

Time & COVID-19: An Industrial Waste?

Harish Sripada

Industrial Management Program
University of Central Missouri
Warrensburg, MO, USA.
HXS60750@ucmo.edu

Jeffrey M. Ulmer, Ph.D.

Technology Management Program
University of Central Missouri
Warrensburg, MO, USA.
julmer@ucmo.edu

Abstract— The manufacturing industry seeks to reduce the wasting of Time. Currently, COVID-19 is robbing the effective use of Time from manufacturing and society in terms of economic growth. The expenditure of Time is essential in all aspects of any human endeavor. Time is a resource that cannot be rescheduled, stored, or wasted. Lean manufacturing methods help society to use this valuable resource to an optimum level in a lean environment. Time management solutions covered in this manuscript may help technology managers maintain or even regain their reputation in the world as a whole and in the marketplace.

Keywords— COVID-19, Lead Time, Lean, Manufacturing, Time, Waste Reduction.

I. INTRODUCTION

Most industrial managers think about industrial waste in the sense of scrap, unwanted material, remaining parts, and so forth. However, there is another type of waste present in an industrial system. It is non-physical but is vitally important. It is TIME. According to Kruse (2016), Time is the most valuable asset for successful people's personal and professional lives. Time is the best thing that you have in your life.

Time, Time, Time that cannot be defined. Many personal experiences are measured in Time, for example, memories, habits, work, thoughts, age, friendship, relationship, and production in industries. Time plays a significant role in our life. Time keeps things going. If a person is punctual about events and activities, then that person will be a successful man/woman in the future (Bilalkkc, 2018).

Let's assume that you are taking an exam to get into NASA, the dream of your life. You are preparing as you did in high school for this exam. Unfortunately, you didn't complete the last question even though you are familiar with, all because you ran out of Time! After the exam results came out, you learn that you did not pass the exam. Now you have that nagging thought, "if only I would have completed that last question..." In this case, you felt the impact of the scarcity of TIME. Precious Time. If only... you could be working at NASA and living the good life.

This paper delves into how managers are wasting Time in industries and what they can do to reduce it. A few potential solutions for this problem are put forth in this manuscript.

II. MANUFACTURING

Making raw material into finished goods using different tools and techniques is commonly known as manufacturing (Kenton, 2020). Before robots or machines in the market, humans worked like dispensable tools in manufacturing. According to Kenton (2020), the industrial revolution was started in the 19th century and brought about the techniques of mass production and assembly line manufacturing; this led to the usage of machines and robots that we are now using.

Total factor productivity is well known as multifactor productivity. Productivity affects the overall efficiency and a part of gross domestic product (GDP) growth. The GDP growth encompasses the "management practices, brand names, organizational change, knowledge, network effects, spillover from production factor, adjustment cost, the economics of sales" (Thomas, 2019). By this statement, we know that manufacturing affects any country's economy.

"In the USA, manufacturing represents 15% of its economic output, including automobiles, aerospace, machinery, telecommunication" (Markus, 2019).

Manufacturing types include:

Repetitive manufacturing is which makes the same item for a dedicated line of production

Discrete: in this, the production depends on the previous manufacturing time. The production time will vary every Time in manufacturing due to the production of different items.

Job shop: used for small production. This production depends upon customer demand in the market

Process: production occurs in batches. For example, one batch may differ from similar batch; a plastic thermal blow mold machine produces a bottle set at first and pipe in the next collection.

Process: this is a mixture of job shop and process manufacturing.

In 2015 Machinedesign.com published an article, written by Goldense (2015) about the types of manufacturing (see Figure 1).

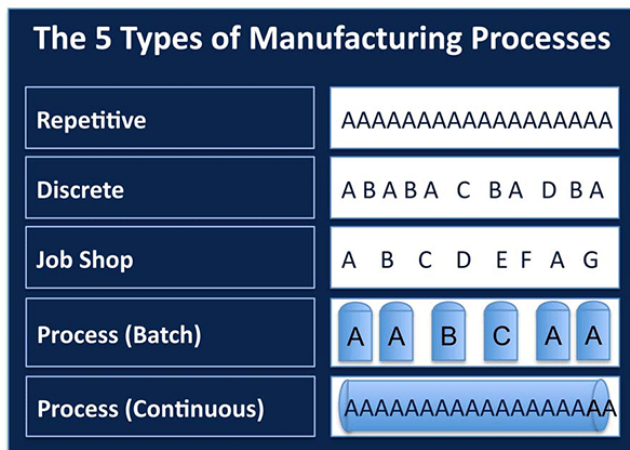


Figure 1: Manufacturing Types

III. TIME IN MANUFACTURING

There is a relationship between Time and manufacturing at the industrial level. Time is the most important in manufacturing because it describes a company's production rate, market demand, and profit. The following illustrates the relationship.

