the context of the company's promises of increasingly faster delivery.⁵⁶

The combination of labor-intensive order picking and the speed with which orders must be shipped has made e-commerce a leading driver of growth in warehousing employment and, interviewees report, has led to increasing interest in technologies to support the order-fulfillment process. With a fixed amount of space within a facility, warehouse operators are limited in the number of workers they can add before congestion creates inefficiencies. Further, in the context of a tight labor market, employers seek to ease their reliance on workers, where possible. Each picking requires a larger workforce, yet the complexity of the process and the limited availability of technologies for nonroutine aspects of the job make automation more difficult. However, because the likelihood that a given facility will adopt new technologies is related to the desire to reduce labor costs, it stands to reason that facilities with large numbers of order-picking workers likely would seek to become technological first movers. These enterprises likely will be leading experimenters and, if proven successful, innovations will diffuse to other operators.

Technological adoption has enabled the rapid expansion of e-commerce, as well as sharp increases in warehousing employment. The long-run impacts of technological change on employment, therefore, must be closely parsed; the warehousing industry likely will experience secular growth for the foreseeable future. At the same time, certain occupations or facilities may experience significant job losses due to automation, as e-commerce facilities lead the way in experimenting with and adopting labor-saving technologies.

3. Technology uptake will be uneven.

It appears that variation will be a key feature of technological change and automation in warehousing. Many factors shape the tendency for uneven technology uptake, and the circulation of ideas and innovations is propelled by a constellation of economic, social, and political forces. There are three main elements to this variation: *unevenness across firms*, *unevenness within firms*, and *unevenness across technologies*.

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Across firms, there are significant differences in approaches to seeking new technologies for warehouse operations. Two main factors help explain these divergences: the profile of the business, including the specific activities occurring in warehouse facilities, and the culture of the organization. A technology may make good economic sense, but not social sense, to an organization.

The first movers in technology adoption likely will be major retailers: firms with a large number of SKUs (500,000–1 million), high throughput, and that perform at least some of their own warehousing. The warehouse facilities that store and distribute these goods are large, employ hundreds or thousands of workers, and run multiple shifts. Those with a high volume of online orders likely will automate e-commerce fulfillment first, even if it's only that section of the operation. Finally, the product market(s) in which a firm is competing (e.g., apparel, pharmaceuticals, cosmetics) and, in particular, the techno-strategies of the firm's competitors, will shape the uneven landscape of uptake.

It's clear that warehouse operators are in disparate stages in their techno-strategy development, and the majority of firms are moving cautiously into automation. A senior executive at a leading 3PL offered this reflection on the uneven landscape of technology adoption: "Everybody's not on the same lap in an eight-lap race. When you talk about e-commerce, oftentimes we find [customers are] in completely different places." His remark suggests that even in the e-commerce realm, where there is the most widespread and enthusiastic interest in automation, companies are taking very different approaches. This is particularly true when comparing retailers with consumer packaged goods (CPG) producers, durable goods manufacturers, and 3PLs, where the former tends to be more advanced. One interviewee, a vice president at a large 3PL, offered this illustration of unevenness among firms: "I can go into one customer, take them an RF [scanning] gun, and they just think that's the most innovative thing they've ever seen; whereas the other customer wants drones running around the warehouse. People's definition of innovation is very different, and where they are in their maturity cycle of being able to adopt that innovation is very different."

It's clear that warehouse operators are in disparate stages in their techno-strategy development, and the majority of firms are moving cautiously into automation.

One indication of the unevenness of technology adoption in the industry is evident in the market penetration of warehouse management systems (WMS). WMS software, which tracks inventory and coordinates order processing for a facility, is the most common technology across the warehousing industry. Yet according to a recent study, 33% of warehouses do not use one.⁵⁷ Operating a WMS is widely considered to be a fundamental building block for the adoption of other technologies, and the study authors estimate that at least one-third of warehouses in the

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United States continue to operate using spreadsheets and paper, without an urgent aspiration to consider technologies that would integrate with the WMS.

Included in the two-thirds of warehouses that *do* use a WMS are those that have not upgraded their system for many years—recall that in many cases, the first WMS software was proprietary and developed in house. Consider the reflection offered by a 3PL vice president:

What shocks me [is] when we go into some of these big Fortune 100 [companies], and you see them running warehouse management systems that are 30 years old, and you just [ask], "How are you surviving?" To think about putting robotics into a facility where they're running a 30-year-old version of a WMS is just not feasible.

WMS adoption is one illustrative example of the uneven landscape and slow uptake of technologies in this industry, but the dynamic is not limited to software innovation. Long-available hardware similarly has had a slow adoption process, which speaks to the cautionary approach that pervades the industry. There are few indications this conservative posture will shift substantially in the near term.

Within firms, there is a range of activities that potentially could be targeted for the application of technology or automation. But firms must make choices about which processes should be prioritized, leading to a variegated landscape of technological sophistication across activities in a warehouse. Even firms at or near the leading edge of innovation in one area often lag behind in other areas. For example, a large parcel company had made massive investments in a state-of-the-art, high-throughput conveyor and automated RF scanning system, but managers still were using spreadsheets, a whiteboard, and countless staff hours to schedule workers to handle fluctuating package volumes.

Finally, *across technologies* there has been highly uneven uptake, in large part because the technologies tend to be specialized to the process for which they are designed. In addition, the political economy of technology development influences which viable product emerges as the market leader. A major obstacle for developers of new technologies is proving the products actually work in a live warehouse environment. Doing so requires convincing a warehouse operator to pilot a technology, which can be disruptive to the normal flow of operations. Yet, without a pilot phase, technologies lack the credibility needed to gain widespread acceptance.

New models of modularity and asset ownership may reduce barriers to adopting some technologies. Two key features set apart some of today's leading technological solutions from those of the past: modularity and leasing programs. Most prominent in the autonomous mobile robot (AMR) space, modular systems allow users to scale their use of AMRs to respond to fluctuating business cycles, adding robots as demand grows year seasonally or over time.

Modularity addresses central problems of past technological advances: it can reduce the initial capital outlay required, putting automation within reach of a new set of market actors, including

small and mid-sized firms and 3PLs. It also allows warehouse operators to increase capacity during high-volume periods and then scale back as demand falls. The latter approach historically has been addressed by adding seasonal labor, often through temporary staffing agencies. During the peak season, when many firms would wish to increase the number of robots in use, larger warehouse operators might be able to leverage their size to access additional robots more easily, potentially leaving smaller firms without the capacity to meet order volumes.

Robot leasing programs have been used in the manufacturing sector for years, but the so-called “robots-as-a-service” (RaaS) model is a more recent arrival to logistics. Companies rent the robots, paying by the amount of time used or per transaction, and thereby reduce the risk of obsolescence. The leasing entity retains responsibility for remote monitoring and maintenance of the robots.

“Even in cases where the activities occurring in a facility have a corresponding technological solution, and that solution is economically feasible for the enterprise, there will be significant divergences among firms in their adoption of new technologies.”

Taken together, these two features may be game changers—but only for those facilities in which modular, RaaS robots make sense. One interviewee, a vice president of a large 3PL, summed it up this way: “Newer, more flexible automation changes things: you can move it around between operations, and you’re leasing the equipment. You can think of [automation] differently, especially if it’s a technology where we have other sites where the technology could fit in.”

In short, these factors suggest that even in cases where the activities occurring in a facility have a corresponding technological solution, and that solution is economically feasible for the enterprise, there will be significant divergences among firms in their adoption of new technologies. It is this fact that complicates aggregate reports of technological change and forecasted impacts on jobs and workers. The unevenness is partly what makes predicting technological change so difficult.

That said, identifying leading firms, the latest processes, and cutting-edge technologies can help industry leaders and policy makers anticipate the effects of new technologies on jobs and workers. Across firms, it is important to understand which companies might be early adopters, and thus which workers likely will face the initial impacts of technology implementation. In the same vein, firms that choose to delay or not to adopt new technologies will have to find other ways to compete, which likely will have effects on the organization of work in

these facilities. Within firms, all things equal, it is high-priority processes, and the occupations involved in these processes, that will be affected first. And across technologies, tracking the products that are gaining attention and investment may be a predictor of emerging frontrunners and their specific impacts on jobs and workers.

4. Technology will have potentially large impacts on 3PLs and outsourcing in the warehousing industry.

Outsourcing is a significant trend in the warehousing sector, and the introduction of new technological capabilities undoubtedly will shift the landscape of subcontracting. This applies to the prevalent practices of both 3PL outsourcing and labor outsourcing to temporary staffing agencies.

3PL Outsourcing

Some interviewees noted a recent trend of companies that are new to e-commerce outsourcing their fulfillment to 3PLs. The motivation behind outsourcing is that companies newer to e-commerce have neither the logistics infrastructure nor a reliable estimate of demand—that is, the ability to forecast volumes is difficult for most internet shopping operations, but particularly so for those just launching an e-commerce channel without brick-and-mortar stores. Some of these companies have the intention to bring e-commerce fulfillment in house once a more accurate forecast of order volumes emerges. But, overall, 3PLs likely will continue to benefit from the expansion of e-commerce.⁵⁸

Yet, even as e-commerce has the potential to expand the use of 3PLs, the extent of warehouse outsourcing complicates the landscape of potential technological uptake. On one hand, there are strong disincentives for 3PLs to invest in new technologies—short contracts (generally three to five years, though interviewees suggested that their customers now are seeking even shorter contract terms) and cost-based competition are among the biggest. Many 3PLs have avoided investments in new technology because of the possibility of losing the customer at the end of the contract, which could make any investment obsolete. Short contracts also make it difficult to recover the costs of the initial investment.

Despite these disincentives, there is evidence that larger 3PLs regard technology as a key differentiator in the increasingly crowded contractor market. 3PLs are piloting robotics products in live warehouse environments, gaining expertise in emerging software and hardware solutions, and trying to carve out a role as technical assistance providers for customers. If successful, these strategies could increase barriers to entry in the 3PL market. The history of outsourced warehousing, however, suggests such higher value-added activities are rarely the driving force behind contracting decisions; in fact, as 3PLs have tried to move their customers up the value curve, most have met resistance.

Of course, some lead firms have bucked the outsourcing trend and kept their warehousing operations in house. For those that seek out outsourcing options, there appear to be three possible scenarios for the changing role of warehouse outsourcing:

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- **Scenario 1:** Lead firms use 3PLs with little automation for less efficient, lower value-added activities (e.g., nonconveyable products like canoes) and, where applicable, retain the more efficient processes in house with increasing levels of technology. It's conceivable the market of smaller 3PLs that are laggards in technology adoption increasingly may be matched with customers that also are lagging. This, in turn, may lead to worsening working conditions—smaller contractor firms are more likely to violate labor laws out of ignorance, lack of staff capacity, or in order to pad thin margins.⁵⁹
- **Scenario 2:** Lead firms seek out 3PLs that are adept with technology to learn about, identify, and implement systems appropriate to their business. Large 3PLs, like DHL and XPO, are actively piloting different technologies to better understand the kinds of operations for which each is appropriate. When a customer is interested in applying a new technology to a warehouse process, the 3PL helps them understand their options. Any customer-3PL relationship that involves technological innovation would benefit from longer contract terms, ideally more than five years.
- **Scenario 3:** Lead firms use 3PLs to run lead firm-owned facilities and technologies. As one interviewee explained, “The fully automated warehouses that I’ve been in are all customer-owned facilities. They may contract with a 3PL to run it, but that’s just a pure labor play for that 3PL.” Data from interviews and secondary sources suggest that firms are more likely to invest in technology tailored to their operations, but lead firms still could choose to outsource the management of these facilities to 3PLs.

3PLs also are experimenting with new organizational configurations and models of collaboration. One interviewee, the president of a midsized 3PL, said his company is exploring how it might commingle smaller e-commerce startups in a single facility and implement automation across all of them. Each startup on its own may have low volume, but by combining their operations, they each could experience faster fulfillment and benefit from “the automation effect.” The task of finding customers whose products, processes, and desired location are complementary might be daunting, but the intent is to allow smaller companies to compete in e-commerce markets at a lower cost.

New models of collaboration take different forms, though central to them is leveraging excess warehouse capacity. For example, the MonarchFX Alliance brings together large 3PL providers, some of whom are direct competitors, with proprietary robotics, inventory and distributed order management, and other technologies—all in an effort to offer customers a logistics infrastructure that can compete with Amazon. Emerging collaborations among 3PLs indicate the exigency of implementing cost-effective technologies in the context of subcontracted operations.

Labor Outsourcing

Temporary staffing is a common workforce strategy pursued by warehouse operators. The industry insiders interviewed for this research offered mixed arguments about the relationship between the adoption of new technologies and the deployment of temporary labor. Discussions centered on three issues:

- If firms don't use new technologies, such as autonomous mobile robots, they'll have to rely more heavily on agency-supplied temporary workers.
- Autonomous mobile robots may increase reliance on temps because automation enhances operators' ability to further de-skill core warehousing processes.
- Firms do not necessarily expect to reduce the need for seasonal labor through automation during the peak season.

Given the industry's cost constraints, temporary staffing agencies likely will remain a key means through which warehouse operators hold down labor costs. Further, new platforms for procuring temporary labor that promise to reduce the friction of finding workers are emerging. Similar to other forms of "gig" work, platforms like Wonolo aim to smooth labor supply and demand matching using algorithms. The potential expansion of temporary staffing arrangements, coupled with well-documented wage differentials between temporary and direct-hire workers, suggests that deleterious conditions could be on the horizon.

3PLs and temporary staffing agencies alike are navigating an uncertain landscape of change with different competitive strategies. Some are exploring new roles that leverage technology, while others appear to be taking a wait-and-see approach without significantly altering their value propositions. The structure of outsourcing, especially 3PL contract terms, constrains the options for 3PLs as they consider new technologies, and technological uptake among 3PLs has the potential to shift the contracting market in a number of ways. The trajectory of this change is, as yet, unclear, but will be shaped by the dynamics of unevenness prevalent across the industry.

SECTION SIX:

Impacts on Tasks, Jobs, and Workers

This section turns to the impacts of new technologies, and the dynamics discussed in Section 5, on tasks, jobs, and workers. Predicting technology's effects on the organization of work is difficult because of the unevenness with which these dynamics are likely to play out. Still, the purpose of this research is to draw on data collected from interviews and secondary sources to analyze unfolding trends and to speculate on potential repercussions, which are detailed below.

1. New technologies are likely to lead to work intensification, especially in each-picking environments.

Most warehouse work is strenuous. It entails manual processes that rely on strength and stamina, which takes a physical and mental toll on workers. It is possible in some cases that the priority tasks to be reorganized through technology adoption represent the most grueling aspects of the job. For example, removing walking or reducing the amount of lifting and twisting that workers must perform could offer significant ergonomic improvements and diminish the stress on workers' bodies. This research suggests, however, that even though some technologies promise to alleviate the need for the most arduous activities, this will be coupled with attempts to increase the pace of work and productivity in other tasks, with new methods of motivating and monitoring workers.

High-Priority Process: Each Picking

Warehouse workers' jobs include various tasks, some of which are higher priority for technological applications than others. First-order targets often are those that are the most labor-intensive and/or contribute the least amount of value to the final product. As was

discussed in Section 5, the highest priority in the short term is to apply labor-saving technologies to high-volume e-commerce order picking (and, because of the similarities of the process, frequent, small-batch replenishments to retail stores that hold limited inventory). The labor-intensive nature of picking individual items to assemble orders—so-called “each picking”—requires large numbers of workers, so warehouse operators place great value on reducing headcount or increasing throughput by reorganizing this activity. Workers involved in each picking likely will see significant impacts on the content and quality of their jobs, due to the introduction of software and hardware applications to particular subtasks, though only some of the process is automatable given current technologies.

There are three key areas in which technologies are changing the each-picking process: order-assembly planning, machine-directed picking, and goods-to-person picking.

Order-Assembly Planning

The process of planning order picking can be organized in one of three ways, which are dispatched by WMS software: discrete, batch, and waveless picking.

- With *discrete order picking*, all of the items for an order are picked at once and packaged. This process requires the most walking, since items might not be located near each other, and is thus the least efficient and most taxing on workers.
- *Batch picking* organizes the picking process so that workers select items that are located near each other for multiple orders. The batched items then are divided up and the orders are consolidated across batch picks. Because the orders are batched based on the proximity of products (i.e., instead of going to the same slot multiple times for an item, all the orders containing that item are batched together and picked at once), the picking sequencing is critical to efficiency. The complexity of this sequencing makes it more difficult to handle urgent orders—for example, a next-day delivery that needs to be picked within an hour of order placement.
- Finally, *waveless picking* was developed to combine the efficiencies of batching orders with the flexibility of adding new, high-velocity orders into the process without interrupting the flow of goods. Many of the leading WMS systems now have the capability to do waveless orders, and for high-volume e-commerce fulfillment, waveless picking is essential.

At first blush, the picking process appears to be a seamless, finely tuned activity. Yet interviewees conceded it is common for too much work to be released into a warehouse at a given time, leading to congestion at chokepoints in the order-assembly process. Congestion, in turn, lowers productivity, a problem that is out of workers’ control yet nevertheless impacts them. The picking process is a promising application for AI, which optimizes the flow of goods and people and, through machine learning, determines over time how to release orders more efficiently into the warehouse. As increasingly sophisticated AI enhances the planning process, workers may find

their jobs improved somewhat. In the meantime, until they are resolved, glitches in the process of releasing orders will continue to impact workers.

Machine-Directed and Goods-to-Person Picking

The hardware that might accompany the picking processes detailed above varies widely in terms of its technological sophistication, and the most prominent among them are largely labor complementing rather than labor substituting. Machine-directed picking systems replace paper pick lists with tech-enabled labor deployment, reduce walking, and serve to constantly orient workers toward their productivity rate. At the lower-tech end of the spectrum, a facility might implement voice-directed picking, in which a warehouse worker is directed to a pick location through a headset. Vision-directed picking, which uses virtual reality glasses to guide workers, is the next wave of innovation, though it is not widely in use given the cost of virtual reality glasses. Some autonomous mobile robots virtually tether a worker to a cart, keeping the worker at defined walking and picking speeds, always engaged with the technology and picking process, with constant feedback on their performance. Others are designed to shuttle goods between areas of the warehouse, again reducing walking and pacing the picking or packing rate. Goods-to-person systems deliver products to a workstation, which can offer a more ergonomic work environment while removing walking.

The common thread among technologies that address each picking is reducing low value-added activities coupled with the ceaseless reinforcement of workers' focus on their effort and efficiency. This research suggests that the main impact on workers as the content of their duties changes likely will be work intensification. Heightened pressures on workers occurs through twin processes.

The first constrains human interaction with co-workers. Linking workers to machine-directed order picking or goods-to-person systems effectively removes the opportunity for workers to interact with one other, even in cases where they might be helping one another perform tasks or solve problems.

The second process enables the micromanagement of work tasks at an unprecedented scale. Many new technologies applied to the picking process utilize algorithms that govern the sequencing of order assembly and picking rate. Algorithms track, analyze, and inform workers about their performance, measured against engineered labor standards as well as the performance of co-workers. Engineered labor standards, along with algorithmic management, point to what some have called "digital Taylorism," or scientific workforce management amplified by an order of magnitude. The time and motion studies that are conducted by engineers now are beginning to be augmented by machine

“The assumption that streamlining processes leads in a linear fashion to greater efficiencies, and thus cost reductions, may be fundamentally flawed.”

learning and data captured by new technologies, such as sensors that track the time it takes a worker to reach a pick location, scan a label, select a product, and place it in a bin. This data has the potential to increase pressure to work quickly, and in the context of the low margins that characterize this industry, productivity becomes paramount and improvements are focused on reducing cost.

Digital Taylorism is well under way in some parts of the warehousing industry. Amazon has attracted significant attention for the productivity rates the company expects of order pickers, and recent media reports detail the difficulty some workers have as they attempt to “make rate.”⁶⁰ Careful tracking of productivity has led to termination when employees are not reaching the target rate, and workers report feeling anxiety about the possibility of being terminated.⁶¹ In order to incentivize workers to maintain high productivity rates, Amazon introduced MissionRacer, a video game that pits workers against one another as they pick customers’ orders.⁶² The gamification of warehouse work is thus far limited, but is garnering increasing interest among warehouse operators seeking new ways to motivate workers.⁶³ While there is some evidence that gamification can ease the monotony of repetitive work, it also highlights the potentially nefarious impacts of competition on both workplace culture, and worker health and safety.⁶⁴

Rising productivity requirements also raise questions about the limits of the human body, and there are concerns that such close scrutiny over workers’ movements could have detrimental psychological impacts. The assumption that streamlining processes leads in a linear fashion to greater efficiencies, and thus cost reductions, may be fundamentally flawed. Gains could be counteracted by new health and safety hazards, as well as increased employee turnover due to overwork and burnout. The toll on workers is both physical and psychological, as increased performance metrics may push workers to exhaustion while heightening anxieties over the threat of being dismissed for missing performance targets. The unintended consequences of work intensification, therefore, could aggravate the challenge of recruiting and retaining workers, especially in tight labor markets.

2. New technologies have the potential to de-skill some jobs.

Most warehouse occupations call for a high school diploma or less. In terms of skills, forklift drivers require training and certification, which often can be completed onsite. Shipping and receiving clerks may need some computer skills, depending on the processes in place. The required level of training and educational attainment, however, belies some warehouse-specific experience and skills that can improve workers’ performance. For example, the commonly used RF scan guns have a small screen and a set of commands and keys that are not intuitive; and the layout of warehouses, including aisle or slot numbering, can be confusing to a newcomer.

Some technologies explicitly endeavor to simplify aspects of warehouse work. Kiva was one of the first technologies to focus on de-skilling. As one interviewee, whose retail company had purchased the Kiva system, noted, “[Kiva] was definitely [geared toward] job simplification, for the most part. Compared to using an RF scanner [where] you’ve got all these menu options, the Kiva was very simple, so you can hire temporary labor to fill in and be productive in a short period of time. That was a benefit, being able to shorten the training times.”

Other technology developers have followed suit. One such project explicitly markets their follow-me AMR, Chuck, as a way to simplify the picking process through a “fully directed workflow”: it leads workers across the warehouse, pacing them as they walk and pick, and streamlines the process of order selection. The shortened training time and simplified interface helps to reduce employee turnover costs and, as the technology company CEO stated at an industry conference, allows employers to rely more heavily on temporary staffing. De-skilling often puts downward pressure on wages and may facilitate the use of temporary workers. For workers, this may lead to wage stagnation and increases in job insecurity.

Other Processes Subject to Possible De-skilling

Beyond the each-picking order-assembly process, the content of other warehouse activities could be de-skilled in the near future. The system for receiving a truckload of goods into a warehouse involves multiple processes that are targets for AI. Shipping and receiving clerks verify that the goods on an inbound truck match what the vendor reportedly sent, and manage inbound and outbound documentation and allocation—a time-consuming process. For one interviewee’s company, a home improvement retailer, this task became a priority for automation, since much of it is repetitive and routine. “Almost all of our paperwork is now automated. It’s not as sexy as robots driving forklifts, but the reduction in workforce was eight or nine people across all the shifts.” Other interviewees echoed the eagerness for automating parts of the receiving process and the subsequent reduction in headcount such automation enables.

The application of AI to shipping and receiving tasks is gaining traction, especially at a time when inventory accuracy—knowing exactly how much product is on hand at any given moment—is becoming increasingly important. AI has many additional warehouse applications, including capturing and analyzing data on equipment utilization, slotting goods within the warehouse, and issuing pallet-building instructions, and the WMS is the most likely place for the AI to reside. All of these applications have the potential to shift decision-making tasks away from workers and reduce the skill content of certain positions. It’s possible that companies will invest in software and AI applications in order to forgo the expense of making large capital investments, instead using more cost-effective software enhancements to gain efficiencies and bide time until lower-cost hardware solutions can be identified. This likely would cause AI-induced de-skilling to occur more quickly than other forms of technological change.

