Effects of the COVID Pandemic on Industrial Warehouse Personnel Training and Education

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Abstract

Industry 4.0 has affected major changes in warehouse distribution industries through innovations regarding automation, big data analysis, and integrated workforces, to name a few. This paper studies the impact that the global pandemic COVID-19 had on the already changing world of warehouses. In 21 open-ended interviews with warehouse managers/supervisors and executives, questions were posed to gauge how the workforce and executive level personnel perceive changes brought about by Industry 4.0, and how their respective departments and companies are equipped to handle those changes. Some of the findings from this data showed that the effects of COVID were discussed differently amongst the managerial level workforce and their upper-level executive counterparts.

For the managers and supervisors, COVID measures and policies were discussed in response to questions investigating major changes in everyday work demands - responses to such questions were patently different for managers and supervisors actually in the warehouse than for the executives of industrial companies. Responses in this portion of the interview complemented each other in that they mainly concerned disruptions in personnel distribution, interactions with customers, and major impacts on supply chains, especially concerning international products. Amongst the executive level responses, COVID measures were discussed in reference not to barriers or negative changes but in an almost unanimously optimistic tone. Rather than a concentration of COVID responses to similar topics, executive level respondents' mentions of COVID range across five different questions praising the accelerations that the pandemic brought about in such areas as digital learning and remote work. The more intimate impact of

COVID on warehouse managers compared to the macro strokes of impact of COVID on executives could affect priorities for training and education of the technology in the near future.

Keywords: Industry 4.0, COVID, future of work, automation, warehouse personnel

Introduction

Industry 4.0 is a relatively new turn of phrase that envelops the landscape of industrial production and its workforce [1]; it refers to the accelerated changes within the industry as a result of technological innovations in automation, big data analysis, and integrated workforces, to name a few. These changes have, and will, necessarily reshape the nature of industrial work and, therefore, the education that goes into training the workforce. Adopting new technologies has increased productivity in most cases, but the long-term implications for the boots-on-ground workers are yet to be fully understood. This paper addresses the humanist perspective of Industry 4.0 insofar as COVID-19 policies and procedures impacted warehouse executive and employee perspectives on the benefits and logistics of the implementation of new technologies.

Literature Review

The innovations offered by Industry 4.0 require that previously low-skill positions be "upskilled" with training that covers programming, cybersecurity, digital networks, cloud computing, databases, and web development [2]. These changes affect the current nature of labor and the daily tasks of warehouse operators and managers, which necessarily implies challenges to policymakers and labor markets concerned with ensuring that workers be trained in the new skills required of them by innovative additions [1]. In light of technological changes, industries have been undergoing significant organizational restructuring, and academic institutions can play a part in training a technologically advanced workforce. To address how the industry might be

more successful with this new wave of innovation, human resource competencies have been identified by studies for managers [3], workers [4], and as integrated social systems [2, 5]. Elsewhere we have observed that studies on workforce competencies are not cohesive [1], but it is generally acknowledged that *avant garde* systems require an overhaul of previous emotional and social competencies in order to prevent the stress, anxiety, and fatigue that comes along with human-robot interaction [6].

In a review of the failures of automated systems that preceded Industry 4.0, Eton et al.[7] point out that small-to-medium enterprises (SMEs) were disproportionately affected by poor selection and implementation of automation technology. As SMEs account for over half of the non-farm GDPs in America [8], it is important to ensure that Industry 4.0 is made more accessible and feasible to these existing industries, lest they fall under threats from commercial giants. Furthermore, Fareri et al. [9] indicate that Industry 4.0 developments will likely lead to major labor gaps due to aforementioned required "upskilling." For essential functions of industries - to name a few: process improvement, process reconfiguration, mistake proofing [10]- to remain relevant in a modernizing environment, it is critical that workers receive continuous skill development [1].

One of the most prominent themes in the literature for workforce preparedness is the overarching need for talent and training; however, a more subtle theme is the need for more transparent communications between those who work in the warehouse and their executive level stakeholders. Industry 4.0 has had positive impacts on warehouse flexibility, facilitating a more dynamic customer to manufacturer relationship [11, 12]. This flexibility is a salient feature in light of the recent COVID-19 regulations and the effects on working conditions and consumerism. The breakdown in communications regarding how companies handled those

regulations illustrates the need for continued work on bridging the gap between warehouse operators/managers and their executive level counterparts.