1. Processing time: Time spent from raw material to finished goods
2. Inspection time: Time expended to check the quality of work
3. Moving Time: the Time required to move into and out of manufacturing
4. Queue time: ideal Time in waiting for the process

These four will make a significant difference in company revenue and helps to maintain a good economic status in production. Time is important in manufacturing.

According to Thomas (2019). this formula can help in calculating Time in manufacturing

$$Q = Ae\lambda C\beta x1L\beta x2K\beta x3E\beta x4$$

where

Q = Real output

C = Real capital stock

K = Real research and development capital

L = Labor (number of employees or labor hours worked)

$Ae\lambda$ = is technological progress with a rate of disembodied technological change

$\beta x n$ = Estimated parameters

The current state of manufacturing started in the 18th century; it is known as the industrial revolution. This Time is well known for hand made products and highly Time taking process. England started using machines in the industry in 1760; it reached America at

the end of this century. Bulk material processing occurred in Oliver Evans building with an automatic floor mill with machinery in 1785 (Grimes, 2018). (para, – 6).

The late 19th century is the seed of the automobile industry that began with Mercedes in Europe and crawled to the USA in the early 20th century. In the USA, car manufacturing started with Ford Motor Company producing the model-T on the assembly line (Grimes, 2018). (para-7). The assembly line was introduced by Ford to reduce the Time of production. In 1913 Ford changed to moving assembly line production is used efficiently after 120 years with improvements in production Time.

In 1953, computers made their entrance into manufacturing viva Computer-Aided Design (CAD). CAD is used to design many tools and individual parts in any production enterprise (Grimes, 2018). (para-8) Using CAD makes a lot of difference in Time variation. Trial and error methods are minimalized because CAD expediates activities with less expenditure of TIME. Prior to CAD, if an automotive company needed to design an automobile, it could potentially take months, if not years, to come into actual production. With CAD, multiple phases of automobile design and manufacture are much more manageable and Time-efficient.

Efficient Time usage was curtailed in the 1970s in manufacturing by introducing the Labor Act, although it was vital to improve safety and health issues for American manufacturing workers. After this, in 2002, the USA introduced the Manufacturing Enterprise Integration Act, which improved the original Labor Act (Public Law, 2002).

In 1981 IBM introduced personal computers (Grimes, 2018). (para-8). Personal computers made manufacturing fast and efficient through Computer-Aided-Design (CAD). From that point to now, every manufacturing company tends to use CAD in their production operations to reduce Time and facilitate accurate processing.

Computer simulation is a tool used to increase production capacity. Simulation software used by Cymer Inc. (the leading producer of laser illumination sources) increased the production capacity from 5 units/month at the beginning of 1999 to 45/month at the end of 1999, an increase by around 400% (Balachandran, Rabuya, Shinde, & Takalkar, 2000, para-2).

The introduction of computer simulation software in manufacturing made an industry revolution reduce the testing costs and the 1000+ hours in testing a single product. The testing conducted by this software ends up with an unlimited number of outcomes with various independent variable inputs. It is accurate and on point without errors. It saves Time of double-checking. Simulation is the best and highest used tool in manufacturing in 2020.

How can we forget about the popular Toyota Production Systems tools? Japanese Lean tools which have helped manufacturing to reconsider our

processes and procedures. If an industry is thinking of reducing waste, Lean tools are the best way to do so. But applying lean tools requires an expert who is well known for using these tools in industry. (Summers, 2011. pp, 2-6).

2010 and beyond: it's an internet world; everything changed from paper to a hard drive or handwriting to typing. With the rise of the Internet and fast computing, industrial design file storage and maintenance became as easy as ever. The Time in filing and calculation was made better in this phase. Pandemics, like COVID-19, is not affecting the market in some companies due to inter-country communications and economic transactions.

Again, TIME affects manufacturing in industrial operations. This section illustrates how companies are chosen poor timing of meaningless market strategies, inventory ordering, delivery delays, labor unions, machine maintenance, environmental disaster, changing plant areas, etc.