Another occupation at risk of potential de-skilling is forklift drivers. Automated guided vehicles, or AGVs, are designed to replace traditional forklifts. One motivating factor for the use of AGVs is that forklift drivers often are some of the highest-paid nonsupervisory workers because of their specialized skill set. Yet AGVs can cost many times more than a standard forklift, making a satisfactory return on investment at this time difficult to achieve.

While there appears to be significant interest in how AGVs can improve productivity in warehouses, there are complications for the adoption of AGVs. Perhaps the most difficult to reconcile is that precision forklift movements have proven difficult to automate. One possible scenario is for AGVs to move products horizontally across a facility, and for humans to perform the precise vertical movements of placing or removing a pallet. This effectively would divide forklift driving into distinct subtasks, while removing skilled labor from the easier-to-automate activities.

Upskilling vs. Labor Reallocation

While it is possible, in principle, for new technologies to produce upskilling effects in the sector, there is little evidence of this occurring at this time. One example of upskilling could be cases in which robots that augment or replace workers need ongoing maintenance, and companies are able to shift work hours from more-manual, routinized activities to higher-skilled maintenance tasks. However, robots-as-a-service introduces a model in which the responsibility for monitoring and maintaining the robots lies offsite with the leasing entity, rather than the warehouse that uses the equipment. A similar dynamic holds true for robotic picking machines that require human intervention to learn how to grasp particular objects, but these jobs are offsite. In these cases, a pathway from less to more skilled work for workers whose jobs might change or be eliminated by robots is unlikely. Other technologies and ownership models might offer more opportunities for higher-skilled work to remain onsite.

In order for incumbent workers to move from less-skilled to more-skilled labor, training infrastructure is required, either through public-sector workforce development systems or within a company. For example, Amazon has proposed a large program to retrain 100,000 existing workers for higher-skilled technical jobs.⁶⁵ Most warehouse operators are unlikely to invest in retraining programs at scale, given the cost constraints of the industry, and thus a more probable outcome than the upskilling of low-skill job functions is limited labor reallocation to other tasks. Interviewees often pointed to the ability to shift workers from menial tasks to those that are less routine and require greater problem solving. At the same time, however, interviewees also conceded that the point of automation is to improve productivity and/or reduce headcount. Labor reallocation in warehousing appears likely to be little more than a provisional stage of technological advance.

3. New technologies are likely to transform how workers are managed.

Algorithmic management introduces new forms of workplace control, where the technological regulation of workers' performance is granular, scalable, and potentially relentless. Capturing worker productivity data has relied largely on widely used RF scan guns, but in the past productivity tended to be calculated at an aggregate level. Newly available products, such as "wearable" warehouse technologies, follow-me carts, and increasingly sophisticated labor management software, allow more granular tracking of workers' movements, including walk speed, routes, bottlenecks, and break time. Coupled with productivity algorithms, these systems can dynamically urge workers to increase speed, and identify efficiency, accuracy, and movements at the individual worker level. At the same time, however, such close monitoring of workers and uncompromising electronic management could corrode working conditions and employee morale.

Worker Monitoring

Sensors and wearable technologies are used to track twisting, bending, walking, and other movements—or breaks—of a worker. Amazon made headlines in 2018 when the company announced patents on a wristband for warehouse workers.⁶⁶ The wristbands, developed in the name of greater efficiency, track and guide workers' hands toward product locations by sending feedback to workers when their hand is in close proximity of the pick location. The digital scrutiny necessary to relay such fine-grained spatial information immediately raised questions concerning workers' rights to privacy and the extent of control a company should be able to exert over its employees.

The Amazon patent points to a device that is many steps beyond the current generation of hands-free RF scanners. Other wearable technologies, such as Modjoul's Smart Belt, include sensors that gather location and motion data into a dashboard for analysis and action. Exoskeletons, while not widely used today, would be worn by workers to support parts of the body likely to experience strain or undue exertion.⁶⁷ They conceivably could reduce exhaustion for workers, but their value may lie more in the data the devices capture about workers' precise bodily movements as they navigate their job tasks. Data collected from these devices would be invaluable to technology developers seeking fine-grained data inputs for the next generation of robots, while also shifting the ways in which employers manage their workforce.

Technologies such as sensors can collect sensitive data on workers' every move.⁶⁸ The data are valuable to warehouse operators, since they monitor worker productivity as well as safety hazards. Yet the same technologies that are augmenting worker movements also are surveilling them. The experience of workers with some new technologies is one of increasing atomization from each

other, removing opportunities for social interaction and on-the-job problem solving. Finally, new technologies are enabling increased worker monitoring and tracking, and the extent of data collection and storage, as well as decisions regarding future use, are not transparent to workers, raising significant privacy concerns.

Scheduling

Another form of algorithmic management is just-in-time scheduling. Well-established in other sectors, most notably retail, scheduling software like Kronos allows managers to dynamically flex workforce size up and down. For workers, algorithmic scheduling has led to greater insecurity in their work hours, leaving some to be essentially “on call” for their employer with no guarantee of being assigned shifts, or having little notice of changes in scheduling. There are, however, ways of using algorithmic scheduling such that the practice includes workers’ preferences for availability and gives workers adequate notice of changes to the schedule; these practices have been shown to improve worker productivity and sales.⁶⁹ While scheduling software is not in wide use today, based on interviews for this project, interest appears high in applying just-in-time scheduling in the warehouse.

The conditions of work in warehouses may be heading toward more rigid forms of monitoring and management. If warehouse workers had little autonomy under existing forms of management, a new regime of machine surveillance could make working conditions more unforgiving. With little transparency into the algorithms being used, employees may question whether the same standards are being applied across the workforce.

4. In the short to medium term, new technologies likely will not cause widespread job loss.

With continued growth in demand, aggregate employment levels in the warehousing industry likely will continue to rise over the next five to 10 years. That said, job growth may be tempered by the increased use of labor-saving technologies in e-commerce warehouses in particular. Many workers will see their working conditions shift as technologies are adopted for particular tasks. Over the long term, in the absence of major shifts in the economy or context of firms’ technological adoption strategies, the increasing use of technology points to a labor reduction.

Some warehouse technologies that are labor-replacing include:

- Automated storage and retrieval systems (ASRS), which are highly efficient but also costly, decreasing the size of the potential market that might adopt this technology; the main impact on workers of ASRS uptake is to reduce employment, since by design it replaces the need for order pickers.

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- Autobaggers and autoboxers that automatically package outbound orders; in a high-volume e-commerce operation, managers report the elimination of 20 to 30 packing workers through the application of automation to the packing process.
- Sensors or RFID tags applied to goods, which allow warehouse operators to track the location and quantity of inventory through a centralized dashboard, rather than relying on workers to count and track products.
- Similarly, drones that automatically perform inventory counts are the subject of widespread interest, but are active in very few warehouse environments at this time because of cost.⁷⁰

Section 4 of this report detailed a set of push factors and constraints that form the current context for technological advances in warehousing. The push factors include tight labor conditions, rising real estate costs, and increased speed requirements; whereas the constraints are the variability in the industry, outsourcing dynamics, inertia, and the state of technology. Significant shifts in any of these dynamics could shorten the timeline for labor replacement and thus job loss. For example, unloading containers requires significant manual labor, and major industrial equipment companies such as Honeywell have developed massive robotic unloading machines that substantially reduce the offloading time and all but eliminate workers from the process. But these technologies still are limited by variable conditions: all boxes in a container must be uniform in size and fall within particular weight parameters, circumstances that remain rare in warehouses today. Without standardization of goods within containers, or a leap forward in the technology's ability to deal with variability, these advances likely will be slow to proliferate.

Finally, the flip side of technologies applied to the above processes is that some products and activities are less amenable to technological applications. The most prominent category is “nonconveyables,” or goods that are too big, heavy, awkward, or varied to move using a conveyor system. Examples include hot tubs and canoes, but also perishable foods like meat and some produce. Nonconveyables often are routed into separate inbound and outbound handling processes because they require manual handling, and some companies outsource the distribution of nonconveyables completely to shed the inefficient operation. Nonconveyable goods handling presumably will remain a largely manual process for the foreseeable future, not subject to reductions in employment opportunities.

Newly available products, such as “wearable” warehouse technologies, follow-me carts, and increasingly sophisticated labor management software, allow more granular tracking of workers’ movements, including walk speed, routes, bottlenecks, and break time.

5. Technology is likely to have uneven impacts across demographic groups and occupations.

Technological change, as was noted earlier, is often uneven in its effects across the labor force. Some technologies will disproportionately impact the employability of older workers, such as engineered labor standards that penalize workers for not reaching exacting productivity targets. Furthermore, new technologies could be especially detrimental to the earnings of certain groups of workers, especially in warehouses that use merit pay or bonuses for productivity as core elements of employee pay. Older workers also may find new workplace technologies more intimidating than their younger counterparts, given that younger workers are more likely to have encountered computerized systems at work or at school.

Women Warehouse Workers

Women are more likely to work in e-commerce fulfillment centers than in traditional warehouses, which expands the employment prospects available to women workers in a traditionally male-dominated industry. Table 2.3 showed that across all occupations, 44% of workers in the warehousing segment of the e-commerce sector are women, versus 28% of workers in traditional warehousing. Yet, as Section 2 showed, there is a wage penalty for some e-commerce occupations relative to traditional warehouses, which suggests that a shift of work hours to e-commerce in effect could reduce overall wages. For example, nearly half (48%) of e-commerce stock clerks and order fillers are women, yet stock clerks in e-commerce earn \$2.32 less per hour than their counterparts in the warehousing industry. Further research is required to determine whether the observed wage differentials reflect a gender bias in pay or whether the pay structure in e-commerce facilities is lower regardless of workers' gender.

In addition, e-commerce order volatility translates into greater scheduling instability, and perhaps extended periods in which nominally full-time workers are employed part time. Conversely, mandatory overtime, particularly on short notice, can be especially difficult for workers with child care responsibilities, which suggests that women would be disproportionately affected by scheduling uncertainty. In short, while e-commerce may offer new employment opportunities to women, some of the benefits of employment could be counteracted by the instabilities that are endemic to warehousing activities.

Summary Occupational Analysis

The following analysis focuses on the effects of technology on the five largest front-line occupations in warehousing, which account for nearly two-thirds of all workers in the industry. The variation in the demographic makeup of these occupations portends uneven exposure to

technological change. Bear in mind that for the industry as a whole, Latinx and Black workers are overrepresented compared with the total U.S. workforce: both groups are employed in warehousing at roughly twice the rate of all of other industries. Male workers also are disproportionately represented: while 47% of the U.S. workforce is male, 72% of workers in warehousing and 56% in e-commerce are male.

Laborers and Freight, Stock, and Material Movers, Hand Stock Clerks and Order Fillers Packers and Packagers, Hand

The three occupational categories above are used somewhat interchangeably for picking, packing, sorting, and shipping jobs in a warehouse. Warehouse workers who are involved in order picking might be counted in any of these occupations, and thus this report considers the effects of technology on order picking across the three categories. Together, these three occupations account for 43% of all warehousing industry jobs and 67% of front-line warehousing jobs.

Recent employment growth suggests that even though technology will be used increasingly in the order-picking process, significant net job losses in the industry are unlikely to occur over the next five to 10 years. This forecast relies, however, on the continued growth of e-commerce and the robust health of the U.S. economy. Further, depending on the widespread adoption of certain technologies, productivity improvements might slow employment growth. These three warehouse occupations may have the highest exposure to technological change because of their prevalence in e-commerce warehouses, coupled with warehouse operators' stated goal to apply technologies to the each-picking process. Conversely, order assembly still will require human pickers for some time to come. Although there is considerable excitement in the industry over the potential of robotic grippers, it likely will be many years before a dexterous robotic picking arm with near-perfect picking accuracy will be available at a sufficiently low price point for it to be widely adopted.

The demographics of workers in these occupations differ somewhat between the warehousing and e-commerce industries, so the workers most likely to be affected by technological change are worth specifying in detail. As Table 6.1 shows, workers in order-picking occupations in e-commerce are more likely than their counterparts in warehousing to be female, White and young. While warehouse workers are more likely to be male in both industries, female workers make up 45% of this workforce in e-commerce, compared with 34% in warehousing. White workers constitute the largest race/ethnic category in

E-commerce order volatility translates into greater scheduling instability, and perhaps extended periods in which nominally full-time workers are employed part time.

e-commerce (45%), while Latinx workers are the largest single race/ethnic group in warehousing (36%). Black workers account for roughly one-quarter of the workforce in both industries. Finally, young workers, particularly those ages 18–24, are the largest age group in both industries.

TABLE 6.1
Demographic Characteristics of Workers in Order-Picking Occupations*

	Percent of Workers in Picking Occupations in Warehousing Industry**	Percent of Workers in Picking Occupations in E-commerce Industry***
Gender		
Male	66%	55%
Female	34%	45%
Race/Ethnicity		
Black, Non-Latinx	26%	26%
Hispanic or Latinx	36%	19%
Asian, Non-Latinx	4%	6%
White, Non-Latinx	32%	45%
Other, Non-Latinx	2%	4%
Age		
18–24	29%	37%
25–34	28%	26%
35–44	17%	16%
45–54	15%	12%
55–64	8%	7%

Source: American Community Survey 2013–2017

*Order-picking occupations are Laborers and Freight, Stock, and Material Movers, Hand; Packers and Packagers, Hand; and Stock Clerks and Order Fillers.

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Depending on the technology implemented, workers in these three occupations may see their travel distances within warehouses decrease, since walking is a high-priority activity for the application of new technologies. This might improve the quality of these jobs somewhat by reducing the need for walking and cart pushing, though, as noted in the previous section, employees likely will experience work intensification alongside automation. Human dexterity will be required for the process of grasping of products and placing goods in either boxes or in totes to be moved to the next task station, so workers in order-picking occupations will continue to perform these tasks and likely see their productivity expectations rise. For workers packing orders into boxes and bags for shipping, autoboxing and autobagging technologies could reduce employment opportunities.

Industrial Truck and Tractor Operators (Forklift Drivers)

The most likely technology that would affect this occupational category is the automated guided vehicle (AGV), a well-developed but still costly solution. Forklift drivers require skill and certification, and often command slightly higher wages than other warehouse workers—in fact, forklift drivers are the highest-paid of front-line warehouse workers, and overwhelmingly male (Table 6.2). White and Latinx forklift drivers make up the largest race/ethnic groups in both warehousing and e-commerce, and Black workers account for roughly one-quarter of forklift drivers. Compared with other warehouse occupations, forklift drivers are more likely to be older.

Simple horizontal pallet moves are easily handled by AGVs, though vertical moves—lifting and placing a pallet on racking—require precision so that goods are not damaged. According to the industry insiders interviewed for this report, the current high cost of AGVs limits the feasibility of implementation in many warehouses. What may change is that companies will begin to capture more data from forklifts and drivers, with at least three possible applications: to understand equipment utilization rates, to inform and improve the next round of AGV development, and to increase the productivity of drivers.

TABLE 6.2
Demographic Characteristics of Industrial Truck and Tractor Operators
(Forklift Drivers)

	Percent of Forklift Drivers in Warehousing Industry*	Percent of Forklift Drivers in E-commerce Industry**
Gender		
Male	93%	82%
Female	7%	18%
Race/Ethnicity		
Black, Non-Latinx	26%	25%
Hispanic or Latinx	34%	36%
Asian, Non-Latinx	2%	–
White, Non-Latinx	36%	35%
Other, Non-Latinx	2%	–
Age		
18–24	18%	40%
25–34	31%	17%
35–44	24%	19%
45–54	17%	18%
55–64	10%	6%

Source: American Community Survey 2013–2017

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Shipping, Receiving, and Traffic Clerks

With the advent of AI-assisted receiving processes, this occupation could undergo significant change (Table 6.3). Freight transportation is becoming increasingly digitized in light of demands for the real-time visibility of truck shipments, though here, too, adoption is uneven across the industry. As this digital capability improves, changes at the nexus of trucking and warehousing will follow, especially in the process of scheduling truck deliveries. WMS software increasingly will integrate AI into planning functions, and these advancements will infringe on what has been the purview of workers in this occupation, possibly leading to a reduction in staffing levels. Major change will depend on the extensive uptake of these technologies, which will be led by first movers who use the most advanced WMS systems and implement digital tracking across the freight-transportation function. Males constitute the majority of workers in this occupation in both industries, and thus have a higher exposure to job change or staffing reductions. White workers make up nearly half (47%) of shipping, receiving, and traffic clerks in e-commerce, and Latinx and White workers each compose 37% of this occupation in warehousing.

TABLE 6.3
Demographic Characteristics of Shipping, Receiving, and Traffic Clerks

	Percent of Shipping, Receiving, and Traffic Clerks in Warehousing Industry*	Percent of Shipping, Receiving, and Traffic Clerks in E-commerce Industry**
Gender		
Male	69%	57%
Female	31%	43%
Race/Ethnicity		
Black, Non-Latinx	20%	26%
Hispanic or Latinx	37%	19%
Asian, Non-Latinx	4%	5%
White, Non-Latinx	37%	47%
Other, Non-Latinx	3%	4%
Age		
18–24	27%	38%
25–34	30%	23%
35–44	18%	15%
45–54	16%	15%
55–64	8%	9%

Source: American Community Survey 2013–2017

*NAICS 493 **NAICS 45411

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Conversely, and with effects across all occupations, warehouse facilities that do not implement new technologies likely will experiment instead with evolving labor strategies to manage demand volatility and risk, as well as to improve efficiency. This could include the increased use of mandatory or voluntary overtime, temporary staffing arrangements, additional shifts, and incentives based on productivity.

SECTION SEVEN:

Conclusion

Technology adoption is not a risk-free undertaking, and there are a number of features of the warehousing industry that inhibit innovation. Lead firms are likely to be in the most advantageous position when it comes to experimenting with new technologies, and e-commerce is driving this trend. Large retailers like Amazon, for example, may be able to leverage both their sizeable order volumes and strong financial positions to secure first-mover advantages through early adoption of new technologies. Furthermore, because they manage their supply chains, and therefore set contracting arrangements, lead firms are not subject to short contract terms and other provisions that elevate the risks incurred when making substantial investments in new technologies. With this said, however, impediments still remain. For the foreseeable future, product variability will continue to present challenges to automation, as do fluctuating order volumes and the overall volatility of consumer demand. Large and small firms alike can face these constraints, and though lead firms certainly have incentives to make investments in logistics infrastructure, such constraints nevertheless serve to slow experimentation.

Most 3PLs face even greater challenges. Chief among these is the cost-based competition that is a defining characteristic of the warehouse industry. Cost-based competition holds down the margins of warehouse operators, and when combined with short subcontract terms, it renders technological experimentation a risky endeavor. Even under the best of circumstances, technological experimentation exposes warehouse operators to financial risks, and the need to secure an adequate return on investment plays a decisive role in technology-spending decisions (especially given that macroeconomic changes can sharply shift patterns of consumer spending). Short contract terms exacerbate these risks, and without the assurances provided by strategic, long-term partnerships with lead firms, a cautious approach to experimentation will prevail. Moreover, because securing upfront investment may prove challenging, especially given the low margins and the general absence of long-term contracts, most operators have taken a cautious approach, which has moderated the scope and pace of change.

For these reasons, widespread full automation of warehouse occupations is little more than a remote possibility over the near to medium term, despite the rapid technological advances that are being made. To the extent that technological adoption occurs within this timeframe,

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experimentation is more likely to occur among lead firms than in the 3PL market, though the possibility of diffusion from early-adopting lead firms to other operators remains.

Partial automation and labor augmentation, on the other hand—where a particular subset of occupational tasks or activities lends itself to a viable technological application—are far more realistic objectives. In the majority of cases, labor augmentation likely will be the most common path of short- and medium-term technological change, and has the potential to alter the content and quality of workers' jobs significantly. It is conceivable that workers will stand to benefit from ergonomic improvements as new technologies replace walking, lifting, repetitive motion, and other physically demanding activities. Where such improvements in health and safety are made, it is imperative that they are not compromised by work intensification. Advances in warehouse ergonomics, including reductions in strenuous, manual activities, could be accompanied by increasing demands on the pace of work and sharply rising workloads. Work intensification could lead to the introduction of new hazards on the job, arising from the presence of new technologies in the workplace or from worker fatigue.

Another possible outcome resulting from the implementation of new technologies is de-skilling. From the perspective of the warehouse operator, de-skilling can enable reductions in worker training time and turnover costs. Simplifying work tasks allows employers to expand the potential labor pool and increase the use of temporary workers. The impacts on workers, however, can be deleterious, leading to further wage stagnation and erosion of job stability.

Over the long run, especially as the technologies being implemented today are used to collect data that will inform the development of next-generation robotics, automation will become more widespread. But the negative effects on employment levels are not predetermined. In one prominent example of automation without worker displacement, Boxed outfitted its distribution center with leading-edge automated processes. Instead of laying workers off, the company trained them to fill new roles around the equipment. This was possible, however, because of the rapid growth of the business: automation allowed Boxed to handle increasing volumes without more workers, and this enabled the return on technology investments. However, even in this case, should growth slow or reverse, this strategy might not be sustainable.⁷¹

The findings from this research raise a number of questions for policy makers, worker organizations, and industry leaders.

Variation in adoption is likely to be an ongoing feature of technological change in the warehousing industry. As a result, effects on facilities and workforces will differ, requiring careful attention to avoid disproportionate impacts on workers who have higher exposure to job change and eventual job loss, especially workers of color (who are disproportionately represented in front-line warehousing occupations) and women (who are more likely to work in e-commerce).

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How can policy makers, equipped with forward-looking information, help to plan and prepare for changes in job quality and the potential unequal distribution of the costs and benefits of technology adoption? What new policies might promote job security to help support workers and their families as technologies change the nature of warehouse work?

A number of the new technologies covered in this report introduce workplace dynamics that have few precedents. The growing use of technology to monitor and manage workers raises ethical issues regarding data privacy, as well as concerns about workplace morale, as electronically mediated forms of supervision threaten to constrain workers' autonomy and introduce new rigidities into the workplace. These, in turn, could lead to increased employee turnover. Algorithmic transparency, data privacy, and worker surveillance are nascent issues that require serious attention by industry leaders, worker organizations, and policy makers. *How might including workers in the process of technology implementation improve employment and operational outcomes? What safeguards might be necessary in order to ensure workers' data are protected?*

Little is known about the range of effects new technologies will have on health and safety over the long run, and it is possible that technologies will have both positive and negative implications for jobs and workers. Workers might feel increased stress and anxiety as a result of electronic monitoring, ergonomic benefits might be coupled with new health and safety risks, and increasing productivity requirements might lead to exhaustion and overwork, possibly hampering employers' efforts to attract and retain workers. *What measures can be put in place to track the physical and psychological impacts of technologies on workers to mitigate any negative effects on workers' health and safety? How might developers' research and design efforts better incorporate an assessment of the full effects of new technologies on workers' well-being?*

Finally, proactive measures are necessary to support workers who are displaced by new technologies to transition to alternative employment opportunities. It is conceivable that, over the long term, the warehousing industry will offer fewer employment opportunities. Policy makers and employers can begin planning today for programs that will prepare workers for nonroutine and newly created jobs in warehousing or to support them as they move to other industries. *What efforts can ensure a safety net for labor market dislocations caused by the introduction of new technologies in order to ease the burden on displaced workers? How can policy makers involve employers in systematically identifying within-industry job opportunities for displaced workers, including on-the-job training?*

Warehouse operators stand to gain substantial efficiencies through technological advances. How these gains will be distributed, especially given the findings of this report, is a pressing question for policy makers, worker organizations, and industry leaders alike. Warehouse operators have latitude in determining how new technologies will be implemented. It is imperative that productivity gains be shared, that workers be involved in identifying which efficiencies should be prioritized and what hazards are being introduced, and that experimentation unfolds with regard for more than just productivity increases. Absent this, the process of technological change in warehousing will resemble a win-lose proposition, where the short-term benefits are captured by the industry and the long-run costs are borne by workers.

