“To what extent is the operational efficiency achieved through digital Taylorism at Amazon warehouses justified by the impact caused to its workers?”

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Research Question

To what extent is the operational efficiency achieved through digital Taylorism at Amazon warehouses justified by the impact caused to its workers?

Introduction

In recent decades, warehouse employment has grown rapidly in the U.S., with about 2 million people working in warehouses (Tung). Within this growing industry, Amazon is the second-largest private employer in the United States and has established one of the world's largest fulfillment networks, operating approximately 1,500 fulfillment centers, delivery stations, and sortation centers worldwide ("Algorithmic Management").

As one of the world's leading e-commerce businesses, Amazon must process large volumes of customer orders while meeting expectations for rapid delivery and controlling fulfillment costs. Its ability to meet these demands heavily depends on the operational efficiency of its warehouses. In the context of Amazon, this means increasing the volume and speed of order fulfillment from available labour and resources while minimizing wasted time and resources throughout warehouse operations (Henaway).

In achieving operational efficiency, a defining feature is Amazon's use of digital technologies. These management practices can be examined through the concept of Digital Taylorism, a modern development of Frederick W. Taylor's Scientific Management theory. Digital Taylorism applies Taylor's principles of measurement and standardization through digital technologies to control labour processes and productivity. However, Amazon's use of such practices has become controversial due to concerns about the impact of intensive monitoring and demanding performance expectations on warehouse workers.

This creates a significant dilemma: while Digital Taylorism may improve Amazon's operational efficiency, it may also create costs for warehouse workers. Therefore, this investigation evaluates both the

operational benefits and human resource consequences of Digital Taylorism. This essay aims to answer the research question: To what extent is the operational efficiency achieved through digital Taylorism at Amazon warehouses justified by the harm caused to workers?

Methodology

This study will rely on secondary research to gather data on the adoption of digital Taylorism in Amazon warehouses. This will involve anlayzing news reports, online articles, academic papers, journals, and the company's annual reports.

The financial analysis will focus specifically on data from 2022 and 2025. The year 2022 was selected as the starting point because the year represents the first full post-pandemic year. Data from earlier years were excluded because the COVID-19 pandemic created unusual economic conditions that could distort the analysis. Therefore, data from 2022 to 2025 provide a more celar basis for assessing the impact of digital Taylorism on Amazon's operational efficiency.

Operational efficiency will be assessed through labour productivity, lean production, and financial analysis. Human impact will be assessed using Self-Determination Theory, industrial relations, and labour turnover.

Digital Taylorism

Digital Taylorism refers to the use of digital technologies and management information systems (MIS) to monitor the behaviour and performance of employees. This approach originates from Frederick W. Taylor's Scientific Management theory, which aimed to improve efficiency and productivity through the systematic measurement, standardization, and control of work (Hoang). Digital Taylorism extends these principles by using digital technologies to replace the direct observation traditionally performed by managers.

In Amazon warehouses, these Digital Taylorist practices can be observed through rate tracking, Time Off Task (TOT), automated warnings and termination, and navigation optimization.

- **Rate Tracking:** Workers use handheld scanners that record activities such as picking, packing, and stowing items. This allows each worker's output to be calculated as a rate, expressed as the number of items processed per hour, and compared with predetermined productivity targets ("Algorithmic Management").
- **Time Off Task:** Records scanner inactivity exceeding a certain threshold (2 minutes) as TOT to monitor periods when workers are not performing tasks ("Algorithmic Management").
- **Automated Warnings and Termination:** Workers who fall below the target rate or accumulate excessive TOT receive automated notifications, and those who fail to improve are ultimately terminated without meaningful human review ("Algorithmic Management").
- **Navigation Optimization:** uses handheld scanners to direct workers towards specific bin locations. This reduces the time spent determining where to move next ("Algorithmic Management").

Through these Digital Taylorist practices of measurement, standardization, and control, digital technologies allow Amazon to monitor and direct warehouse labour in real time.

Labour productivity

Labour productivity measures the amount of output produced from a given amount of labour input (Hoang). In Amazon warehouses, this can be measured by the number of items picked, packed, or processed per worker within a given period of time. Higher labour productivity improves operational efficiency because Amazon can process more customer orders without a proportional increase in labour input.