"Time is manufacturing; manufacturing is Time" when Time is addressed industrially. Every company should maintain its schedule (Time) to cope up with the market and demand for their products. Many companies addressed the issue of Time maintenance in the past and present; that's why Toyota Production Systems, Supply Chain Management, and Lean Tools are derived from Time.

If a company wants to increase production, that industry needs to be up to date by introducing new machines, adapting technology, automated tools, robots, computers, etc. This is all done to reduce the Time of each product as it is turned from raw material to a fine finished product. This is called a transforming revolution. From an Internet presentation at T.E.D., Scalabre (2016) says that we are in the next manufacturing revolution by indicating all the technological improvement in the past decade and applying it – meaning we are in a new industrial revolution.

IV. COMPANY TRANSITIONS & SOLUTIONS

Time is not only crucial in manufacturing but also in companies like software, accounting, security services, etc. The security companies should be on Time - if not, that's a disaster. Let's come to software companies; many of the software companies in the USA are composed of immigrants. Time, if not used efficiently, can result in these software projects to take longer than expected and could potentially be a reason for future failure.

Lead Time is the Time taken for a product from start to end (finished product). Kenton (2019) states that "In manufacturing, the lead Time represents the Time it takes to create a product and deliver it to a consumer."

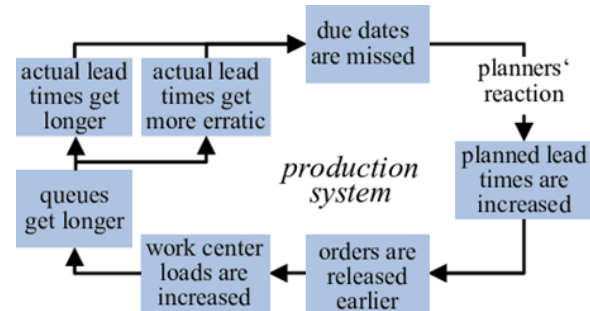


Figure 2: Lead time syndrome flow chat
(Bendul, & Knollmann, 2016)

An article published in 2016, written by Bedul and Knollmann, explains why this syndrome has occurred and what we can do (see Figure 2). Every company tends to reduce their lead time to increase production; this will make them a syndrome that pressuring people and machines to their ultimate thrust.

Sometimes, companies doom their reputation and lose market value. Being in the present puts the company in most dangerous situations because we have some estimations that came from the past; in essence, we can only predict the future. Facing the present is most valuable. Making good decisions is vital in any company. If a decision is wrong, then a company may begin bankruptcy proceedings.

A. Apple iPhone Warranties

The ongoing COVID-19 pandemic put the Apple company in a bad situation. The shortage of iPhones means the lead Time in manufacturing is more—this impacted sales and revenue for the company. There are solutions to this.

This all started when China announced the lockdown. Most of Apple's assembly operations (nearly all) were staged in china; on March 4, 2020, and Apple warned retail employees about the shortage of phones - according to an article (Gurman, 2020), which was published on the evening of the same day.

Apple also recently told technical support store staff that replacement iPhones for heavily damaged devices would be in short supply for as long as two to four weeks. This made Apple lose customers in large numbers. This is what happens when you don't make the right decisions at the right Time.

Some think that Apple should have divided its assembly line to different countries with the Time passing and therefore increased its sales. By the Time they realized that they should manufacture more, they had to go and started a new assembly system in other countries like INDIA, Indonesia, Brazil, etc. This is a major issue that is addressed in Time in manufacturing companies (Vijayasathya, 2019).

B. Ford Automobiles

Now the situation is like every automobile car parking is full of new cars without sales. The production of these cars is unexpected, but it happens.

USA automobile companies are way more productive, and they are in trouble now. There is a great solution for it.

Ford shut down all European and North American production on March 19 to help combat the spread of COVID-19. While Ford intended to reopen facilities and restart production on March 30, the company on March 31 delayed that goal indefinitely. However, it plans to start ventilator production at one of its US facilities on April 20. Production of Ford vehicles and engines across the pond is expected to resume on May 4 at the soonest (Szymkowski,2020).

Every automobile company in the USA is in overproduction and does not know how to sell those with this economy on the ground.

C. IBM

IBM is a multinational company, which introduced computer technology in the 1970s. IBM was reported to have the best software engineers in the past, but Apple hired many of them in the early 2000s. The reasons behind will be discussed in the next part of this paper.