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Institute for Research on Labor and Employment
University of California, Berkeley
2521 Channing Way
Berkeley, CA 94720-5555
(510) 642-0323
laborcenter.berkeley.edu



2102 Almaden Rd. Suite 112
San Jose, CA 95125
(408) 809-2120
wpusa.org



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Working Partnerships USA is a community organization bringing together the power of grassroots organizing and public policy innovation to drive the movement for a just economy. Based in Silicon Valley, it tackles the root causes of inequality and poverty by leading collaborative campaigns for quality jobs, healthy communities, equitable growth and vibrant democracy. WPUSA builds the capacity of workers, low-income neighborhoods and communities of color to lead and govern.

EXHIBIT 2

EXHIBIT 3

Ruthless Quotas at Amazon Are Maiming Employees

This holiday season, Amazon will move millions of packages at dizzying speed. Internal injury reports suggest all that convenience is coming at the expense of worker safety.



Paul Kuroda / Reveal

Story by Will Evans

NOVEMBER 25, 2019 | **TECHNOLOGY**

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This story is a collaboration between The Atlantic and Reveal from the Center for Investigative Reporting. Sign up to read more stories from Reveal.

WHEN CANDICE DIXON showed up for her first day of work at an Amazon warehouse in Eastvale, California, she stepped into a wonder of automation, efficiency, and speed. Inside the sprawling four-story

building in Southern California's Inland Empire, hundreds of squat orange robots whizzed across the floor, carrying tall yellow racks.

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As a stower, her job was to stand in a spot on the floor, like hundreds of others in that million-square-foot warehouse, and fill an unending parade of merchandise racks. Another worker, known as a “water spider,” would bring her boxes upon boxes of goods—jars of protein powder, inflatable unicorn pool floats, laptops, makeup, Himalayan sea salt, vibrators, plastic toy cars. She'd grab each item out of a box, scan it, lift it onto the rack, and scan its new location. She'd use a stepladder to put things on the top of the rack. For heavy items—she remembers the cases of pet food in particular—she'd have to squat down to hoist them in, then pop back up to grab the next item. As soon as she'd filled a rack, she'd press a button, and one robot would zip it away while another robot would bring a new one to fill.

The moment an Amazon customer clicked “place your order,” a robot would haul one of those racks to a picker, who would grab the right item for the order and send it on a series of long conveyors to a packer, who would stuff it in one of those familiar, smiling cardboard boxes.

The clock was always ticking on Amazon's promised delivery time. Dixon had to scan a new item every 11 seconds to hit her quota, she said, and Amazon always knew when she didn't.

Dixon's scan rate—more than 300 items an hour, thousands of individual products a day—was being tracked constantly, the data flowing to managers in real time, then crunched by a proprietary software system called ADAPT. She knew, like the thousands of other workers there, that if she didn't hit her target speed, she would be written up, and if she didn't improve, she eventually would be fired.

Amazon's cutting-edge technology, unrelenting surveillance, and constant disciplinary write-ups pushed the Eastvale workers so hard that in the last

holiday season, they hit a coveted target: They got a million packages out the door in 24 hours. Amazon handed out T-shirts celebrating their induction into the “Million Unit Club.”

Rachel de Leon / Reveal

But Dixon, 54, wasn't around for that. She started the job in April 2018, and within two months, or nearly 100,000 items, the lifting had destroyed her back. An Amazon-approved doctor said she had bulging discs and diagnosed her with a back sprain, joint inflammation, and chronic pain, determining that her injuries were 100 percent due to her job. She could no longer work at Amazon. Today, she can barely climb stairs. Walking her dog, doing the dishes, getting out of her chair—everything is painful. According to her medical records, her condition is unlikely to improve.

So this holiday-shopping season, as Amazon's ferocious speed is on full display, Dixon is at a standstill. She told Reveal in mid-October that her workers'-compensation settlement was about to run out. She was struggling to land a new job and worried she'd lose her home.

“I'm still too young to feel like I'm 90 years old,” Dixon said, sitting in the living room of her Corona, California, home, which was decorated with inspirational sayings (“You never know how strong you are until being strong is the only

choice you have”). “I don’t even know how I’m going to make it in a couple of months.”

AMAZON’S FAMOUS SPEED and technological innovation have driven the company’s massive global expansion and a valuation well over \$800 billion. It’s also helped make Amazon the nation’s second-largest private employer behind Walmart, and its CEO, Jeff Bezos, one of the richest humans on Earth. Now an investigation by Reveal from the Center for Investigative Reporting has found that the company’s obsession with speed has turned its warehouses into injury mills.

Reveal amassed internal injury records from 23 of the company’s 110 fulfillment centers nationwide. Taken together, the rate of serious injuries for those facilities was more than double the national average for the warehousing industry: 9.6 serious injuries per 100 full-time workers in 2018, compared with an industry average that year of 4.

While a handful of centers were at or below the industry average, Reveal found that some centers, such as the Eastvale warehouse, were especially dangerous. Dixon’s was one of 422 injuries recorded there last year. Its rate of serious injuries—those requiring job restrictions or days off work—was more than four times the industry average.

[Austin Murphy: I used to write for ‘Sports Illustrated.’ Now I deliver packages for Amazon.]

“According to Amazon’s own records, the risk of work injuries at fulfillment centers is alarmingly, unacceptably high,” said David Michaels, the former head of the federal Occupational Safety and Health Administration, who is now a professor at George Washington University’s public-health school. “Amazon needs to take a hard look at the facilities where so many workers are being hurt and either redesign the work processes, replace the top managers, or both, because serious-injury rates this high should not be acceptable to any employer.”

Amazon officials declined repeated interview requests. Instead, a company spokesperson, Ashley Robinson, provided a written response to some of Reveal’s questions. Robinson said Amazon’s injury rates are high because it’s aggressive

about recording worker injuries and cautious about allowing injured workers to return to work before they're ready.

“We know that by making a conservative choice to *not* place an injured associate back into a job, we are elevating restricted and lost time rates as a company, but with the intent to benefit the associate,” Robinson wrote.

Many workers said that was not their experience. They spoke with outrage about having been cast aside as damaged goods or sent back to jobs that injured them further. Dixon said she had doctor orders not to pull or lift heavy objects and to alternate between sitting and standing, but she wasn't given a chair and heavy boxes kept coming her way.

“For Amazon,” Dixon said, “all they care about is getting the job done and getting it out fast and not realizing how it's affecting us and our own bodies.”

The company does instruct workers on the safe way to move their bodies and handle equipment. But several former workers said they had to break the safety rules to keep up. They would jump or stretch to reach a top rack instead of using a stepladder. They would twist and bend over to grab boxes instead of taking time to squat and lift with their legs. They would hoist extra-heavy items alone to avoid wasting time getting help. They had to, they said, or they would lose their jobs. So they took the risk.

Then, if they got hurt, they would lose their jobs anyway. Even some workers who loved the pace, camaraderie, and compensation at Amazon's fulfillment centers told Reveal that they were quickly replaced as soon as their bodies broke down.

The problems Reveal uncovered go far beyond common sprains, strains, and repetitive stress injuries. When a gas leak inundated the Eastvale warehouse where Dixon used to work, managers wouldn't slow down, several workers said, even though they were dizzy and vomiting. They were told that they'd have to use personal time off if they wanted to leave.

And when disaster struck at one Indiana warehouse, Amazon's economic might may have helped the company evade accountability. When a maintenance worker

was crushed to death by a forklift there, state officials in Indiana, which then was jockeying for Amazon's second headquarters, sided with the company over their own investigator. "When you order something from Amazon and you've worked inside Amazon, you wonder, 'Hey, is ordering my package going to be the demise of somebody?'" said one former safety manager, who had worked at multiple Amazon facilities.

THE ROOT of Amazon's success appears to be the root of its injury problem, too: the blistering pace of delivering packages to its customers.

Amazon's busiest season, which the company calls "peak," begins with the run-up to Black Friday. Amazon said it shipped Prime members more than a billion items last holiday season. This year, Amazon has a new promise: free one-day delivery for Prime members.

It's also crunch time for the human body. Employees face the exhaustion of mandatory 12-hour shifts, and warehouses are crammed with seasonal workers unaccustomed to the grind. The company's 2018 logs show that weekly injury counts spiked at two distinct moments when Amazon offered special deals: Cyber Monday and Prime Day.

[Read: What Amazon thinks you're worth]

Robinson, the Amazon spokesperson, said total injuries do go up during those peak times, but that's only because the company brings on more workers then. Robinson said the rate of injuries historically has stayed steady, or even decreased, at peak times. Amazon declined to provide data to back up that claim.

As ever-increasing production targets flow down from corporate, regional managers lean on warehouse directors, who put pressure on the supervisors, who oversee all those water spiders, stowers, pickers, and packers. And the key to advancement is great production numbers.

"It incentivizes you to be a heartless son of a bitch," said a former senior operations manager who had leadership roles at multiple facilities.

The former senior operations manager described going from the omniscient ADAPT system to an Amazon competitor, where he had to search occasionally

updated Excel spreadsheets to find productivity numbers.

Marc Wulfraat, president of the supply-chain and logistics consulting firm MWPVL International, described Amazon as more aggressive than any other industry player in what the company expects from workers. “And they will not waste time hanging on to people who can’t perform,” he said.

The Amazon tenure of Parker Knight, a disabled veteran who worked at the Troutdale, Oregon, warehouse this year, shows the ruthless precision of Amazon’s system. Knight had been allowed to work shorter shifts after he sustained back and ankle injuries at the warehouse, but ADAPT didn’t spare him. Knight was written up three times in May for missing his quota.

The expectations were precise. He had to pick 385 small items or 350 medium items each hour. One week, he was hitting 98.45 percent of his expected rate, but that wasn’t good enough. That 1.55 percent speed shortfall earned him his final written warning—the last one before termination.

“You are expected to meet 100 percent of the productivity performance expectation,” the warning reads. Days later, the company informed him he was being fired because of an earlier confrontation over workers’-compensation paperwork.

Robinson said Amazon has performance expectations “like most companies.”

“We measure actual performance against those expectations,” she said. “Associate performance is measured and evaluated over a long period of time—at least six weeks—as we know a variety of things could impact the ability to meet expectations in any given day or hour.”

The company’s aggressive production demands have overwhelmed its safety teams’ efforts to protect workers, according to five former Amazon safety managers, who oversaw safety at fulfillment centers around the country and spoke on condition of anonymity because they feared retaliation.

One of them, a former senior safety manager, said it’s well known internally that the injury rates are too high, but there’s no way Amazon will slow down. “It’s not

a conversation that can be had,” the former manager said. “We’re never going to fix safety at Amazon, because we’re never going to fix what the real issue is.”

AMAZON IS FOND of showing off its industry-changing innovation: The fleets of robots, it claims, not only speed up production; they also make employees’ jobs easier and safer. Instead of having to walk miles of warehouse floor every day, pickers stand in one spot as robots come to them.

But injury records and interviews with three of the former Amazon safety managers suggest the introduction of the robots led to even more injuries. Of the records Reveal obtained, most of the warehouses with the highest rates of injury deployed robots. One robotic facility in Kent, Washington—which a senior operations manager boasted was “the flagship of fulfillment,” as one of the few centers in 2016 to ship a million packages in a day—logged 292 serious injuries last year, for a rate of about 13 serious injuries per 100 workers.

(Jason Raish)

After Amazon debuted the robots in Tracy, California, five years ago, the serious-injury rate there nearly quadrupled, going from 2.9 per 100 workers in 2015 to 11.3 in 2018, records show.

Jonathan Meador watched the transition from his position loading boxes into big-rig trailers. The robots at the Tracy warehouse were so efficient that humans could barely keep up. Suddenly, the pickers and packers were expected to move more products every minute, and more boxes shot down the conveyor belt toward Meador.

“Before robots, it was still tough, but it was manageable,” he said. Afterward, “we were in a fight that we just can’t win.”

The Oregon facility where Knight worked opened with robotics in August 2018 and had the highest serious-injury rate Reveal found: nearly 26 per 100 employees, more than six times the industry average.

New warehouses sometimes are rushed to open before they’re ready, said two of the former safety managers, leading management to skimp on training and start operations without full safety teams in place.

Robinson declined to comment on the elevated injury rates at robotic warehouses. But she said Amazon doesn’t launch new buildings until they are “ready and safe for employees.”

I NJURY RECORDS are supposed to be one way of holding companies accountable for their safety culture. The U.S. Department of Labor under the Obama administration proposed posting them online, but under President Donald Trump, the agency has reversed course and also fought public-records requests. And Amazon has resisted making its own safety records public.

Reveal filed multiple requests to OSHA for injury records from Amazon facilities in more than a dozen states, many of which were released with critical information redacted; Reveal has filed suit to challenge those redactions.

Still, by law, employers must provide complete injury records to any current or former employee who requests them. Reveal reached out to Amazon warehouse workers past and present and explained how to request records for their work site, ultimately receiving 2018 records for 23 fulfillment centers in 14 states. Two of the injury logs came from a collaboration of worker advocacy groups, including New York Communities for Change and Make the Road New York.

Reveal now is seeking to compile the remaining injury logs. (If you’ve worked for Amazon, here’s how you can get the records and share them with Reveal.)

In at least a dozen cases, Amazon either ignored these employee requests or provided only partial records, in apparent violation of federal regulations.

Amazon told some workers that they were entitled only to the records for the time period they worked there; an OSHA spokesperson, Kimberly Darby, said that's incorrect. And when Amazon did provide records, warehouse managers used identical language to call them confidential and request they be kept secret. Yet OSHA guidance says, and Darby confirmed, that employers are not allowed to restrict workers from sharing the records. Some workers said they felt intimidated by the notice, fearing they might get sued by Amazon for sharing the records with a news organization.

Several years ago, according to three of the former safety managers, Amazon had a policy for systematically hiding injuries. A former safety specialist in a warehouse confirmed their account. He said higher-ups instructed him to come up with justifications for not recording injuries that should have been counted by law.

After OSHA cited Amazon for failing to record dozens of injuries at a New Jersey warehouse in 2015, Amazon changed the practice, and the former safety managers said the company became more diligent about counting injuries. (OSHA requires companies to record work-related injuries on official logs only when they result in days away from work, job restrictions, or medical treatment beyond first aid.)

Robinson said that Amazon never had a policy for underreporting injuries but that in 2016, it implemented a policy change after recognizing the challenge of ensuring “consistency and accuracy.”

“Amazon took the decision to shift to a fully transparent reporting model as we would rather over-report and lead in this space for our associates’ safety than optimize for optics,” she said.

The former senior safety manager said some warehouse managers still found ways to avoid directing workers to the on-site health clinic—such as sending them to the break room instead—so their injuries wouldn't get recorded. A few workers said supervisors would get upset if they reported injuries or sought medical treatment.

The logs Reveal obtained are scattered with lacerations and concussions and fractures, but most of the injuries are labeled as sprains and strains. The pain from these injuries can be debilitating. About a third of the injured workers had to take off more than a month to recover.

A handful of the injuries were far worse.

IN SEPTEMBER 2017, Amazon announced a search for a second headquarters, saying it would invest more than \$5 billion and bring as many as 50,000 jobs to whichever city won the sweepstakes.

Indiana Governor Eric Holcomb got the news while on a trip to Japan. He returned home on a Friday night and spent the weekend in deliberations. On Monday, he announced his state would join the bidding war. He put the Indiana Economic Development Corporation in charge of putting together a package of local and state incentives.

“We are doing what Amazon has asked us to do: coordinating efforts with all interested regions of the state to put our best bid forward,” he said in the statement.

He had tough competition. Arlington, Virginia, offered \$550 million in cash and a helipad. Atlanta dreamed up an exclusive airport lounge with free parking for Amazon executives. Maryland’s Montgomery County dangled \$6.5 billion in tax incentives.

The efforts of Indiana state officials to vie for Amazon’s interest were about to intersect with the life of one local Amazon employee, 59-year-old Phillip Lee Terry.

Terry had been at Amazon for about two years. He started as a picker in a Plainfield fulfillment center, then moved to the maintenance department. He had a background in an unrelated field—marketing—but quickly took on the task of handling complicated industrial equipment.

Terry made a surprisingly strong impact on his co-workers, even at a big, busy warehouse. He’d chat them up and make them laugh whenever he could, said Jennie Miller, who worked picking orders with Terry.

“There’s only kind of a few people that you ever meet in your life that have those kinds of sparkling personalities,” she said.

On September 24, just a few days after he’d been eating ice cream and watching college football with his grandkids, Terry showed up for work and was sent to do maintenance on a forklift. He walked under the machine’s forks and metal platform to work on it with a wrench. Suddenly, the 1,200-pound piece of equipment dropped down and crushed him.

His body lay there for nearly two hours before a co-worker noticed the pool of blood.

The next day, a safety inspector with Indiana OSHA headed to Amazon to investigate.

Safety was the family business for John Stallone. His father had worked his way up to become director of enforcement for the Alaska state branch of OSHA. Years ago, when Stallone joined the U.S. Air Force and served in Afghanistan, his father told him that wherever his career took him, to always get involved in safety work. And so he did, volunteering on safety committees in the military, then working in industrial safety in oil and gas fields. On a shelf near his front door, he keeps a collection of hard hats from his safety work around the globe.

As he surveyed the site of the accident, Stallone quickly figured out the problem: A tall pole, lying just feet away, should have been used to prop up the forklift during maintenance. In a recording he made of his inspection, Stallone asked an Amazon manager whether there was any written documentation of Terry being trained on that.

“No, sir,” the supervisor says on the recording. He told Stallone that Terry had been informally trained by a co-worker.

Stallone interviewed a co-worker of Terry’s, who put the blame on Amazon’s safety culture coming in second to production demands.

“The safety issues I’ve brought up have been dismissed and not dealt with,” the worker said in a signed statement. “I want to see the safety culture in Amazon

change and ensure the maintenance workers have the appropriate amount of training. There's no training, there's no safety, it's 'Get 'er done.' ”

Stallone (Rachel de Leon / Reveal)

Stallone repeatedly pressed Amazon to provide records showing Terry had been trained on that piece of equipment. In the end, he found that Amazon failed to provide adequate training, exposing Terry to a fatal hazard.

Indiana OSHA issued four serious safety citations, for a total fine of \$28,000. Stallone sought more, but he was getting pushback. On November 20, 2017, Stallone joined his boss, Indiana OSHA Director Julie Alexander, as she called Amazon officials. He secretly recorded the conversation, which is legal in the state, and shared the recording with Reveal.

During the call, Alexander told the Amazon officials what she'd need from them in order to shift the blame from the company to “employee misconduct,” according to the recording.

And she walked them through how to negotiate down the fines. “We sometimes like to consider grouping citations to lower the penalty amounts,” she said.

She suggested Amazon could partner with her agency as a “leader in safety” to kick off a program promoting best practices in the logistics industry.

After hanging up with Amazon, Alexander said: “They’re wanting to probably take this offer and go back and look and say, ‘Hey, we’re partnering with Indiana. We’re going to be the leader.’”

She told Stallone, “I hope you don’t take it personally if we have to manipulate your citations.”

Amazon had said it would appeal the citations and had further information that it would share in confidential settlement negotiations. Alexander wondered what it could be. Then she speculated out loud that the information might be about Terry himself, saying, “I’m guessing the guy was probably on drugs or something.”

By this point, a coroner had found nothing in his blood except nicotine and caffeine.

Stallone said he was disgusted. But the pressure to placate Amazon didn’t stop there.

Some days after the conference call with Amazon officials, Stallone said Indiana Labor Commissioner Rick Ruble pulled him into his office. The governor was there, too, standing by the commissioner’s desk, according to Stallone.

He recalled that Holcomb told him how much it would mean to Indiana if the state won the Amazon headquarters deal. Then, Stallone said, the commissioner told him to back off on the Amazon case—or resign.

Later, in early December, while the Amazon citations still were being appealed, Stallone said he was called into a meeting by his supervisors and told that he was going to be terminated over alleged job-performance issues. Stallone and a colleague with knowledge of the matter told *Reveal* that the job-performance claims were baseless and likely a pretext, levied in retribution for his pressing for the safety citations against Amazon. The meeting took place just three months after Stallone had received two awards at a staff retreat for his safety work.

Stallone said he resigned that same day; the governor’s office asserts that he was fired. Indiana state personnel records list his departure as a termination for failing to “successfully complete [a] probationary period.”

On December 6, 2017, shortly after his departure, Stallone sounded the alarm to a federal OSHA official. In an email he shared with Reveal, Stallone told the federal official that “someone higher than Director Alexander” wanted the Amazon case to go away “in the hopes it would keep Indianapolis in the running for their new HQ location.”*

The governor’s office denied the meeting with Stallone and the labor commissioner took place, with Press Secretary Rachel Hoffmeyer writing, “The Governor never gets involved in Department of Labor cases.”

The same day Stallone sent his whistle-blower email, Amazon’s corporate offices in Seattle gave a \$1,000 campaign contribution to Indiana’s governor. It was years before Holcomb would next face reelection, and Amazon hasn’t donated to him before or since.

A year after Terry’s death, Indiana officials quietly signed an agreement with Amazon to delete all the safety citations and fines. The agreement said Amazon had met the requirements of an “unpreventable employee misconduct defense.” The official record now essentially blames Terry for his own death.

At that point, Indianapolis was one of 20 finalists for the Amazon headquarters deal. Three and a half weeks after the citations were deleted, Amazon held a small-business roundtable event in Indianapolis. Holcomb was there, sitting next to a company representative.

“Our tax and regulatory climates are very—not just attractive, but enticing,” he told a local TV reporter at the event. “And we want to grow together.”

Ultimately, Indiana didn’t win the big sweepstakes; Amazon chose Arlington for its second headquarters. Federal OSHA declined to investigate Stallone’s complaint.

[Derek Thompson: Amazon’s HQ2 spectacle isn’t just shameful—it should be illegal]

The governor’s office and Indiana labor officials declined interviews. The Indiana Labor Department, which oversees the state OSHA, responded to questions about Stallone’s account of the meeting and Alexander’s statements by email,

writing that, “The allegations are nothing short of bizarre and fantastical—in addition to being absolutely false.”

In a later statement, the department said it couldn’t prove Amazon should have known Terry wouldn’t properly prop up the forklift. A Labor Department spokesperson, Stephanie McFarland, said Amazon produced proof that Terry was properly trained, including a video of Terry handling the equipment the right way another time. But the agency did not provide any documentation of Amazon’s evidence or any records that would corroborate the department’s account.

Two of the former Amazon safety managers who were aware of Terry’s death at the time faulted Amazon for failing to use formally trained maintenance professionals. One of them, the former senior safety manager, said Amazon had a systemic problem, vividly recalling a report from another warehouse in which a maintenance worker also had failed to properly brace a forklift while working on it, months after Terry’s death.

“If there was any misconduct there, it’s putting a person that has little to no experience [to work] on this piece of equipment,” said the other former safety manager, who has worked at multiple facilities. “Whoever allowed that to happen—that’s the misconduct.”

Ashley Robinson, the Amazon spokesperson, would not comment on the circumstances surrounding Terry’s death, citing privacy concerns.

Stallone was so troubled by the incident that he attended Terry’s funeral.

(Courtesy of the Terry family)

“Someone died on the job because they don’t have a good safety culture,” Stallone said. “I think Amazon was given a pass, and they were able to walk away from this fatality incident with no blood on them.”

More than two years later, Terry’s son, Zach, still thinks about his dad each day.

“I have a lot of anger built up because of everything that’s happened,” he said. “He wasn’t an accident. He was the patriarch of our family.”

CANDICE DIXON REMEMBERS her excitement when the Amazon warehouse opened in Eastvale in March 2018. The new fulfillment center would help make Amazon the Inland Empire’s largest private employer, offering a decent wage and health benefits—with no experience necessary. That fall, an Amazon executive, Dave Clark, chose the Eastvale warehouse to make the announcement that Amazon’s new minimum wage would be \$15 an hour. The hundreds of workers crowded around him broke into cheers and applause.

But the jobs, Dixon soon found, came with a brutal work pace. She and other Eastvale workers said nothing was allowed to stand in the way of Amazon’s delivery targets.

On New Year’s Day 2019, the smell of gas wafted through the giant warehouse and workers started to fall ill.

A call came in to the local 911 dispatcher just after midnight on January 2, five and a half hours into the night shift.

“There’s a lot of people sick,” an Amazon worker said.