Digital Taylorism can contribute to higher labour productivity by allowing Amazon to establish predetermined productivity rates for workers rather than allowing individual workers to determine their own working pace. Although specific data on Amazon's actual labour productivity is not available, Amazon uses specific metrics to measure the productivity expected of each worker. Workers in robotic facilities are expected to meet the following rates:

- **Stowing:** Workers are required to take items from bins and place them into robotized standing containers at a rate of up to 350 items per hour (Sanders).
- **Picking:** Workers are required to select items from robotized standing containers and place them into different bins at a rate of up to 450 items per hour (Sanders).
- **Packing:** Workers are required to take items out of bins on a conveyor belt, place them into packages, and seal the packages. When packing multiple items, workers are required to complete up to 200 packages per hour. When working at SmartPac stations, workers are required to complete up to 600 packages per hour (Sanders).

Through rate tracking, Amazon continuously compares each worker's actual output against these predetermined standards. This allows workers performing below the expected rate to be identified and creates pressure to maintain consistently high levels of output. As a result, rate tracking can reduce variation in worker output and increase the average output generated from each labour hour. Time Off Task (TOT) can also contribute to labour productivity by monitoring periods of worker inactivity. By discouraging extended periods of inactivity, TOT can increase the proportion of each labour hour devoted to processing orders, increasing output from the same amount of labour input.

In addition, Digital Taylorism improves the efficiency of managerial labour by increasing the span of control of Amazon's managers. Span of control refers to the number of employees supervised by a manager. Amazon's span of control increased from 10 workers per supervisor in 2012 to 20 workers per

supervisor in 2020. This increase is consistent with Amazon's growing use of digital management systems as rate tracking and Time Off Task automate parts of monitoring that traditionally require human supervision. By reducing the need for direct human supervision, Digital Taylorism allows each supervisor to oversee more workers, improving operational efficiency.

However, these figures do not demonstrate that digital Taylorism has increased actual labour productivity. The target rates represent expected rather than achieved output, while the increased span of control does not directly measure changes in worker productivity. Therefore, the evidence more strongly demonstrates Amazon's use of digital Taylorism to standardize worker output and reduce the need for direct managerial supervision than actual productivity gains.

Lean production

Lean production is a philosophy of streamlining production processes to increase efficiency and reduce waste. Waste refers to any activity that consumes time or resources without adding value. There are eight sources of waste (muda): defects, overproduction, waiting, non-utilized talent, transportation, inventory, motion, and excess processing (Hoang). This analysis focuses on four sources of waste that are particularly relevant to evaluating the operational efficiency gains from Digital Taylorism in Amazon warehouses.

Motion: Lean production aims to eliminate unnecessary motion because excessive worker motion consumes time without contributing to output. Amazon's navigation optimization uses handheld scanners to direct workers towards specific bin locations, reducing unnecessary walking and the time workers spend deciding where to move next (Wood 3). By reducing unnecessary travel between storage locations, workers can spend a greater proportion of their working time processing items. This can increase output per worker and improve labour productivity.

Waiting times: Lean production aims to eliminate delays in the production process. Amazon uses Time Off Task (TOT) to track periods during which a worker's scanner is inactive. Inactivity exceeding a specified threshold can be recorded as TOT, allowing Amazon to identify and reduce periods of inactivity ("Algorithmic Management"). By reducing idle labour time, a greater proportion of each labour hour can be spent processing orders. This can increase output without a proportional increase in labour input, thereby improving labour productivity and operational efficiency.

Non/under-utilized talent: Lean production aims to utilize resources effectively, including employees' talents, skills, experience, and knowledge. Amazon assigns employees to specialized warehouse roles and uses algorithmic management to track and monitor their performance (Wood 6). This allows managers to identify workers performing below predetermined targets and provide them with performance feedback (Wood 8). Through systematic monitoring and feedback, Amazon can improve the utilization of its human resources.

Defects: Lean production also aims to reduce defects because errors require reprocessing, increasing operational costs and wasting resources. Amazon uses barcode scanning and standardized digital instructions to reduce errors in picking and processing items. Fewer errors can reduce the need for reprocessing and therefore lower the time and resources wasted correcting mistakes.