While IBM isn't completely gone and out of sight from the entire general public, many of the younger generations just don't pay it any consideration. Why worry about IBM when Apple just announced the iPhone 12? In addition to the lack of interest from the younger generations, IBM has taken a more back seat approach as they continue to acquire companies and partners and help other companies, i.e., Apple. From now until the unforeseeable future, it is inevitable that IBM will not close down and die out but rather be the quote "puppet master" behind the whole operation. Through meticulous planning and constant evolution, IBM will continue to reap the rewards of nearly a century of hard work and dedication (Rogers, 2017). (para-6).

Not only IBM, but many highly rated companies went through this type of problem, for example, but the mobile legend Nokia is also now thriving to sell their mobiles in the market. The great Orkut just vanished like that in the introduction of Facebook. There is a lot of small business that ran out of business with the same problem.

D. Lean Tools

Lean tools are the best tools in the market to reduce waste, most importantly, Time. The automobiles companies in the USA should have used the Just In Time technique in the production to reduce their waste in this situation. Just in Time is a method that runs according to defined schedules. The production will be done once the order is placed by the customer (Banton, 2020). This is the best way to maintain a timed schedule in any manufacturing company. Using Just in Time in the food industry will lead to less usage of preservatives in products if this can be implemented, there is so much change in food production companies.

Not only the Just in Time, but other Lean tools are also used to decrease Lead Time in companies. Small

companies can benefit more if they use lean tools because it concentrates on waste in the company and gives solutions for the waste.

E. Robotic Algorithms

Robotics programming is creating many jobs in the market; this is happening for the past decade; they are commonly known as software engineers. This sector has received many updates. From a simple hand-operated machine to an automatic machine working on its own, with a great algorithm written by an engineer.

These programs facilitate autonomous robot operation. When robots came into existence in the workplace, many companies highly decreased production Time, which increased profits and market share for these companies. Most of these robotic algorithms are written with open-source codes.

F. Market Strategies

Changing marketing strategies with Time will make industrial companies more profitable and attract new customers to buy their products. Some market strategies by Adams (2017).

1. Use social media
2. Create video tutorials (use YouTube)
3. Blogging
4. Understand search engine optimization
5. Leverage influencers
6. Build a great lead magnet
7. Use LinkedIn in the right way
8. Email marketing is required.

G. Management Directives

All companies are dependent on their managers, whether it is a top-level or middle level. Scheduling time is in the hands of management, which can control manufacturing rates. Middle-level and lower-level managers, those who will work on the ground, will have to have high regard for Time to maintain optimal lead Times in manufacturing plants (duBrin, 2006). (pp-539-543)

Imagine a manager that is late every day on a task or activity. Automatically, a worker, who receives instructions from this late manager, will be late. These late activities work its way down through the manufacturing system. This makes the company lose money in every day to day manufacturing due to this poor manager affecting his subordinates. This should not be! Yet it happens countless times every day in every manufacturing plant around the world. What a waste of Time!

The above-mentioned example will lead to less productivity. Suppose the worker experiences stress issues due to this daily occurrence. This can affect productivity even further and waste even more Time. Considering the manager and the worker, production

may go down until someone fires the manager for his/her actions. The same happens for partiality towards some workers; partiality causes some people to become lazy because he/she knows that they will not get fired. What if the late, partiality-driven manager was also untrustworthy? For the untrustworthy manager, this person may doom your company by selling trade secrets to your company's competition. This is why a good middle-level manager is needed in the workplace to maintain schedules and coordinate optimal lead Times

Oftentimes, sub-optimal use of worker Time is due to sub-par working wages. The idea here is to pay workers a little more to do their tasks on Time. Every company makes a mistake when declaring a bonus after work is completed. Announcing the bonus before work makes the workers more energetic, and they are willing to work at a higher rate.

Paying a worker \$42, instead of \$40, per hour for the work rendered may work on the wage-earning worker because they are making \$16 a day more. He/she works more to achieve the goal of what the company will put on them. For example, if a person is working as a packaging courier; he/she totes ten boxes an hour for \$40 per hour. Tell them that they will be paid an extra \$10 for a day if they pack 75 boxes in a day instead of 70. Maybe they can't reach that number in one day, but they will attempt to be more productive. While the task may be a financial inducement, it will still help to decrease the waste of Time and end up increasing productivity.

V. CONCLUSION

Time is the most valuable resource we have in the world. Using it to our gain makes us a Professional. Wasting Time has the potential of pushing us into homelessness. That is why everyone should maintain their punctuality and schedules in the workplace to maintain a good productive environment.