The person on the line, Christina Van Vorce, a robotics floor monitor, had been smelling gas since the start of her shift. Some workers had been moved to another part of the building, and others were sent briefly to a break room, but the warehouse had not been evacuated, according to accounts by Van Vorce and four others at work that night. After seeing pickers throwing up into trash cans, Van Vorce clocked out to dial 911. She told the dispatcher she didn’t want Amazon to know she had called.

“Where I was at on my floor, pretty much everyone on that side felt sick,” she can be heard saying in the recording. “Two associates that I know for sure that were vomiting. One girl almost completely passed out. She had to be taken by a wheelchair. And then everyone else has got, like, headaches and the burning in the chest and the nose.”

The dispatcher said everyone should evacuate the building. Robinson told Reveal that Amazon shut down the site for about an hour and a half while a maintenance team repaired the leak. But Van Vorce told the dispatcher that management wouldn’t stop operations.

“They’re trying to tell us we have to use our personal time if we want to leave,” she says in the 911 recording.

Another worker called 911 with a similar report, saying she and her co-workers smelled gas and she had clocked out with a headache, but management wouldn’t evacuate. The fire department arrived and found that wind had damaged a gas line, funneling gas into the building.

One current Eastvale worker, who spoke on condition of anonymity, fearing retaliation, said a friend drove her to a hospital in Upland, where she spent several hours on oxygen, an account the friend confirmed. The friend said she herself ended up out of work for weeks with dizziness and headaches. Amazon’s injury logs did record one worker’s “respiratory irritation” that day.

Robinson said that before firefighters arrived, gas was shut off to the building and its safety team “assessed we had fresh air entering the building and there was no risk” to workers. She insisted that no one was hospitalized.

Van Vorce and other workers said Amazon docked their personal time off for leaving work during the leak, though Robinson told Reveal that was against company policy. She confirmed that anyone docked time off got it reversed if they complained.

“It was all about numbers,” Van Vorce said in an interview. “They didn’t want to stop production.”

If Amazon’s Eastvale leadership wouldn’t pause production for a gas leak, they certainly didn’t pause for something as mundane as a trip to the bathroom.

Bathroom visits are tracked carefully at Amazon fulfillment centers, according to multiple current and former workers and managers, with each gap in scanning labeled as “time off task.” Too much time off task can trigger a write-up, and workers describe being caught between wanting to stay hydrated and trying to avoid long treks across a giant warehouse to the bathroom.

Robinson said Amazon ensures every worker has access to a restroom a “short walk” away “whenever needed.” But she did not address whether workers are docked for such trips as time off task. It was that threat that sparked some workers to devise workarounds.

Adam Kester, who worked as a picker at a fulfillment center in Phoenix until last year, said he and other workers would bring customers’ orders into the bathroom with them to scan midway through. “It sounds disgusting,” he acknowledged.

Kristi Shrum, who worked as a stower until 2018 at another Amazon warehouse in Southern California, said she sometimes would have friends scan items for her while she went to the bathroom to make it look as though she were working. Still, she said she got multiple urinary tract infections.

“You have to hold your pee or not make your rate. Which one you want to do?” Shrum said. “I had to make my rate.”

Faith Gerdon of Anaheim said she developed urinary tract infections while working as a stower at the Eastvale warehouse last year. At one point, she got so upset that she told her supervisor, “I’m happy to bring puppy pads and pee here on the floor.”

As Eastvale—a member of last year’s Million Unit Club—again gears up for the frantic holiday season, Gerdon won’t have a chance to earn all that overtime.

Last December, injuries to both of her thumbs and wrists put her off work, according to Amazon’s logs. She hasn’t worked since.

Amazon CEO Jeff Bezos, meanwhile, is focused relentlessly on his customers.

“We are ramping up to make our 25th holiday season the best ever for Prime customers—with millions of products available for free one-day delivery,” he said in an October 24 press release about Amazon’s most recent earnings report. “Customers love the transition of Prime from two days to one day—they’ve already ordered billions of items with free one-day delivery this year.”

Rachel de Leon, Byard Duncan, Melissa Lewis, Katharine Mieszkowski, and Hannah Young contributed reporting.

* These three paragraphs were updated after Indiana’s State Personnel Department released information from the Indiana OSHA safety inspector John Stallone’s personnel record to Reveal. The circumstances of Stallone’s departure from his job became a matter of public dispute November 29, when Indiana Governor Eric Holcomb issued a cease-and-desist letter to Reveal and the *Indianapolis Star* in response to the publication of this story.

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EXHIBIT 4

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PACKAGING PAIN

Workplace Injuries in Amazon's Empire



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Executive Summary

Over the past two decades, Amazon has built a massive eCommerce empire that has transformed the way that many products get from factories to our living rooms. The company has established a massive logistics network that is capable of getting products from our computer screens to our front doors in two days, one day or even an afternoon, setting a new standard for the eCommerce industry.

But as Amazon sets the standard for delivery and fulfillment in the eCommerce industry, it also undeniably sets the standards for employment practices and working conditions in the industry. That is alarming news for the millions of workers in the warehouse and logistics industry. Inside Amazon’s fulfillment centers, delivery stations and other warehousing operations, tens of thousands of workers are paying for the cost of free two-day shipping with their bodies.

While journalistic reports of unsafe working conditions at Amazon’s warehouses have been widely published in recent years, some of the most troubling accounts of Amazon’s health and safety practices don’t come from whistleblowers or workers; these troubling accounts can be found in the company’s own internal documents.

This report relies on data from OSHA 300 and 300A logs collected from Amazon warehouses around the country to develop a systematic understanding of health and safety performance at the company’s facilities and identify solutions for making these workplaces safer for workers.

Amazon’s own internal data paints a very troubling picture about what is happening inside the company’s fulfillment centers:

- In 2018, the Total Recordable Injury Rate (TRIR) at Amazon facilities in the sample was 10.76 per 100 workers. This is **three times as high as the injury rate across all private employers** (2.8 recordable injuries per 100 workers) and **more than twice as high** as the injury rate in the notoriously hazardous general warehousing industry (5.2 recordable injuries per 100 workers).
- Workers at Amazon suffered the most serious injuries at rates five times the national average for all private industries. The injuries suffered by workers at Amazon are so serious that workers had to be removed from their job at Amazon—**88.9 percent of workers who were injured had to miss work or be placed on restricted duty**.
- These injuries are severe. Workers injured at Amazon were **forced to miss an average of five-and-a-half weeks of work to recover** from their workplace injuries.
- **Injury rates spike during the peak holiday shopping season** between Black Friday and Christmas. Injury rates begin to climb dramatically throughout the peak shopping season before spiking at two-and-a-half times the company’s annual average in the 50th week of the year—approximately two weeks before Christmas.
- The overwhelming majority of injuries recorded in Amazon’s OSHA 300 Logs include musculoskeletal injuries, such as sprains, strains and tears. These injuries accounted for almost 75 percent of the injuries recorded in the logs. The body parts most commonly injured are workers’ backs, shoulders, knees, wrists, ankles and elbows. These **types of injuries are often caused by workers assigned tasks involving ergonomic hazards** including forceful exertions, repetitive motions, twisting, bending, and awkward postures.
- Over the past five years, federal inspectors from the Occupational Safety and Health Administration (OSHA) have **issued 67 citations at Amazon’s facilities, levying fines totaling \$262,132**. This enforcement activity, however, likely only scratches the surface of safety violations

at Amazon facilities. Over the past half-decade, **78 percent of Amazon’s facilities have not received a single visit from OSHA inspectors.**

Federal law requires that, *“each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.”*¹ Amazon’s own data clearly shows that the company is breaking the law and as a result, workers are being injured in fulfillment centers around the country at shockingly high rates. These injuries are forcing workers to miss weeks of work while they recover and, in too many cases, experience pain for the rest of their lives. And the vast majority of these injuries are preventable.

Amazon must take immediate action to eliminate hazards in its warehouses and other facilities and make its workplaces safe for workers. The company must,

- Identify and address ergonomic hazards in fulfillment centers and other facilities and implement safer workstation designs and practices **to reduce the risk of injury to workers;**
- **Reduce the speed of work** and increase break times to address the hazards of fast-paced, stressful, repetitive work in its workplaces;
- Provide **adequate medical care** for employees who are injured on the job.
- Share readily available information on injuries and illnesses with workers to allow them to **better understand the risks to which they are being exposed;**
- Ensure that senior management, the Board of Directors and shareholders all **take responsibility for creating safe workplaces;** and
- Engage with **worker-led health and safety committees** to identify and eliminate hazards in its facilities.

Each of these solutions could dramatically improve health and safety outcomes for the hundreds of thousands of workers in Amazon’s fulfillment centers and warehouse facilities. If done well, many of these changes would cost very little in comparison to the company’s annual revenues and could actually improve the efficiency and reliability of the company’s fulfillment networks. Workers are being hurt at an alarming rate and there is no good reason for Amazon to further delay taking meaningful action to fix these hazards and make work safer.

¹ “OSH Act of 1970 | Occupational Safety and Health Administration,” accessed November 26, 2019, <https://www.osha.gov/laws-regs/oshact/section5-duties>.

Introduction

Amazon is rapidly transforming key aspects of our society and our economy, from the way that we shop to the way that we store and access information to the way that we work. Over the past two-and-a-half decades, the company has built out a mammoth logistics and fulfillment network aimed at moving goods from customers’ computer screens to their front doors faster than ever before. With more than 100 million subscribers to its Prime service, Amazon has made two-day shipping the standard across the eCommerce industry and is working to deliver some products in a day or less as competitors race to catch up.

Amazon has invested billions in artificial intelligence (AI) and robotics to automate its warehousing and distribution network, but it still relies on hundreds of thousands of workers to pull orders, make deliveries, and keep its distribution network running. With more than 200,000 employees in the U.S. and 640,000 around the world, Amazon is the country’s second-largest private-sector employer behind only Walmart.

While workers in Amazon’s fulfillment centers fill essential roles that cannot efficiently be performed by robots, this has not stopped Amazon executives and engineers from treating workers like robots. In the company’s fulfillment centers—massive warehouses stretching over several football fields where customer’s orders are picked and prepared for shipment—workers’ tasks are assigned, and their movements are closely monitored by Amazon’s automated systems.

The system tells workers where to walk and which items to pull. It also monitors each workers’ individual productivity and whether or not they are meeting “rate” by pulling the number of packages that the system thinks workers should be pulling

each hour. The system tracks “time off task” or “TOT,” and automatically generates warnings when too much time elapses between scanning packages.²

For Amazon workers, rate is a constantly moving goal with new algorithms being introduced to speed up rates and force workers to work faster. In at least one iteration of the rate program, the number of items each worker was expected to pull each hour would be increased as soon as 75 percent of the workforce was able to meet the rate. Under that version of the program the slowest 5 percent of employees would be placed on a training plan and possibly subject to discipline or firing.³

Amazon’s constant pressure on workers to move faster has also spread to city streets across the United States. In an effort to reduce delivery costs and improve delivery time, Amazon has established its own network of last-mile delivery drivers. While some of the drivers work for a contractor or other delivery company, all of these last-mile drivers are provided with a GPS device called a “rabbit” that allows Amazon to track deliveries, provide turn-by-turn instructions and monitor drivers’ progress. Amazon sets daily delivery loads for drivers—sometimes as high as 400 deliveries per day during the peak holiday season—and drivers are forced to scramble to keep up with the delivery rate. In interviews about their experience working as Amazon delivery drivers, current and former drivers almost universally reported speeding or violating other

² Colin Lecher, “How Amazon Automatically Tracks and Fires Warehouse Workers for ‘Productivity,’” *The Verge*, April 25, 2019, <https://www.theverge.com/2019/4/25/18516004/amazon-warehouse-fulfillment-centers-productivity-firing-terminations>.

³ Lecher.

traffic laws to keep up with their daily delivery quotas.⁴

Amazon sets the standard for delivery and fulfillment in the eCommerce industry and it also undeniably sets the standards for employment practices and working conditions in the industry. That is alarming news for the millions of workers in the warehousing and logistics industry. Behind the turnstiles of Amazon’s fulfillment centers, delivery stations and other warehouse and delivery operations, tens of thousands of workers are paying for the cost of free two-day shipping with their bodies.

As Amazon’s promise of free and fast delivery has become more and more ubiquitous, so too have reports of unsafe working conditions inside the company’s fulfillment centers. Amazon has topped the National Center for Occupational Safety and Health’s (NCOSH) “Dirty Dozen” list of employers who put workers and communities at risk for two years straight, with NCOSH reporting, *“Workers labor at a relentless pace, with constant monitoring of their activities. This high stress environment leads to physical and emotional ailments – but reports indicate that the company*

*does not provide adequate support to those suffering on-the-job injuries.”*⁵

Pressure inside some Amazon facilities is so intense that many employees have experienced mental health crises. Analyzing 911 records and police reports, researchers Max Zahn and Sharif Paget found at least 189 instances of emergency services personnel being called to Amazon facilities for suicide attempts, suicidal thoughts, or other mental-health episodes between October 2013 and October 2018. One former employee described their experience at an Amazon facility in Florida in stark terms: *“It’s this isolating colony of hell where people having breakdowns is a regular occurrence...[It’s] mentally taxing to do the same task super-fast for 10-hour shifts, four or five days a week.”*⁶

And when workers are injured on the job, many have reported that Amazon management forced them back to work too quickly after their injuries or failed to properly compensate them for their injuries. A 2018 investigation by the Guardian uncovered a number of cases where Amazon workers suffering from workplace injuries found themselves homeless, unable to work or without income.⁷

⁴ Hayley Peterson, “Missing Wages, Grueling Shifts, and Bottles of Urine: The Disturbing Accounts of Amazon Delivery Drivers May Reveal the True Human Cost of ‘free’ Shipping,” Business Insider, accessed August 15, 2019, <https://www.businessinsider.com/amazon-delivery-drivers-reveal-claims-of-disturbing-work-conditions-2018-8>.

⁵ National Council for Occupational Safety and Health, “The Dirty Dozen,” 2019, http://nationalcosh.org/sites/default/files/uploads/2019_Dirty_Dozen.pdf.

⁶ Sharif Paget and Max Zahn, “‘Colony of Hell’: 911 Calls from Inside Amazon Warehouses,” *The Daily Beast*, March 11, 2019, sec. tech, <https://www.thedailybeast.com/amazon-the-shocking-911-calls-from-inside-its-warehouses>.

⁷ Michael Sainato, “Accidents at Amazon: Workers Left to Suffer after Warehouse Injuries,” *The Guardian*, July 30, 2018, sec. Technology, <https://www.theguardian.com/technology/2018/jul/30/accidents-at-amazon-workers-left-to-suffer-after-warehouse-injuries>.

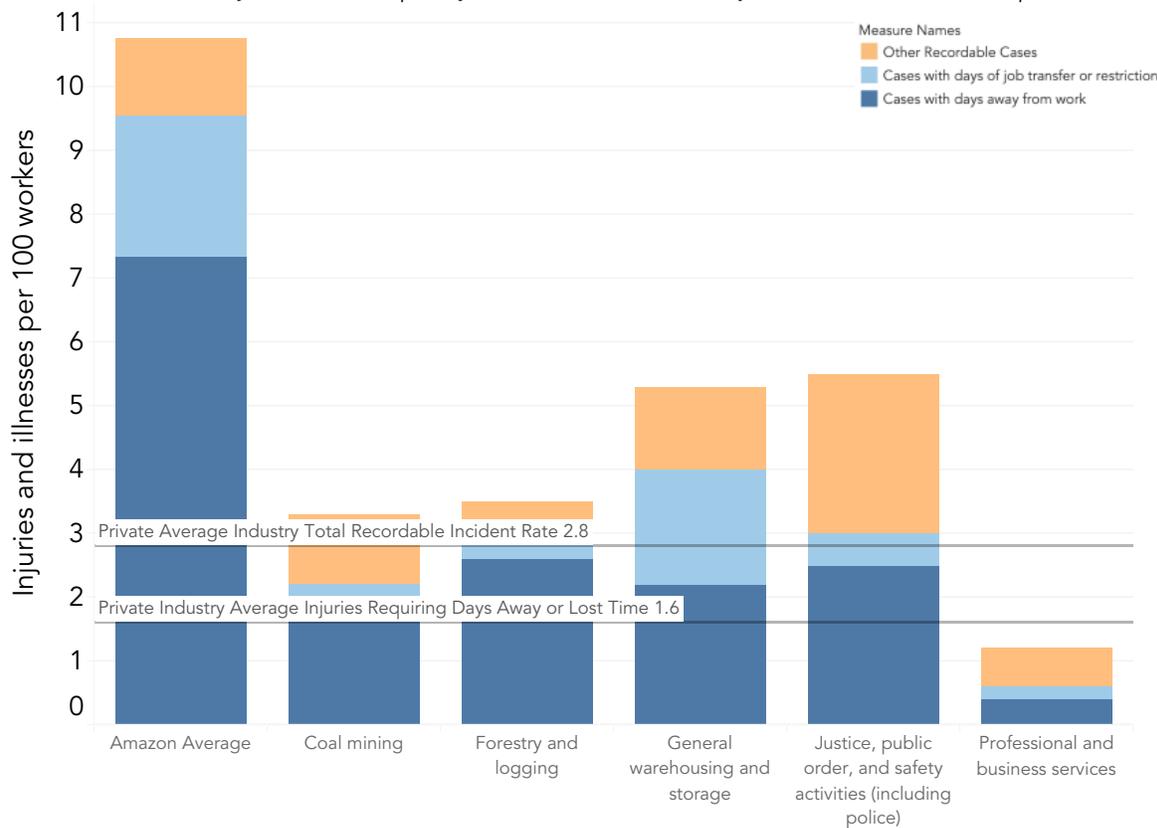
Amazon’s Internal Data Shows Alarming High Injury Rates

Some of the most troubling accounts of Amazon’s health and safety practices don’t come from whistleblowers or workers; they can be found in the company’s own internal documents. The Occupational Safety and Health Administration requires employers to maintain records of serious occupational injuries and illnesses using the “OSHA 300” log form to help regulators, workers, and employers to identify workplace hazards and work together to prevent injuries. By law, workers and former workers have the right to request their own copies of these logs so they can better understand the hazards that are present in their workplaces and work to protect themselves and their coworkers.⁸

Amazon’s own internal data paints a very troubling picture about what is happening behind the turnstiles at the company’s fulfillment centers. Every year, one out of every 10 Amazon workers suffers a recordable injury at work. These injuries are so severe the average injured worker is forced to miss six-and-a-half weeks of work to recover. The sheer number of workers impacted by this epidemic of workplace injury is staggering.

Injury rate at Amazon is three times as high as the national average

Workers at Amazon are injured more frequently than coal miners, lumberjacks, trash collectors and police officers



Injury rates at Amazon are based on OSHA 300A log data from all facilities in the sample for the year 2018—a total of 24 facilities from 15 states. Injury rates for other industries come from the BLS Injury, Illness, and Fatalities Data for 2018 https://www.bls.gov/iif/oshwc/osh/os/summ1_00_2018.htm

⁸ “1904.35 - Employee Involvement. | Occupational Safety and Health Administration,” accessed May 30, 2019, [https://www.osha.gov/laws-regs/regulations/standardnumber/1904/1904.35#1904.35\(b\)\(1\)\(iv\)](https://www.osha.gov/laws-regs/regulations/standardnumber/1904/1904.35#1904.35(b)(1)(iv)).

To develop this report, current and former workers at 28 Amazon facilities in 16 states requested Amazon’s internal injury records (OSHA 300 logs) from their managers to help better understand the hazards that they and their coworkers have been exposed to in their facilities.^{9 10}

Amazon’s internal records from these warehouses show injury and illness rates far above industry averages. In 2018, the Total Recordable Injury Rate (TRIR) at the Amazon facilities in the sample was 10.76 per 100 “full-time equivalent”¹¹ workers. This is three times as high as the injury rates across all private employers (2.8 recordable injuries per 100 employees) and almost twice as high as the injury rate in the notoriously hazardous general warehousing industry (5.2 recordable injuries per 100 employees) in the same year. Based on Amazon’s own internal numbers, workers at Amazon are more likely to be injured at work than police officers, solid waste collectors, lumberjacks or coal miners.¹²

Most alarming, in 2018 workers at Amazon suffered the most serious injuries at rates five times the national average for all private industries: 9.57 disabling injuries per 100 workers, compared to 1.6 for all private industry. That year 88.95 percent of workers who were injured had to miss work or be placed on restricted duty.¹³

Injuries Increase Dramatically During the “Peak” Holiday Shopping Season

The timing and frequency of injuries at Amazon facilities provides some insights on the factors that may be causing this high injury rate. Injury rates appear to be relatively consistent within Amazon facilities throughout the year until November and December, when Amazon workers suffer a steep increase in the number of injuries. This increase matches up with Amazon’s annual peak holiday season, which runs approximately from Black Friday (the Friday after Thanksgiving) to Christmas. During peak season, workers are forced to work longer hours with standard shifts extending from 10 hours per day to 11 or 12 hours per day. Amazon also places significant restrictions on workers using accrued time off during this four-to-six-week stretch.¹⁴

Injury rates climb quickly through peak season before spiking in the 50th week of the year—two weeks before Christmas. A portion of the increase in injuries is likely related to fluctuations in the number of hours worked and staffing levels within the facilities. But Amazon’s OSHA 300 logs show that in the 50th week of the year, injuries are occurring in the company’s facilities at more than two-and-a-half times Amazon’s annual average—an increase much greater than can be attributed to increased headcount inside the facilities.

⁹ Amazon classifies its warehouses in several different categories based on their size, function and equipment. In sortable fulfillment centers, workers work alongside robots to pick, pack and ship packages that are smaller than about 18 inches. In non-sortable fulfillment centers, workers pick, pack and ship bulky or larger-sized items that cannot be processed by robotic systems. At sortation (or “sort”) centers, workers sort orders by final destination and consolidate them onto trucks for faster delivery. <https://www.aboutamazon.com/amazon-fulfillment/our-fulfillment-centers/fulfillment-in-our-buildings/>

¹⁰ For a full listing of facilities included in the sample and an explanation of the methodology see the Technical Note in Appendix A of this document

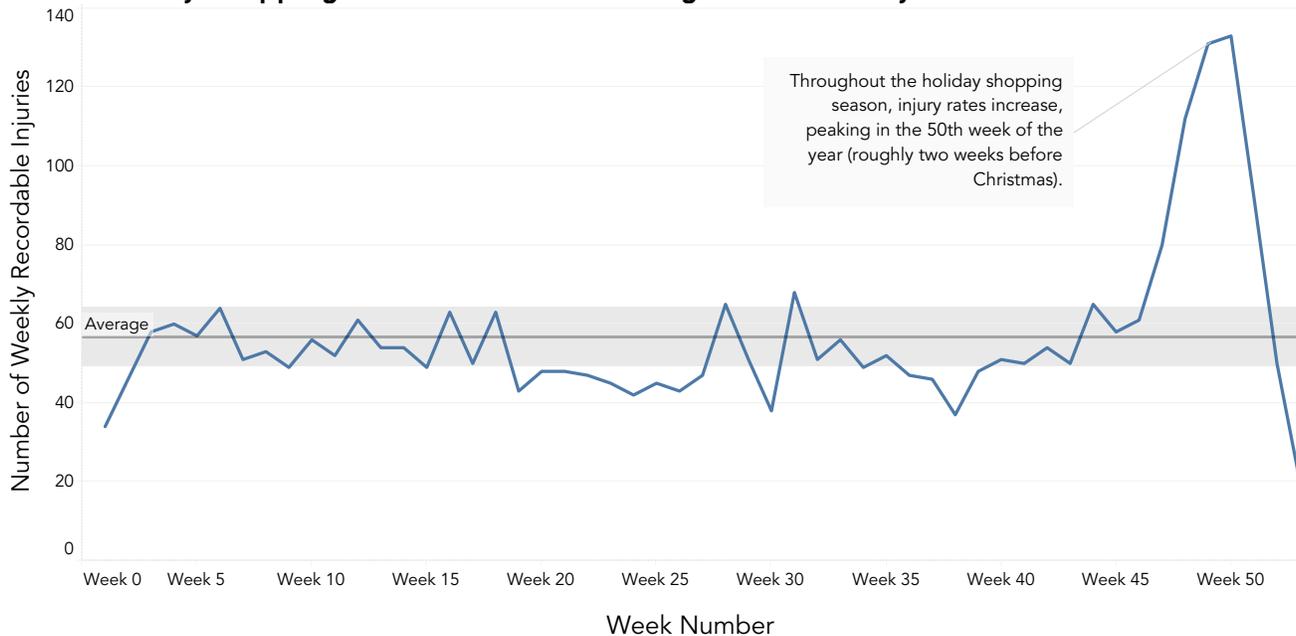
¹¹ Full time equivalent workers is calculated by dividing the total number of hours worked in each facility by 2,000.