Methodology

This paper focuses on an unpredicted aspect of an exploratory study into the experience of warehouse managers/operators and their executive level counterparts. While our cumulative findings will be published elsewhere, this paper is concerned with the unforeseen topic of COVID and how it relates to the warehouse and supply chain sectors in respect to Industry 4.0. In the larger study, 21 open-ended interviews conducted over the course of 5 months (October 2020 - February 2021), questions were posed to SME personnel to gauge how the workforce and executive level personnel perceive changes brought about by Industry 4.0, and how their respective departments and companies are equipped to handle those changes. Out of the 21 interviews, COVID was mentioned by 8 participants, Tables I and II describe the roles and organizations of the participants who mentioned COVID during these interviews.

The organizations from which we drew participants represent a variety of operations with stakes in the industrial supply chain (see Tables I and II). We conducted 11 interviews with executive level personnel self-described as either CEO, Vice Presidents, or Directors; within the workforce we interviewed 10 individuals who self-described as either Warehouse/Operations Managers or Department Leads/Supervisors. Interviews were conducted using a semi-structured protocol and field notes. Interviews were recorded, transcribed, and submitted to thorough analysis by the authors using a grounded-theory framework; we employed Strauss and Corbin's [13] guidelines for open, axial, and selective coding which resulted in an interesting depiction of the effects of COVID on the warehouse industry and its associated personnel.

Participants were interviewed and categorized by two groups, *viz.* Executive Level and Labor Level, and were asked a series of questions that largely mirrored the other group, with certain questions that focused on either group's unique experiences. Out of 13 interview questions, 9 were the same for both groups and 4 were tailored specifically to gauge particular differences between the groups. Out of the 21 interviews, COVID was mentioned by 8 participants, Tables I and II describe the roles and organizations of the participants who mentioned COVID during these interviews.

Table I

Executive Level Participants

Job Title	Pseudonym	Organization	Number of Employees	Operating Regions
Vice President of Strategic Development	John	Automation Technology Industry	>3000	International
President	Ben	Industrial Machinery Rental & Service*	<500	AR, TX, LA
Vice President of Operations	Jane	Industrial Security & Electronic Distribution*	1000 - 5000	Continental U.S.
Vice President of Business Operations	Matt	Industrial Support Services and Transport	>25000	Global

**indicates that this company had reports of COVID from both executive and labor level participants*

Table II

Labor Level Participants

Job Title	Pseudonym	Organization	Number of Employees	Operating Regions
Warehouse Manager	Mark	Industrial Equipment Distribution	<500	Texas
Warehouse Manager	Daniel	Industrial Machinery Rental & Service*	<500	AR, TX, LA
Supervisor	Jordan	Industrial Security & Electronic Distribution*	1000 - 5000	Continental U.S.
Operations Manager	Roger	Industrial Chemical Distribution	>17000	Global

**indicates that this company had reports of COVID from both executive and labor level participants*

Findings

Of the participants who mentioned COVID, 4 were from the executive side and 4 were from the labor side. Two companies had mentions of COVID from both their executive and labor levels accounting for 4 of the mentions. Five participants discussed COVID in relation to more than one question, 4 of which were executive level participants; the remaining 3 discussed COVID only in relation to one topic each. The following sections will review which topics garnered conversation about COVID.

Geography and Company Size

COVID was mentioned by three separate participants in relation to geography and company size: two on the labor level, Jordan and Roger, and one on the executive level, John. From the labor perspective, the work of these industries concerned with COVID were in relation to close-quarter work that was considered essential during the pandemic lockdowns, *e.g.* Industrial Security & Electronic Distribution and Industrial Support Services and Transport, and the risk of infection from the movement of freight from one location to another.

Jordan, a supervisor, commented that while personnel in offices were working from home, warehouse workers obviously could not do so and of those employees "everybody reported basically every day." The company's COVID policies were reduced to mostly rudimentary hygiene practices and requesting customers not enter the premises. Considering such work to be essential necessarily precipitated the risk of infection among employees gathering in warehouses for distribution work. Roger spoke of infection in a warehouse that caused shortages of the workforce leading to the closing of sites and ports critical to the supply chain:

> We have cases of infection. Of course, the warehouse has to be shut down. So we have some difficulties getting the products in or out. And we see this translated onto a

> bigger scale. … one of the group members gets infected by a load, they cannot unload the cargo into the next port. So we see a massive impact in the supply chain because of what happened with COVID. Now, I don't know if you know, but there's a global problem of containers not being in the right spot to get it moved. Historical height levels of freight worldwide. So it's a domino effect. COVID has cost.