The industries should take schedule activity compliance seriously to gain profits and maintain sustainable lead Times in manufacturing. Many small-scale industrial companies do not adhere to due diligence in regard to on-Time schedule compliance and hence are driven into bankruptcy. Using sound Time management and Lean techniques will make them great companies like Tesla, Great Value, Tommy Hilfiger, etc.

Many companies are missing out on profits due to the inefficient use of Time. This includes the project handovers to other companies. Every company should look into how they manage their operations in terms of Time. Sometimes these inefficient companies cannot even reach demand in the market place due to the inability to use the schedule designed by top-level management. COVID-19 has taught us that industrial manufacturing schedules cannot always be kept. But, it has also reminded society that Time is a resource that we cannot waste.

VI. REFERENCES

- Adams, R.L. (2017, September 12). 10 marketing strategies to fuel your business growth. Entrepreneur. <https://www.entrepreneur.com/article/299335>
- Banton, C. (2020). Just in Time. Investopedia. Retrieved on May 1, 2020 from <https://www.investopedia.com/terms/j/jit.asp>
- Balachandran, A; Rabuya, L; Shinde, S; & Takalkar, A. (2000, April 7). introduction to modeling and simulation system. Retrieved from <https://uh.edu/~lcr3600/simulation/historical.html>
- Bendul, I., & Knollmann, M. (2016). The lead time syndrome of manufacturing control: comparison of two independent research approaches. *Sciencedirect*, 41(2016), 81-86. <https://doi.org/10.1016/j.procir.2015.08.104>
- Bilalkkc, (2018). The importance of Time, meaning, and value of the Time in everyone's life, essay. Steemit. <https://steemit.com/importance/@bilalkkc/importance-of-time-meaning-and-value-of-the-time-in-everyone-life-essay>
- Goldense, B. (2015). The 5 types of manufacturing processes. Machine design. Retrieved on April 17, 2020 from <https://www.machinedesign.com/community/contributing-technical-experts/article/21831946/the-5-types-of-manufacturing-processes>
- Grimes, A. (2018). An abbreviated history of manufacturing in the united states. Tykma electrox. Retrieved on April 18, 2020 from <https://www.permanentmarking.com/history-of-manufacturing/>
- Gurman, M. (2020). Apple warns stores about a shortage of replacement iPhones. Bloomberg. Retrieved on April 16, 2020 from <https://www.bloomberg.com/news/articles/2020-03-04/apple-warns-stores-about-shortage-of-replacement-iphones>
- Kenton, W. (2020). Manufacturing. Investopedia. Retrieved on April 20, 2020 from <https://www.investopedia.com/terms/m/manufacturing.asp>
- Kenton, W. (2019). Lead Time. Investopedia. Retrieved on April 16, 2010 from <https://www.investopedia.com/terms/l/leadtime.asp>
- Kruse, K. (2016, July 18). Successful people agree: this is their most valuable asset. Forbs. <https://www.forbes.com/sites/kevinkruse/2016/07/18/successful-people-agree-this-is-their-most-valuable-asset/#c637afe42d78>
- Markus, J. (2019). Manufacturing. Oberlo. Retrieved on April 20, 2020 from <https://www.oberlo.com/ecommerce-wiki/manufacturing>
- Public law (2002, November 5). Enterprise integration act of 2002. Public law. 107-277. <https://www.congress.gov/107/plaws/publ277/PLAW-107publ277.pdf>

Rogers, B. (2017). What happened to IBM-the lifecycle of a giant. Retrieved on April 30, 2020 from <https://gazettereview.com/2016/02/what-happened-to-ibm/>

Szymkowski, S. (2020). COVOD-19 and plant closures: the automotive industry's response to the pandemic. Retrieved on April 19, 2020 from <https://www.cnet.com/roadshow/news/covid-19-automakers-plant-shutdowns-coronavirus-pandemic-outbreak/>

Ted [Olivier Scalabre]. (2016, September 13). The next manufacturing revolution is here [video]. YouTube. <https://www.youtube.com/watch?v=AyWtlwwEgS0>

Thomas, D. (2019). Flow time innovations: the effect on productivity and production in US manufacturing. NIST. Retrieved on April 17, 2020 from <https://www.nist.gov/publications/flow-time-nnovations-effect-productivity-and-production-us-manufacturing>

Vijayasathy. S. (2019). Apple to start mass production of iPhones in India with the help of roxconn. INDIA TODAY. <https://www.indiatoday.in/technology/news/story/apple-foxconn-iphone-mass-manufacturing-in-india-report-1502794-2019-04-16>