¹² “TABLE 1. Incidence Rates of Nonfatal Occupational Injuries and Illnesses by Industry and Case Types, 2018,” accessed November 11, 2019, https://www.bls.gov/iif/oshwc/osh/os/summ1_00_2018.htm.

¹³ Ibid

¹⁴ Isobel Asher Hamilton and Aine Cain, “Amazon Warehouse Employees Speak out about the ‘brutal’ Reality of Working during the Holidays, When 60-Hour Weeks Are Mandatory and Ambulance Calls Are Common,” *Business Insider*, February 19, 2019, <https://www.businessinsider.com/amazon-employees-describe-peak-2019-2>.

The holiday shopping season is the most dangerous time of year for Amazon workers



This chart shows the trend of sum of number of weekly recordable injuries throughout the year. All data in the sample is included for all years 2014-2018. Sample includes OSHA 300 logs for two facilities for 2014, five facilities for 2015, seven facilities for 2016, ten facilities for 2017, and 12 facilities for 2018.

Nature and Severity of Injuries

The overwhelming majority of injuries reported in the Amazon OSHA 300 logs in our sample include musculoskeletal injuries, such as sprains, strains and tears. These injuries accounted for almost 75 percent of the injuries recorded in the logs. The body parts most commonly injured are workers’ backs, shoulders, knees, wrists, ankles and elbows. These types of injuries are often caused by workers assigned tasks involving ergonomic hazards including forceful exertions, repetitive motions, twisting, bending, and awkward postures. The risk of injury associated with these tasks increases dramatically with the pace of work. At Amazon facilities, the rate at which workers fill orders is carefully monitored, as is the amount of time employees spend resting or ‘off task.’ Amazon’s human resources management software automatically generates discipline notices and even dismissal letters for employees who fail to maintain the rate that management has set for workers.¹⁵

When workers are injured at Amazon facilities, they are typically sent to an “AmCare” onsite medical facility for first aid. The staff at AmCare—referred to by Amazon as “Onsite Medical Representatives,” are typically emergency medical technicians (EMTs), not physicians or registered nurses. EMTs are qualified to provide first-aid and determine whether or not a worker needs to be transported to a hospital. EMTs are not certified to diagnose or treat injuries that need more than first aid, nor are they certified to write prescriptions, give medications, order x-rays or lab tests.

In 2015 an OSHA inspection revealed that AmCare employees were providing medical care beyond the first aid treatment that they were qualified to offer. The OSHA area director overseeing the inspection

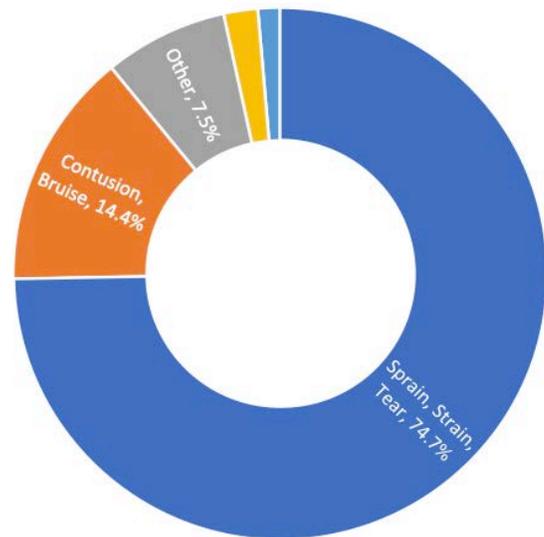
¹⁵ Lecher, “How Amazon Automatically Tracks and Fires Warehouse Workers for ‘Productivity.’”

was so alarmed by the situation that she sent a letter directly to Amazon CEO Jeff Bezos notifying him that her inspection revealed, “AMCARE personnel were providing medical care beyond what is allowed by their licensing and certification without the supervision of a board certified qualified medical professional licensed to practice independently.”¹⁶ When OSHA conducted an additional inspection of the Robbinsville facility in February of 2019, investigators learned that while care protocols had been updated, AmCare Onsite Medical Representatives were being allowed to treat workers for up to 21 days before referring a worker to a physician. The OSHA area director responsible for that investigation wrote that, “a delay in physician-supervised treatment of that duration is not consistent with the standard of medical care expected at a health care facility.”¹⁷

AmCare first aid staff attempting to provide medical care without the proper training or qualifications can lead to disastrous consequences for workers. In October 2019, Billy Foister, a 48-year-old Amazon fulfillment center employee went to AmCare complaining of chest pain. The AmCare staff diagnosed him with dehydration, gave him two beverages to drink and sent him back to work. A week later, Foister suffered a severe heart attack and died while working in the fulfillment center.¹⁸

Many of the sprains, strains and tears that are so common in Amazon facilities are considerably less dramatic than Billy Foister’s case. But if AmCare employees without appropriate medical training attempt to diagnose and treat workers suffering from musculoskeletal injuries, the outcomes can be devastating as well. When Amazon workers experience severe muscle or joint pain at work, the EMTs at AmCare provide first aid care—typically applying ice to the injury and offering over-the-counter pain relievers before sending them back to work—often in as little as 15 minutes. In an investigation into treatment of injuries at AmCare facilities conducted by The Intercept, two-thirds of AmCare staff interviewed reported that their bosses pressured them to send injured employees back to the warehouse when they likely needed additional medical attention.¹⁹

Sprains, strains and tears are the most common injuries suffered by Amazon workers



■ Sprain, Strain, Tear ■ Contusion, Bruise ■ Other
■ Cut, Laceration ■ Fracture

Nature of injury as percentage of all injuries in the sample. All data in the sample is included for all years 2014-2019. Sample includes OSHA 300 logs from two facilities for 2014, five facilities for 2015, seven facilities for 2016, eight facilities for 2017 and 11 facilities for 2018. Nature of injury is determined by performing a keyword match of the Narrative of Injury field from the OSHA 300 logs for the 11 injury "Nature of injury, illness" major categories that appear in the BLS Occupational Injury/Illness Classification System Manual (<https://www.bls.gov/iif/oshoiics.htm>).

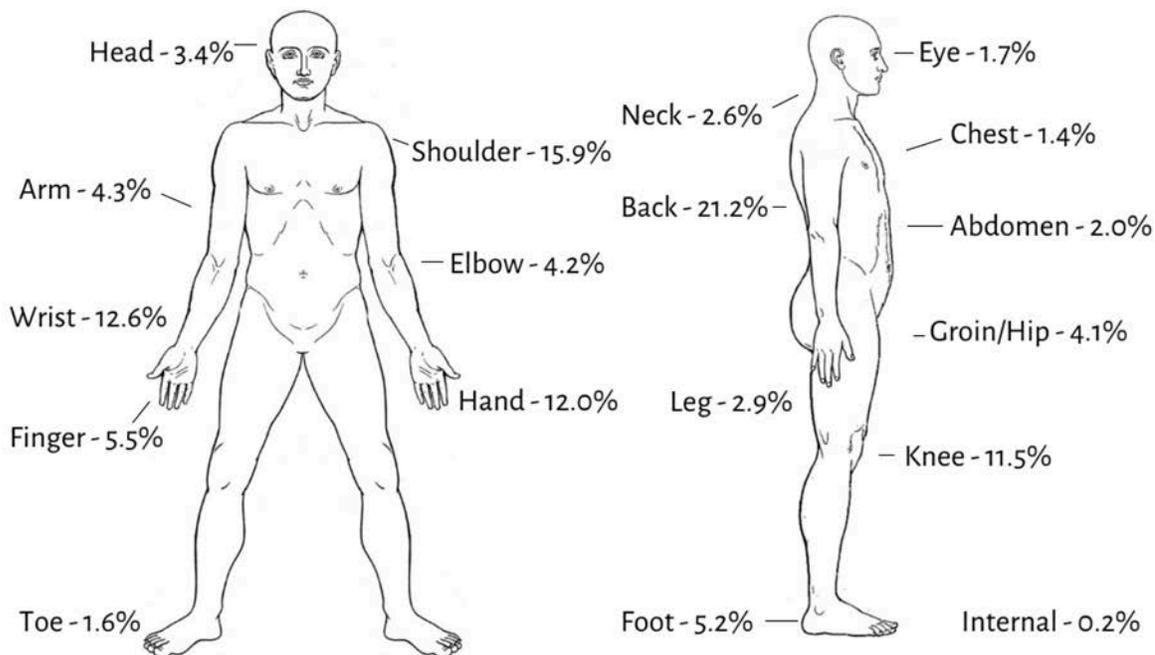
¹⁶ Occupational Safety and Health Administration, “OSHA Hazard Letter,” January 6, 2015, https://www.osha.gov/ooc/citations/Amazon_1074833_HAL.pdf.

¹⁷ Occupational Safety and Health Administration, “OSHA Hazard Letter,” August 19, 2019

¹⁸ Michael Sainato, “‘Go Back to Work’: Outcry over Deaths on Amazon’s Warehouse Floor,” *The Guardian*, October 18, 2019, <https://www.theguardian.com/technology/2019/oct/17/amazon-warehouse-worker-deaths>.

¹⁹ H. Claire Brown, “How Amazon’s On-Site Emergency Care Endangers the Warehouse Workers It’s Supposed to Protect,” *The Intercept* (blog), December 2, 2019, <https://theintercept.com/2019/12/02/amazon-warehouse-workers-safety-cyber-monday/>.

Where Amazon Workers are Getting Injured



Percentage of recordable cases involving injuries to each body part. Sample includes OSHA 300 logs from two facilities for 2014, five facilities for 2015, seven facilities for 2016, eight facilities for 2017 and 11 facilities for 2018. Body part is identified by keyword matching major body parts with the "Narrative of Injury" from OSHA 300 logs. Because some cases resulted in injuries to multiple body parts that total of percentages is greater than 100%.

First aid is not a substitute for professional diagnosis and treatment of repetitive trauma disorders that can cause debilitating and permanent muscle or joint injury. Conducting this type of diagnosis is outside of the scope of practice of EMTs that staff AmCare facilities and delaying visits to a qualified doctor who can provide competent diagnosis and adequate medical treatment can make such injuries worse.²⁰

Ice and over the counter pain relievers can help in masking pain and in getting workers back at their workstations. But that first aid does nothing to help workers actually recover and heal. Worse, it does nothing to address the hazards that caused the injury. When supervisors send workers back to work while still injured, force them to work long hours, and prohibit them from taking days off for weeks at a time, even small injuries can turn into much more severe injuries. Research has shown that when employers do not proactively address musculoskeletal injuries and reduce or eliminate ergonomic hazards, injured workers miss an average of 36 percent more days of work and are significantly less likely to return to work at all.²¹ Additionally, forcing injured workers to return to jobs with the same or similar ergonomic hazards like excessive pace, repetitive

²⁰ "National EMS Scope of Practice Model," National Highway Traffic Safety Administration, February 2007, <https://www.ems.gov/education/EMSScope.pdf>.

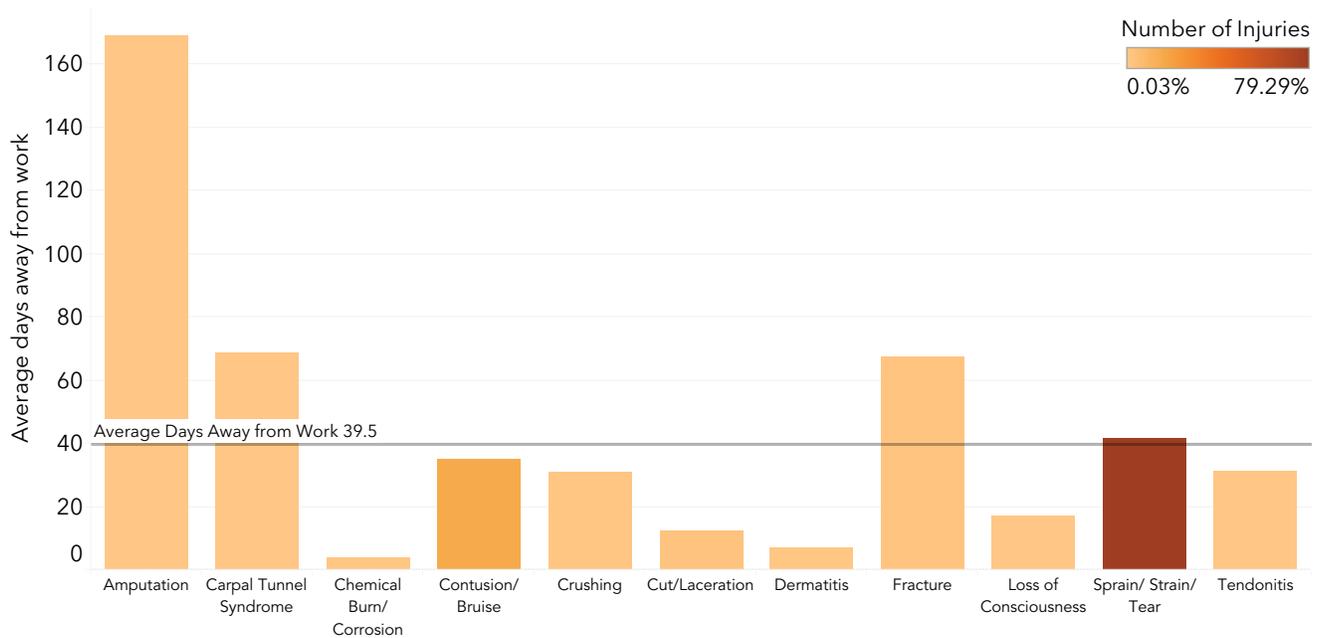
²¹ Bengt B. Arnetz et al., "Early Workplace Intervention for Employees with Musculoskeletal-Related Absenteeism: A Prospective Controlled Intervention Study," *Journal of Occupational and Environmental Medicine* 45, no. 5 (May 2003): 499, <https://doi.org/10.1097/01.jom.0000063628.37065.45>.

continuous strain and stressful working positions, has been shown to increase risks of reinjury and raise barriers to workers being able to return to work at all.²²

This helps to explain the high rate of severity of the injuries recorded in Amazon’s OSHA 300 logs. Workers who suffered from recordable injuries were forced to miss an average of five and a half weeks of work. As shown above, workers experiencing sprains, strains and tears, the most common injury recorded in Amazon’s OSHA 300 logs were forced to miss an average of nearly six weeks of work.

The types of severe injuries that workers are suffering from—sprains, strains and tears to the shoulder, back, knee, wrist and foot—are injuries that can stay with workers for the rest of their lives leading to chronic pain and an elevated risk of reinjury and long-term disability. The prospect of suffering a life-long injury is particularly troubling for the younger workers who make up the majority of the warehousing and electronic shopping industry. According to U.S. Census data, 27 percent of workers in the warehousing industry are younger than 25 years old and 56 percent of warehouse workers are younger than 35 years old.²³

Injured workers miss an average of five-and-a-half weeks of work



Average number of days away from work for each nature of injury. All data in the sample is included for all years 2014-2019. Sample includes OSHA 300 logs for two facilities for 2014, five facilities for 2015, seven facilities for 2016, ten facilities for 2017, 12 facilities for 2018 and nine facilities for 2019 (partial year). Nature of injury is determined by performing a keyword match of the Narrative of Injury field from OSHA 300 logs for the 11 "nature of injury, illness" major categories that appear in the BLS Occupational Injury/Illness and Fatal Injuries Profile. Shading represents the frequency that each nature of injury appears in the sample.

²² Niklas Krause and Thomas Lund, "Returning to Work After Occupational Injury," in *The Psychology of Workplace Safety*, ed. Julian Barling and Michael Frone (American Psychological Association, 2004), 265–99.

²³ US Census Bureau American Community Survey 2013-2017.

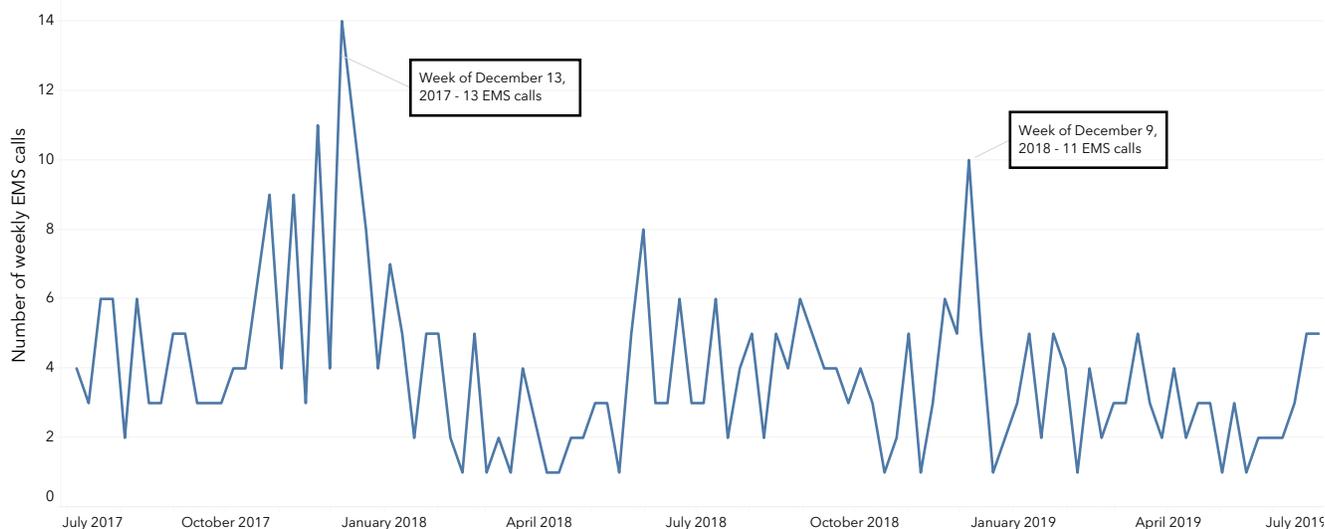
911 Logs Show Frequent Emergency Medical Service Dispatches to Amazon Facilities

In addition to the company’s own internal data, records of calls from Amazon facilities to local emergency responders offer another look at health and safety performance inside of Amazon’s facilities. The Boone County Public Safety Communications Center released two years of Computer Aided Dispatch (CAD) logs from July 1, 2017 to July 1, 2019 for six Amazon facilities in the town of Hebron, Kentucky in response to a Kentucky Open Records Act (KRS 61.870-61.884) request. Hebron, Kentucky is a major hub of operations for Amazon’s national distribution network including three fulfillment centers, one cross dock, two sortation centers and the new hub for Amazon Air Cargo operation at Cincinnati’s CVG airport.

The timing of calls for EMS services at the Amazon facilities in Hebron mimics the timing of injuries and illnesses recorded in the company’s other facilities included in the sample, with noticeable spikes in 911 calls during the peak season between Black Friday and Christmas each year.

911 calls from Amazon’s Boone County facilities increase dramatically during the peak holiday season

July 1, 2017-July 1, 2019

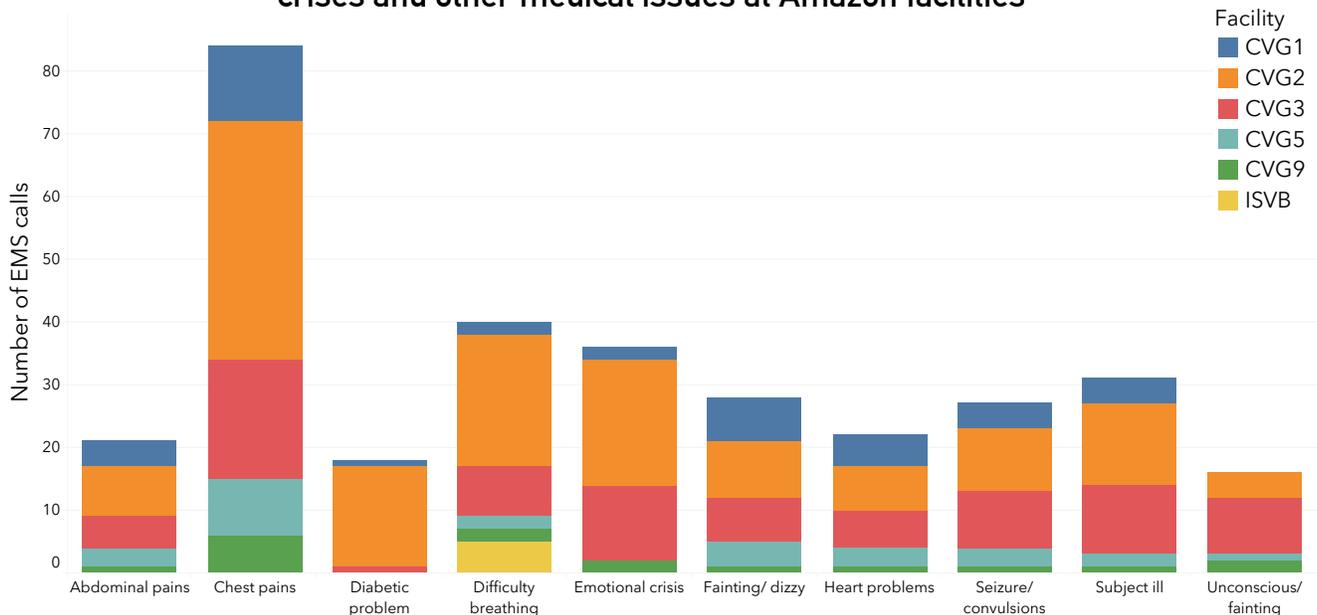


Records of 911 calls to Amazon facilities in Boone County, Kentucky from July 1, 2017 to July 1, 2019 provided by the Boone County Public Safety Communications Center in response to a Freedom of Information Act request. The data set includes records of 911 calls where EMS personnel were dispatched to six Amazon facilities in Boone County including CVG1 (Specialty Fulfillment), CVG2 (Fulfillment), CVG3 (Cross dock), CVG5 (Sortation), CVG9 (Sortation) and ISVB (Specialty Fulfillment).

Where the information reported in the Boone County 911 logs begins to show some important differences from Amazon’s OSHA 300 logs is in the types of incidents recorded. By far, the most frequent incident triggering a 911 call in Hebron during this two-year timespan was workers experiencing chest pain—EMS personnel responded to 84 calls about workers experiencing chest pain. Emergency personnel also

responded 40 times for reports of workers with difficulty breathing, 36 for workers in an emotional crisis, 26 times for workers who had fainted or were experiencing dizziness, and 27 times for seizures or convulsions.²⁴

EMS personnel respond to calls reporting chest pains, difficulty breathing, emotional crises and other medical issues at Amazon facilities



Records of 911 calls to Amazon facilities in Boone County, Kentucky from July 1, 2017 to July 1, 2019 provided by the Boone County Public Safety Communications Center in response to a Freedom of Information Act request. The data set includes records of 911 calls where EMS personnel were dispatched to six Amazon facilities in Boone County including CVG1 (Specialty Fulfillment), CVG2 (Fulfillment), CVG3 (Cross dock), CVG5 (Sortation), CVG9 (Sortation) and ISVB (Specialty Fulfillment). The ten most frequent types of incident are shown.

Interestingly, many of the frequent reasons for 911 calls are not the issues we find in Amazon’s OSHA 300 logs. These 911 calls — for chest pains, heart problems, emotional crises, dizziness, difficulty breathing, etc. — were likely not recorded in the OSHA 300 logs because Amazon decided they were not “work-related.” If this is the case, it could mean that a large number of serious medical incidents at Amazon’s warehouses are not being recorded in the company’s OSHA 300 logs.

