The Waste Caused by Using Paper in Manufacturing

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Abstract

The Research Project "The Waste Caused by Using Paper in Manufacturing" looks at waste costs and potential remedies. Companies considering a digital transformation by switching from an antiquated paper system to an electronic paperless system can utilize the project as a proof of concept. The major goal is to locate and calculate all the waste produced by employing paper copies rather than a good system. The project's findings led to choices and recommendations for how to build a manufacturing system employing cost savings.

Introduction

Waste processing will always have an effect on a company's quality. Every company should be aware about the expense of poor quality due to internal and external failures. The purpose of this study is to identify the wastes and the ways in which a properly integrated system could stop them. In 2022, companies should stop using this ineffective processing method. The majority of the funding for continuous improvement in manufacturing organizations, particularly small and medium-sized businesses, is allocated to production processes. The main obstacle keeping organizations from implementing a better paperless system is cost. But companies typically neglect to estimate the real cost of paper.

Methodology

This study's main objective will be to effectively identify and quantify all the wastes caused by poor processing on paper.

o Defects: The effort of reworks, incorrect information, or typos. (This may trigger delays like waiting, motion, and extra processing).

o Overproduction: Processes in a paper may not have instructions, and employees can fill more or less than needed causing overproduction.

o Waiting: Usually, manufacturing processes need more than one approval; in some cases, multiple (more than 3). Motion waste is created when two or more people are waiting on the same paper in the possession of another employee.

o Unused talent: In the same way of waiting, other employees are waiting on the paper to be moved along, causing un utilization.

o Transportation: Because the paper is physical, not digital, it has to move from employee to employee and sometimes from building to building, causing unnecessary movements.

o Inventory: Because the paper is physical, if it's not stored correctly, it may get lost if miss placed, causing all other waste over again.

Methodology Cont.

o Extra-Processing: This waste is often caused by any other defect in the process. If there is a typo, missed information, or any other error, the is a high chance that the paper needs to be done again.

We were able to convey the process' current condition and pinpoint the most important steps thanks to the value stream map. Without having the new system in place, it was clear that the hard copies were causing too much movement in the present situation. The hold release form needs to be signed by numerous departments. Typically, a "triage" is necessary in all manufacturing businesses; this includes at least three signatures from the departments of quality, manufacturing, and engineering.

We utilized the spaghetti diagram in addition to the VSM. This tool showed that more time was required than anticipated to gather the signatures for the hard copy form. In the worst case, a call must be sent to arrange for a person who is not already in the facilities to travel to the plant and complete the signature. Sometimes the QA handling the event had to walk between separate buildings to obtain a signature. All of these distances add time to the hold release procedure, which slows it down.

Results and Discussion

As mentioned before, we worked in a baseline current state map; this is the current process:

Step No.	Step Title	Duration mins
1	Detect the nonconformance event	10
2	Confirm the NC with quality (triage)	20
3	Create Hold (PAPER/SAP)	20
4	Initiate documentation (PAPER)	10
5	Add affected items to NC (segregation) (PAPER)	30
6	Generate a quality notification (SAP)	10
7	Add Reference documents (SAP)	20
8	Disposition tasks (SAP)	30
9	Close Hold (PAPER / SAP)	10
10	Generate corrective action	10
	Total	170

The first three through the ninth steps are the most important ones. They also incur the greatest loss in productivity due to paper waste.

We started to see more significant downtimes when:

- A mistake was made after step 3; if the mistake is found in step 9, the paper will likely need to be redone or resigned, which adds time.
- The paper copy must be rewritten or relinquished if new conditions or objects are added to the NC event.
- A number of mistakes or differences between the system and the document.

Results and Discussion

Step No.	Step Title	Duration mins	Error	Error with System
1	Detect the nonconformance event	10		
2	Confirm the NC with quality (triage)	20		
3	Create Hold (PAPER/SAP)	20	20	5
4	Initiate documentation (PAPER)	10	10	2.5
5	Add affected items to NC (segregation) (PAPER)	30	30	7.5
6	Generate a quality notification (SAP)	10	10	2.5
7	Add Reference documents (SAP)	20	10	2.5
8	Disposition tasks (SAP)	30	30	7.5
9	Close Hold (PAPER / SAP)	10		
10	Generate corrective action	10		
	Total	170		
	Total with errors		**280**	**197.5**

As we can see, the downtime is reduced drastically by implementing the paperless system. The rework in the paper is always greater than the system. The person factors it is reduced considerably; the SAP and QMS systems can be automated to add, change or cancel NC or action items automatically, making the steps instant.

In the next ANOVA we did a simulation to measure the entire process duration with errors on paper and with errors in system.

Paper	System
281	182
288	213
286	189
297	205
299	210
300	177
297	201
298	214
283	194
300	209
270	185
273	196
279	197
275	197
284	178
297	177
281	208
275	191
285	202
299	181
281	208
279	192
284	198
272	209
278	206
287	195
276	200
295	190
296	207
300	181

	Mean	Min	Max
Paper	286.5	270	300
System	196.4	177	214

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Analysis of Variance

Source  DF  Adj SS  Adj MS  F-Value  P-Value
Factor  01  121770  121770  1071.94  0.000
Error   58  6589    114
Total   59  128359
```

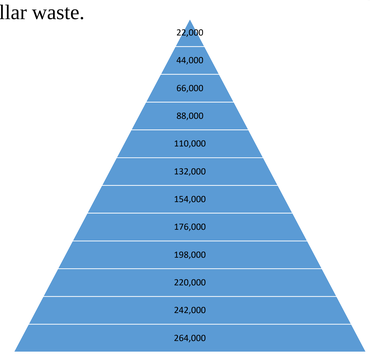
Based on the simulation of the 30-non-conformance event, we got a **37.31% Improvement in downtimes**.

With a p-value of 0.0, we can conclude that there is statistical significance in the overall process with a correct sample size. When dealing with errors in the process with paper, the mean was 286.5 minutes versus 196.40 handling with the system.

According to the medical device manufacturer, an hour of production line downtime costs $22,000. The average cost of the NC disposition event in paper with errors is $102,850 instead of $72,013.33 with a capable system.
The savings per event at this company average $30,836.67.

Conclusions

When a process is being worked on paper, many different scenarios can occur. Downtimes can escalate quickly; as we can see, a 12-hour downtime can cause more than a quarter of a million-dollar waste.



The main topic of this paper was to identify and quantify the wastes caused by manufacturing processes on paper instead of a proper system. We found that most of the time, manufacturing companies spend most of their budget on production processes, machines, and human and not human resources but spend less on digital transformation.

Based on the finding of this project, we found that the waste caused by paper can escalate quickly, increasing downtime and waste costs. Based on this medical device company, the downtime cost of a production line was $22,000 per hour. The NC disposition event in paper with errors has an average cost of $102,850 versus $72,013.33 with a proper system.

In this company, the average saving is $30,836.67 per event.
An implementation cost of an SAP system to address these wastes is $350,000. For this company, 11 events in paper will have the same cost as an implementation of a paperless system. Any company yearly will have more than 11 NC events, so for this company, it's a must and an easy decision.

Future Work

This paper was heavily focused on waste identification with interest in reducing downtime in manufacturing processes. Future researchers can use this paper as a starter guide for an in deep research on inventory waste. The lean waste of inventory and the actual physical paper waste it's so big that entire research could be done on that topic. A few topics would be the physical archive system, archive retrieval, real estate, security, and government compliance with archiving time and environmental requirements. Remembering, archiving paper forms for dozens of production lines for 5-10 years is difficult.