Overall, lean production can improve Amazon's operational efficiency by reducing waste, including motion, waiting time, non-utilized talent, and defects. However, these efficiency gains cannot be quantified from the available evidence. Although TOT measures scanner inactivity, the system does not distinguish between avoidable wasted time and necessary inactivity, such as recovery from physically demanding work. Therefore, although reducing wastes improves the short-term utilization of labour, lean production does not capture the potential human costs of maximizing labour utilization.

Financial analysis

Financial analysis provides evidence of the operational efficiency gains associated with Digital Taylorism. Although financial data reflects Amazon's operations across multiple businesses including cloud computing, advertising, and subscription services, e-commerce is a core part of its business. Additionally, although these financial trends cannot be solely attributed to Digital Taylorism, these figures can indicate whether the operational efficiency gains identified through labour productivity and lean production are reflected in Amazon's financial performance.

Table 1: Amazon's Fulfillment Cost Efficiency from 2022 to 2025

Year	Net Sales ($B)	Fulfillment Expense ($B)	Fulfillment Expense as % of Net Sales
2022	514.0	84.3	16.40%
2023	574.8	90.6	15.77%
2024	638.0	98.5	15.44%
2025	716.9	109.1	15.21%

Table 1 indicates an improvement in Amazon's fulfillment cost efficiency between 2022 and 2025. Although Amazon's fulfillment expenses increased from $84.3 billion to $109.1 billion, net sales increased at a faster rate, from $514.0 billion to $716.9 billion. As a result, fulfillment expenses as a percentage of sales declined from 16.40% in 2022 to 15.21% in 2025. This shows that Amazon incurred lower fulfillment expenses for each dollar of sales, suggesting an improvement in the cost efficiency of its fulfillment network.

Digital Taylorism may have contributed to this improvement through the operational efficiency gains identified in the previous analysis. However, fulfillment expenses may also be influenced by other factors, such as improved inventory placement and the regionalization of Amazon's U.S. fulfillment network, which reduced transportation distances and delivery costs (Jassy). Therefore, the declining fulfillment expense ratio provides indirect evidence that the operational efficiency gains associated with Digital Taylorism are reflected in Amazon's financial performance.

Table 2: Amazon's profit margin from 2022 to 2025

Year	Net Sales ($B)	Profit before interest and tax ($B)	Profit Margin (%)
2022	514.0	12.2	2.38%
2023	574.8	36.9	6.41%
2024	638.0	68.6	10.75%
2025	716.9	80.0	11.16%

Table 2 shows a substantial improvement in Amazon's profitability between 2022 and 2025. Amazon's profit margin increased from 2.38% in 2022 to 11.16% in 2025. This indicates that Amazon became more effective at managing its costs and generating profit from its sales.

Digital Taylorism may have contributed to this improvement by increasing labour utilization and reducing waste. However, Amazon's profit margin reflects the performance of multiple businesses, meaning that changes in profitability are influenced by factors beyond warehouse operations, such as the performance

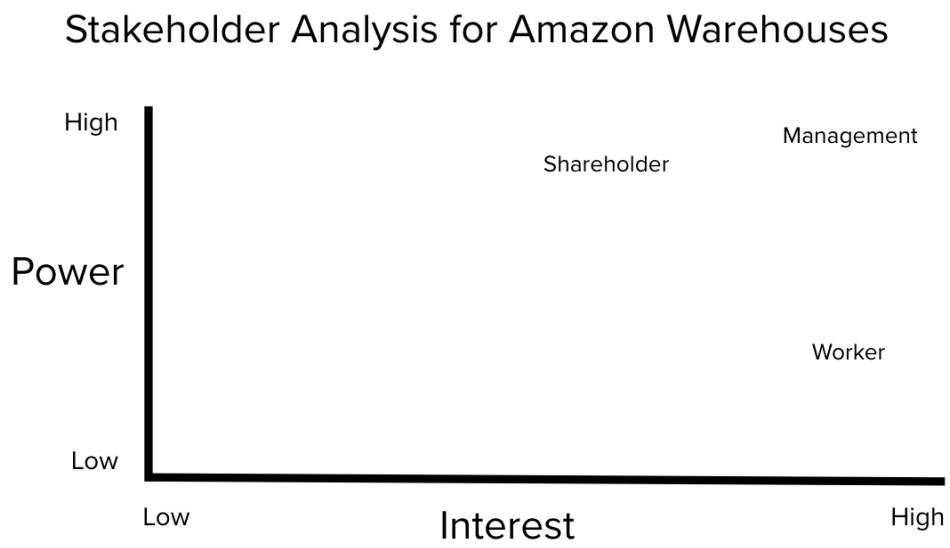
of AWS. Therefore, the increase in Amazon's profit margin provides only indirect evidence of the financial gains associated with Digital Taylorism.