There is no way to definitively determine whether the medical incidents that led to 911 calls in Hebron were work-related. But, it’s hard to believe that all of the 84 incidents where workers experienced chest pains, 40 incidents where workers experienced difficulty breathing, or 36 cases where workers experienced emotional crises were unrelated to the extremely fast-paced and injury-laden work in Amazon’s warehouse. It is possible that some of these incidents could have been caused by existing medical conditions that had nothing to do with the workplace. But it is also likely that the heavy physical labor, constant monitoring and incessant pressure to work faster contributed in important ways to a number of these incidents.

²⁴ Records of 911 calls to Amazon facilities in Boone County, Kentucky from July 1, 2017 to July 1, 2019 provided by the Boone County Public Safety Communications Center in response to a Freedom of Information Act request. The data set includes records of 911 calls where EMS personnel were dispatched to six Amazon facilities in Boone County including CVG1 (Specialty Fulfillment), CVG2 (Fulfillment), CVG3 (Cross dock), CVG5 (Sortation), CVG9 (Sortation) and ISVB (Specialty Fulfillment). The ten most frequent types of incident are shown.

OSHA Cites Amazon for Dozens of Violations but Only Scratches the Surface of the Company’s Distribution Empire

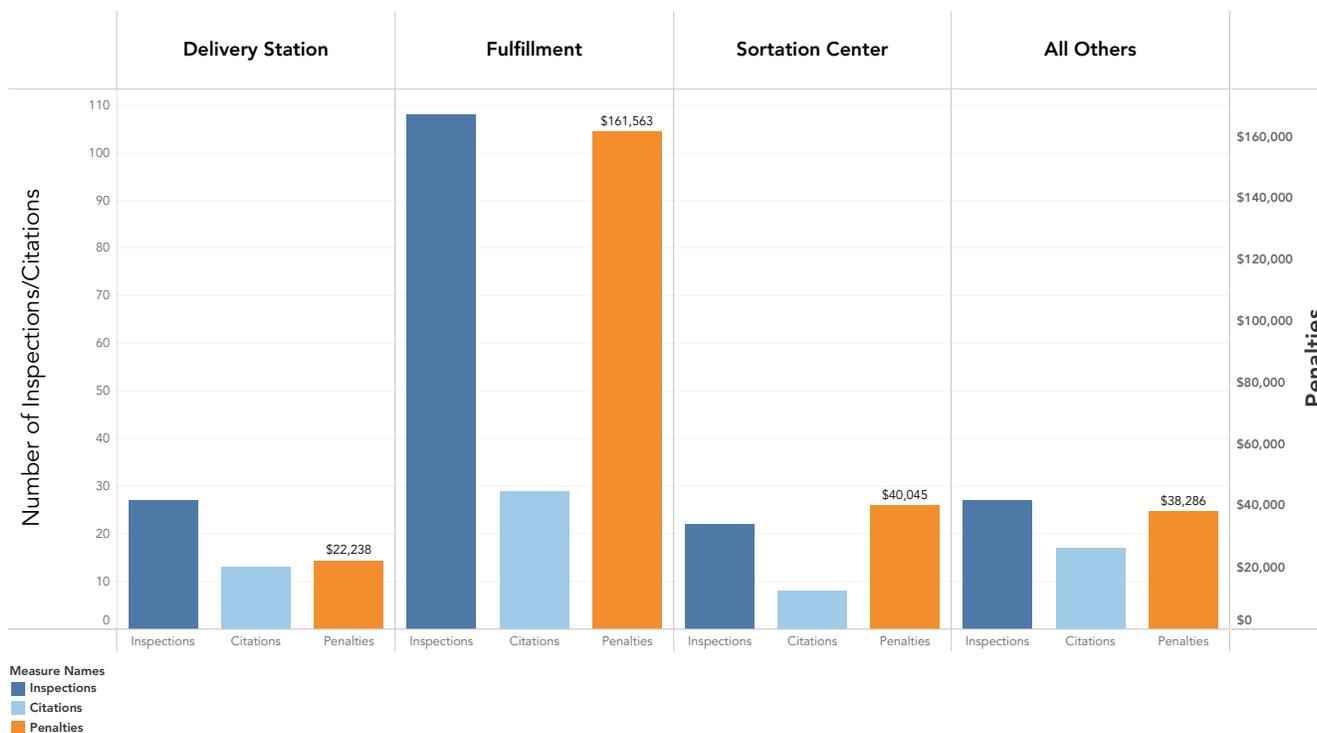
The high volume and elevated severity of illnesses and injuries experienced by Amazon workers are truly alarming. By any measure, the rate of injuries recorded in Amazon’s own records represent a significant public health concern. So why has Amazon been able to continue to injure workers year after year?

The federal agency responsible for overseeing health and safety in most of the workplaces in the United States is the Occupational Safety and Health Administration (OSHA). OSHA has the authority to set and enforce

workplace health and safety standards and a mandate to enforce those standards (as well as provide training, outreach, education and assistance to workers and employers).

OSHA has, in fact, inspected a number of Amazon sites and issued citations and fines to the company for violations of federal health and safety standards. Over the past five years, OSHA conducted 102 inspections at Amazon facilities issuing 67 citations and penalties totaling over \$262,132 (a sum of money that is roughly .0087 percent of Amazon’s profits in 2018 alone).

OSHA Inspections and Citations by Facility Type



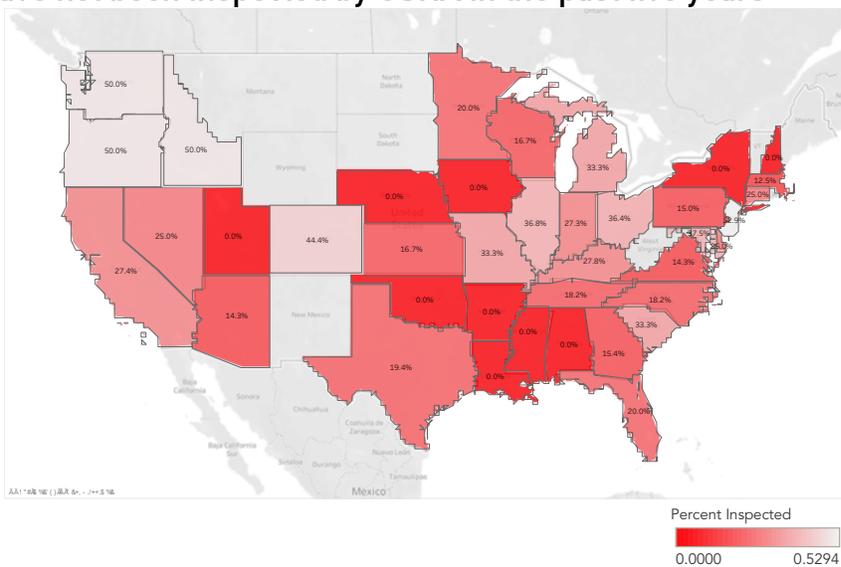
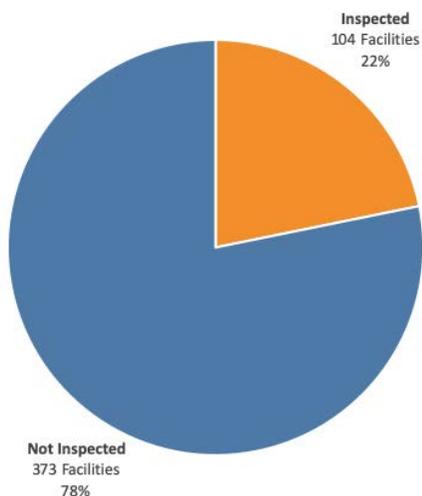
Data retrieved from OSHA inspection records of Amazon facilities from November 1, 2014-November 1, 2019 from the US Department of Labor Enforcement Data website <https://enforcedata.dol.gov> (accessed (November 4, 2019)).

While the number of OSHA citations issued at Amazon indicates that something is seriously wrong with Amazon’s health and safety practices, OSHA’s ability to effectively deter employers’ behavior that leads to health and safety violations is relatively limited—especially at huge employers like Amazon. OSHA, along with its state partners, has fewer than 2,000 inspectors to cover over 9 million worksites, and it is estimated

it would take OSHA over 100 years to investigate every workplace under its jurisdiction just once. The average penalty for any single serious violation is only \$3,580.²⁵

Over the past five years, OSHA has only conducted inspections at 22 percent of Amazon facilities. Nationwide there are 373 Amazon facilities that have not been inspected by OSHA at any time in the past half-decade.

78% of Amazon facilities have not been inspected by OSHA in the past five years



Graphs show a comparison of a master list of of Amazon facilities nationwide cross-referenced with a OSHA inspection records for facilities identified as Amazon facilities from 2014-present from the US Department of Labor Enforcement Data website <https://enforcedata.dol.gov> (accessed 10/15/19). The pie chart on the left represents the percentage of all Amazon facilities inspected. Because some facilities were inspected several times while other nearby facilities the map on the right shows the ration of facilities to inspections, which may overstate the portion of facilities inspected in the timeframe.

²⁵ AFL-CIO, “Death on the Job. The Toll of Neglect. A National and State-By-State Profile of Worker Safety and Health in the United States,” April 2019, https://aflcio.org/sites/default/files/2019-05/DOTJ2019Fnb_1.pdf.

Amazon Treats Workers as Disposable Parts in a Machine

For decades, Amazon leadership has cultivated a culture of treating workers as disposable parts in a big machine—pushing their minds and bodies alike until they are no longer useful and then letting them go. According to a survey by PayScale, Amazon has one of the highest employee turnover rates of any Fortune 500 company with a full half of its workforce working with the company for less than one year.²⁶ Current and former employees at every level describe a “churn and burn” culture at Amazon and even CEO Jeff Bezos proudly proclaims, “It’s not easy to work here.”²⁷

This churn and burn culture can be particularly acute in the company’s fulfillment network where the company makes around one-third of its annual sales during the holiday shopping season.²⁸ To prepare for the holiday peak season, Amazon dramatically increases hiring, recruiting more than 100,000 new workers each year. But by January, when the holiday rush is over, the company does not need nearly as many workers.²⁹ The hundreds of workers who are injured during the Peak season are no longer needed to keep products moving through the fulfillment system.

Amazon’s algorithms and tracking systems constantly monitor worker productivity throughout the workday. In distribution centers workers are required to keep up with a constantly-increasing “rate,” pulling hundreds of items each hour throughout their shifts. When workers fall behind, Amazon’s management software automatically generates warning letters, targets workers for

“retraining” and even discharges workers without the involvement of any human manager in the process.³⁰

The tracking system also monitors workers’ “Time Off Task” or “TOT” and generates written warnings when the system observes workers taking too much time between scanning items. When the system generates enough warnings for an employee in a six-month period, it will automatically generate a termination letter, once again, without any involvement from a human manager. Workers are scheduled for two 15-minute breaks and one 30-minute lunch break each 10 or 12 hour shift. Any additional breaks to use the restroom or rest from the relentless pace of the work are counted against worker’s time off task and rate. According to internal documents, in one fulfillment center Amazon fired a full 10 percent of its workforce in a single year based on these tracking metrics.³¹

Amazon also maintains a notoriously draconian no-fault attendance policy that assigns workers points for missing work—regardless of the reason. Calling in sick for one shift costs an employee 1.5 points. When employees reach six points, they face termination. During the peak season, which generally runs from the Friday after Thanksgiving through Christmas, employees are typically scheduled for mandatory overtime—up to 60 hours per week—and the company severely

²⁶ “Full List of Employee Tenure at Fortune 500 Companies,” PayScale, accessed September 30, 2019, <https://www.payscale.com/data-packages/employee-loyalty/full-list>.

²⁷ Jodi Kantor and David Streitfeld, “Inside Amazon: Wrestling Big Ideas in a Bruising Workplace,” *The New York Times*, August 15, 2015, sec. Business, <https://www.nytimes.com/2015/08/16/technology/inside-amazon-wrestling-big-ideas-in-a-bruising-workplace.html>.

²⁸ Amazon.com, Inc., “Form 10-K,” 2019, <https://ir.aboutamazon.com/static-files/ce3b13a9-4bf1-4388-89a0-e4bd4abd07b8>.

²⁹ Michael J. Coren, “Amazon’s Hiring More Humans, but Robots Are Handling the Holiday Crush,” Quartz, accessed October 29, 2019, <https://qz.com/1735219/amazons-robots-may-be-handling-the-holiday-crush/>.

³⁰ Lecher, “How Amazon Automatically Tracks and Fires Warehouse Workers for ‘Productivity.’”

³¹ Lecher.

restricts workers from using their accrued time off.³²

The relentless rate, combined with constant monitoring of time off task, strict attendance policy and forced overtime through the busy peak season together have a dramatic cumulative impact on workers’ bodies. As physical fatigue from the long hours sets in during the weeks just before and after the Christmas holiday, workers experience a dramatic spike in injuries

with injury rates climbing over two-and-a-half times the annual average. And those injuries are severe: In 2018, the OSHA 300 logs that Amazon workers were able to obtain for this report recorded 93 injuries requiring workers to miss 180 or more days of work (OSHA’s cap for recording lost time injuries), and 31 percent of those injuries occurred in the month of December alone.³³

³² Isobel Asher Hamilton and Aine Cain, “Amazon Warehouse Employees Speak out about the ‘brutal’ Reality of Working during the Holidays, when 60-Hour Weeks Are Mandatory and Ambulance Calls Are Common,” *Business Insider*, February 19,

2019, <https://www.businessinsider.com/amazon-employees-describe-Peak-2019-2>.

³³ Sample includes OSHA 300A logs from 10 Amazon facilities for the year 2018.

Roadmap to Improving Health and Safety at Amazon

In just over two decades, Amazon has transformed major portions of our economy. The company has changed the way that we pick out birthday presents for our loved ones, the way that companies store and understand data, and the way that we get many products from factories to our living rooms. Amazon has built an incredibly sophisticated and efficient logistics network that is capable of getting products from our computer screens to our front doors in two days, one day, or even an afternoon. And for these impressive accomplishments, Amazon’s executives and investors have taken home hundreds of billions of dollars.

In his 2019 annual letter to shareholders, Jeff Bezos reflected on how Amazon has always worked to create a culture of builders:

“From very early on in Amazon’s life, we knew we wanted to create a culture of builders – people who are curious, explorers. They like to invent. Even when they’re experts, they are ‘fresh’ with a beginner’s mind. They see the way we do things as just the way we do things now. A builder’s mentality helps us approach big, hard-to-solve opportunities with a humble conviction that success can come through iteration: invent, launch, reinvent, relaunch, start over, rinse, repeat, again and again. They know the path to success is anything but straight.”

The work that the builders of Amazon’s empire have done over the past two decades has objectively been nothing short of amazing. The company has created and then become a leader in at least a dozen businesses that didn’t even exist two decades ago. From AI-powered talking assistants in homes around the world, to a massive

cloud computing operation that powers the CIA, to two- or one-day delivery of millions of products, Amazon has found a way to create solutions to problems we didn’t even know we had. If Amazon can accomplish so much for its shareholders, there is no reason this company cannot make its fulfillment centers and warehouses safe for workers.

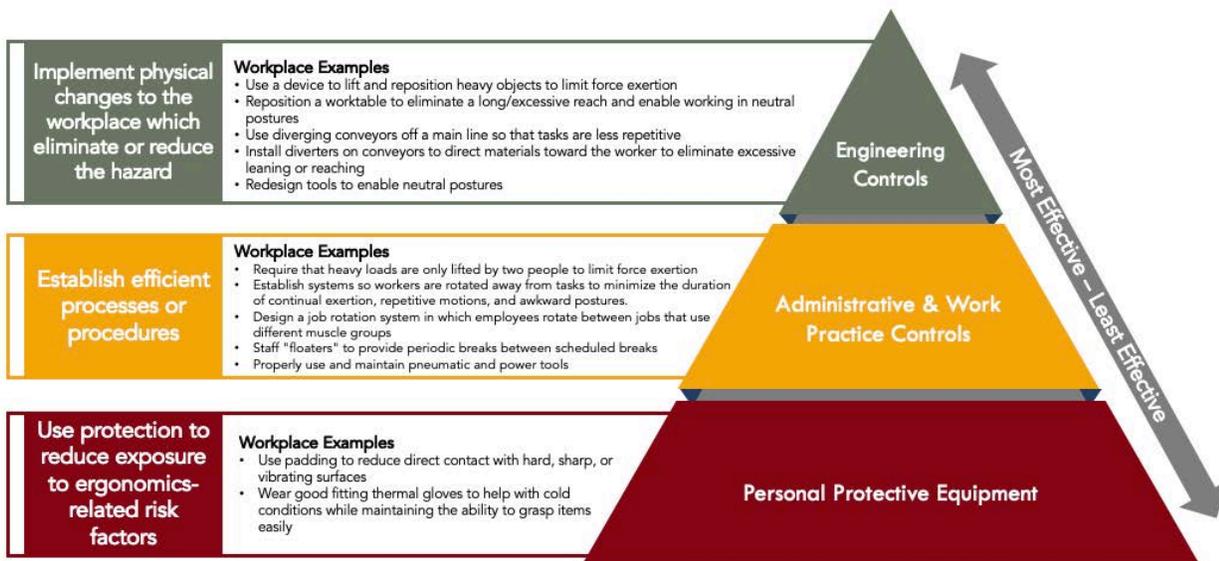
Amazon’s current approach to addressing ergonomic hazards assumes that workers are to blame for their own injuries. Managers lead stretching sessions at the beginning of shifts and instruct workers on how to lift and bend to supposedly reduce the risks of injury. But as Amazon’s records clearly show, stretching and lifting instructions are not preventing the injuries, because the injuries workers are experiencing are caused by unsafe conditions at work. Four decades of research shows that designing safer workplaces and establishing safer processes to organize the work are the most effective approaches for reducing injuries.³⁴

Amazon has a legal responsibility to eliminate ergonomic hazards in its warehouse facilities, and it must take this as seriously as it takes the work of designing the next version of Alexa. First and foremost, the company should investigate the underlying causes of these thousands of injuries and implement its workers’ recommendations for preventing additional crippling cases of back, shoulder, hand and joint injuries. It is stunning that given these high rates of disabling injuries, Amazon still has not taken responsibility for creating safe and healthy workplaces and focused its efforts on making meaningful physical changes to the workplace or changing work processes to eliminate hazards. Amazon must immediately make dramatic changes to make its warehouses and other

³⁴ Occupational Safety and Health Administration, “Ergonomics - Solutions to Control Hazards” (US Department of Labor, n.d.), <https://www.osha.gov/SLTC/ergonomics/controlhazards.html>.

facilities safer for the hundreds of thousands of workers employed in the company’s massive fulfillment operation.

Decades of Research Shows that the Most Effective Way to Reduce Injuries is to Eliminate Hazards



Amazon should build and manage safer workplaces

Many of the types of injuries that workers in Amazon facilities are suffering from most frequently—sprains, strains and tears, to the back, shoulder, knee, wrist and foot—often occur when workers are exposed to ergonomic hazards including forceful exertions, repetitive motions, twisting, bending and awkward positions and tasks. These ergonomic hazards emerge when workplaces and equipment are not designed to fit workers’ bodies and workers are forced to push, pull and lift objects, often while bending, twisting and stretching into awkward positions over and over again to complete their jobs.

Compared to other common serious and disabling workplace injuries like amputations, burns or broken bones, the injuries ergonomic hazards cause often aren’t sudden and dramatic; instead workers’ bodies gradually break down after days, weeks, and months of repetitive motions in unnatural positions. Negligent managers often blame workers themselves for failing to lift properly or complaining about painful conditions. But these kinds of injuries are the most common source of disabling worker injuries in the entire economy.³⁵

The data on injuries in Amazon’s fulfillment centers and other warehouses should be impossible to ignore. It is clear that there is something seriously wrong about the way these facilities are designed. Workers are humans, not

³⁵ Occupational Safety and Health Administration, “Ergonomics - Solutions to Control Hazards” (US Department of Labor, n.d.), <https://www.osha.gov/SLTC/ergonomics/controlhazards.html>.

robots, and work tasks should be designed to fit workers’ bodies, not force workers’ bodies to contort to fit Amazon’s equipment. Amazon should hire qualified ergonomists to collaborate with workers and engineers to identify and address the ergonomic hazards in fulfillment centers and other warehouse facilities. This could include redesigning workstations, tools, or equipment, or making changes in work methods, practices or techniques to reduce the amount of times workers are forced to twist, bend, or move into stressful postures.

Amazon must also implement administrative and work practice controls to establish safer processes and procedures in its workplace. Typically these controls include increasing the frequency or duration of breaks for workers exposed to ergonomic hazards; rotating employees to minimize the duration of continual exertion, repetitive tasks and awkward postures; and staffing jobs in a way that allows for heavy loads to be lifted by two workers to limit force exertion.

Amazon should reduce the speed of work so workers can safely perform their jobs

Combined with other ergonomic hazards like forceful exertions, repetitive motions, twisting, bending and awkward positions and tasks, the pace of work at Amazon is a risk multiplier. As pace increases, strain on joints and muscles increases, muscle fatigue sets in, and workers become much more susceptible to injury.

In fulfillment centers, Amazon pushes workers to work harder and faster by setting “rate,” or the number of tasks (for instance, pulling packages or stowing items) that supervisors require employees to perform in a shift. The company’s computers also constantly monitor workers’ “time-off-task” or the amount of time in between completing tasks. Workers are required to meet their rate goals and minimize time-off-task or face computer automated discipline or

discharge on a weekly basis. Amazon must identify and fix the hazards of fast-paced, stressful, repetitive work in its facilities, and make a commitment to preventing all injuries. No worker should be forced to sacrifice their health for a paycheck.

If workers cannot meet Amazon’s rate expectations without being injured, Amazon must reduce the rate workers are required to work and stop using rate as a tool for disciplining workers. The company should remove any rate-related discipline letters from employees’ records in any job where workers are reporting pain or injuries. Amazon managers and computer systems must provide allowances for fatigued workers to take extra breaks as needed to provide relief from arduous, hazardous workloads. These breaks must be provided with the assurances that workers will not suffer retaliation, discipline, or loss of pay—even if they would otherwise trigger warnings for “time off task.” Until Amazon can fix the underlying ergonomic hazards that are pervasive in its warehouses, such breaks will be an essential part of any effective effort to improve workplace safety at Amazon.

Further, both managers and computer systems for assigning and monitoring tasks must take into account workers’ needs for both rest breaks and reasonable workloads—based on the active input from workers, not just algorithms. If the current volume of work cannot be performed safely by the current workforce, Amazon should examine staffing levels and hire additional workers to meet demand.

Amazon should provide adequate medical care for employees who are injured on the job

When workers suffer injuries at Amazon facilities, they typically receive first-aid treatment from staff at AmCare, the company’s on-site medical units. Many of these facilities are staffed

by emergency medical technicians, not nurses or physicians. EMTs are well qualified to provide first aid but they do not have the training needed to diagnose or treat injuries and they are not licensed to practice medicine. If injuries, such as repetitive trauma disorders, are not treated early and managers force workers to return to work and be re-exposed to the same ergonomic hazards, those initial injuries can become aggravated and turn into much more severe medical problems.

Amazon should staff its AmCare with EMTs and nurses that operate under the direct supervision of a doctor. The company should also review the treatment protocols to ensure that workers are sent to see a physician if they report pain more than once to AmCare, to assure the injuries are being treated properly. Summaries of those protocols should be provided to workers who are treated at AmCare so they can be confident that the treatment or referrals that they are receiving are consistent with the protocols that have been established by a licensed physician. When AmCare staff encourages workers to seek appropriate treatment from qualified personal physicians or specialists, the company should provide the workers and their physicians with a full, detailed picture of both the work assignment and prior injury experience of workers in the same facility.

Amazon should share information on injuries with workers

OSHA requires employers to collect data on injuries and illnesses on 300 logs so workers, regulators, and employers can recognize patterns and fix hazards in workplaces. Yet, Amazon currently does not even record specific job titles for injured workers on those logs—every single employee is just listed as “Amazon Associate.” Without detailed information about where in the facility a worker was injured, it is more difficult for Amazon and workers to use these logs to identify hazards and prevent injuries.