The benefits of automation and the affect it could have on industry was observed from the executive perspective by John, "mostly because COVID accelerated the acceptance of digital learning … and get[ting] help from anywhere from anybody who's able to respond and do it," rendered geography to a lower priority. However, John also mentioned that this boon caused a correlating inconvenience in the redistribution of personnel and their ability to compete with larger companies: "when you have exponential growth, you have exponential demand on people, and there's only so many people available in a market."

Industry 4.0 Innovation

COVID was mentioned by 5 separate participants in relation to Industry 4.0 innovations: 2 on the labor level, Mark and Daniel; and 3 on the executive level, John, Ben, and Matt. Three distinct categories were discussed in these responses: remote work, effects on the supply chain, and training.

Remote Work

Ben and Daniel are respectively executive and labor level participants from the same company in industrial machinery, both of whom comment on the nature of remote work. Ben comments on the organization as a whole, noting that "warehouse, shipping, and receiving is one of those functions that doesn't lend itself to working remotely." Ben notes that sales were negatively impacted during the lockdown as the organization could not send personnel to visit

their customers as regularly. Ben's warehouse manager, Daniel, mentions that his site no longer receives visits from salesmen, nor do they send their employees out of state which directly contributes to how "some of our vendors are handling customers direct rather than going through a distributorship like us." Through all these troubles, however, Ben tells us that his company implemented changes during the lockdowns that "dealt more with some of the internal people working remotely and making sure we have the infrastructure in place to be able to do that."

Supply Chain

With warehouses and ports being closed, as explicated above, supply chains worldwide encountered issues with stock shortages. Mark, a warehouse manager, elucidates the supply chain issue as an already fraught situation that was brought "to a standstill almost" by the COVID pandemic:

> The ports are backed up so raw materials aren't coming in from overseas. And it's just a snowball effect, you know it goes down the line all the way to the end consumer who aren't getting what they need. And so everybody's looking for the magic bullet, so to speak, trying to figure out how do we expedite these materials and this product? and how can we do it at a lower cost?

Industry 4.0 innovations provide the answers for some of these questions, allowing companies to operate more efficiently especially in times of emergency; however, implementing new tools into the workplace generates its own set of problems. John, an executive at an automation technology company, told us that "COVID accelerated everything. You went from having no automation in most warehouses to demanding the absolute most state of the art automation in your warehouses." John explains a dilemma of intensifying pressure on business leaders who have not

taken the appropriate steps towards implementing new technologies until the pandemic fallout rendered it necessary, which leads us directly to the next section of training.

Training

Executives John and Matt both discuss training issues that arose as a result of the COVID pandemic. John's concerns were centered around supply chain shortages and the increasing need for warehouse automation and immediate implementation: "when you step out in the warehouse and you look at all the things that need to happen, it's just absolutely overwhelming." Most companies, at this point, turn towards consultants who can help put organizations on the right track through training. However, John speaks of the daunting hegemony of vastly different professions and ruminates over the best options available to them: "who do you trust? Is it the supply chain expert? or is it the computer scientist expert? and where do you blend those two technologies together to find something that fits your business style?"

Matt's organization took a somewhat more positive outlook on the changes that COVID brought, but this optimistic perspective was foregrounded in the nature of his company's prior commitment to "always assessing how our technology roadmap can bring more value to our organization." Matt tells us that his company has always encouraged extra training, and COVID assisted this initiative in that it expanded the opportunities for personnel to engage in external professional development courses through Zoom conferences. Matt noted that "the changes we've seen in the industry because all this COVID" would be integrated into his organization's commercial and operational roadmap.

Perception Surrounding Major Changes

COVID was mentioned by 2 separate participants in relation to changes in their warehouses: Jane, an operations executive, and Jordan, the warehouse supervisor. Jane and

Jordan both work for an industrial security and electronics distributor - considered essential work during the pandemic lockdowns. Jane mentions that the innovations of remote work generated by COVID put her organization “a decade ahead” causing personnel to view future innovations with a sense of “unbridled optimism.” Concurrently, Jordan notes that while work may have slowed down a bit during the lockdowns, change happened apace; he notes that business is thriving, but only due to the personnel’s commitment to being open to change and technological evolutions.

Conclusion

It would seem that automation might be the answer to the concerns expressed by both executive and labor personnel perspectives: automation in warehouses would allow warehouse employees to properly distance themselves from others, it would decrease the risk of infection, and subsequently decrease the likelihood of a stymied or blocked supply chain. In order to respond to emergencies more effectively, warehouses need the opportunities made available by Industry 4.0. The above perspectives confirm the need for reskilling the current workforce to adapt to innovations of Industry 4.0, and the COVID pandemic produced a window of time that made the benefits of such adaptations apparent.

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