COVID-19 as a Stimulus for Remote Manufacturing Efforts

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Abstract

Remote operations of manufacturing systems are needed now more than ever. With the current world pandemic, it is essential today to reduce human interaction in workplaces such as manufacturers. Manufacturing floors in search of this objective should rely on computer-oriented systems that assist the manufacturers objectives with automation, robotics, and computer programming. It is important that Puerto Rico manufacturers get more digitalized and remote to assist workers safety.

Introduction

Proposing monitoring operations on manufacturers to be covered mostly by efficient remote systems and solutions rather than human direct interaction [1] is the focus of this investigation. Implementing and motivating manufacturing companies in Puerto Rico to operate on remoted systems is essential with the current world pandemic. A reduced workforce in site means less waste and additional worker safety thanks to digitalization and automation.

Background

The COVID-19 world pandemic has offered room for improvement and revolution of the digitalization of many hardware and software systems. Maintaining the 'business as usual' mentality thought the COVID-19 pandemic is an approach all businesses in Puerto Rico are taking very seriously. Avoiding the negative effects of the pandemic is part of the objectives of remote working. There is a chance for optimism as manufacturers can see this as a chance to speed up digitalization and introduce remote and virtual technologies. Remote controlled manufacturing floors might include the use of web-based integrated systems and networks that can be accessible from employees' homes with secured connections or Virtual Private Networks [2]. The use of such off-site technologies, access and systems allow the design and part of the manufacturing effort to be from anywhere geographically [5].

Problem

Needing of less on-site staff supervision. Need to increase safety measurements. Need less physical monitoring of hardware and software equipment. Make aware of the internet of things. Suggestion of tools to support remote environments with application to manufacturing hardware and software. Needing a plan for manufacturers of Puerto Rico to migrate into remote technologies.

Methodology

Lowering the on-site personnel can be replaced with active monitoring using security cameras and webcams. Media use such as video, could be installed in more areas of the manufacturing machinery or systems. This can allow workers to remotely monitor the manufacturing floor and alarm the site if something goes wrong, so that personnel that is currently at the site can take the appropriate actions. Personnel that are at the site, need to be properly trained to act as backup and take actions that they would not be normally responsible for. There are areas, tasks, projects that do not require personnel to be on-site so such workers should be selected to do remote work. There are many tools available today that support remote working and that should be implemented and normalized across all manufacturers in Puerto Rico. A tool for remoting into computers at a distanced network is Radmin (Figure 1).

Figure 1. Radmin offers a server side and a viewer client.

Maintaining the 5S (Figure 2) mentality is key to prevent the spread of COVID-19.

Sort
- Materials/tools that have been in use need to be separated into designated cleaning areas.
- Remove all materials and tools that are not essential from work areas to reduce the surface area for the virus to spread.

Straighten
- Employees are to make sure that all the required materials and tools are properly labeled as clean or not-clean.
- Labels are not visually blocked.

Shine
- Tools/materials that have been in contact with personnel need to be disinfected.
- Designated cleaning area reduce the risk of employees to accidentally have contact with contaminated tools/materials.

Standardize
- Implement walk pathway directions in the manufacturing floor and other common areas that reduce close contact.
- Personal Protective Equipment is adjusted for COVID-19 prevention.