Amazon must record more detailed information on worker titles on its OSHA 300 Logs to allow workers and Amazon to better understand the causes of injuries and make improvements. The company should also make sure that workers have access to this important information. While workers have a legal right to copies of those logs if they know to request them, few workers are notified that the logs even exist. Amazon should distribute OSHA 300 and 300A logs to every worker annually and provide training on reviewing and understanding the documents. The company should also provide comparisons of safety performance across different Amazon facilities as well as appropriate industry benchmarks along with these logs.

Amazon should take responsibility for creating safe workplaces at every level of the company—especially top management and the Board of Directors

Amazon’s own internal documents show alarming injury and illness rates across Amazon facilities with thousands of workers suffering from serious injuries every single year. Amazon’s senior leadership and Board of Directors has a responsibility to carefully oversee the company’s health and safety performance. An appropriate committee of the Board of Directors should review the company’s health and safety performance metrics quarterly and set company-wide goals for preventing workplace injuries and illnesses. A topic as important as the health and safety of the more than 600,000 people who work at Amazon is far too important to be relegated to junior executives or site-level managers.

Amazon’s shareholders also must have access to information on the company’s health and safety performance in order to assess the financial risks created by the company’s poor safety performance. Currently, Amazon does not disclose any metrics on health and safety performance that can be used to compare the

company’s performance against industry benchmarks and competitors.³⁶ Amazon should begin to publicly report on the company’s health and safety performance in its annual Environmental, Social and Governance (ESG) report to investors.

Disclosing data on the Total Recordable Incident Rates (TRIR) and Days Away, Restricted, or Transferred rates (DART) at the company’s facilities will allow investors to compare safety outcomes at Amazon’s facilities against industry benchmarks and competitors. But because these lagging indicators of safety performance tell little about the company’s efforts to prevent future injuries, Amazon should implement the recommendations in OSHA’s recent guidance document on “Using Leading Indicators to Improve Safety and Health Outcomes.”³⁷

This could include reporting information such as numbers of serious strain-and-sprain injuries investigated; the types of hazards found; the common causes of these hazards (such as excessive repetition/rate, packages stored at the wrong heights, excessive package weights given the reaches and postures involved, etc.); common solutions identified; the time taken to intervene and fix hazards after solutions found; and the results of systematic worker surveys about the usefulness of the changes. These are all common features of a data-driven, scientifically-based 21st century ergonomics program.

Amazon should listen to workers’ recommendations for improving safety

No one is better equipped to identify health and safety issues in workplaces than the

workers themselves. While Amazon does operate health and safety committees in some of its facilities, these committees have clearly been ineffective in eliminating the hazards that exist in the company’s fulfillment centers and warehouses. In facilities where workers choose to form their own, democratically elected health and safety committees, Amazon management should meet with those committees and take their recommendations seriously.

Because efforts to improve safety often break down when they are perceived as punitive for workers, worker representatives on health and safety committees should not be asked to engage in monitoring or surveillance of their coworker’s behaviors for the purposes of discipline.

Health and safety committees should receive training on best practices for identifying and addressing workplace hazards to reduce the risk of injury. The committees should also be regularly provided with health and safety performance data and aggregated data on AmCare cases to help them understand facility-wide trends. Amazon should make qualified industrial hygienists, occupational physicians, ergonomists or other appropriate health and safety professionals available to these committees to support them in their work. If worker committees choose to consult their own health and safety professionals as advisors, those professionals should be invited into the facility to participate in inspections and join meetings between the worker health and safety committees and management.

³⁶ “Sustainability,” US About Amazon, accessed November 24, 2019, <https://www.aboutamazon.com/sustainability>.

³⁷ Occupational Safety and Health Administration, “Using Leading Indicators to Improve Safety and Health Outcomes,” June 2019.

Conclusions

Over the past 20 years, Amazon has proven that it has the capacity to do incredible things, transforming key aspects of our society. The company has shown that when it makes solving a problem a priority and dedicates the resources needed to rise to that challenge it can do truly amazing things. Amazon’s own internal data shows that workers are being injured in fulfillment centers around the country at shockingly high rates. These injuries are forcing workers to miss weeks of work while they recover and, in too many cases, experience pain for the rest of their lives. And the vast majority of these injuries are preventable.

Amazon must take immediate action to eliminate hazards in its warehouses and other facilities and make its workplaces safe for workers. The company must:

- Identify and address ergonomic hazards in fulfillment centers and other facilities and implement safer workstation designs and practices **to reduce the risk of injury to workers;**
- **Reduce the speed of work** and increase break times to address the hazards of fast-paced, stressful, repetitive work in its workplaces;
- Provide **adequate medical care** for employees who are injured on the job.
- Share readily available information on injuries and illnesses with workers to allow them to **better understand the risks to which they are being exposed;**
- Ensure that senior management, the Board of Directors and shareholders all **take responsibility for creating safe workplaces;** and
- Engage with **worker-led health and safety committees** to identify and eliminate hazards in its facilities.

Each of these solutions could dramatically improve health and safety outcomes for the hundreds of thousands of workers in Amazon’s fulfillment centers and warehouse facilities. If done well, many of these changes would cost very little in comparison to the company’s annual revenues and could actually improve the efficiency and reliability of the company’s fulfillment networks. Workers are being hurt at an alarming rate and there is no good reason for Amazon not to take meaningful action to fix these hazards and make work safer.

Appendix A – Technical Note

The data set examined in this report includes OSHA 300 and/or 300A logs from 28 Amazon facilities in 16 states around the United States obtained from Amazon by current and former employees and provided to workers’ rights organizations and media outlets in summer and fall of 2019. While federal regulations require employers to provide workers with 300 and 300A logs from their workplaces covering the previous five years regardless of when they worked at the facility, in many cases Amazon unlawfully restricted workers’ access to that data by only providing records for a small portion of that window. As a result, there is significant variation in the years covered in the logs.

Because this data set is a convenience sample, not a random sample, it is possible that the safety performance in the 28 facilities in this sample is not representative of Amazon workplaces as a whole. The safety performance and the injury experience reported across the sample is relatively consistent and the data set is sufficiently large, however, so there is no reason to believe that there is any sort of systematic sampling bias in this data set. The authors would welcome the opportunity to perform a similar analysis of safety performance and injury experience at all Amazon facilities and strongly encourage Amazon management to make that data publicly available.

Calculations of injury rates including total recordable incident rate (TRIR) and days away, transferred or restricted rates (DART) are based on data from OSHA 300A logs in the sample. Calculations of injury types, dates, and severity are based on data from OSHA 300 logs in the sample. Partial year data from 2019 is included in analysis of nature of injury and body parts injured but excluded in analysis of the timing of injuries.

Facility	2014	2015	2016	2017	2018	2019 (partial year)
ABE2 – Breinigsville, PA	300, 300A	300, 300A	300, 300A	300, 300A		
ABE4 – Easton, PA			300, 300A	300, 300A	300A	300, 300A
BDL5 – Wallingford, CT		300	300, 300A	300		
BFI3 – DuPont, WA					300A	
BFI4 – Kent, WA					300, 300A	300, 300A
BOS7 – Fall River, MA					300A	
BWI2 – Baltimore, MD					300A	
CHA2 – Charleston, TN					300A	
DEN2 – Aurora, CO				300, 300A	300, 300A	300
DEN3 – Thornton, CO					300, 300A	
DFW7 – Fort Worth, TX					300A	

Facility	2014	2015	2016	2017	2018	2019 (partial year)
EWR4 – Robbinsville, NJ					300A	
FAT1 – Fresno, CA					300A	
FTW3 – Fort Worth, TX					300A	
JFK8 – Staten Island, NY					300A	300A
IND5 – Indianapolis, IN	300	300	300	300		
LGA9 – Edison, NJ					300, 300A	
LGB3 – Eastvale, CA					300A	
MDW4 – Joliet, IL					300, 300A	300
MKE1 – Kenosha, WI		300, 300A	300, 300A		300A	
MSP1 – Shakopee, MN				300, 300A	300, 300A	
MSP5 – Shakopee, MN		300	300, 300A	300, 300A	300	
OAK4 – Tracy, CA					300A	
ONT6 – Moreno Valley, CA			300, 300A	300, 300A	300, 300A	300
PDX5 – Hillsboro, OR				300A	300A	
PDX9 – Troutdale, OR					300A	
SMF1 – Sacramento, CA					300A	
TPA2 – Lakeland, FL					300A	

EXHIBIT 5

United States Senate

WASHINGTON, DC 20510

February 7, 2020

Jeff Bezos
Chief Executive Officer
Amazon.com, Inc.
410 Terry Ave. North
Seattle, WA 98109

Dear Mr. Bezos:

We write to express our serious concern about the safety of Amazon's employees, particularly after the busy holiday season. Recent investigations into Amazon's safety records found that the injury rate of workers at Amazon facilities is much higher than the injury rate for private sector employers in the U.S. – and even for the warehouse industry generally. Any practice that puts profits before worker safety is unacceptable. We urge you to take immediate steps to protect your employees from workplace injuries. Your employees' lives and well-being depend upon your swift action.

Recent analysis of Amazon's own internal injury records by *The Atlantic*, *Reveal from the Center for Investigative Reporting*, and by a coalition of worker advocate organizations found disturbing injury rates at Amazon warehouses. In the article "Ruthless Quotas at Amazon Are Maiming Employees," published November 25, 2019 in *The Atlantic*, workers detail Amazon's strict quota requirements that force employees to fulfill orders so quickly they are either unable to complete tasks safely or must perform so many tasks that they pay the physical consequences for doing so. Workers report going to great lengths to meet their quotas – which you refer to as target performance expectations – because failure to meet it three times leads to an employee's termination. Pressure to meet their quotas is so great that workers report urinating in plastic bottles on the warehouse floor, or are even avoiding restroom breaks altogether. Some employees were even discouraged from evacuating a facility where a noxious gas leak occurred. Perhaps the most emblematic example of the company's seeming disregard for worker safety is the failure to notice a worker fatality for more than two hours at an Indiana facility.

The firsthand accounts included in *The Atlantic* article are part of a larger pattern of Amazon employees suffering workplace injuries. The recently published report "Packaging Pain: Workplace Injuries In Amazon's Empire" documents the extent to which workplace injuries are stunningly widespread throughout Amazon facilities. According to the report, Amazon workers are three times as likely to get injured than employees at other private employers. Moreover, Amazon employees are more than five times as likely to suffer a serious injury (involving days away from work, job restriction or transfer) than employees at other private employers – with almost nine out of ten injured Amazon workers forced to take time off of work or transfer. When such injuries are serious enough to force employees to miss work, they are so severe that Amazon employees miss an average of five and a half weeks of work. Amazon's worker injury numbers are also more than twice as bad in the pre-Christmas crunch period.

These reports make clear that by placing such a priority on speed and quota fulfillment, your company requires employees to risk their safety and health to perform and keep their jobs. The safety of workers should come first. To ensure it does, and consistent with the reports' conclusions, we urge you to immediately take the following action:

- Reduce workers' quotas and speed requirements, schedule frequent rest breaks during high production shifts, and eliminate the policy of terminating workers who do not meet their quotas three times;
- Cease including bathroom breaks as "time off task" and ensure workers are allowed and encouraged to hydrate and use the bathroom as needed;
- If Amazon provides worksite medical care, ensure it is staffed by licensed health care professionals operating within their legal scope of practice;
- Provide immediate referrals to a physician for workers who report to Amazon's on-site medical care that their symptoms are not improving and for workers who request medical care from a physician so they can see the doctor or urgent care provider of their choice and receive adequate medical treatment;
- Conduct a comprehensive ergonomic evaluation of all warehouse tasks involving manual material handling and implement changes to the physical workplace and to work practices that reduce or eliminate employee risk to ergonomic injuries;
- Implement a strong and enforceable company policy that prohibits supervisors and managers from discrimination or retaliation when workers report injuries or safety concerns;
- Ensure workers, who know their jobs and working conditions best, have a guaranteed way to raise safety and health concerns and provide recommendations to correct identified hazards and keep workers apprised in a timely fashion of action taken by management regarding their concerns; and
- Make public Amazon's summary record of serious injuries (OSHA 300 A) on Amazon's website for all of the company's worksites.

Amazon's dismal safety record indicates a greater concern for profits than for your own workers' safety and health. We urge you to overhaul this profit-at-all costs culture at your company and take the immediate steps identified in this letter to ensure Amazon's managers treat your workers fairly and do not require them to risk their own health and safety in the course of doing their jobs.

We request a written response to this letter, including detailed descriptions of the action the company is taking to adopt the policy changes outlined in this letter, by February 21st.

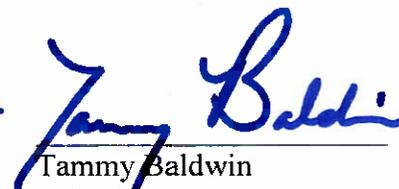
Sincerely,



Sherrod Brown
United States Senator



Bernard Sanders
United States Senator



Tammy Baldwin
United States Senator

Kirsten Gillibrand

Kirsten Gillibrand
United States Senator

Richard Blumenthal

Richard Blumenthal
United States Senator

Elizabeth Warren

Elizabeth Warren
United States Senator

Chris Van Hollen

Chris Van Hollen
United States Senator

Tina Smith

Tina Smith
United States Senator

Richard J. Durbin

Richard J. Durbin
United States Senator

Christopher Murphy

Christopher Murphy
United States Senator

Kamala D. Harris

Kamala D. Harris
United States Senator

Edward J. Markey

Edward J. Markey
United States Senator

Mazie Hirono

Mazie K. Hirono
United States Senator

Jeffrey A. Merkley

Jeffrey A. Merkley
United States Senator

Cory A. Booker

Cory A. Booker
United States Senator

January 24, 2020

VIA E-MAIL

Office of Chief Counsel
Division of Corporation Finance
Securities and Exchange Commission
100 F Street, NE
Washington, DC 20549

Re: *Amazon.com, Inc.*
Shareholder Proposal of the International Brotherhood of Teamsters General
Fund and the CtW Investment Group
Exchange Act of 1934—Rule 14a-8

Ladies and Gentlemen:

This letter is to inform you that our client, Amazon.com, Inc. (the “Company”), intends to omit from its proxy statement and form of proxy for its 2020 Annual Meeting of Shareholders (collectively, the “2020 Proxy Materials”), a shareholder proposal (the “Proposal”) and statements in support thereof (the “Supporting Statement”) received from the International Brotherhood of Teamsters General Fund and the CtW Investment Group (the “Proponents”).

Pursuant to Rule 14a-8(j), we have:

- filed this letter with the Securities and Exchange Commission (the “Commission”) no later than eighty (80) calendar days before the Company intends to file its definitive 2020 Proxy Materials with the Commission; and
- concurrently sent copies of this correspondence to the Proponents.

Rule 14a-8(k) and Staff Legal Bulletin No. 14D (Nov. 7, 2008) (“SLB 14D”) provide that shareholder proponents are required to send companies a copy of any correspondence that the proponents elect to submit to the Commission or the staff of the Division of Corporation Finance (the “Staff”). Accordingly, we are taking this opportunity to inform the Proponents that if the Proponents elect to submit additional correspondence to the Commission or the Staff with respect to this Proposal, a copy of that correspondence should be furnished concurrently to the undersigned on behalf of the Company pursuant to Rule 14a-8(k) and SLB 14D.

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THE PROPOSAL

The Proposal states:

Resolved: That the shareholders of Amazon.com (the “Company”), urge the Board of Directors (the “Board”) to prepare a report, within 90 days before the 2021 annual meeting, at a reasonable cost and excluding proprietary and personal information, on the steps the Company has taken to reduce the risk of accidents. The report should describe the Board’s oversight process of safety management, staffing levels, inspection and maintenance of Company facilities and equipment and those of the Company’s dedicated third-party contractors.

A copy of the Proposal and its supporting statement, as well as related correspondence with the Proponents, is attached to this letter as Exhibit A.

BASIS FOR EXCLUSION

We respectfully request that the Staff concur in our view that the Proposal may be excluded from the 2020 Proxy Materials pursuant to Rule 14a-8(i)(7) because the Proposal relates to the Company’s ordinary business operations.

BACKGROUND

The Company, which is one of the largest companies in the world and has operations around the globe, is committed to maintaining a strong culture of safety. As reaffirmed in the Company’s Global Human Rights Principles, the Company strives to be the most safety-centric organization in the world.¹ It endeavors to provide a clean, safe, and healthy work environment where the health and safety of workers is a top priority. The Company also devotes significant resources and effort to address the safety of its employees and contractors. The Company’s dedication to innovating on behalf of customers is the same approach it has for employees, which can be broken down into three categories: improvement, investment, and innovation. The Company’s workplace safety policy (the “Safety Policy”) describes how workplace safety is an integral part of the Company’s ordinary business operations.² As described in the Safety Policy, the Company has feedback processes in place, such as Voice of Associate boards and Safety Leadership Index questions, designed to afford employees access to management to provide feedback on workplace safety. In addition, the Company has established a Workplace Health and Safety program, comprising more than 2,000 professionals dedicated to overseeing workplace safety for the Company’s employees. The Company provides ongoing safety training to employees and

¹ Available at <https://sustainability.aboutamazon.com/governance/amazon-global-human-rights-principles>.

² Available at <https://www.aboutamazon.com/amazon-fulfillment/our-fulfillment-centers/amazons-commitment-to-workplace-safety>.

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performs thousands of safety inspections each day across its worldwide facilities. The Company also regularly invests in safety improvements in its fulfillment centers and other facilities. The Company's safety policies and standards are continually adjusted as needed, both to remain compliant with changing regulations and applicable laws and to incorporate on-going learning and innovation.

ANALYSIS

The Proposal May Be Excluded Under Rule 14a-8(i)(7) Because It Deals With Matters Relating To The Company's Ordinary Business Operations.

A. The Ordinary Business Standard.

Rule 14a-8(i)(7) permits a company to omit from its proxy materials a shareholder proposal that relates to the company's "ordinary business" operations. According to the Commission's release accompanying the 1998 amendments to Rule 14a-8, the term "ordinary business" "refers to matters that are not necessarily 'ordinary' in the common meaning of the word," but instead the term "is rooted in the corporate law concept [of] providing management with flexibility in directing certain core matters involving the company's business and operations." Exchange Act Release No. 40018 (May 21, 1998) (the "1998 Release").

In the 1998 Release, the Commission stated that the underlying policy of the ordinary business exclusion is "to confine the resolution of ordinary business problems to management and the board of directors, since it is impracticable for shareholders to decide how to solve such problems at an annual shareholders meeting," and identified two central considerations that underlie this policy. As relevant here, one consideration is that "[c]ertain tasks are so fundamental to management's ability to run a company on a day-to-day basis that they could not, as a practical matter, be subject to direct shareholder oversight." Examples of the tasks cited by the Commission include "management of the workforce, such as the hiring, promotion, and termination of employees, decisions on production quality and quantity, and the retention of suppliers." 1998 Release.

The 1998 Release further distinguishes proposals pertaining to ordinary business matters from those involving "significant social policy issues," the latter of which are not excludable under Rule 14a-8(i)(7) because they "transcend the day-to-day business matters and raise policy issues so significant that it would be appropriate for a shareholder vote." *Id.* In this regard, when assessing proposals under Rule 14a-8(i)(7), the Staff considers the terms of the resolution and its supporting statement as a whole. *See* Staff Legal Bulletin No. 14C, part D.2 (June 28, 2005) ("In determining whether the focus of these proposals is a significant social policy issue, we consider both the proposal and the supporting statement as a whole.").

A shareholder proposal being framed in the form of a request for a report does not change the nature of the proposal. The Commission has stated that a proposal requesting the dissemination

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of a report may be excludable under Rule 14a-8(i)(7) if the subject matter of the report is within the ordinary business of the issuer. *See* Exchange Act Release No. 20091 (Aug. 16, 1983). In addition, the Staff has indicated that “[where] the subject matter of the additional disclosure sought in a particular proposal involves a matter of ordinary business . . . it may be excluded under [R]ule 14a-8(i)(7).” *Johnson Controls, Inc.* (avail. Oct. 26, 1999).

Similarly, a proposal’s request for a review of certain risks also does not preclude exclusion if the underlying subject matter of the proposal is ordinary business. In Staff Legal Bulletin No. 14E (Oct. 27, 2009) (“SLB 14E”), the Staff explained the way in which it will analyze shareholder proposals requesting an evaluation of risks, stating, “rather than focusing on whether a proposal and supporting statement relate to the company engaging in an evaluation of risk, we will instead focus on the subject matter to which the risk pertains or that gives rise to the risk.” SLB 14E also sets forth the Staff’s views on proposals that address a board’s role in risk oversight. It states:

[T]here is widespread recognition that the board’s role in the oversight of a company’s management of risk is a significant policy matter regarding the governance of the corporation. In light of this recognition, a proposal that focuses on the board’s role in the oversight of a company’s management of risk may transcend the day-to-day business matters of a company and raise policy issues so significant that it would be appropriate for a shareholder vote.

While thus acknowledging that certain proposals addressing a board’s oversight “*may*” transcend a company’s ordinary business, the Staff has repeatedly concurred in exclusion of proposals addressing a board’s role in the oversight of a company’s management of risk when those proposals also request a review of risks and the underlying subject matter of the risk review involves ordinary business. Under SLB 14E, when assessing whether the Proposal properly may be excluded under Rule 14a-8(i)(7), one must “consider whether the underlying subject matter of the risk evaluation involves a matter of ordinary business to the [C]ompany.” Here, although the Proposal states that the requested report should address “the Board’s oversight process of safety management,” the Proposal does not focus on the Board’s oversight in the management of risk, but instead focuses on safety management generally.³ As discussed below, the subject matter of

³ This is demonstrated by the Supporting Statement, which calls for certain enumerated “key comparable metrics . . . that the [C]ompany can publish to allow shareholders to understand the Company’s safety performance” and states, “We believe that a report to shareholders on the steps Amazon.com has taken to reduce the risk of accidents will provide transparency and increase investor confidence in our Company.” Although the Supporting Statement also asserts that the charters of the board committees fail to identify which committee has specific responsibility for these issues, the Company’s Audit Committee charter states that it is responsible for overseeing management of, among other things, operational risks and the charter of the Board’s Leadership Development and Compensation Committee states that it is responsible for overseeing strategies and policies related to human capital management, including workplace environment and safety.

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the Proposal, accidents and workplace safety, demonstrates that the Proposal is excludable pursuant to Rule 14a-8(i)(7) because it implicates the Company’s ordinary business operations.

B. The Proposal Is Excludable Because It Relates To Workplace Safety.

The Staff has regularly concurred that a company’s safety initiatives, including those relating to workplace safety, are a matter of ordinary business and concurred in exclusion of such proposals under Rule 14a-8(i)(7). The Staff recently considered this issue in the context of a virtually identical proposal. In *The Chemours Co.* (avail. Jan. 17, 2017), a proposal with virtually identical language to the Resolved clause of the Proposal requested a board report “on the steps the [c]ompany has taken to reduce the risk of accidents” and stated that “[t]he report should describe the [b]oard’s oversight of Process Safety Management; staffing levels; inspection and maintenance of facilities and other equipment.”⁴ Notably, the supporting statement to *The Chemours Co.* proposal cited a number of industrial accidents at the company’s facilities, and cited significant regulatory fines that had been assessed against the company and one of its corporate predecessors for various safety violations. The company argued that the proposal was excludable under Rule 14a-8(i)(7) because it related to the company’s workplace safety, which was “a significant component of the design and operation of the [c]ompany’s production facilities,” and that such decisions were central to the company’s core business activities. The Staff concurred in exclusion noting “that the proposal relate[d] to workplace safety.”