Amazon is a profit-driven, publicly traded company that prioritizes maximizing shareholder value. Therefore, the increasing trend in profitability may justify the implementation of Digital Taylorism from the perspective of shareholders and management. However, the indirect relationship between Digital Taylorism and Amazon's financial performance limits the extent to which increased profitability can justify its harmful impact on workers.

Stakeholder Anlaysis

While the financial analysis suggests that Digital Taylorism may be justified from the perspective of management and shareholders, these benefits should be weighed against its impact on workers. Stakeholder analysis can be used to examine how differences in stakeholder interests and levels of power influence whether Digital Taylorism can be justified.

Figure 1: Stakeholder Anlaysis for Amazon Warehouses



Management - High Interest, High Power

Amazon's management has high interest and power because they control the implementation of Digital Taylorism to maximize productivity and operational efficiency. This priority is evident in Amazon's internal project, called "Project Soteria," which identified a relationship between work speed and injuries. The project recommended measures such as pausing disciplinary action against workers who failed to meet speed requirements and providing workers with additional time off. However, Amazon rejected theser recommendations because Amaon believed that they could "negatively impact rate/productivity and the ability to deliver on time to customers" (Sanders). Amazon's response to criticism of its management practices further reflects this position. Amazon's response to criticism of its management practices further reflects this position. Founder Jeff Bezos and subsequent CEOs have defended these practices, arguing that productivity targets are reasonable and that automated management provides greater objectivity and consistency than traditional human management.

Worker - High Interest, Low Power

Warehouse workers have high interest because Digital Taylorism directly affects their working conditions and safety. However, individual workers have low power over Amazon's practices, due to Amazon's opposition to unionization that limits workers' ability to increase their collective power. Predetermined productivity targets and Time Off Task (TOT) monitoring can increase work intensity and discourage workers from taking sufficient time to recover from physically demanding tasks, especially during peak periods such as Prime Day and the holiday season. The significance of this concern is reflected in Amazon's injury rates. Amazon's serious injury rate was 5.9, compared with an industry average of 3.3, making Amazon's rate nearly twice the industry average (BBC). Similarly, a report by Quebec's labour standards commission found that 79 out of approximately 800 workers across two Montreal facilities were on occupational health and safety leave between 2020 and 2022. Workers have reported repetitive-motion injuries, including sprains, strains, and musculoskeletal disorders, as physical consequences of demanding warehouse work (Sanders).

Shareholder: High Interest, High Power

Shareholders have high interest and power because they seek to maximize shareholder value through Amazon's financial performance. Digital Taylorism benefits shareholders as operational efficiency reduces fulfillment costs and improves profitability, as suggested by the financial analysis. However, in the long term, high labour turnover and industrial action potentially create additional costs that reduce shareholder value. Therefore, Digital Taylorism can be justified from the shareholder perspective only if its efficiency gains contribute to long-term shareholder value.

Overall, the stakeholder analysis demonstrates that management and shareholders possess greater power and benefit from improvements in operational and financial performance. However, workers have relatively less power and experience increased work intensity and safety risks. Therefore, Digital Taylorism is more justified from the perspective of management and shareholders than from that of workers. However, this justification depends on whether the long-term costs to workers undermine its operational benefits, which will be further assessed using human resource management tools.

Self Determination Theory

To assess the significance of these costs, Self-Determination Theory can be used to examine how Digital Taylorism affects worker motivation. Deci and Ryan's Self-Determination Theory suggests that three basic factors motivate people: autonomy, competence, and relatedness.

Autonomy: Autonomy refers to an individual's ability to make their own decisions and exercise control over their work. The adoption of Digital Taylorism in Amazon warehouses can reduce employees' autonomy through the monitoring of workers' performance and the standardization of work processes. Through handheld scanners and individual accounts, workers receive instructions and have their productivity rates tracked. Workers are required to follow these instructions and meet predetermined

productivity rates. This means that workers have limited independent decision-making power over how and at what pace their tasks are completed. Delfant highlights that warehouse employees “experience standardized processes and managerial techniques relentlessly imported from the United States, as Amazon replicates them everywhere in its global network of warehouses” (Henaway). Additionally, Amazon has used AI-enabled cameras to capture and analyse workers' movements and generate reports for operational managers. During the COVID-19 pandemic, for example, the system identified violations of the two-metre distancing rule, and supervisors communicated the previous day's monitoring results to workers (Henaway). As a result, employees' motivation may decrease because they may feel excessively surveilled and have limited control over their work.