Sustain
- Educate employees on COVID-19 prevention responsibilities.
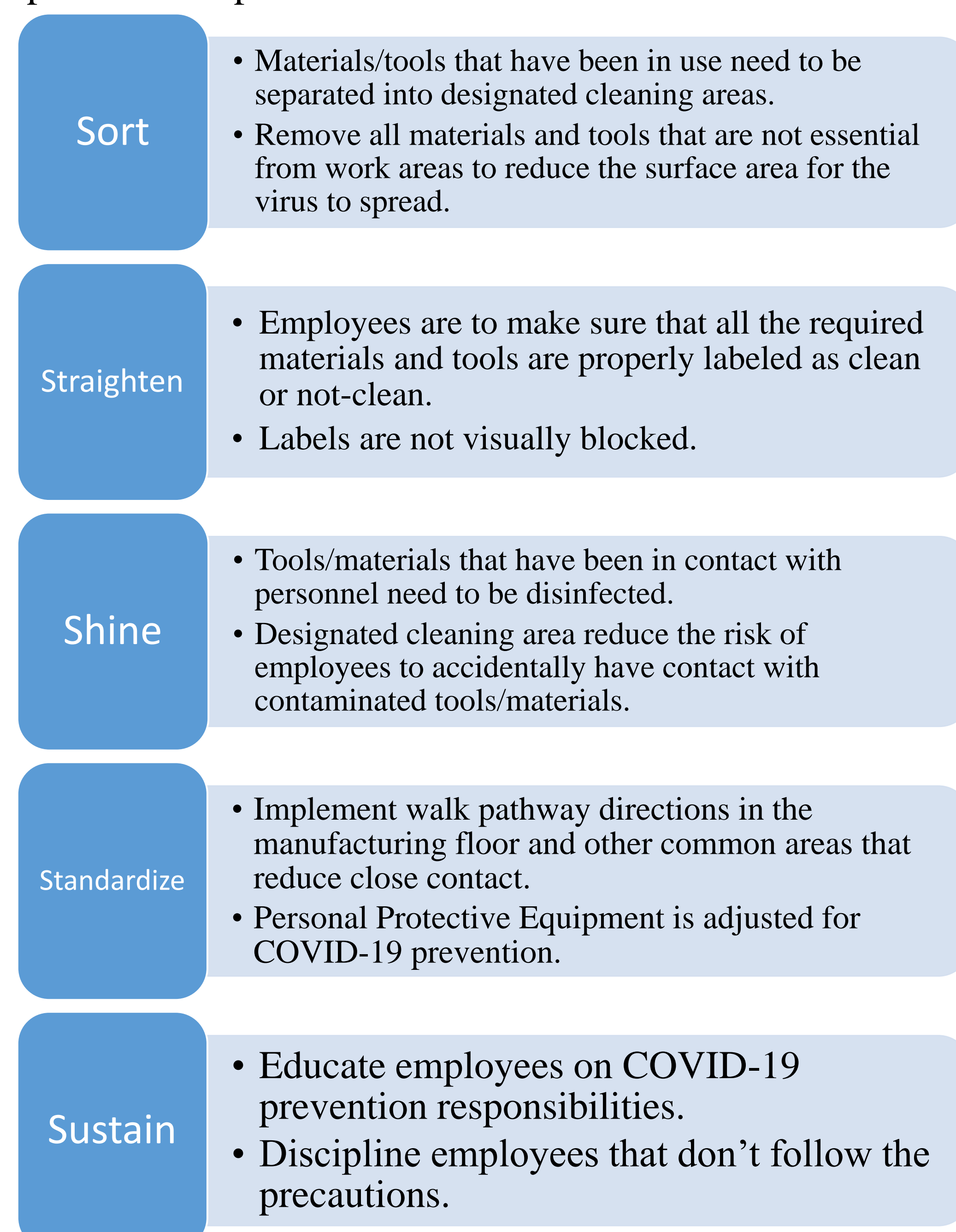- Discipline employees that don't follow the precautions.

Figure 2. Taking the actions to sort, straighten, shine, standardize and sustain practices are more important to follow now than ever at the site and at the remote office location.

Results and Discussion

Industrial processes and manufacturing floor environments need their technical guidelines and rulesets dependent of job risk levels to prevent the virus spread. The plan needs to be updated with regards to current local government restrictions and requirements. A plan for a future normal return to work needs to be addressed including considerations for workers with delicate cases. The plan needs to be linked to the Occupational Safety and Health Act regulations and guidance [3]. Site entry protocols, personal protection equipment needs, area and tool disinfecting practices, physical space usage, individual travel walk path flow, building ventilation/filtration and support from other contractor services such as maintenance, security and cafeteria personnel need to be clear in this proposed plan of action. Also, a strategy for monitoring suspected cases needs to be defined. Each manufacturer needs to be responsible for the communication approaches for on-site and off-site personnel. It is important for all facilities to discourage tool and equipment sharing and need to provide a plan for the proper tool and equipment handling.

Different from employee behavior, remote use of systems can be aided by Radmin, providing features like keyboard locking, full remote access and controlling, screen monitoring, screen recording, file transfer, secure user authenticating and copy/paste amongst clients. This software is highly recommended for current use at industries since the connections are secured for all data that is transmitted. For industrial automation and machinery, Matlab and Simulink (Figure 3) provide personnel with the tools to develop production systems that control industrial equipment and Programmable Logic Controllers [4]. With the mentioned software, design machinery controls and testing them in a virtual manner is possible. Running automatic test scrips using this system with a combination of the previously described Radmin is a recommended setup for remote work. Virtual commissioning is possible with Matlab and Simulink so that personnel can simulate, test and verify model systems, plant floors and even components with scripts before doing actual production, and can all be done remotely. Model-based design approaches are recommended as part of the modernization of the manufacturing equipment and software systems as they promote characteristics for teleworking.

Figure 3. Matlab & Simulink Combination Logo

Conclusions

The COVID-19 outbreak in a workplace can affect in many negative ways and interrupt supply and delivery, increasing personnel absences and a change of demand patterns. The pandemic can also bring some positive technological improvements on the hardware and software that supports the industry or manufacturer equipment that promote digitalization, automatization, internet network security protocols and equipment modernization. A defined pandemic response plan needs to be developed by each manufacturer that resides in Puerto Rico to provide specific guidelines on technical and non-technical procedures that adhere to the site or manufacturing floor while avoiding virus propagation.

Future Work

How manufacturers reacted to the pandemic and how did it affect the production and revenue of the company using 5S strategies specifically for COVID-19 prevention could be detailed in future studies. Comparisons of personnel performance that are physically on-site versus teleworking employees can be quantified on future research when companies adapt the proposed measurements. A deeper quantitative study can be evaluated for manufacturer digitalization cost depending on personnel and new site limitations is of great interest to be presented in a future.

Acknowledgements

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