Similarly, in *Pilgrim’s Pride Corp.* (avail. Feb. 25, 2016), the proposal requested that the company publish a report describing the company’s policies, practices, performance and improvement targets related to occupational health and safety. The supporting statement to the *Pilgrim’s Pride Corp.* proposal noted that workers in that company’s industry suffer injury and

⁴ As illustrated in the table below, the operative language in the Resolved clause of the Proposal differs from the Resolved clause in *The Chemours Co.* proposal only by referring to “process of safety management” (whereas *The Chemours Co.* proposal referred to “Process Safety Management”) and by requesting that the report address the facilities and equipment not only of the Company but also “of the Company’s dedicated third-party contractors.”

The Proposal	<i>The Chemours Co.</i>
<p>Resolved: That the shareholders of Amazon.com (the “Company”), urge the Board of Directors (the “Board”) to prepare a report, within 90 days before the 2021 annual meeting, at a reasonable cost and excluding proprietary and personal information, on the steps the Company has taken to reduce the risk of accidents. The report should describe the Board’s oversight process of safety management, staffing levels, inspection and maintenance of Company facilities and equipment and those of the Company’s dedicated third-party contractors.</p>	<p>RESOLVED: Shareholders of The Chemours Company urge the Board of Directors to report by the 2018 annual meeting, at reasonable cost and excluding proprietary and personal information, on the steps Chemours has taken to reduce the risk of accidents. The report should describe the Board’s oversight of Process Safety Management, staffing levels, inspection and maintenance of facilities and other equipment.</p>

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illness at five times the national average, and suffer carpal tunnel syndrome at seven times the national average. The supporting statement further claimed that the company “was recently named to OSHA’s Severe Violator Enforcement Program for repeated or willful occupational health and safety (“OHS”) violations, and has been fined more than \$300,000 in the last four years for OHS violations.” The company noted that workplace safety is at the core of its business operations, and that “[t]he design and operation of the [c]ompany’s production facilities center on workplace safety and efficiency.” In light of this, the company argued that the broad report requested by the proposal “implicates every aspect of the [c]ompany’s workplace safety efforts” and therefore related to the Company’s ordinary business operations. The Staff concurred, noting that the proposal “relates to workplace safety.”

The Staff’s determinations in the foregoing recent precedent are consistent with decades-old precedent concurring with the exclusion of proposals addressing workplace safety issues as implicating a company’s ordinary business operations. *See CNF Transportation, Inc.* (avail. Jan. 26, 1998) (concurring in exclusion of a proposal requesting that the board of directors develop and publish a safety policy accompanied by a report analyzing the long-term impact of the policy on the company’s competitiveness and shareholder value because “disclosing safety data and claims history” was a matter of the company’s ordinary business); *Chevron Corp.* (avail. Feb. 22, 1988) (concurring in the exclusion of a proposal as ordinary business because it related to the protection of the safety of company employees).

Here, the Proposal requests a report on the Company’s efforts to “reduce the risk of accidents” and to “describe the Board’s oversight process of safety management, staffing levels, inspection and maintenance of facilities and equipment and those of the Company’s dedicated third-party contractors.” In addition, the Supporting Statement suggests that the Company implement board-level oversight procedures on workplace health and safety. As with the proposals in *The Chemours Co.* and *Pilgrim’s Pride Corp.*, the Proposal seeks information on a broad array of day-to-day safety issues that confront the Company. As explained above, workplace safety is a key focus of the Company. However, the issue is integrally related to the management of the Company’s operations, the design of the Company’s facilities, and many other aspects of the Company’s day-to-day operations, including employment staffing levels and the extent to which the Company invests in technology such as robotics. While the Supporting Statement focuses on the Company’s fulfillment centers, the Company’s workplace safety policies apply throughout the Company’s worldwide operations, including the Company’s office facilities, its data centers, and its transportation network, as well as to its suppliers.⁵ As a result, workplace safety issues involve an enormous range of issues, such as compliance with varying regulations around the world and attracting and retaining associates. In short, workplace safety is a significant component of the design and management of the Company’s worldwide operations. Thus, as in *The Chemours Co.*, *Pilgrim’s Pride Corp.*, and the other precedent discussed above, because

⁵ See Amazon’s Key Commitments, available at <https://sustainability.aboutamazon.com/key-commitments> (“Safe and healthy workplaces are a top priority for Amazon”).

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workplace safety is an integral and routine element of the Company's day-to-day business, the Proposal may properly be excluded under Rule 14a-8(i)(7) as relating to the Company's ordinary business operations.

C. *The Proposal Does Not Focus On A Significant Policy Issue That Transcends The Company's Ordinary Business.*

SLB 14E states that “[i]n those cases in which a proposal’s underlying subject matter transcends the day-to-day business matters of the company and raises policy issues so significant that it would be appropriate for a shareholder vote, the proposal generally will not be excludable under Rule 14a-8(i)(7) as long as a sufficient nexus exists between the nature of the proposal and the company.” The Staff reaffirmed this position in Note 32 of Staff Legal Bulletin No. 14H (Oct. 22, 2015), explaining “[w]hether the significant policy exception applies depends, in part, on the connection between the significant policy issue and the company’s business operations,” and later stated in Staff Legal Bulletin No. 14K (Oct. 16, 2019) that “a policy issue that is significant to one company may not be significant to another.”

Although workplace safety is a key focus of the Company, the Proposal does not raise issues that transcend the Company's ordinary business. The fact that the Supporting Statement cites a number of workplace safety concerns does not make workplace safety unique or transcendent to the Company, as the supporting statements in both *The Chemours Co.* and *Pilgrim's Pride Corp.* cited unfortunate workplace incidents that occurred at those companies.⁶ The Company acknowledges that workplace accidents can be very serious and agrees that workplace safety issues are important. However, nothing about the Proposal, which refers broadly to addressing the “risks of accidents” and addresses safety issues across the Company's facilities and equipment and those of the Company's “dedicated third-party contractors,” raises it beyond the day-to-day safety management issues that are incident to the Company's ordinary business operations.

In this respect, the Proposal is comparable to one addressed in *Union Pacific Corp.* (avail. Feb. 25, 2008), which also addressed safety concerns in the course of the company's operations. The proposal requested disclosures of the company's efforts to safeguard the company's operations from terrorist attacks and “other homeland security incidents.” The company argued that the proposal was excludable because the proposal related to the company's day-to-day efforts to safeguard its operations—including not only terrorist attacks, but also earthquakes, floods, and other routine operating risks that were overseen by the Department of Homeland Security but were incident to the company's ordinary business operations. The Staff's response noted that the

⁶ The Company notes that the supporting statements in *The Chemours Co.* and *Pilgrim's Pride Corp.* cited to OSHA fines and *findings*. In contrast, the Supporting Statement addresses an OSHA Hazard Alert Letter issued to the Company, which is a form of warning letter. The Company disputed the findings in that letter, and OSHA took no subsequent action on the matters addressed in the letter.

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proposal was excludable because it included matters relating to the company's ordinary business operations despite the fact that safeguarding against terrorist attacks might be viewed as not part of the company's ordinary business. *See also PetSmart, Inc.* (avail. Mar. 24, 2011) (granting no-action relief with respect to a proposal requesting the board require suppliers to certify that they had not violated animal cruelty-related laws, finding that while animal cruelty is a significant policy issue, the scope of laws covered by the proposals was too broad).

Here, the Proposal's broad application to "accidents" encompasses matters incident to the Company's (and many other businesses') ordinary business operations, ranging from employee injury and illness (including matters of simple first-aid), to acts of nature (such as when an unprecedented tornado in Maryland caused a section of the Company's distribution facility to collapse in 2018), and even to automobile accidents involving the Company's delivery vehicles that may be caused by third parties. Thus, the Proposal's broad scope renders the Proposal excludable because the report requested by the Proposal implicates the Company's ordinary business. As with the proposal in *Union Pacific Corp.*, even if certain aspects of the Company's workplace safety program were deemed to implicate significant policy issues (which the Company does not believe is the case), the Proposal's broad request does not transcend the day-to-day business matters of the Company, and as such, the Proposal is properly excludable under Rule 14a-8(i)(7).

CONCLUSION

Based upon the foregoing analysis, we respectfully request that the Staff concur that it will take no action if the Company excludes the Proposal from its 2020 Proxy Materials.

We would be happy to provide you with any additional information and answer any questions that you may have regarding this subject. Correspondence regarding this letter should be sent to shareholderproposals@gibsondunn.com. If we can be of any further assistance in this matter, please do not hesitate to call me at (202) 955-8671 or Mark Hoffman, the Company's Vice President & Associate General Counsel, Corporate and Securities, and Legal Operations, and Assistant Secretary, at (206) 266-2132.

Sincerely,



Ronald O. Mueller

Enclosures

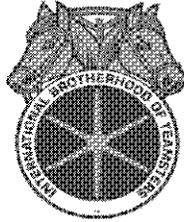
cc: Mark Hoffman, Amazon.com, Inc.
Louis Malizia, International Brotherhood of Teamsters
Tejal K. Patel, CtW Investment Group

EXHIBIT A

INTERNATIONAL BROTHERHOOD OF TEAMSTERS

JAMES P. HOFFA
General President

25 Louisiana Avenue, NW
Washington, DC 20001



KEN HALL
General Secretary-Treasurer

202.624.6800
www.teamster.org

CAPITAL STRATEGIES DEPARTMENT FAX COVER SHEET

TEL. No. 202.624.8100

FAX. No. 202.624.6833

DATE: Friday, December 6, 2019

TO: David Zapolsky, Snr. VP & Secy.

FROM: FAX_CapStrat

DESTINATION FAX NUMBER: 12062667010

No. PAGES FOLLOWING COVER: 04

COMMENTS:

Teamsters General Fund shareholder proposal, cover letter and proof

of shares for the 2020 Shareholders meeting.

CONFIDENTIALITY NOTICE

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INTERNATIONAL BROTHERHOOD OF TEAMSTERS

JAMES P. HOFFA
General President

25 Louisiana Avenue, NW
Washington, DC 20001



KEN HALL
General Secretary-Treasurer

202.624.6800
www.teamster.org

December 6, 2019

BY FAX: 206.266.7010
BY EMAIL: David.Zapolsky@amazon.com
BY UPS GROUND

David A. Zapolsky, Esq., Senior Vice President,
General Counsel and Secretary
Amazon.com Inc.
410 Terry Avenue North
Seattle, WA 98109-5210

Dear Mr. Zapolsky:

I hereby submit the enclosed resolution on behalf of the Teamsters General Fund, in accordance with SEC Rule 14a-8, to be presented at the Company's 2020 Annual Meeting.

The General Fund has owned 7 shares of Amazon.com Inc., continuously for at least one year and intends to continue to own at least this amount through the date of the annual meeting. Enclosed is relevant proof of ownership.

Any written communication should be sent to the above address via U.S. Postal Service, UPS, or DHL, as the Teamsters have a policy of accepting only union delivery. If you have any questions about this proposal, please direct them to Louis Malizia of the Capital Strategies Department at (202) 624-6930.

Sincerely,

A handwritten signature in cursive script that reads "Ken Hall".

Ken Hall
General Secretary-Treasurer

KH/lm
Enclosures

RESOLVED: That the shareholders of Amazon.com (“the Company”), urge the Board of Directors (“the Board”) to prepare a report, within 90 days before the 2021 annual meeting, at a reasonable cost and excluding proprietary and personal information, on the steps the Company has taken to reduce the risk of accidents. The report should describe the Board’s oversight process of safety management, staffing levels, inspection and maintenance of Company facilities and equipment and those of the Company’s dedicated third-party contractors.

SUPPORTING STATEMENT: Amazon.com employs approximately 647,500 full and part-time employees, making it the second largest private employer in the United States. The number of employees has more than quadrupled over the past four years.

The Company’s online retail business provides customers with fast delivery guarantees, including same day service. This creates a high speed, high stress, work environment particularly for employees at the Company’s 186 warehouses and drivers of Amazon.com’s fleet of 20,000 owned and leased delivery vehicles.

The Center for Investigative Reporting using Amazon’s own OSHA reporting from 22 fulfillment centers in 14 states revealed extremely high rates of injury, more than twice the national warehouse rate. The Company’s reports showed that severity of the injuries forced employees to miss an average of 5.5 weeks of work. (<https://revealnews.org/article/behind-the-smiles/>)

The U.S. Department of Labor’s Occupational Safety and Health Administration (OSHA) issued a warning letter to the Company in August 2019 for failure to provide adequate medical care in six separate instances despite workers going through the Company’s onsite care facility – Amcare. (<https://theintercept.com/2019/12/02/amazon-warehouse-workers-safety-cyber-monday/>)

These instances are cause for concern for investors who prioritize the sustainability of the Company. The injury rates combined with the lack of disclosure on how the Company is dealing with the issue leaves Amazon.com exposed to legal, regulatory and reputational risks.

We believe Board level oversight of health and safety performance is needed. The charters of the board committees fail to identify which committee has specific responsibility for these issues.

The Company’s corporate social responsibility report includes: a section on employee safety but it does not include a single comparable metric. (<https://www.aboutamazon.com/amazon-fulfillment/our-fulfillment-centers/safety>) The report lists how many safety professionals they have and how many hours of safety training employees sat through. But there are key comparable metrics—total recordable incident rates, days

Teamsters Fund/Amazon.com Proposal

December 6, 2019

Page 2

away/reduced time rates, and severity rates—that the company can publish to allow shareholders to understand the Company’s safety performance. These are measures that the Bureau of Labor Statistics publishes detailed industrial data on annually <https://www.bls.gov/lif/> so investors can benchmark the Company’s performance against the rest of the industry.

We believe that a report to shareholders on the steps Amazon.com has taken to reduce the risk of accidents will provide transparency and increase investor confidence in our Company.



December 6, 2019

David A. Zapolsky, Esq., Senior Vice President
General Counsel and Secretary
Amazon.com Inc.
410 Terry Avenue North
Seattle, WA 98109-5210

RE: Amazon.com Inc. - Cusip # 023135106

Dear Mr. Zapolsky:

Amalgamated Bank is the record owner of 7 shares of common stock (the "Shares") of Amazon.com Inc., beneficially owned by the International Brotherhood of Teamsters General Fund. The shares are held by Amalgamated Bank at the Depository Trust Company in our participant account # 2352. The International Brotherhood of Teamsters General Fund has held the shares continuously since 11/12/2013, and will continue to hold these shares through the date of the Annual shareholders Meeting.

If you have any questions or need anything further, please do not hesitate to call me at (212) 895-4974.

Very truly yours,

A handwritten signature in black ink, appearing to read "Suzette Spooner", with a long, sweeping horizontal line extending to the right.

Suzette Spooner
Vice President

cc: Louis Maliza

America's Labor Bank®

275 SEVENTH AVENUE NEW YORK, NY 10001 212-255-6200 www.amalgamatedbank.com

CtW Investment Group

December 9, 2019

Mr. David A. Zapolsky
Senior Vice President, General Counsel and Secretary
Amazon.com, Inc.
410 Terry Avenue North
Seattle, Washington 98109-5210

Dear Mr. Zapolsky:

On behalf of the CtW Investment Group (“CtW”), I hereby submit the enclosed shareholder proposal (“Proposal”) for inclusion in Amazon.com Inc. (“Company”) proxy statement to be circulated to Company shareholders in conjunction with the next annual meeting of shareholders. We are co-filing this proposal with Teamsters General Fund. The Proposal is submitted under Rule 14(a)-8 (Proposals of Security Holders) of the U.S. Securities and Exchange Commission’s proxy regulations.

CtW is the beneficial owner of approximately 3 shares of the Company’s common stock, which have been held continuously for more than a year prior to this date of submission. The Proposal requests that the Board prepare a report on the steps the Company has taken to reduce the risk of accidents.

CtW intends to hold the shares through the date of the Company’s next annual meeting of shareholders. The record holder of the stock will provide the appropriate verification of the Fund’s beneficial ownership by separate letter. Either the undersigned or a designated representative will present the Proposal for consideration at the annual meeting of shareholders.

If you have any questions or wish to discuss the Proposal, please contact Tejal K. Patel, at (202) 721-6079 or tejal.patel@ctwinvestmentgroup.com. Copies of correspondence or a request for a “no-action” letter should be forwarded to Ms. Patel in care of the CtW Investment Group, 1900 L St. NW, Suite 900, Washington, DC 20036.

Sincerely,



Dieter Waizenegger
Executive Director, CtW Investment Group

RESOLVED: That the shareholders of Amazon.com (“the Company”), urge the Board of Directors (“the Board”) to prepare a report, within 90 days before the 2021 annual meeting, at a reasonable cost and excluding proprietary and personal information, on the steps the Company has taken to reduce the risk of accidents. The report should describe the Board’s oversight process of safety management, staffing levels, inspection and maintenance of Company facilities and equipment and those of the Company’s dedicated third-party contractors.

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away/reduced time rates, and severity rates—that the Company can publish to allow shareholders to understand the Company’s safety performance. These are measures that the Bureau of Labor Statistics publishes detailed industrial data on annually (<https://www.bls.gov/iif/>), so investors can benchmark the Company’s performance against the rest of the industry.

We believe that a report to shareholders on the steps Amazon.com has taken to reduce the risk of accidents will provide transparency and increase investor confidence in our Company.

December 23, 2019

VIA OVERNIGHT MAIL AND EMAIL

Tejal K. Patel
CtW Investment Group
1900 L Street Northwest, Suite 900
Washington, DC 20036
tejal.patel@ctwinvestmentgroup.com

Dear Ms. Patel:

I am writing on behalf of Amazon.com, Inc. (the “Company”), which received on December 9, 2019, the shareholder proposal submitted by CtW Investment Group (the “Co-Filer”) pursuant to Securities and Exchange Commission (“SEC”) Rule 14a-8 for inclusion in the proxy statement for the Company’s 2020 Annual Meeting of Shareholders (the “Proposal”).

The Co-Filer’s December 9, 2019 letter indicates that the Co-Filer is co-filing the Proposal with the Teamsters General Fund. We understand that the Teamsters General Fund is the primary filer of the Proposal. Therefore, we understand that the Teamsters General Fund is authorized to represent and act on behalf of the Co-Filer in all matters relating to the Proposal, including any presentation or withdrawal of the Proposal. If this is incorrect, please let us know at the address below who, if anyone, is authorized to act on behalf of the Co-Filer with respect to the Proposal.

The Proposal contains certain procedural deficiencies, which SEC regulations require us to bring to your attention. Rule 14a-8(b) under the Securities Exchange Act of 1934, as amended, provides that shareholder proponents must submit sufficient proof of their continuous ownership of at least \$2,000 in market value, or 1%, of a company’s shares entitled to vote on the proposal for at least one year as of the date the shareholder proposal was submitted. The Company’s stock records do not indicate that the Co-Filer is the record owner of sufficient shares to satisfy this requirement. In addition, to date we have not received proof that the Co-Filer has satisfied Rule 14a-8’s ownership requirements as of the date that the Proposal was submitted to the Company.

To remedy this defect, the Co-Filer must submit sufficient proof of the Co-Filer’s continuous ownership of the required number or amount of Company shares for the one-year period preceding and including December 9, 2019, the date the Proposal was submitted to the Company. As explained in Rule 14a-8(b) and in SEC staff guidance, sufficient proof must be in the form of:

Tejal K. Patel
December 23, 2019
Page 2

- (1) a written statement from the “record” holder of the Co-Filer’s shares (usually a broker or a bank) verifying that the Co-Filer continuously held the required number or amount of Company shares for the one-year period preceding and including December 9, 2019; or
- (2) if the Co-Filer has filed with the SEC a Schedule 13D, Schedule 13G, Form 3, Form 4 or Form 5, or amendments to those documents or updated forms, reflecting the Co-Filer’s ownership of the required number or amount of Company shares as of or before the date on which the one-year eligibility period begins, a copy of the schedule and/or form, and any subsequent amendments reporting a change in the ownership level and a written statement that the Co-Filer continuously held the required number or amount of Company shares for the one-year period.

If the Co-Filer intends to demonstrate ownership by submitting a written statement from the “record” holder of the Co-Filer’s shares as set forth in (1) above, please note that most large U.S. brokers and banks deposit their customers’ securities with, and hold those securities through, the Depository Trust Company (“DTC”), a registered clearing agency that acts as a securities depository (DTC is also known through the account name of Cede & Co.). Under SEC Staff Legal Bulletin No. 14F, only DTC participants are viewed as record holders of securities that are deposited at DTC. You can confirm whether the Co-Filer’s broker or bank is a DTC participant by asking the Co-Filer’s broker or bank or by checking DTC’s participant list, which is available at <http://www.dtcc.com/~media/Files/Downloads/client-center/DTC/alpha.ashx>. In these situations, shareholders need to obtain proof of ownership from the DTC participant through which the securities are held, as follows:

- (1) If the Co-Filer’s broker or bank is a DTC participant, then the Co-Filer needs to submit a written statement from the Co-Filer’s broker or bank verifying that the Co-Filer continuously held the required number or amount of Company shares for the one-year period preceding and including December 9, 2019.
- (2) If the Co-Filer’s broker or bank is not a DTC participant, then the Co-Filer needs to submit proof of ownership from the DTC participant through which the shares are held verifying that the Co-Filer continuously held the required number or amount of Company shares for the one-year period preceding and including December 9, 2019. You should be able to find out the identity of the DTC participant by asking the Co-Filer’s broker or bank. If the Co-Filer’s broker is an introducing broker, you may also be able to learn the identity and telephone number of the DTC participant through the Co-Filer’s account statements, because the clearing broker identified on the account statements will generally be a DTC participant. If the DTC participant that holds the Co-Filer’s shares is not able to confirm the Co-Filer’s individual

Tejal K. Patel
December 23, 2019
Page 3

holdings but is able to confirm the holdings of the Co-Filer's broker or bank, then the Co-Filer needs to satisfy the proof of ownership requirements by obtaining and submitting two proof of ownership statements verifying that, for the one-year period preceding and including December 9, 2019, the required number or amount of Company shares were continuously held: (i) one from the Co-Filer's broker or bank confirming the Co-Filer's ownership, and (ii) the other from the DTC participant confirming the broker or bank's ownership.

The SEC's rules require that any response to this letter be postmarked or transmitted electronically no later than 14 calendar days from the date you receive this letter. Please address any response to me at Gibson, Dunn & Crutcher LLP, 1050 Connecticut Avenue NW, Washington, D.C. 20036. Alternatively, you may transmit any response by email to me at rmueller@gibsondunn.com

If you have any questions with respect to the foregoing, please contact me at (202) 955-8671. For your reference, I enclose a copy of Rule 14a-8 and Staff Legal Bulletin No. 14F.

Sincerely,



Ronald O. Mueller

Enclosures

From: Tejal Patel <tejal.patel@ctwinvestmentgroup.com>
Date: December 30, 2019 at 6:05:01 AM PST
To: "Twu, Victor" <VTwu@gibsondunn.com>
Cc: "Mueller, Ronald O." <RMueller@gibsondunn.com>
Subject: RE: [Amazon.com](https://www.amazon.com), Inc. Correspondence

[External Email]

Victor and Ronald,

Thank you for your letter. Amalgamated Bank sent Amazon a letter confirming our ownership on December 9, 2019. A copy of this letter is attached. Please let me know if you need anything else or further information regarding our proof of ownership.

Best,

Tejal



HOWARD N. HANDWERKER

First Vice President

OFFICE (626) 432-9907

CELL (626) 437-4819

howardhandwerker@amalgamatedbank.com

December 9, 2019

David A. Zapolsky
Corporate Secretary
Amazon.com, Inc.
410 Terry Avenue North
Seattle, Washington 98109

Dear Mr. Zapolsky:

Please be advised that Amalgamated Bank holds 3 shares of Amazon.com, Inc. ("Company") common stock beneficially for the CTW Investment Group (CTW), the proponent of a shareholder proposal submitted to the Company on December 9, 2019, in accordance with Rule 14(a)-8 of the Securities and Exchange Act of 1934. CTW has continuously held at least \$2,000.00 worth of the Company's common stock for more than one year prior to submission of the resolution and plans to continue ownership through the date of your 2020 annual meeting.

Amalgamated Bank serves as custodian and record holder for CTW Investment Group. The above-mentioned shares are registered in a nominee name of Amalgamated Bank. The shares are held by the Bank through DTC Account #2352.

Sincerely,

A handwritten signature in black ink that reads "Howard N. Handwerker".