Competence: Competence refers to an individual's need to feel capable of performing tasks. Digital Taylorism can make employees feel frustrated when they perceive productivity targets as unrealistic or difficult to achieve. Amazon warehouse employees highlight that they work in a physically demanding environment that requires continuous movement to meet productivity targets and are being pressured by managers, supervisors, and assistants to work faster in order to meet quotas (Relevancy & History Project -- Inland Empire). Additionally, negative feedback through automated warnings can cause employees to experience feelings of inadequacy and incompetence. For example, workers' performance data are flagged to operation managers through TOT monitoring (Wood 6). As a result, workers may be required to participate in meetings, which can cause them to become anxious and insecure. According to Jarrow Insights, which collected 2,000 responses from self-identified Amazon warehouse workers, 59% of workers felt that Amazon’s monitoring was excessive, while 53% feared losing their jobs due to Amazon’s monitoring technologies (UNI Global Union). This means that excessive monitoring demotivates workers by creating anxiety and a fear of underperformance.

Relatedness: Relatedness refers to an individual's need to feel connected to others and experience a sense of belonging in the workplace. Because Amazon warehouses emphasize individual productivity through

performance monitoring and measurement, employees focus on meeting productivity targets rather than interacting and collaborating with other employees. For example, brief conversations with coworkers can be recorded as Time Off Task (TOT), forcing employees to minimize social interaction during working hours ("Algorithmic Management"). This reduces opportunities to develop supportive relationships with coworkers and weaken their sense of belonging in the workplace. Furthermore, algorithmic monitoring may weaken relationships between workers and managers when employees perceive management systems as surveillance rather than support.

Overall, Self-Determination Theory suggests that Digital Taylorism may reduce worker motivation by undermining autonomy, competence, and relatedness. However, the theory does not demonstrate the magnitude of these effects across all Amazon warehouses, as much of the supporting evidence comes from specific warehouse case studies. Therefore, although Digital Taylorism generates short-term efficiency gains, its negative effects on worker motivation weaken the extent to which these gains can justify the harm to workers. The long term consequences of these working conditions will be further assessed through industrial relations and labour turnover.

Industrial relation

Industiral relations are used to assess whehter Digitial Talyroism causes conflict between workers and management that affect Amazon's operational efficiency. Conflict refers to a situation of friction between two or more parties. A key source of conflict in Amazon warehouses is the contrasting needs and wants of senior management and warehouse workers.

The contrasting needs and wants are evident in the conflict between Amazon and warehouse workers at its BHX4 facility in Coventry, UK. Workers organized industrial action supported by the GMB trade union. In January 2023, approximately 300 workers participated in the first formal strike and union membership subsequently increased. The conflict imposed costs on Amazon, as a later week-long strike

was estimated by GMB to cost the company approximately £2 million. (Shenker) In addition to the financial consequences, Coventry is a cross-dock facility that receives and sorts products before distributing them to other fulfillment centers. Therefore, disruption at the facility could affect Amazon's wider fulfillment network, particularly during busy periods such as Prime Week.

Additionally, in 2024, workers at Amazon's STL8 fulfillment center in St. Peters, Missouri, filed an unfair labor practice charge with the National Labor Relations Board (NLRB). Workers alleged that Amazon's use of algorithmic surveillance interfered with their ability to communicate and organize collectively over working conditions (Sainato). This suggests that Digital Taylorist monitoring can weaken trust between employees and management.

Overall, strained industrial relations weaken the justification for Digital Taylorism. Although Digital Taylorism improves operational efficiency in the short term, its efficiency gains may be offset by the financial and operational costs of industrial action. If worker-management conflict results in repeated industrial action and disruption to warehouse operations, the short term gains are not sustainable in the long term.

Labour turnover

One significant consequence of reduced employee motivation and strained industrial relations is increased labour turnover. Labour turnover refers to the amount of people who leave an organization, expressed as a percentage of the workforce. According to a 2021 investigation by the New York Times, an annual warehouse turnover rate was about 150% (Segal). This means that around 3% of its warehouse workers each week leave the company, which is nearly double the rate of similar businesses.

High labour turnover reflects Amazon's disposable labour model, in which warehouse workers are treated as replaceable rather than being retained over the long term. Former Amazon executives indicated that

Bezos was concerned that long employee tenure could lead to a stagnant workforce, described as a "march to mediocrity"(Brancaccio et al.). High turnover can also weaken workers' collective bargaining power. This is because high turnover makes it difficult for workers to develop lasting relationships and organize collectively, as union supporters leave and are replaced by new employees who are unfamiliar with organizing efforts (Cyril).

Digital Taylorism can support this disposable labour model in two ways. First, intensive performance management, including rate tracking and Time Off Task (TOT), can create demanding working conditions by requiring workers to continuously meet predetermined productivity expectations. Second, digital management can make departing workers easier to replace. Amazon has used an automated recruitment system referred to as "lights-out hiring," which reduces human involvement in the hiring process and enables workers to be recruited at a large scale (Brancaccio et al.).

However, high labour turnover creates both direct and indirect costs that can reduce Amazon's operational efficiency. Direct costs include the repeated recruitment, hiring, and training of replacement workers. Indirect costs include lower productivity during training and the loss of experienced workers' knowledge. Warehouse workers require about 8-12 weeks to become fully trained and operate at around 50% efficiency during the first month (Primero Staffing). Furthermore, according to a professor at the University of Connecticut, when experienced employees leave, Amazon loses valuable firm-specific human capital (Segal). This means that employees take knowledge and experience specific to Amazon with them, which must be developed again through the training of replacement workers (Segal). This can temporarily reduce labour productivity because new employees need time and training to reach the productivity levels of experienced workers (Segal). According to a leaked internal Amazon memo, high attrition costs an "estimated $8 billion annually for Amazon and its shareholders."

Overall, high labour turnover weakens the long-term justification for Digital Taylorism because it requires Amazon to repeatedly recruit and train replacement workers, creating additional costs and potentially reducing operational efficiency. However, Amazon's high turnover cannot be attributed solely to Digital Taylorism, as employees may leave Amazon for other reasons. Therefore, the $8 billion attrition cost cannot be considered a direct cost of Digital Taylorism, but demonstrates the financial significance of Amazon's "disposable labour model."

Conclusion

To answer the research question, "To what extent is the operational efficiency achieved through Digital Taylorism at Amazon warehouses justified by its harmful impact on workers?", the findings suggest that Digital Taylorism is only partially justified, as its operational benefits must be weighed against significant human and long-term operational costs.

Digital Taylorism improves operational efficiency through predetermined productivity rates, Time Off Task (TOT) monitoring, and navigation optimization, which reduce operational waste. The decline in fulfillment expenses as a percentage of net sales and the increase in profitability demonstrate improvements in Amazon's operational efficiency. However, although Digital Taylorism increases labour utilization in the short term, strained industrial relations can result in industrial action and operational disruption. Additionally, high labour turnover requires repeated recruitment and training of replacement workers, with Amazon estimating approximately $8 billion in annual attrition costs. Therefore, worker-related costs undermine the sustainability of Digital Taylorism's short-term efficiency gains.

Therefore, Digital Taylorism is more justified in the short term and from the perspective of management and shareholders. From their perspective, even the estimated $8 billion annual cost of labour turnover is considered tolerable, with profit before interest and tax reaching approximately $80 billion in 2025. However, it is less justified from the perspective of workers, who experience increased work intensity and

reduced motivation. In the long term, labour turnover and industrial conflict reduce the operational benefits valued by management and shareholders. Therefore, the extent of justification depends on the stakeholder perspective and whether efficiency is evaluated in the short or long term.

Limitations

The limitation of this investigation is the limited availability of accessible data, regarding the impact of Digital Taylorism on warehouse workers. Amazon does not publicly disclose sufficient data on individual worker productivity, the causes of labour turnover, or the effects of algorithmic management on employee motivation. Furthermore, evidence of worker impacts relies on individual warehouse case studies, worker interviews, and investigative reports, which may not represent Amazon's entire warehouses.

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